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*AN ANALYSIS OF THE NEW ZEALAND
SUPPLY OF CALLA TO THE
UMEDA WHOLESALE AUCTION MARKET*

A thesis presented in partial fulfilment
of the requirements for the degree of
Master of Horticultural Science
in Economics
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ABSTRACT

This paper is an exploratory analysis and discussion of the supply of New Zealand Calla to the Umeda wholesale auction market in Osaka, Japan. The hypothesis, that total revenue has not been maximised at the Umeda market, was tested and found to be true. The test was conducted by optimising the supply schedule, constrained by the total volume of imported Calla (white and coloured) sold at Umeda each season.

To conduct this test, data collection at the Umeda wholesale auction market was necessary. The results are based on observations of two and a half seasons (January 1992 to June 1994) for each Calla product (i.e. Japanese white Calla, Japanese coloured Calla, imported white Calla and imported coloured Calla). As New Zealand supplies 90-95 per cent of Calla imports each year, it was assumed that all imported Calla sold at Umeda were grown in New Zealand.¹ In conjunction with data collection, many representatives of the Japanese cut-flower market were interviewed in order to provide descriptive information as well as the requirements and expectations of the Japanese market (not just the Umeda wholesale auction market).

The results show that, in terms of maximising total revenue, imported Calla tend to be poorly allocated over the season. The exception to this was imported white Calla in the 1993/4 season, where maximum total revenue was only NZ\$4,600 more than the actual. In the previous season, imported white Calla attained a total revenue of NZ\$17,700 less than the maximum. The imported coloured Calla results show that maximum total revenue was NZ\$20,000 more than the actual in 1992/3 and NZ\$17,800 more in 1993/4.

As this paper is of an exploratory nature, total revenue maximisation was not the only focus. Constant Market Shares Analysis was also applied to the data, in an attempt to explain changes in the share of imported Calla at Umeda. The results of Constant Market Shares Analysis were inconclusive with respect to explaining the observed changes. This tested the limits of this deterministic form of analysis. Specifically where the appropriateness of Constant Market Shares Analysis on small data sets and products where the underlying product composition (cultivar and grade mix) changes from season to season. In both respects Constant Market Shares Analysis was found to be very limited as a simple means of explaining changes in supply.

¹ The statement that 90-95 per cent of imported Calla are from New Zealand holds for 1989-1994.

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CHAPTER ONE

INTRODUCTION

The purpose of this chapter is to introduce this thesis. This is done by specifically presenting the statement of the problem, along with the objectives of this study, the rationale of this study, hypotheses to be tested and the organisation of this thesis.

1.1 Statement of Problem

For an industry to remain successful, in an economic context, it requires information from the markets that it supplies. Market information enables strategies to be formed that allow profits to be maximised in the long term. Such information comes in the form of price signals from the purchasers of the product. These signals are normally intended for the suppliers of a product. This is because market information usually flows back along the marketing and distribution channels for any particular product.

Given this, why do some upstream producers not receive the price signals that are so vital to the continued survival of their business? Alternatively, why are price signals ignored and not analysed to give vital market information for the growers? In order to answer these questions, a small, but successful industry was chosen, this being the New Zealand Calla lily industry. This industry grew from nothing ten years ago to now be New Zealand's second largest floricultural export earner, behind orchids.

The New Zealand Calla industry is currently represented by seven grower groups. None of these groups have authority over the others, in fact, little contact between these groups occurs. The point is that the New Zealand Calla industry has no nationally organised 'umbrella' organisation. Therefore the independent growers are left alone to compete in the international marketplace. The New Zealand Calla industry is a freely trading industry with no government intervention, at either the point of production or export.

Considering the success of the New Zealand Calla in the Japanese market place, one would think that the New Zealand Calla industry has timely, pertinent and reliable information. The fact that over the past ten years the industry has grown from somebody's back yard to New Zealand's second largest floricultural export earner, one would expect that the industry was well informed. However this does not appear to be the case, while each grower attempts to be a maximise profits, they appear to be poorly informed on market trends or expectations for the Japanese market.

The central problem is that it appears that New Zealand Calla growers either do not receive market data or they do translate it into useful information. Therefore, it seems that very little market intelligence on the Japanese market reaches the New Zealand Calla grower industry. However this problem appears to be restricted to market information alone as technical, or production, information is widely available in the industry from each of the grower groups.

1.2 Objectives of the Study

The purpose of this study is not to ensure that market information does reach the growers via the normal pathways, but rather to address the problem of the apparent lack of market information.¹ This means that raw data needs to be collected from the Japanese market and then analysed to form useful information on the Umeda wholesale auction market for Calla.

The results from this analysis along with information on the distribution and marketing channels in Japan are presented in this thesis. This study is as much a source of information on the Japanese cut-flower market as it is an economic analysis of the supply of Imported Coloured Calla and Imported White Calla to the Japanese market.

The explicit objectives of this study are:

- to describe how the Japanese cut-flower market and distribution channels operate;
- to identify the inter-relationships of the four different Calla products;
- to provide a strategy to improve the total revenue accruing to the New Zealand Calla industry from the Japanese Calla Lily market; and
- to examine the appropriateness of Constant Market Shares Analysis to explaining changes in small data sets, where the product is continually improved and changed, such as by new cultivar breeding.

¹ Normal Pathways involve the flow of market information up the marketing and distribution channels of a product. For instance, the normal market information flow is from the market, back to the importer, then the exporter and then back to the grower.

1.3 Rationale and Premise of the Study

Market information is vital to the New Zealand Calla industry. The lack of market information from normal sources suggests that the information flow is blocked, either inadvertently or because of the importance of such information for strategic planning of rivals (eg Japanese Calla growers). Alternatively, New Zealand growers lack either the time or knowledge to transform this raw data into useful information.

Therefore the relevance of this research is to New Zealand growers and exporters of Calla. Firstly this is because this research attempts to explain how the Japanese market operates for Calla, and for other cut-flowers. Secondly, this research attempts to promote a strategy to optimise the supply schedule for Calla, thereby maximising total revenue at the margin for the New Zealand Calla industry.

The central premise of this study is that data on the Japanese wholesale auctions is available to the New Zealand Calla industry. However, little or no attempt has been made to analyse it, thereby converting the raw data that growers and exporters have into useful information. The main reason for this is that the industry seems to be preoccupied with the physical product. In itself this is no failing of the New Zealand Calla industry, as the technical and production focus of the industry has enabled the industry to become world leaders in breeding new cultivars of Calla. But rather, the industry needs to seriously consider interpreting the market data that they have.

Recently, progress appears to have been made by the majority of the seven Calla industry groups. This progress has come in the form of group newsletters with articles on market trends and expectations. In addition to this written information, the industry groups hold regular meetings at which the strategic direction of the industry, amongst other agenda items, are discussed.

Despite these activities, published papers have failed to provide such information, instead any commercial market research, as published by the New Zealand Calla Council (1993), or the New Zealand Trade Development Board (1990 and 1993) are all based on surveys of Japanese retail florists. Such information has its uses, however it fails to provide accurate and reliable information on the specific market trends and expectations of key Japanese wholesale auction markets that the New Zealand Calla industry supplies. This paper is an attempt to provide this data on one such market, and at the same time test the appropriateness of Constant Market Shares Analysis, to see how it may be of use to the industry.

1.4 Hypotheses to be Tested

As outlined in Section 1.2 the explicit objectives of this study focus on two separate issues. Firstly this study attempts to provide information to the New Zealand Calla industry on the Umeda wholesale auction market (and the larger Japanese market) for Calla lilies (and other flowers). This is in the form of a descriptive section on market and distribution channels, and also in the form of econometric price models, which attempt to maximise total revenue at the margin. Secondly, this thesis attempts to explain changes in export performance of the New Zealand Calla industry by utilising Constant Market Shares Analysis. This second form of analysis tests the theoretical aspects of Constant Market Shares Analysis when applied to small data sets of changing differentiated products.

Specifically this study will attempt to test the following four hypotheses;

Hypothesis One

That the price of imported Calla products is independent of the volume of other Calla products.

Hypothesis Two

That the New Zealand Calla industry is not attaining maximum total revenues from the Umeda wholesale cut-flower auction market.

Hypothesis Three

That Constant Market Shares Analysis is an appropriate tool for explaining changes in export performance, where small data sets are involved.

Hypothesis Four

That Constant Market Shares Analysis is an appropriate tool for explaining changes in export performance, where the underlying product undergoes significant product innovation and diversification during between the two time periods.

1.5 Organisation of the Study

This thesis is organised into seven chapters. The next chapter (Chapter Two) is a descriptive chapter which explains the Japanese cut-flower market, concentrating on Calla Lilies. Chapter Two describes market and distribution channels from Japanese production or importation from New Zealand through to retail consumption in Japan. Japanese Government intervention is also discussed in relation to changes happening in the distribution channels of cut-flowers.

The third chapter concentrates on theoretical issues that are involved with Constant Market Shares Analysis and economic optimisation. This is in the form of a review of the relevant literature.

Exploratory data analysis is summarised and presented as Chapter Four. Data collection and the data are also explained in this chapter. This chapter explores the data and then explains how and why certain decisions were made, regarding what data to utilise in the subsequent analysis.

Chapter Five focuses on the methodology utilised to analyse the data. Both Constant Market Shares Analysis and the techniques of econometric analysis are detailed. The process of optimising marginal revenues, to maximise total revenue is also described.

The sixth chapter presents the quantitative analysis and findings of this research. The results of Constant Market Shares Analysis and analysis based on the regression equations for the wholesale auction price at Umeda are presented for both Imported White Calla and Imported Coloured Calla. The total revenue maximising supply schedule and marginal revenues are expressed in this chapter.

The last chapter is Chapter Seven, in which the conclusions and recommendations of this study are presented. The usefulness and applicability of Constant Market Shares Analysis are expressed here. Finally the conclusions and recommendations based on the analytical results from the regression equations and optimisation are presented.

Three appendices follow the references. The first appendix presents a list of the people and organisations interviewed and with whom discussions were held. The second appendix is a more detailed explanation of Constant Market Shares Analysis. Appendix three presents tables of the raw data collected from three Osaka wholesale cut-flower auction markets.

CHAPTER TWO

AN OVERVIEW OF THE JAPANESE CUT-FLOWER MARKET AND MARKETING AND DISTRIBUTION CHANNELS

This chapter overviews the Japanese Calla lily market. Much of the information is analogous to the Japanese market for other flowers, as the distribution and marketing channels are common amongst many flowers. Specifically this chapter describes Japanese floricultural production, the importation of cut-flowers (especially Calla), and wholesale distribution of Calla and other flowers in Japan. Government intervention in the Japanese cut-flower wholesale channels is discussed along with a brief summary of costs of the marketing and distribution channels. Finally this chapter attempts to give a general picture of consumption of Calla in Japan.

2.1 Japanese Floricultural Production

Many of the larger Japanese industries have felt the impact of the current depression in the Japanese and world economies. However, smaller industries such as floricultural production, distribution and marketing have flourished.¹ The main reason for this is the Japanese enthusiasm for floral products. While Japanese floricultural output rose by over a third between 1987 and 1991, the more recent years have seen a positive but slower rate of growth (New Zealand Trade Development Board, 1993).

Floricultural production in Japan can be found in the sub-arctic north, throughout temperate central Japan and in the sub-tropical southern regions of Japan.² These different climates enable Japanese floriculturists to produce flowers year round in the south, and only for a brief mid to late summer period in northern regions (Ohteki, 1982). This means that there are always Japanese flowers available, even in mid winter (January and February). However the main season is during mid to late spring (April and May) and the summer months of June and July.

For Calla lilies this means that the on season for Japanese supply occurs during April, May, June and July, with a low season from October through to early February. More specifically the season Japanese White Calla season peaks in April while the peak of Japanese Coloured Calla production is in June and July. The important point is that Japanese floriculturists supply the Osaka and Japanese markets during their off, or low, season as well. Another important point is that the Japanese supply of Calla lilies significantly increases from February through to April, peaking in June and July. Japanese supply falls off quickly over the months of August and September.

Two challenges continually shape the Japanese floricultural industry. Firstly the shortage of land suitable for floricultural production and secondly the lack of younger people becoming involved in the cut-flower industry. The encroachment of housing and industry are seriously limiting the land area available for floricultural production (New Zealand Trade Development Board, 1993). Because cut-flowers are so perishable, the best site for cultivation is close to wholesale auction markets. The

¹ Watanabe, E., Assistant Manager of Floriculture and Hazama, M., Chief Assistant to General Manager of Agribio Business Division, Kirin Brewery Co. Ltd., Tokyo (a cut-flower importer) (June 1994) *pers. comm.*

² Imanishi, Prof. H., Laboratory of Ornamental Horticulture, University of Osaka Prefecture, Osaka (June 1994) *pers. comm.*

ideal of having the production site near the market augments the conflict between land use for production or for industry or housing.

The continuing shortage of agricultural labour is a result of the overall aging of the Japanese population in combination with the other interests of the younger generations. Younger Japanese people show little interest in working on the land thereby intensifying the shortage of agricultural labour (New Zealand Trade Development Board, 1993). These factors have continued to shape Japanese floricultural production, but there are other pressures on the industry too.

Floriculturists need to respond to centralisation and consolidation of the cut-flower wholesale markets. This is a result of the Japanese central government attempting to simplify the wholesale marketing and distribution of cut-flowers in Japan.³ Another problem that the Japanese growers and distributors must deal with is that of growing traffic congestion. This is important as it slows down the distribution of the flowers, thereby making the transport of flowers more expensive (Kennedy 1993). The Japanese floriculturists also have to alter their focus as the retail market changes from expensive "formal flowers" to less expensive "casual flowers" (Anon., 1993 and New Zealand Trade Development Board, 1993).⁴ Floriculturists must realign production, grading, packing and freight methods to respond to and meet these challenges.⁵

³ Sakamoto, Y., President, Y.M.S. Co. Ltd., Osaka (a cut-flower importer) (May 1994) *pers. comm.*

⁴ Professor Kawano, T., Faculty of Economics, Hitotsubashi University, Tokyo (July 1994) *pers. comm.*

⁵ Kayano, J., President, Create Ltd., Osaka, (a cut-flower importer) (May 1994) *pers. comm*

2.2 Importation

As the Japanese cut-flower market has increased in volume over time, domestic production has been unable to supply the entire market. Over recent years more cut-flowers have had to be imported to satisfy domestic demand (New Zealand Trade Development Board, 1990, and 1993). This trend is true both on the generic cut-flower market and for specific flowers, such as Calla Lilies. While the Japanese economy was booming, the cut-flower import market also flourished.⁶ However when Japanese economic growth slumped in the early 1990's, the price of imported cut-flowers reduced and the volume imported cut-flowers eased. The extent of this is portrayed in the fact that in 1992, for the first time in the last 30 years, Japan imported fewer cut-flowers than in the previous year (New Zealand Trade Development Board, 1993). Table 2.1 shows the total imports of flowers into Japan from 1985 to 1990.

This reduction in the importation of cut-flowers results from both the worldwide economic recession and the switch from formal flowers to casual flowers. Japanese demand for flowers in the 1980s was driven by formal flowers, but now individual consumers are demanding more and more casual flowers.⁷ Casual flowers are cheaper than formal flowers, but the important detail is that casual flowers do not necessarily conform to the extremely high quality requirements of formal flowers.⁸ One of the major reasons for this switch in demand results directly from the world economic recession felt in Japan (New Zealand Trade Development Board, 1993). When the recession struck, companies and corporations had less money to spend on luxuries, such as formal flowers.

Naturally, not all the pressures and challenges felt by the Japanese floricultural industry pertain only to the Japanese floriculturists. Imported cut-flowers also face many similar constraints to the Japanese suppliers, as well as the increasing costs of

⁶ Imanishi, Prof. H., Laboratory of Ornamental Horticulture, University of Osaka Prefecture, Osaka (June 1994) *pers. comm.*

⁷ Shibata, T., Cut-Flower and Horticulture Section, Ocean Trading, Kyoto (a cut-flower importer) (June, 1993) *pers. comm.*

⁸ Kaiichi, Y., Auctioneer, Nishi-Nihon, Osaka (a regional cut-flower auction), (June, 1994) *pers. comm.*

supplying the market, and longer distribution channels in Japan.⁹ Many Japanese importers believe that imported cut-flowers can generally only demand a lower price than domestic flowers.¹⁰ Reasons for this included the increased time from harvest, international freight conditions, storage conditions, quarantine compliance (that is fumigation for some imported flowers, and physical inspection of a sample of the flowers).¹¹

On top of these pressures there are the cost pressures of supplying imported Calla. Examples of costs that only apply to imported cut-flowers include quarantine inspection and fumigation charges, international freight charges and the commission of exporters, an extra member of the distribution channel for imported cut-flowers.

Table 2.1 Imports of cut-flowers into Japan by origin and value (US\$m).

	1985	1986	1987	1988	1989
Total Imports	22.5	37.47	57.65	102.07	110.29
Netherlands	1.72	5.22	11.77	29.88	40.70
Thailand	9.90	16.73	23.12	32.95	27.92
ASEAN ¹	3.44	3.37	6.25	11.83	12.73
New Zealand	1.55	3.72	5.15	7.96	7.74
Singapore	1.41	1.68	2.84	4.88	6.35
Australia	0.40	0.85	2.37	6.19	4.56
United States	2.88	3.90	3.79	4.40	3.99
Other	1.20	2.00	2.36	3.98	6.30

¹ Association of South East Asian Nations

Source: ITC UNCTAD/GATT Geneva 1991.

⁹ Maeda, K., Sales Manager, Toa Trading Co., Ltd., Osaka (a cut-flower importer) (June, 1994) *pers. comm.*

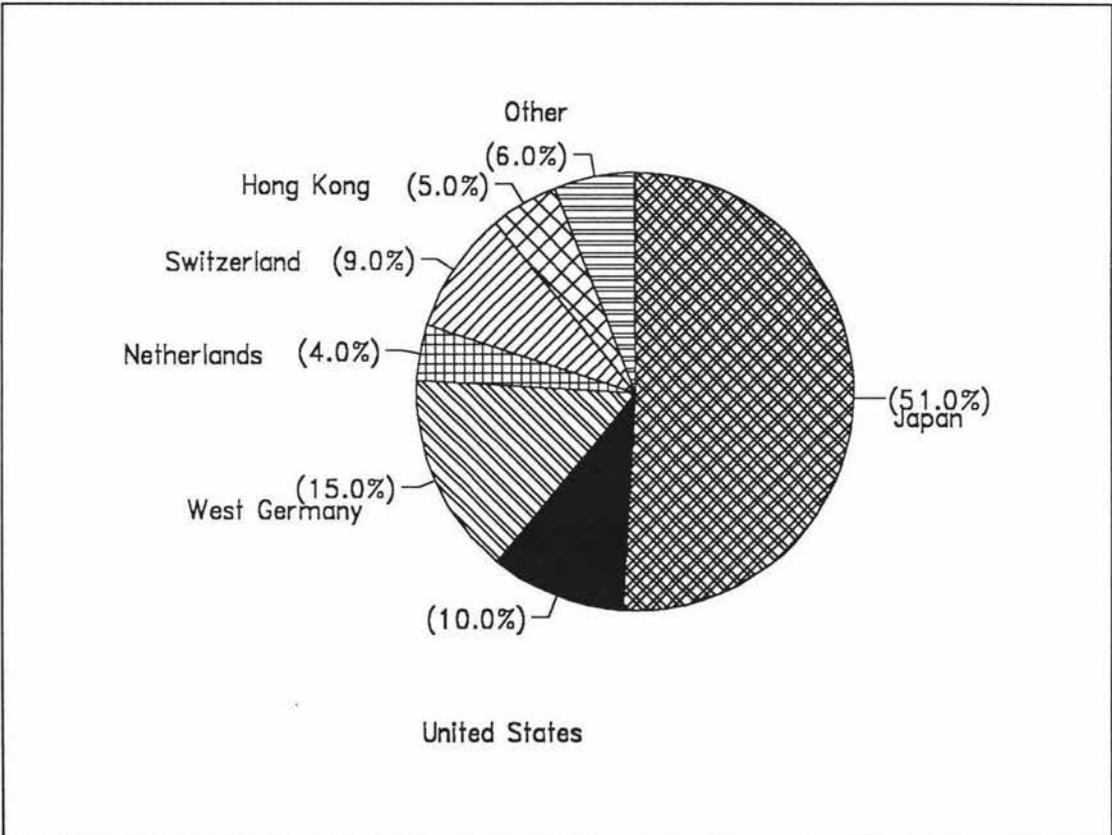
¹⁰ Maruyama, M., Senior Marketing Officer, New Zealand Trade Development Board, Tokyo Office (June, 1993) *pers. comm.*

¹¹ Yoshimoto, C., Main Trader, Toa Trading Co. Ltd., Osaka (a cut-flower importer) (June, 1994) *pers. comm.*

In 1990 New Zealand exported approximately NZ\$2m of Calla to Japan, accounting for 37 per cent of the New Zealand Calla export crop (Clemens and Welsh, 1993). The other major markets for New Zealand Calla in 1990 were the United States, Germany, the Netherlands, Switzerland and Holland. Together these other markets accounted for 55 per cent of the New Zealand Calla crop.

1991 saw Japan take 51 per cent of the New Zealand Calla crop. Figure 2.1 shows the relative percentage of New Zealand Calla exported to the six major markets in 1991. The total export earnings of Calla in the 1991 season was NZ\$2.9m (New Zealand Calla Council, 1992). 1992 saw this figure increase to NZ\$3.44m for the nine months ending 31 March 1992.

Figure 2.1 New Zealand Calla Flower Export Markets.



Source: ITC UNCTAD/GATT Geneva 1991

Despite the changing export share that Japan has for New Zealand Calla flowers, New Zealand has consistently accounted for between 90 and 94.5 per cent of the total volume of Calla flowers imported into Japan (Prime Ministers' Office, 1994).

2.3 Distribution

Compared with the market channel for other goods in Japan, the market channel for cut-flowers is short and relatively simple. The major reason for the simplicity of the cut-flower market channel is that cut-flowers are very perishable (MIPRO, 1986). This means that the flowers must move quickly from the point of harvest to the end consumer. Japanese flowers are generally available to the end consumer within 24 to 36 hours of harvest. In contrast imported cut-flowers are not available to end users until three or four days of harvest.¹²

The wholesale auction markets supply the majority of the Japanese retail cut-flower market. On average less than 15 per cent of the imported cut-flowers are directly purchased from importers, i.e. sold directly to retailers.¹³ The remainder of the market is supplied by the wholesale auction marketing channel. The ongoing consolidation and centralisation of the wholesale auction markets have meant changes to the traditional marketing channel.

Traditionally the volume of cut-flowers in a consignment was small enough for individual retailers to directly purchase them at the auction. However the average volume of cut-flowers in a consignment has increased, therefore it is common for secondary wholesalers to buy the flowers at the auctions (New Zealand Trade Development Board, 1993). These secondary wholesalers usually sell the flowers at secondary wholesale auctions in outlying districts (Kitson and Dunphy, 1981). This distribution channel is shown in Figure 2.2 amongst the other possible distribution channels for fresh cut-flowers in Japan.

The diversification of Japanese floral retail outlets have increased the market penetration of fresh cut-flowers (Prime Minister's Office, 1994). Traditionally specialist florists controlled the Japanese cut-flower retail market, but today department stores through to corner convenience stores and even vending machines all retail fresh cut-flowers. Associated with the differentiation of the retail cut-flower market is the continued emergence of 'casual' flowers.

¹² Sugiyama, S., Chairman of the Japanese Cut-Flower Import Association, and President of Flora International Co. Ltd., Tokyo, (a cut-flower importer) (June 1994) *pers. comm.*

¹³ Hanano, Y., Deputy General Manager, Horticulture Department, Mitsui, O.S.K. Kogyo Kaisha, Ltd., Tokyo (a cut-flower importer) (June, 1994) *pers. comm.*

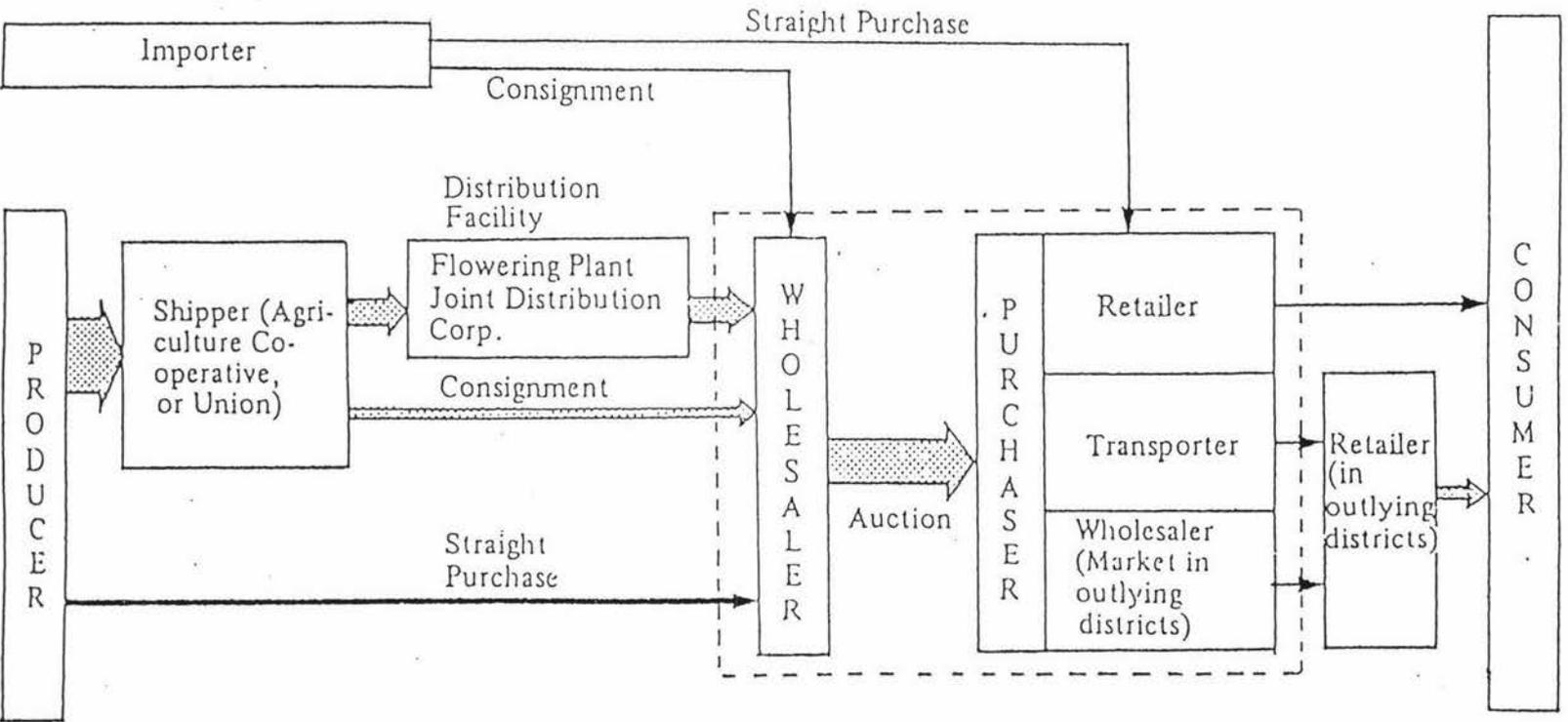


Figure 2.2

Distribution channels for cut-flowers in Japan.

Source: Kitson and Dunphy, 1981.

2.3.1 Government Intervention in the Distribution of Cut-Flowers in Japan

Both the central and local governments have encouraged and in some cases forced the consolidation and centralisation of the wholesale markets. This is especially true in large consumption markets, such as Tokyo and Osaka.¹⁴ The main objectives of the authorities becoming involved in the wholesale cut-flower markets are to stabilise and lower the wholesale price of fresh cut-flowers.¹⁵ The theory behind wholesale market centralisation involves economies of scale, thereby enhancing the efficiency of the wholesale markets by centralising them (Prime Minister's Office, 1994). Gains in the efficiency of the wholesale markets and retailers are expected to be passed directly on to the consumers, by a series of wholesale and retail price reductions.

Centralising the wholesale markets also means that the flowers can move through the marketing channel more quickly. Speeding up the distribution channel means that cut-flowers of the same freshness and quality should be available for a lower price as holding costs would be reduced and passed on to the consumer.¹⁶ The rationale behind this states that the purchaser will receive better value for money, if they buy a superior quality (fresher) flower for the same price as a lower quality (older) flower, instead of the poorer quality flower.

The second reason for government intervention in the Japanese wholesale cut-flower market is to stabilise the wholesale auction price. Retail florists maintain a relatively large margin of 100-200 per cent (New Zealand Calla Council, 1993). They claim that they must maintain such a high margin because of the fluctuations in the wholesale price of cut-flowers. On the other hand consumers and other channel members claim that current retail margins are excessively high.¹⁷ Consumer groups lobbied the government to lower the retail price of fresh cut-flowers. At the same time the retailers lobbied the government to defend their margins or stabilise the

¹⁴ Maruyama, M., Senior Marketing Officer, New Zealand Trade Development Board, Tokyo Office, (June, 1994) *pers. comm.*

¹⁵ Watanabe, E., Assistant Manager of Floriculture, Kirin Brewery Co. Ltd., Tokyo (a cut-flower importer) (June, 1994) *pers. comm.*

¹⁶ Hazama, M., Chief Assistant to General Manager of Agribio Business Division, Kirin Brewery Co. Ltd., Tokyo (a cut-flower importer) (June, 1994) *pers. comm.*

¹⁷ Zwijsen, V., Florimex, Ltd., Tokyo, (a cut-flower importer) (June, 1994) *pers. comm.*

wholesale auction price for cut-flowers.

To remove the necessity for high retail margins, wholesalers and consumers have convinced the Japanese government of the need to stabilise the wholesale auction price of cut-flowers. To do this the government encourages secondary wholesalers to act as buffers between the wholesale auction price and the price paid by retailers.¹⁸ Today secondary wholesalers (secondary wholesale auction markets) are commonplace in Japanese cut-flower marketing channels (New Zealand Trade Development Board, 1993). However the standard marketing channel does not yet include secondary wholesalers. Therefore retail margins remain at high levels, upholding the retail price of fresh cut flowers.

Secondary wholesalers purchase flowers at the primary auctions and divide these large consignments into smaller lots and repackage them. The secondary wholesalers then auction these smaller consignments directly to retailers. Another important function that the secondary wholesalers undertake is to redistribute cut-flowers into other areas of Japan. They do this by operating in different areas to the primary wholesale auctions, thereby supplying retailers who are not directly serviced by the primary wholesalers. This extra transaction lengthens the distribution channel whenever secondary wholesalers are involved in the channel.

Secondary wholesalers charge a commission of between 10 and 20 per cent for their services. The amount of commission charged is largely dependent on freight, repackaging and secondary auction costs. The central government has encouraged secondary wholesalers to become commonplace in the distribution channel for cut-flowers in Japan. The reason for this recent government involvement is based on the expectation that if the secondary wholesalers act as buffers they will eliminate the justification for high retail margins (Egberts, 1992). However at this stage, secondary wholesalers are not a common part of the distribution channel for cut-flowers.¹⁹ This means that most retailers still charge large retail margins as their wholesale price is still highly variable.

¹⁸ Sakamoto, Y., President, Y.M.S. Co. Ltd., Osaka (a cut-flower importer) (May, 1994) *pers. comm.*

¹⁹ Sugiyama, S., Chairman of the Japanese Cut-Flower Import Association, and President of Flora International Co. Ltd., Tokyo, (a cut-flower importer) (June 1994) *pers. comm.*

2.3.2 Costs of the Japanese Cut-Flower Distribution Channels

The largest single cost in Japanese cut-flower marketing and distribution channels is the retail margin. Retailers charge anywhere between 100 and 200 and even 300 per cent retail margins. They justify these high retail margins with two incongruent statements. Firstly, the end users demand a relatively stable retail price, and secondly, the wholesale auction price is varies considerably. Therefore the retailers believe that they must act as buffers between the variable prices of wholesale auctions and the stable retail prices.

Other costs in the distribution channel are comparatively small, however the longer the distribution channel, as measured by the number of members in the channel, the higher the marketing and distribution costs. For imported cut-flowers, whether they be Calla lilies, orchids or another flower, the marketing channel generally involves exporters, importers, wholesale auctions and retailers. Normally the importer acts as an agent of the exporter, collecting a 10 per cent commission (New Zealand Calla Council, 1993). The importer clears the flowers through customs and quarantine, while the exporter is responsible for any costs incurred from quarantine and customs procedures.²⁰ Title of the flowers generally belongs to the exporter until title passes at the wholesale auction.²¹ The importer then sells the flowers, on behalf of the exporter, at the wholesale auction on a consignment basis.

A direct purchase agreement is an alternative to selling the flowers on consignment at the auction markets. A direct purchase agreement is where the importer repacks the flowers and sells them direct to a retailer. A higher commission of 20-30 per cent is levied where for the extra services supplied. Generally direct purchase agreements involve the importer repacking and regrading the flowers into shipments small enough for individual retailers to handle (New Zealand Calla Council, 1994).²² However generally only the larger retailers use direct purchase agreements.

²⁰ Yoshimoto, C., Main Trader, Toa Trading Co. Ltd., Osaka (a cut-flower importer) (June, 1994) *pers. comm.*

²¹ Baldwin, S., Marketing Executive, Flower Exports, Chiquita Brands New Zealand Ltd., Auckland (a cut-flower exporter) (April, 1994) *pers. comm.*

²² Kayani, T, President, Create Co. Ltd., Osaka (a cut-flower importer) (June, 1994) *pers. comm.*

As for Japanese produced cut-flowers, it is normal practice for an Agricultural Cooperative, or Union to purchase cut-flowers from the producer and sell them at the wholesale auctions. Sometimes growers bypass the Agriculture Cooperatives and sell the fresh cut-flowers direct to wholesale auctions. The purchaser at the wholesale auctions is either a retailer, transporter or a secondary wholesaler. Secondary wholesalers normally add a 10-20 per cent margin to the primary wholesale auction price before selling the cut-flowers (Kitson and Dunphy, 1981).²³ In many cases secondary wholesalers operate secondary wholesale auctions.

²³ Nobayashi, H., Managing Director, Art Vahno Corp., Tokyo, (a cut-flower importer) (June, 1994) *pers. comm.*

2.4 Consumption

Every year the Japanese spend more and more money on fresh cut-flowers. Recent years have seen a steady upwards trend in retail sales (Prime Ministers Office, Tokyo 1994). In 1992 the Japanese Ministry of International Trade and Industry surveyed the 25,940 retail outlets of fresh flowers in Japan. In 1994, the Japanese Ministry of Agriculture, Forestry and Fisheries conducted more in depth research into the wholesale cut-flower market in Japan. Table 2.2 presents summary data from this investigation of the Japanese cut-flower wholesale market.

Table 2.2 Summary Statistics of the Total Japanese Calla Lily Retail Market.

	1989	1990	1991	1992	1993
Value (Million Yen)	48.133	100.568	223.605	247.410	324.030
Volume ('000 Stems)	482.56	761.4	1,745	2,055.4	2,933.4
Average Price (Yen)	99.76	132.09	128.14	120.37	110.46

Source:(Japanese) Prime Minister's Office, 1994. Research undertaken by the Japanese Ministry of Agriculture, Forestry and Fisheries.

With the underlying trend towards casual flowers, people in the Japanese cut-flower wholesale marketing channel expect imported flowers to become less expensive.²⁴ This trend is not expected to reverse even as the Japanese economy improves, as Japanese industry now understands that it can not afford to spend large sums of money on luxuries.^{25 26}

²⁴ Kimoto, S., Director, General Manager, Cut Flower Division, Corunum Corp., Tokyo (a cut-flower importer) (July, 1994) *pers. comm.*

²⁵ Kawano, Prof. T., Faculty of Economics, Hitotsubashi University, Tokyo (June, 1994) *pers. comm.*

²⁶ Sugimoto, M., Managing Director, Osaka Chamber of Commerce and Industry, Osaka (June, 1994) *pers. comm.*

The Japanese casual flower retail market is still establishing itself. In the past exporters did not consider casual flowers to be very important in the Japanese market. Recent years have seen the emergence of increasing demand for casual flowers. The extremely high quality standards imposed on formal flowers do not necessarily apply to casual flowers.²⁷ Today casual flowers rival formal flowers for volume demanded. With the recent market development of casual flowers it is generally accepted that casual flower demand will continue to grow (New Zealand Trade Development Board, 1993; New Zealand Calla Council, 1993; and the International Trade Centre UNCTAD/GATT, 1991). It is expected that eventually demand for casual flowers will exceed demand for formal (or institutional) flowers.²⁸

This means that overall the Japanese cut-flower market is expected to continue expanding, as consumer demand appears to exceed supply.²⁹ This is evidenced by the high retail price of flowers in Japan, as excess demand would reduce the retail price. Satisfying the Japanese demand for casual flowers means that imported flowers need to become lower priced than they currently are. It is important to stress that the market for formal flowers will most likely continue to exist, however the growth of the Japanese cut-flower market is in the continued development of the casual flower market.

The switch from formal flowers to casual flowers dominating the Japanese fresh cut-flower market may be a result of the economic recession that Japan felt in the early 1990's. The subsequent collapse in asset values of many Japanese people resulted in severe reductions in their marginal propensity to consume (New Zealand Trade Development Board, 1993). The floricultural sector, along with other sectors were hard hit by the economic recession and resultant asset devaluation.

Because of the recession the high quality and high priced gift and institutional sectors of the Japanese retail cut-flower market faltered. This resulted in a sharp decrease in the market size for gift and institutional fresh flowers. However the private consumption of fresh flowers was not significantly effected by economic recession

²⁷ Kawano, Prof. T., Faculty of Economics, Hitotsubashi University, Tokyo (June, 1994) *pers. comm.*

²⁸ Sugimoto, M., Managing Director, Osaka Chamber of Commerce and Industry, Osaka (June, 1994) *pers. comm.*

²⁹ Sakamoto, Y., President, Y.M.S. Co. Ltd., Osaka (a cut-flower importer) (June, 1994) *pers. comm.*

nor the resultant aftermath that caused the high priced sectors of the floricultural market to stumble.³⁰ This meant that overnight the private consumption sector enlarged it's share of the retail cut-flower market in Japan.

The idea of casual flowers evolved because individuals could not afford formal flowers that companies preferred. The trend away from formal flowers has been enhanced by institutions and companies recognising that they can no longer sustain the level of expenditure on formal flowers that they had in the 1980s. The emerging importance of casual flowers not only demands lower prices but also allows for lower quality flowers.³¹ However it is important to note that no reduction in import quarantine requirements are expected (Prime Minister's Office, 1994).

As a whole the Japanese cut flower market is highly seasonal. Peaks in demand for specific varieties remain centred on traditional festivals (New Zealand Trade Development Board, 1993). Many importers and auctioneers are confident that New Zealand flowers will soon begin to dominate the import market. To achieve this it is necessary for New Zealand to further exploit off season supply by exporting more main stream flowers, such as roses and carnations.³² In this respect New Zealand has a unique advantage over northern hemisphere floricultural industries. Also the reputation of the New Zealand flower industry is relatively good in comparison with other southern hemisphere producers.

The Japanese cut-flower market holds specific floricultural crops produced in New Zealand, such as the Calla lily, Santisonia and Cymbidium orchids in high esteem. This is despite the fact that Japanese people consider all imported flowers to be of an inferior quality to Japanese flowers. The development of new colours of existing varieties and new varieties is essential to the success of the New Zealand cut-flower export industry as a whole. On top of this the New Zealand floricultural industry must be aware of the changes occurring in the structure of the Japanese distribution system. It must also understand the changing demand requirements and supply for the increasing demand for casual flowers in Japan.

³⁰ Kawano, Prof. T., Faculty of Economics, Hitotsubashi University, Tokyo (June, 1994) *pers. comm.*

³¹ Kimoto, S. Director, General Manager, Cut Flower Division, Corunum Corp., Tokyo (a cut-flower importer) (July, 1994) *pers. comm.*

³² Hanano, Y., Deputy General Manager, Horticulture Department, Mitsui, O.S.K. Kogyo Kaisha, Ltd., Tokyo (a cut-flower importer) (June, 1994) *pers. comm.*

CHAPTER THREE

REVIEW OF THE RELEVANT LITERATURE

The purpose of this chapter is to review the relevant literature on the impact of market uncertainty on profits, Constant Market Shares Analysis, and alternative methods of optimisation.

3.1 Review of the Literature Pertaining Uncertainty and a Lack of Market Knowledge

Conceptually it is easy to see that producers would be hesitant to supply markets of which they have little prior knowledge. In general it could be said, that producers are relatively risk adverse. This is exemplified by their involvement in market and technological research. Being profit maximising entities, each producer would prefer to have perfect information, which would enable them to determine the optimum time and product range to supply each market.

However, perfect market information is impossible to attain. Instead producers must make do with partial information. With insufficient market information, producers may have little concept of market trends, their competitors, and how to maximise profits at each market. Despite the importance of such information, little research has been specifically conducted on the significance of market information on producer/supplier profitability. It appears to be generally accepted that for an industry where all producers are equal in all respects, except that one producer has superior market information, that that producer has the capacity to achieve higher profits than their competitors. Even research into the knowledge based advantages of domestic suppliers over foreign suppliers is seldom mentioned in the literature.

It is normally the role of the marketing and distribution channels to provide market information. Consider a marketing channel consisting of a producer, an exporter, an importer and a retailer. Normally market information, that the producer requires to maximise profit, would flow backwards up the marketing channel.

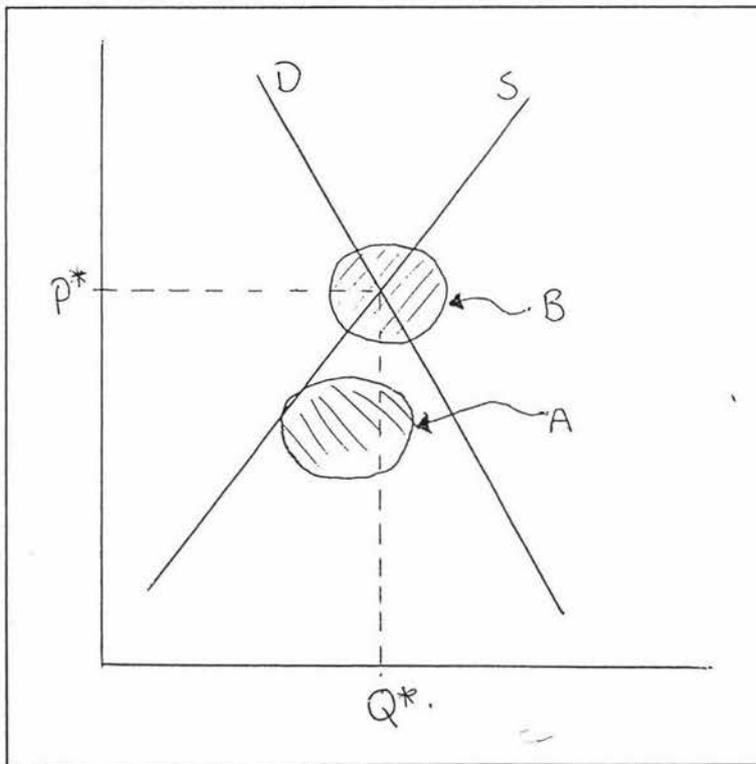
Where this system 'breaks down', the producer has to rely on alternative sources of market information (Freebairn, 1973). However alternative sources are often employed to supplement market information gained from the marketing and distribution channels. Without perfect market information the decision maker (the producer) is not always able to choose the *ex post* optimum product set to trade, the amount of each product to trade, nor which markets to supply (Freebairn, 1973).

Freebairn points out that the difference in profits between the optimum decision and the actual decision (based on imperfect knowledge) can actually be viewed as a loss. This point is demonstrated by two examples, one based on market uncertainty, whereas the second example involves technological uncertainty. The framework in

which these examples are illustrated is that of statistical decision theory.¹ Freebairn considers a single producer who is a price taker and has the objective of maximising their expected utility (which is approximated to be short run profit). The concept behind Freebairn's method is that if a business could predict market prices with certainty, it would be able, on average, to attain a higher level of profit.

Improved market information would also reduce the terms of trade and increase producer welfare (Freebairn, 1973). Superior information has two forms of potential benefit. Firstly, the bias of a firm's estimate of prices could be reduced, and secondly, the variance of such price estimates could also be reduced. Figure 3.1 signifies that a firm's estimate of price (area A), where due to insufficient market information they consistently underestimate the price. Therefore Figure 3.1 shows the bias of the firm's estimate. Area B represents an unbiased estimate of price, P^* .

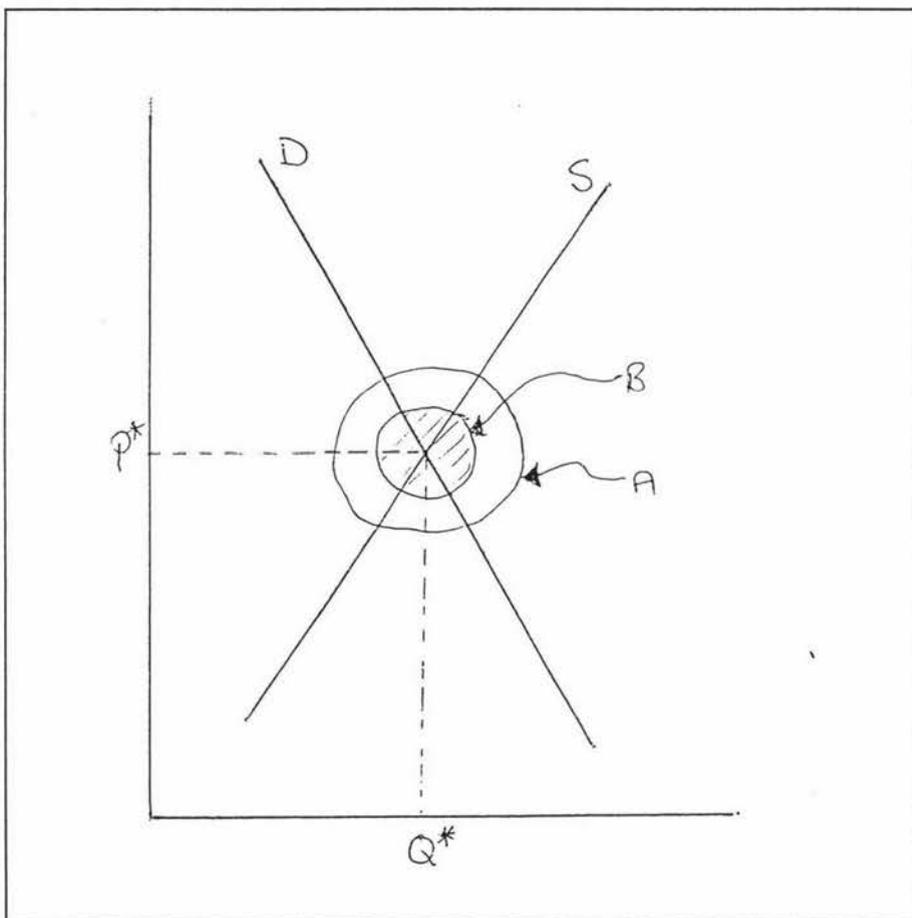
Figure 3.1 A pictorial view of a firms biased estimate of the actual price, P^* .



¹ Freebairn (1973) states that suitable discussions of the procedures and the axioms on which these procedures of statistical decision theory are based include: Raiffa, H. (1968) *Decision Analysis*, Reading, Addison; and Dillon, J.L. (1971); and An Expository Review of Bernoullian Decision Theory in Agriculture: Is Utility Futility? *Review of Marketing and Agricultural Economics*, 39: March;

Figure 3.2 demonstrates the variance of a firm's estimate of prices. In this example, the supplying entity is non-biased, however with imperfect information their estimate is varied. Therefore, over time, they will predict prices in area A. However if these firms were to gain more accurate and reliable market information, then their prediction of the market price would be constrained to the less variable area B. This shows that a decision maker with better information will make more consistent, less variable estimates of prices.

Figure 3.2 A graphical illustration of the impact of information on the variance of a price estimate.



3.2 Review of the Literature Pertaining to Constant Market Shares Analysis

This section details some of the research that has been undertaken using the Constant Market Shares technique. The three articles reviewed in this section are Sprott (1972) on Australian wheat exports, Alias and Suleiman (1993a) on Malaysian, Thai and Indonesian natural rubber exports, and Ahmadi-Esfahani (1993) on the Egyptian wheat market. These three articles were chosen because they represent a wide range of applications of Constant Market Shares Analysis.

Sprott (1972) uses the 'second level decomposition' of the Constant Market Shares Analysis (CMSA) identity to explain the changes of Australia's wheat exports between 1950/51 and 1969/70 (Sprott, 1972). The second level decomposition is also known as traditional CMSA. Traditional CMSA is a very simply analytical framework which is based on a derivation of the identity that a change in volume (or value) is equal to the initial volume (value) less the final volume (value). Therefore CMSA is an ex-post analytical technique of a deterministic nature. Despite the obvious limitations of CMSA (e.g. the inability to forecast, or estimate changes in market shares) the simplicity of this technique has proven to be useful in exploratory analyses.

Sprott (1972) employs traditional CMSA to explain changes in the export performance of the Australian wheat industry between 1950/1 and 1969/70. The second level decomposition of the CMSA identity has three components, these being the structural effect, the second order effect and the competitiveness residual. Sprott found that the structural effect was the largest portion of the total gain that Australia had made since 'period 1' (the average of 1954/55 to 1957/58). The competitiveness residual was the second largest effect while the second order effect was small.

The structural effect accounted for 51 per cent (75.8 million bushels of wheat) of the total gain (148.8 million bushels). In terms of Australian wheat exports, the structural effect accounts for the part of the total gain which is explained by the overall growth in the global trade of wheat. The competitiveness residual accounted for 46.5 per cent (69.2 million bushels) of the total gain. The competitiveness residual is calculated as the difference between actual exports in period 2 (for Sprott's paper, period 2 is the average of 1966/67 to 1969/70 Australian wheat exports) and the hypothetical exports in period 2 at the period 1 global market share. Sprott found that the second order effect accounted for 3.7 million bushels (2.5 per cent of the

total gain). This means that the difference between the hypothetical exports in period 2 at the period one market shares in each designated market is only marginally larger than the hypothetical exports in period 2 at the global market share for Australian wheat exports in period 1.

In contrast to Sprott's use of traditional CMSA, Alias and Suleiman (1993a) employ traditional CMSA to explain why Malaysia has suffered a relative decline in its export market share of natural rubber. This shows the range of situations where CMSA can be usefully employed. This diverse range is extended when one considers that the seminal study of export performance using the CMSA decomposition (Tyszynski, 1951) was conducted on manufactured commodities, whereas Sprott, Alias and Suleiman and Ahmadi-Esfahani all conducted CMSA on agricultural commodities. The different levels of the CMSA decomposition are more fully discussed in Appendix Two.

Alias and Suleiman (1993a) used the second level decomposition of the CMSA identity. An analysis of Malaysia's natural rubber by destination show considerable structural changes in Malaysia's share of the global market (Alias and Suleiman, 1993a). The analysis shows a discernable decline in Malaysia's market share in all markets, especially the EC and the former USSR. In fact, Malaysia has experienced an absolute decline in natural rubber exports from 1976 to 1990.

CMSA apportions this actual decline into structural components and a residual competitiveness effect. If Malaysia maintained its 1976 market share (51.9 per cent) in 1990 then total exports would have been 2,105,600 tonnes, as compared with the actual total Malaysian exports of 1,150,800 tonnes. However if Malaysia had maintained its 1976 market share in each individual market, total exports would have been 1,976,600 tonnes in 1990. The second order effect (known as the market distribution effect) is equal to the difference of these two hypothetical total export volumes for 1990 (i.e. -129,100 tonnes). As the second order effect is negative, CMSA indicates that Malaysia's exports of natural rubber are concentrated in markets where demand is growing at a pace that is slower than the growth of world demand.

The difference between the hypothetical exports in 1990 at 1976 market shares and the actual 1976 exports of natural rubber from Malaysia (485,500 tonnes) is the structural effect. The concept that CMSA distinguishes here is that if a country maintains market share and global demand for that product is growing, then the exporting country can expand exports. The competitiveness residual is found by

subtracting the structural and second order effects from the total gain/loss. This competitiveness residual is the largest traditional CMSA component (-654,800 tonnes). The same analysis was also undertaken on natural rubber exports from the other two major suppliers, Indonesia and Thailand, however Malaysia is the focus of Alias and Suleiman's paper.

Alias and Suleiman account for both the absolute and relative decline in Malaysia's natural rubber exports with qualitative reasons for this result. According to Alias and Suleiman (1993a) Malaysia has concentrated on producing high quality natural rubber, which they export to higher priced niche markets. Malaysia has also witnessed a large increase in the domestic use of natural rubber, this in combination with fewer plantings, has resulted in less natural rubber available for export.

Alias and Suleiman conclude that while CMSA is useful in indicating the direction of individual components of market share, the results need to be supplemented with an analysis of non-price factors. This conclusion is based on the need to clarify the result for the competitiveness residual as it is in some ways misleading.

In an attempt to determine the impact of the US Export Enhancement Programme (EEP) and EC subsidies on relative shares of the Egyptian wheat market, Ahmadi-Esfahani (1993) employs both traditional CMSA and an improved version of the CMSA identity. The Egyptian wheat market has expanded from four per cent of the world market in 1974/5 to seven per cent in 1989/90. This rapid increase led to Egypt becoming one of the more sought after wheat markets. Hence the introduction of the US EEP and EC subsidies were seen as ways to improve the individual export share of these (and other) countries in the Egyptian market.

Improved CMSA is also referred to as the third level decomposition of the CMSA identity (Jepma, 1986). Ahmadi-Esfahani states this improved identity and distinguishes it from the simple first level identity.² Ahmadi-Esfahani briefly mentions the index and order problems that Jepma's improved CMSA identity solves.

Jepma's improved CMSA identity is designed for examining the total exports of one country, so Ahmadi-Esfahani amends the basic improved CMSA identity by removing both the commodity effect and the structural interaction effect. This is done because Ahmadi-Esfahani's paper examines the export of one commodity (wheat) to one

² Details of the development of the improved CMSA identity are provided in Appendix Two.

country (Egypt) from four suppliers. Each of the seven components of the improved CMSA identity are defined and explained in Appendix Two.

Both the traditional CMSA identity (equation A2.2) and the improved CMSA identity (equation A2.9 as revised by Ahmadi-Esfahani) are employed in Ahmadi-Esfahani's paper. Using both decompositions demonstrates the advantages of the improved identity over the traditional CMSA identity.

The results of Ahmadi-Esfahani's study of the Egyptian wheat market indicate that the USA has outperformed the three other major wheat exporters (Canada, the EC and Australia). This is understood to have resulted from the introduction of the US EEP, which despite the high market share that the US had in the pre-1985 period, appears to have increased the US share in the Egyptian wheat market. The CMSA results suggest that the market share gains of the US have chiefly been made at the expense of the EC and to a lesser extent, Australia.

Despite this improvement for the US, Ahmadi-Esfahani is quick to point to other studies of the US EEP, such as Abbott *et al.*, 1987 and Seitzinger and Paarlberg, 1990.³ Such studies have shown that the benefits of the EEP are marginal and are not necessarily globally beneficial to the US. Ahmadi-Esfahani, like all other researchers who have used CMSA, clearly states that other methods, such as non-price analyses, are required to verify and supplement the CMSA results.

³ The full references for these two articles are:

Abbott, P.C., Paarlberg, P.L., and Sharples, J.A. (1987) Targeted agricultural export subsidies and social welfare, *American Journal of Agricultural Economics*, 69(4), pp723-732.

Seitzinger, A.H., and Paarlberg, P.L. (1990) A simulation model of the US export enhancement program for wheat, *American Journal of Agricultural Economics*, 71(1), pp95-103.

3.3 Review of the Literature Pertaining to Optimisation

Optimisation, whether it be the timing of supply, or spatial allocation of limited resources, has been conducted using various methods. Such methods include the Lagrangian method (Liu and Forker, 1990; Collender and Zilberman, 1985; and Rae, 1978), the Hamiltonian method (Kellogg, Easley and Johnson, 1988) and simulating Markovian relationships (Hochman, Leung, Rowland and Wyban, 1990 and Garoian, Mjelde and Conner, 1990). A brief review of the literature for each of these three methods is discussed below.

3.3.1 The Lagrangian Method

Employing the Lagrangian expression is a very simple method for optimising economic factors that are subject to constraints. This method of optimisation involves setting the partial derivatives of the Lagrangian expression, taken with respect to each of the 'n' variables and 'r' Lagrangian multipliers in turn, to zero. The next step is to solve the resulting set of (n+r) simultaneous equations. (Allen, 1967)

Research undertaken by Liu and Forker (1990) investigates the optimum level of expenditure on New York State milk promotion. The premise for their research is that "non-optimum allocation of funds miss opportunities to achieve higher returns" (Liu and Forker, 1990). Their rationale is concerned with the possibility of potential losses which emphasises the importance of understanding the economics of dairy promotion. From this and previous research they approach the issue of promotion expenditure as a problem of optimal control.

The Lagrangian expression is employed to provide insight into the optimal level of expenditure on New York State milk promotion. The solution of the Lagrangian gives the constraint that total sales of fluid milk are equal to the total farm supply of milk in the state of New York. This accounts for 'n' first order solutions as Liu and Forker accounted for 'n' months in their research. The one other first order solution is the differential of the Lagrangian expression with respect to the Lagrangian multiplier. The 'n+1' solutions are the optimal allocation of advertising expenditure over the 'n' months. Therefore the last dollar spent on advertising equals the shadow value of the additional fluid milk sales. This is the allocation at which the optimal expenditure on New York State milk promotion occurs.

An important limitation that Liu and Forker's point out, is that the conditions of the Lagrangian expression limit the optimal solution to a steady state. Therefore the optimal steady state level of expenditure is interpreted as being when the marginal benefits of advertising are equal to the marginal opportunity cost of advertising.

Collender and Zilberman (1985) modelled the optimal allocation of land to alternative agricultural industries, where returns are uncertain. Collender and Zilberman's paper develops a general framework for allocating land. The allocation of land under this general framework was optimised using the Lagrangian multiplier technique.

The problem that Collender and Zilberman solve is how many acres of land should a farmer allocate to each crop. This is where the area of land is restricted to 'l' acres and there are 'N' alternative crops. Therefore the solution of the Lagrangian expression has N+1 first order conditions. The first N conditions are the derivative of the Lagrangian expression (L) with respect to the price is each month while the other first order condition is the differential of L with respect to λ , the Lagrangian multiplier.

Upon substitution of the constraint derivative solution into the N first order conditions, the solution value for λ is found. This value of λ is then used to calculate the optimum area of land to allocate to each crop. Thereby maximising net returns to the farmer, given the constraints of overall land area and number of crops.

The same approach is applied to maximising revenue net of storage costs for the New Zealand Apple and Pear Marketing Board (the Board). The strategic problem that Rae (1978) answers is, given the ability and cost of storing apples, when is the optimum time to sell the fruit. The first hypothesis of Rae's study states that "the Board has consistently sought a weekly pricing and storage policy that would not maximise net revenue from given supplies and demands" (Rae, 1978). Whereas the second hypothesis deals with the difference in the consumers' welfare between the Boards' consistent week to week price stability policy and the profit maximising pricing policy.

As the relevant point here is the use of the Lagrangian expression, the method pertaining only to the first hypothesis is explained. Firstly, the total revenue equation is expressed along with an equation for the total quantity over the time constraint (K). Where K is defined as:

$$K = \sum_{t=1}^T \hat{Q}_t$$

where \hat{Q}_t = weekly estimates of sales volumes from the demand equations, and t = each week in which a price is estimated.

As the research conducted by Rae (1978) focused on total revenue (TR) net of total variable storage costs (VSC) the Lagrangian expression (L) is formed:

$$L = TR - VSC + \lambda(K - \sum_{t=1}^T \hat{Q}_t)$$

where λ = the Lagrangian multiplier.

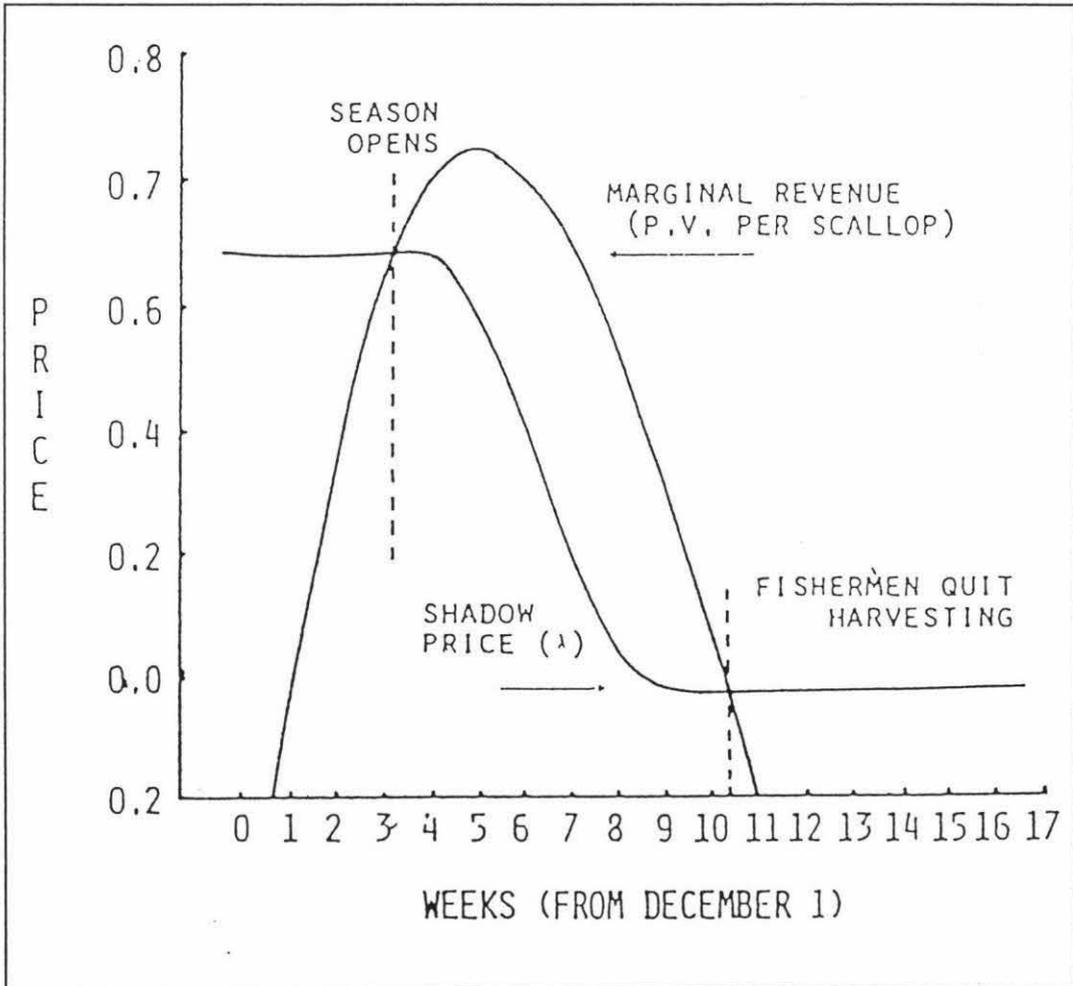
The differential of L with respect to price t in each week along with the differential of L with respect to λ forms T+1 differential equations. The objective is to maximise L as this maximises total revenue net of total variable storage costs, given the quantity constraint. To do this, each of the T+1 differential equations is set to zero and the equations are solved for λ . Rae undertook an iterative procedure to determine the value of λ that held true for the T+1 differential equations.

The conclusions reached support both hypotheses. Therefore Rae (1978) concludes that the empirical evidence suggests that the Board has not maximised profits, and therefore has discriminated against suppliers. This is because the Board has forgone small amounts of revenue, less than ten per cent of the Board's actual revenue, and consumers have enjoyed a consumer surplus approaching 40 per cent. This means that the Board " has chosen a policy which has resulted in considerable gains to consumers, at a relatively low cost to growers." (Rae 1978)

3.3.2 The Hamiltonian Method

Kellogg, Easley and Johnson (1988) used the Hamiltonian method to determine the optimal season to harvest scallops in North Carolina bay. They employ the Hamiltonian as a switching function, which indicates whether the season should be open or closed. This decision is dependent on the relative size of the 'user cost per scallop' and the 'discounted net revenue per scallop harvested.' If the user cost exceeds the discounted net revenue, on a per unit basis, then the season should either close, or remain closed, i.e. the switching function is negative. However if the per unit discounted net revenue equals or exceeds the per unit user cost, then the season should be open as the switching function is positive.

Figure 3.3 A graphical illustration of the procedure for solving for the optimal harvest period.



Note: Price is in 1967 cents and $\lambda_0 = 0.007$.
 Source: Kellogg, Easley and Johnson (1985, page 58)

A dynamic programme is employed to determine the optimal harvest season using the Hamiltonian expression. The Hamiltonian is first determined before the harvest season begins. As is expected the switching function is negative. Where the switching function is negative in one week, the dynamic programme skips to the beginning of the next week and the Hamiltonian is rerun. If the switching function in this week is positive, then the programme solves two differential equations before advancing to the next week. The first differential equation is solved for a new 'x' (equation of motion) and the second differential equation is solved for ' λ ' (the per unit user cost) (Kellogg *et al*, 1988). Figure 3.3 shows how λ moves throughout a season for the harvest of North Carolina Bay Scallops.

Figure 3.3 shows the trend of λ where λ_0 is set at 0.007. This is because the general solution of the adjoint equation requires that λ be defined at a specific point in time (λ_0). The optimal solution is then found by varying λ_0 until the switching function, which corresponds to the maximum net present value of the season harvest, is identified (Kellogg *et al*, 1988).

The optimal λ_0 gives the optimal time to open and close the season. The results show that the optimum time to open the season was between the first week of January and the first week of February. However, the North Carolina bay scallop season has historically been opened in early December. But, more recent seasons have seen the opening of the season delayed until early January, is recognition of the optimum time to open the season.

3.3.3 The Markovian Method

Markovian relationships can also be employed to determine the optimum timing of supply. The Markovian decision process has been applied to optimally schedule the harvest of shrimp mariculture (Hochman, Leung, Rowland, and Wyban, 1990) and to determining optimal strategies for marketing rangeland calves and yearlings (Garoian, Mjelde, and Conner, 1990).

When shrimp producers decide to harvest their crop, they simultaneously determine revenue for themselves, as they are price takers. The problem lies in when is the optimal time to harvest (Hochman *et al*, 1990). The optimal harvest policy takes into account the decision to enter the new season with either the existing crop, or to sell the existing crop and begin with young stock.

The efficiency of the algorithm is improved by making use of three nested loops. The first loop is a search which begins at the time of highest revenue. The search continues down to the lower revenues, but it never reaches the lowest revenue. This is because the search stops at the first 'cut-off' revenue that results in keeping the shrimp for another week. The search then moves onto the second loop. This loop considers all possible ages for the shrimp. The search begins at the youngest shrimp, at that week, along with the solution for the relevant cut-off revenue, and progresses to the older shrimp. The third loop introduces the preceding week and then repeats loops one and two. This process continues until the third loop has accounted for all 52 weeks in the year.

Following this, the algorithm is employed on the previous years data. Once all three steps are completed, the two years are compared, and the algorithm is used to determine the optimal harvest policy in each year equal. Markovian analysis results in a single number. For Hochman *et al*'s paper, this number ranges between zero and 20. The closer that this number is to 20, the higher the cut-off revenue and therefore the higher the possibility that harvest will be postponed until the next week. A harvest and sell situation occurs when the number is zero. For any given week, the number falls as the shrimp age, this is because shrimp need to be a certain size before they are worth harvesting.

Hochman *et al* (1990) conducted this analysis for each week of the year, thereby taking into consideration seasonal implications. The results that they gained, show that the shrimp tend to be ready for harvest 15 weeks from introduction to the ponds. In late autumn and early spring the shrimp tend to grow quicker, thereby enabling early harvesting in these months.

Garoian *et al* (1990) use Markovian relationships in dynamic programming to optimise strategies for the marketing of rangeland calves and yearlings in the United States. The methodology centres on the decision of whether to sell the cattle as calves in October, or to retain the calves and sell them as yearlings seven months later in May. In May all yearlings are sold and are replaced by calves. The decision process is undertaken in October and May for each year of the 'planning horizon'.

Incorporating the Markovian relationships between the price variables for calves (October) and yearlings (May) into the dynamic programme enables the optimal decision to be made. Garoian *et al* (1990) consider only these two (May and October) decision points in each year. For the May decision point the dynamic programme

quantifies the number of yearlings available for sale and the yearling prices. Whereas for the October decision the number of calves available for sale, and their respective prices are computed. The dynamic programme takes both these decision points into account before determining the optimum number of calves to sell in October thereby leaving the optimum number of yearlings for the May sales.

The results of the work carried out by Garoian *et al* (1990) suggest that net farm revenues can be increased by holding smaller cow herds and retaining more calves in October to sell as yearlings in May. This is because current practice commonly involves larger herds and a substantial number of calves being sold in October. This is due to the pressures on feed and other resources of over-stocking over winter.

3.3.4 Rational for Employing the Lagrangian Expression

Both the Hamiltonian and the Markovian methods relate to the optimisation of a switching function. The Markovian method was used to determine the optimal time to harvest shrimp (Hochman, *et al.*, 1990) and to determine the optimal decision of whether to sell calves in October, or wait until May and sell them as yearlings (Garoian *et al.*, 1990). Whereas the Hamiltonian was used to determine the optimal time to open and close the scallop harvesting season in North Carolina Bay (Kellogg *et al.*, 1988).

Each of these two methods are perfectly adapted for applying as a switching function. However, switching functions are a less appropriate method for determining the optimal volume of Calla to supply in each month. For this reason the Lagrangian was investigated. The Lagrangian, as applied by Rae (1978) was used to determine the optimal volume of apples to sell each week of the season.

Similarly Liu and Forker (1990) employed the Lagrangian to provide the optimal solution for allocating promotion funds for the New York State milk industry. Collender and Zilberman (1985) modelled the optimum land allocation to alternative agricultural industries. Like this research, these situations were unsuitable for being solved by a switching variable. Therefore, the Lagrangian method was seen to be the most simple and appropriate method for optimising the supply schedule of imported Calla to the Umeda wholesale cut-flower auction market. The optimal solution is calculated in a similar manner to Rae, (1978), Liu and Forker, (1990) and Collender and Zilberman (1985).

CHAPTER FOUR

DATA COLLECTION AND EXPLORATORY DATA ANALYSIS

The first purpose of this chapter is to explain how data was collected and to discuss what data was collected. The second purpose of this chapter is to explore the data that was collected and to determine what trends and oddities appear in the actual data. Market size is detailed, prices at the three major auction markets are compared. This chapter also justifies the selection of the Umeda wholesale cut-flower auction market as a 'sample' of the wholesale cut-flower markets in Osaka Prefecture, and to a wider extent, the whole of Japan. Following this justification this chapter concentrates on the Umeda wholesale auction market, separating Calla into four products. These four products (Japanese white Calla, Japanese coloured Calla, imported white Calla, and imported coloured Calla) are then contrasted market trends for each product are presented.

4.1 Data Collection

Three rounds of interviews were undertaken. Each round had a different objective and therefore each type of interview was conducted in a different manner. The interviews have been named according to the chronological order in which they were conducted. This means that the first round of interviews are called 'primary interviews', with the second type being 'secondary interviews' and the final round being 'tertiary interviews'. Appendix One lists all who were interviewed in the primary, secondary and tertiary interviews.

The statistical data was collected as a part of the secondary interviews, and indeed was the principal reason for the secondary interviews. Primary interviews had the objective of explaining the distribution channel and interactions between channel members. The tertiary interviews were conducted with the objective of explaining uncertainties in the exploratory data analysis.

4.1.1 Primary Interviews

The primary interviews involved interviewing five New Zealand exporters of Calla lilies and five Japanese importers of Calla lilies and other cut flowers. Of the five Japanese importers interviewed, three operate in Osaka Prefecture and the other two operate in Tokyo. The interviews were conducted on a person to person basis. Most of the questions were of an open ended type. This ensured that the primary interviews involved considerable discussion on how the Japanese cut-flower wholesale market operates, from both the perspective of Japanese importers and New Zealand exporters.

The most important functions of the primary interviews were to increase the number of contacts in the Japanese cut-flower distribution channels and to further explain how the markets operated and who is involved. Other useful information evolved from the discussion, including the recent history of auction markets and individual wholesalers, importers and exporters (to Japan). The primary interviews highlighted the government, central and regional, pressures on the centralisation and consolidation of the wholesale auctions.

4.1.2 Secondary Interviews and Numerical Data Collection

The Japanese cut-flower distribution channels vary between different suppliers, buyers and types of flowers. This means that data collection needed to be conducted at a part of the marketing and distribution through which most cut-flowers pass, this being the at the primary wholesale auctions. Data was collected from three wholesale auction markets in Osaka, Japan. These three markets are:

Osaka Seika Oroshi Kakushiku Kaisha, Daini Eigyo Sho;
Osaka Kaki Engei Chiho Oroshi Ichiba, Umeda Kaki Ichiba and Nishi-
Nihon Co. Ltd

Data was collected for two and a half years from January 1992 through to June 1994. However data common to both the *Osaka Seika Oroshi Kakushiku Kaisha, Daini Eigyo Sho* (hereonin referred to as ‘Osaka Number Two’) and the *Osaka Kaki Engei Chiho Oroshi Ichiba, Umeda Kaki Ichiba* (hereonin referred to as ‘Umeda’) wholesale auction markets only occurred for two years, from June 1992 through to May 1994. Data was also collected from *Nishi-Nihon Co. Ltd* (hereonin referred to as ‘Nishi-Nihon’), however this is a new company and was established in October 1993. Nishi-Nihon developed as a result of the consolidation and centralisation of 21 small wholesale auctions in Osaka Prefecture.

Specifically the data that was collected from each of the three wholesale auction markets included monthly volumes and prices for white and coloured Calla. This data was further disaggregated into import supply and supplies from each of the 50 prefectures in Japan. At this stage it must be pointed out that strictly speaking the prices are ‘unit values’. This is because the prices collected are an average of prices for specific grades and cultivars of Calla supplied in each month.

The secondary interviews had the principal objective of collecting statistical data. However they also had the secondary purpose of gaining a different perspective of the Japanese wholesale market for Calla lilies. While the primary and tertiary interviews were conducted with importers and wholesalers and some New Zealand exporters, the secondary interviews involved the wholesale auction companies. Four wholesale auction companies in Osaka were interviewed. However only three were able to provide statistical data, as the fourth organisation (*Osaka Seika Oroshi Kakushiku Kaisha, Dai-ichi Eigyo Sho*), the sister company of Osaka Number Two, collapsed on June 24 a casualty of government intervention in the processes of

centralisation and consolidation.

4.1.3 Tertiary Interviews

The tertiary interviews were conducted as the statistical data from the secondary interviews became available. These interviews were also of a face to face nature and involved three distinct groups of interviewees. Firstly 16 of Japan's largest cut-flower importers and wholesalers were interviewed. These companies were sited in three different cities, Osaka, Kyoto and Tokyo. The second group of interviewees included three university professors at different universities in Osaka and Tokyo, a representative of the New Zealand Trade Development Board from their Tokyo Office and three staff at the Osaka Chamber of Commerce and Industry. The third group consists of the *Dai Ichi Seed Co. Ltd.* The manager of the Tokyo based *Dai Ichi Seed Co. Ltd.*, was interviewed because it was the largest importer (by volume) of Calla lily bulbs in Japan.

The primary aim of the tertiary interviews was to supplement the statistical data and exploratory data analysis with a qualitative description of the Japanese Calla lily market. This set of interviews also had the objective of providing qualitative information about possible changes in the structure, conduct and performance of the distribution channels and auction markets. These aspects were investigated as a direct result of the importance of the Japanese central and regional governments' ongoing intervention in the distribution and auction of fresh cut-flowers.

4.2 Exploratory Data Analysis

As the statistical data became available, exploratory data analysis was conducted with three specific purposes in mind. The first purpose was to identify errors in creating the computerised data set from the raw data. Such errors were viewed as suspiciously high or low values for prices, supply volumes and total values that did not match the remainder of the data set. The second purpose of employing exploratory data analysis was to gain statistical proof of what had been learnt in the preliminary interviews. Exploratory data analysis was also employed to further explain the qualitative information realised in the secondary interviews.

Specifically the data set was graphed and trends were observed. Any values identified as being inconsistent with expected trends were checked against the raw data, to check for errors. Corrections were made where necessary, however many of these suspect values resulted from the apparent randomness of supply by some Japanese prefectures to the specific Osaka wholesale markets. These 'random' values do not fit any trends on an individual market basis, but do conform with the trends when the data for the major wholesale auction markets in Osaka Prefecture are aggregated together.

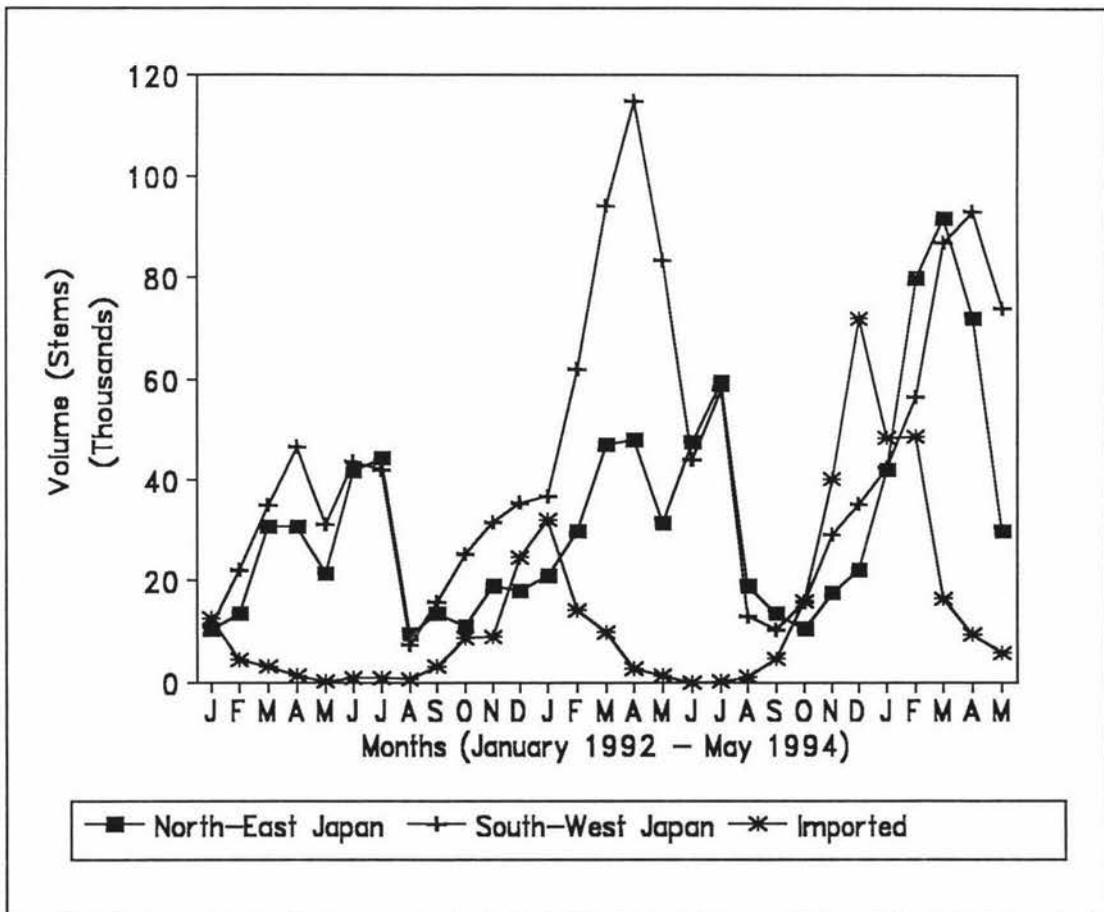
Initially the data was graphed from January 1992 through to June 1994. Then the data were graphed on an annual basis. This allowed for the direct comparison of prices, volumes and total values for each month with the other years for which data were collected. Then the price data was graphed against volume data. Trends in individual supply volumes and values were also graphed against each other.

The results of exploratory data analysis also served as pointers in the tertiary interviews. Where aspects that were not clarified by exploratory data analysis were concerned, the results made possible the quick focusing of the tertiary interviewees into providing clear and concise information on these specific areas. Therefore exploratory data analysis, in conjunction with all three types of interview, clarified what the distribution channels, market interactions and roles of different channel members were. Exploratory data analysis also provided trends in supply volumes, prices and total values, as well as adding to the information on channel member perceptions of these trends gained in the interviews.

4.3 Market Size

The size of the wholesale Calla lily market in Osaka Prefecture can be calculated in terms of both total volume and total value. Figure 4.1 shows the trend in total volume, as a measure of market size. However it is important to note that Figure 4.1 is easily misunderstood. The reason for this is, that firstly data was collected from what are now the three largest wholesale cut-flower markets in Osaka. The principal problem in comparing the three auction markets is the time period covered by the data for each market. This problem was discussed in section 4.1.2 in the discussion on numerical data collection.

Figure 4.1 Aggregate volume data for the three major wholesale cut-flower markets in Osaka Prefecture, from the three main suppliers of Calla to the Osaka markets; North-Eastern Japan, South-Western Japan, and Imports.



Source: For all figures in this Chapter, the data was independently collected from the Umeda, Osaka Number 2 and Nishi-Nihon auction markets.

Figure 4.1 also shows the relative importance of different regions of supply for Callas to the auction markets in Osaka Prefecture. The regions are North-Eastern Japan, South-Western Japan, and foreign supply (imports).^{1,2} Most importantly the graph shows that the New Zealand supply peak occurs just two or three months before the Japanese production peaks. Production in Northern-East Japan peaks two to three months after the South-West Japan. As Osaka is located in central Japan it was expected that supply is dominated by producers in the prefectures around Osaka.

It was also possible to show market share trends in terms of the value of supply. However at it was superfluous to show a total value graph as they are very similar to the volume graphs presented in Figure 4.1.

¹ The prefectures included in the North-Eastern region of Japan are Hokkaido, Aomori, Akita, Iwate, Miyagi, Yamagata, Niigata, Fukushima, Tochigi, Gumma, Ibaraki, Chiba, Tokyo, Saitama, Kanagawa, Shizuoka, Yamanashi, Nagano, Toyama, Ishikawa, Fukui, Gifu and Aichi. Whereas the South Western Region of Japan includes the prefectures of Kyoto, Shiga, Mie, Nara, Wakayama, Osaka, Hyogo, Tottori, Okayama, Shimane, Hiroshima, Yamaguchi, Kagawa, Tokushima, Kochi, Ehime, Fukuoka, Saga, Nagasaki, Oita, Kumamoto, Miyazaki, Kagoshima and Okinawa.

² Approximately 93 per cent of imported Calla are imported from New Zealand.

4.4 Comparison of the Three Auction Markets

The Osaka Number 2 wholesale cut-flower auction market is the largest in Osaka, and accounts for roughly 25 per cent of the total Osaka Prefecture market. However Osaka Number 1 and Osaka Number 2 markets have now combined, as Osaka Number 1 market crashed on June 24, 1994 and their suppliers shifted to Osaka Number 2. The resultant increase in size is the principal reason why Osaka Number 2 is not chosen as the focus market, even so data was collected for 24 months from June 1992 through to June 1994. No data was collected from Osaka Number 1 as it was seen to be a dying market as early as May 1994 by importers, wholesalers and other auctions in Osaka.

Nishi-Nihon is the newest wholesale auction market for cut-flowers in Osaka Prefecture. Nishi-Nihon began operating in October 1993 and now accounts for 15 to 17 per cent of the total market size. The principal reason for the immediate success (in terms of total market size) is because Nishi-Nihon is a consortium of many smaller markets in Osaka Prefecture. Together the members of this consortium invested in new technology to improve the efficiency of auctioning fresh cut-flowers and formed a new auction company, *Nishi-Nihon Co. Ltd.*

The Umeda Wholesale cut-flower auction market is the second largest market in Osaka Prefecture. Umeda accounts for approximately 20 per cent of the total wholesale cut-flower market. Data was collected for the Umeda market for 30 consecutive months from January 1992. As Umeda is the second most dominant auction market in Osaka and is not currently undergoing structural change, Umeda is the focus market of this research.

4.4.1 Comparison of Prices

Average wholesale auction prices for fresh Calla flowers at the three major auctions in Osaka Prefecture were graphed against each other. The purpose of this exercise is to determine how consistent the wholesale auction price is between auction markets. Figure 4.2 shows that for Japanese produced Calla the wholesale auction price is relatively similar irrespective of which of the three major auction markets that the Calla flowers are sold in.

The other important point to note in Figure 4.2 is that the wholesale price for Japanese Calla flowers peaks in September and October, when there is a severe fall in total supply. The average wholesale price then falls as the year draws to an end and is at a minimum in April, at the first peak in Japanese supply volume.

Figure 4.2 Comparison of the average wholesale auction price at the Umeda, Osaka2 and Nishi-Nihon auctions for Japanese Calla lilies.

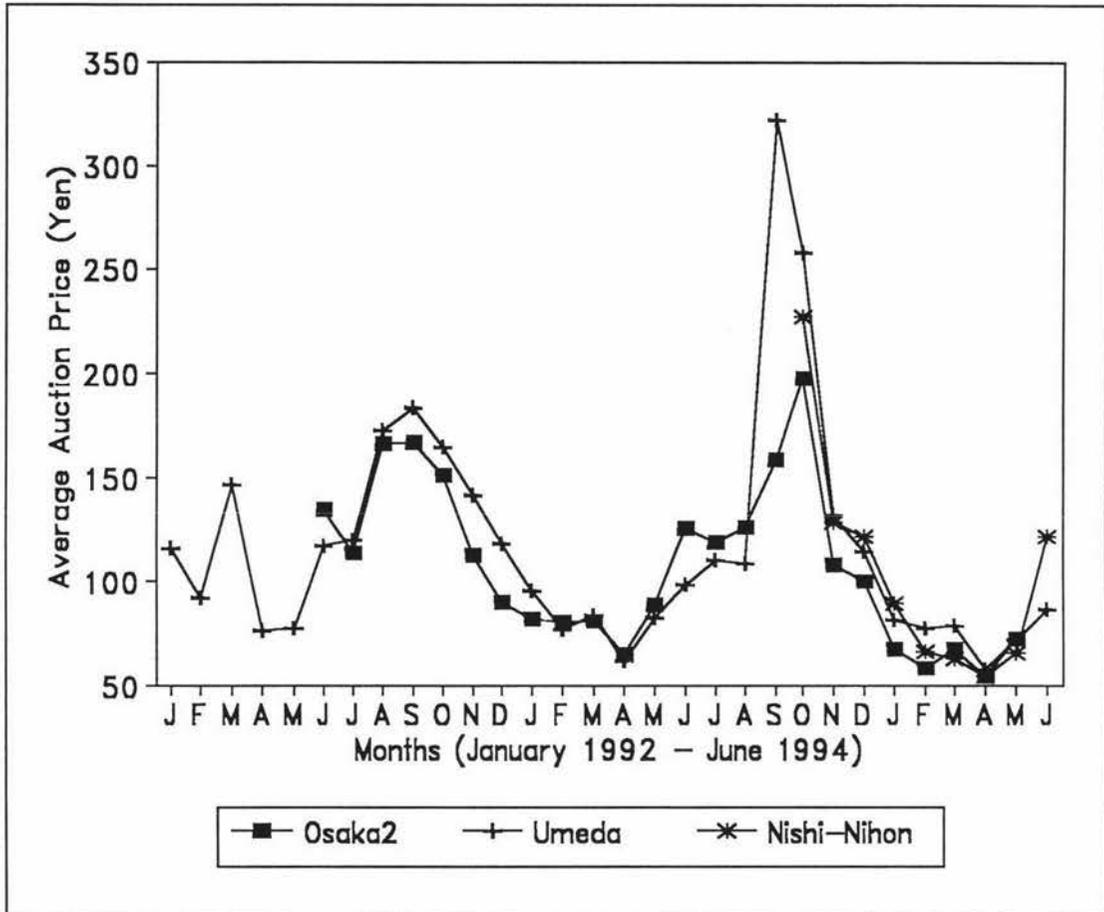
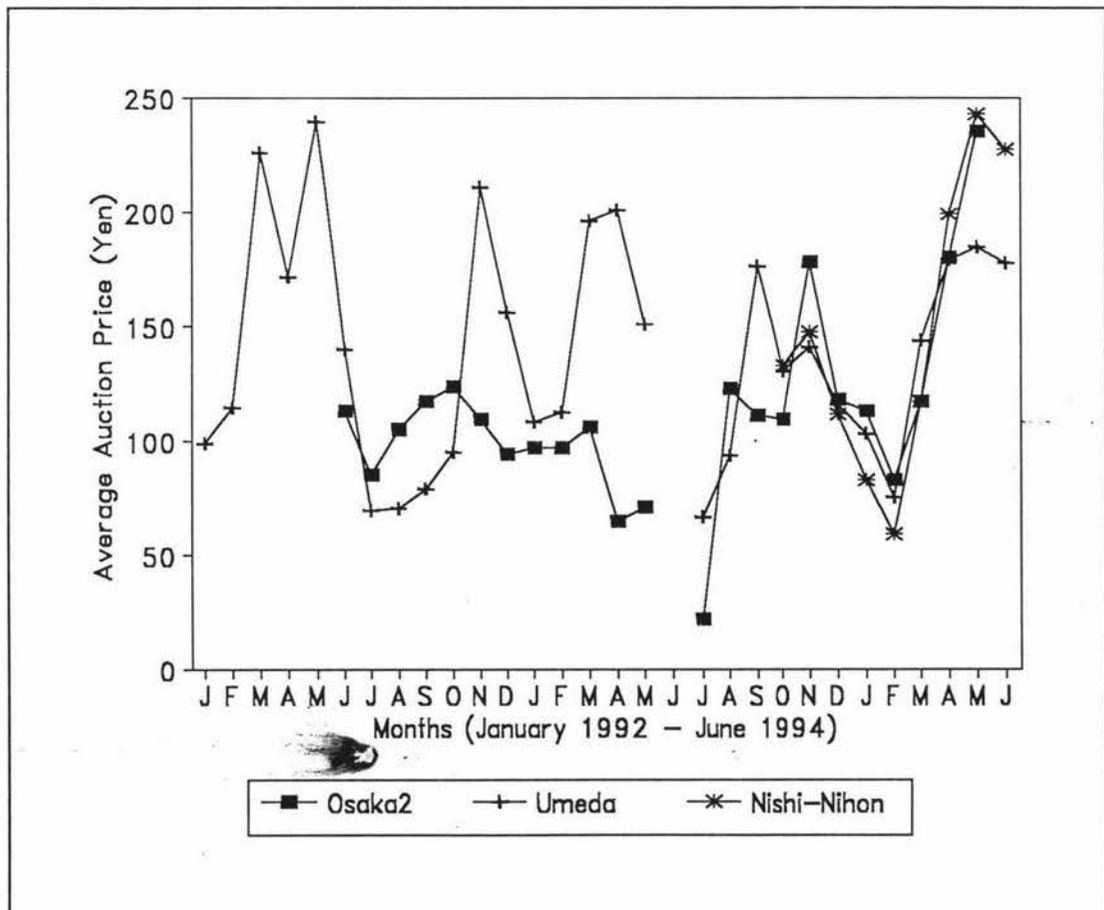


Figure 4.3 portrays the average wholesale price for imported Calla lily flowers. This graph clearly shows that prices were inconsistent between Umeda and Osaka Number 2 auction markets in 1992 and 1993. But for some reason the prices are congruous in late 1993 and the first half of 1994. This is the time period for which the Nishi-Nihon wholesale auction markets came into being and opened for business. Assuming that everything else was held constant over the data collection period (January 1992 through to June 1994), this variation in wholesale auction price could result from uncertainty about the Governments ongoing plans for consolidation and

centralisation of cut-flower auction markets.

Figure 4.3 shows that the average auction price for imported Calla lilies peaks prior to the import season (in September/October), and then again in May after the end of the import season (October through to April). The average auction price tends to fall as import volume peaks, reaching a minimum in February, which is between one and two months after the peak in import supply volume. The average auction price for imported Calla sharply rises during the months of March and April to reach the post-import season peak in May. As only minimal volumes are supplied during the months of May through to September, only a few data points exist for off import season prices. However the data points that do exist (when no imported Calla were supplied) tend to conform more with the Japanese average prices, trends downwards to a minimum in July and then quickly rising to the pre import season peak in September.

Figure 4.3 Comparison of average wholesale auction prices at the Umeda, Osaka2 and Nishi-Nihon auctions for imported Calla lilies.



The average auction price of both imported and Japanese Calla lilies indicates that the Umeda wholesale auction market is more variable than the Osaka Number 2 and Nishi-Nihon auction markets. Differences in price and supply volumes of various varieties could account for part of the variation between different markets.

4.4.2 Comparison of Volumes

In order to compare the volumes of Calla sold at the three major markets in Osaka Prefecture, the volume data for each wholesale auction market is graphed. Firstly the volumes of Japanese Calla are compared in Figure 4.4 and then imported Calla volumes are contrasted in Figure 4.5.

Figure 4.4 Total volumes of Japanese Calla lilies sold at Osaka Number 2, Umeda and Nishi-Nihon wholesale auction markets.

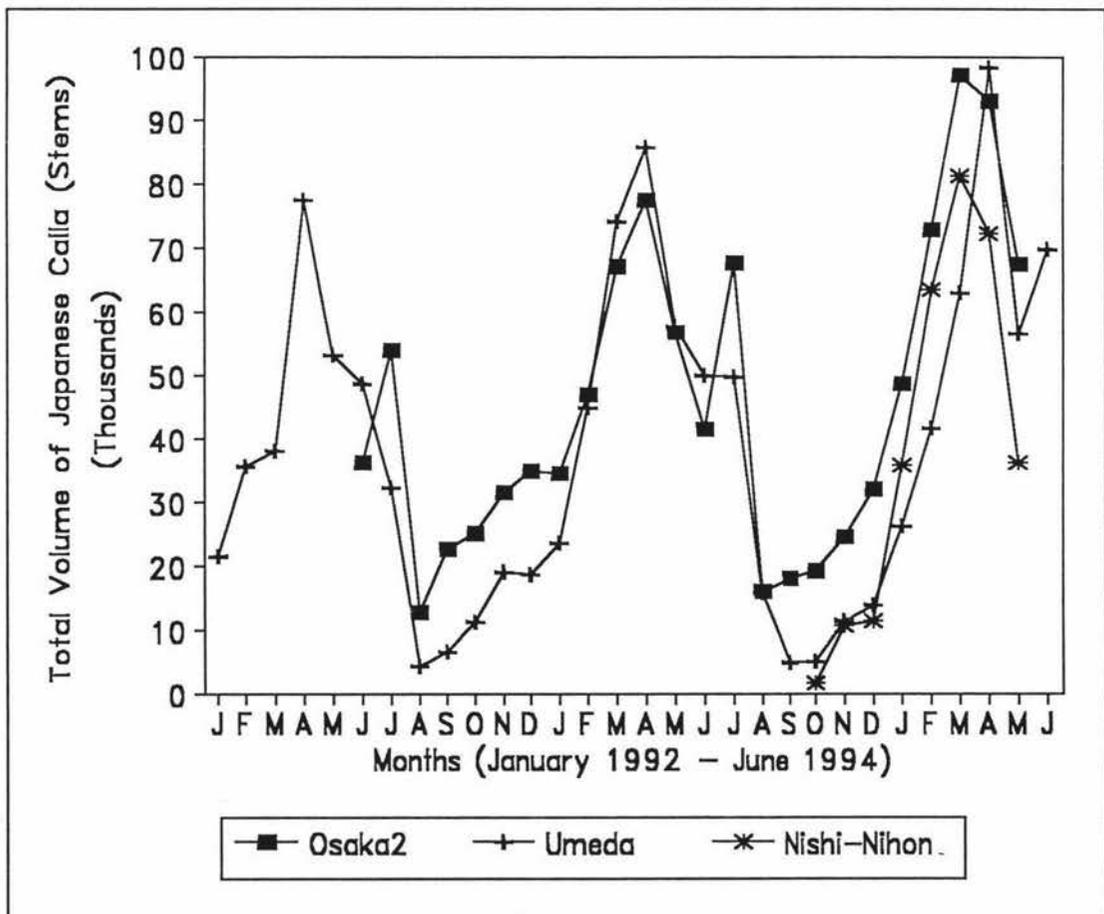
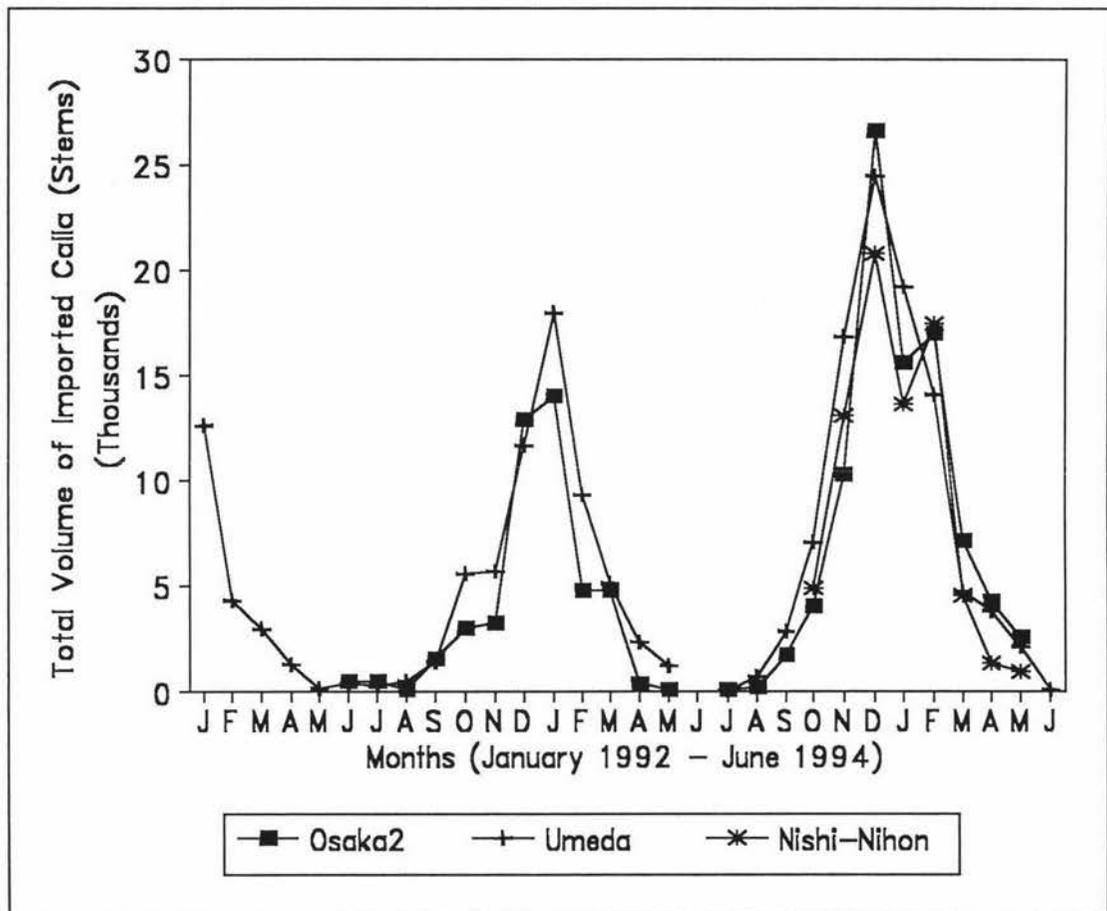


Figure 4.4 compares the volume of Japanese Calla sold at each of the three auction

markets. As can easily be seen in Figure 4.4 the Japanese supply volume peaks in March-April and is at a low in August-September. This contrasts with the supply of imported Calla, as portrayed in Figure 4.5. The peak in import supply of Calla lilies occurs in December-January and is at a minimum in June, July and August. Another important point to take from Figures 4.4 and 4.5 is the relative height of the Japanese total volume of supply over the imported supply volume, see sections 4.4.1 and 4.4.2.

Figure 4.5 Total volume of imported Calla lilies sold at the Osaka Number 2, Umeda and Nishi-Nihon wholesale auction markets.



The Umeda wholesale auction market was focused on as it is both a major market in Osaka Prefecture and characteristic of the majority of large Japanese wholesale cut-flower markets. The reasons for this decision are threefold, firstly the average price at Umeda is largely consistent with the other auction markets, secondly the Umeda wholesale auction market is not undergoing, nor during the data period has it undergone any structural change, and thirdly data was able to be collected for a longer time frame at Umeda than any other wholesale auction market.

4.5 Umeda Wholesale Auction Market Trends

White Calla are a group of five different cultivars, while the coloured Calla are the aggregate of 15 different cultivars. The five white cultivars are known as *White*, *Black Eyed Beauty*, *Alba*, *Childsila*, and *Green*. The cultivar known as *White Calla* is the common white Calla found in Japan, and is sold in copious quantities, far exceeding all other Calla cultivars in terms of volume. The fifteen coloured Calla cultivars are individually known as *Yellow*, *Wine*, *Cameo*, *Moonlight*, *Pink Pastel*, *Bridal Blush*, *Sweet*, *Sunlight Yellow*, *Jumbo Yellow*, *Brown*, *Cream*, *Orange Black Magic*, *Mixed Colours* and *Unknown*, a 'catch all' for unknown cultivars.

4.5.1 White Calla Trends

Figure 4.6 Trends for the quantity of imported and Japanese white Calla sold at the Umeda wholesale auction market.

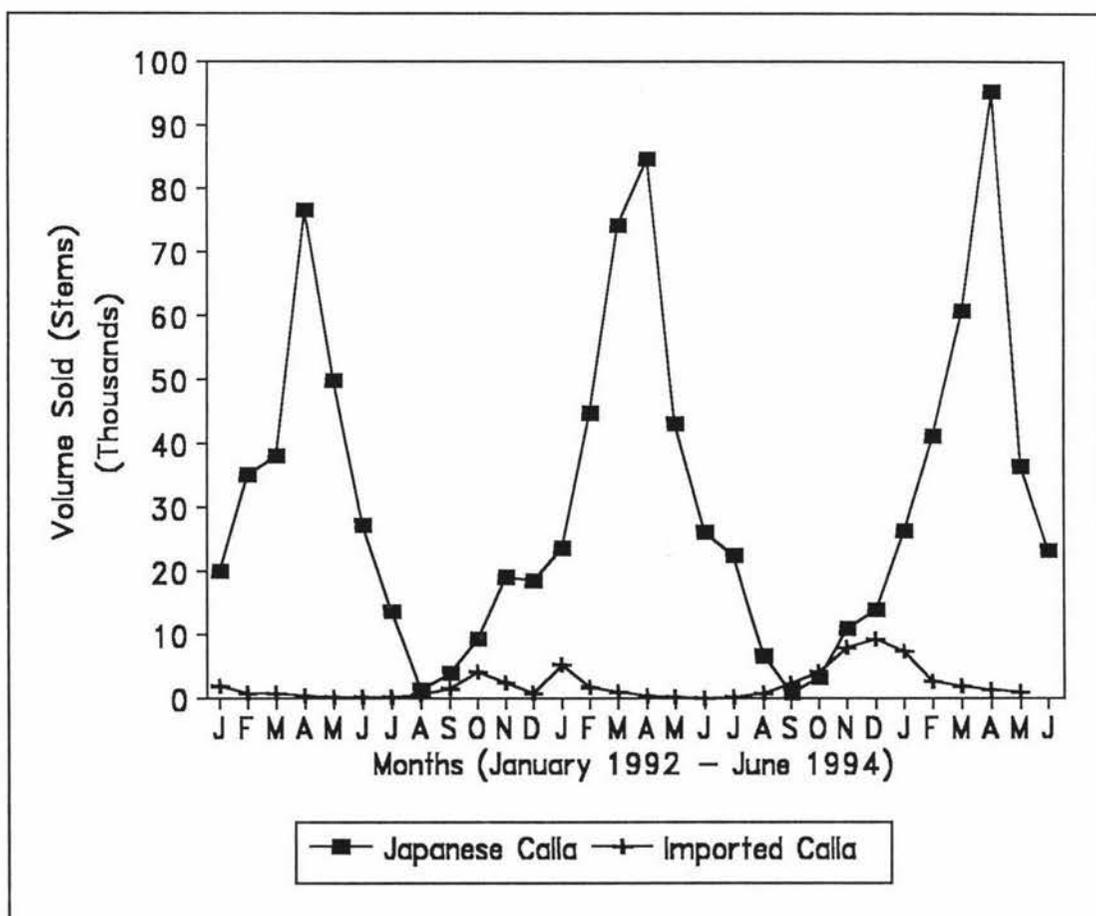


Figure 4.6 shows how dominant Japanese white Calla are over imported white Calla. The only time of the year that imported white Calla account for a majority of the supply of white Calla is in the months of September and October 1993. Reasons for this are two-fold, firstly the volume of imported white Calla in 1993/4 almost doubled since the previous season. Secondly, the 1992-93 season shows the low in Japanese supply of White Calla occurring in August, not in September as seen for the 1993-94 season.

Figure 4.7 Trends in average price per Calla flower for imported and Japanese white Calla at the Umeda wholesale auction market.

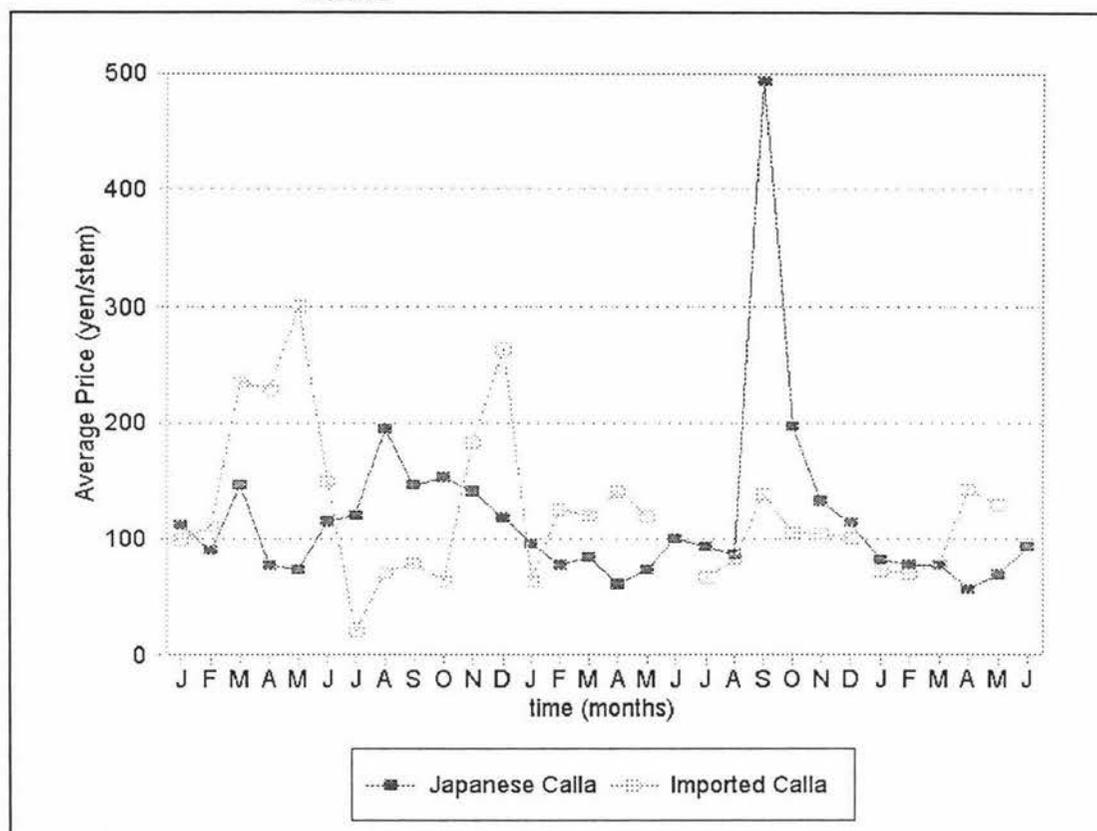


Figure 4.7 shows the average prices of white Calla stems for both foreign supplies (93 per cent of which is supplied by New Zealand) and Japanese supplies. For Japanese white Calla, it is easy to see an overall downward trend. This is especially evident at the height of the Japanese white Calla season (in April), where the resulting price has successively become lower each year. The exceeding high price seen in September 1993 is most likely due to the fact that not many white Calla were available in September 1993, while in September 1992 there had been substantially more white Calla available.

A second important point to note from Figure 4.7 is that the price of imported white Calla is seemingly unrelated to the price of Japanese white Calla. The only time that the two prices appear to be related is from November 1993 through to March 1994.³ This implies, that for the most part, imported white Calla and Japanese white Calla are different products, however during the height of the imported white Calla season they appear to be related products.

The imported white Calla prices show a very different trend. During the import white Calla season, imported white Calla face a price which declines from August/September through to March. But during the imported white Calla off-season, the price initially increases in April and May, but then falls to a second minimum in July. This implies that the price of imported white Calla is dominated by the vast quantities of Japanese white and coloured Calla during the imported white Calla off-season.

4.5.2 Coloured Calla Trends

The sale of coloured Calla is just as seasonal as for white Calla. The important difference between coloured and white Calla is the timing of supply. In general white Calla, flower, are harvested and auctioned earlier than coloured Calla. This is clearly shown in Table 4.1 below. Table 4.1 is based on the observed trends of imported and Japanese white and coloured Calla in Figures 4.6 through to 4.9.

Table 4.1 Seasonality of imported and Japanese white and coloured Calla sold at the Umeda wholesale auction market.

peak		zw	zc	zc	jw	jw		jc			
high		zw	zc	zw	jw	zc		jc jw		jc	
mid	zw	zc	jw	jw	zw	zw	zc jc		jw	jc	
low	zc	jw				jc	zw zc			jw zw	
	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.

Where: zw=imported White Calla; zc=imported Coloured Calla;
jw=Japanese White Calla; and jc=Japanese Coloured Calla.

³ This accounts for most of the imported white Calla season.

Figure 4.8

Total volume of coloured Calla supplied by imports and Japanese production from January 1992 to June 1994.

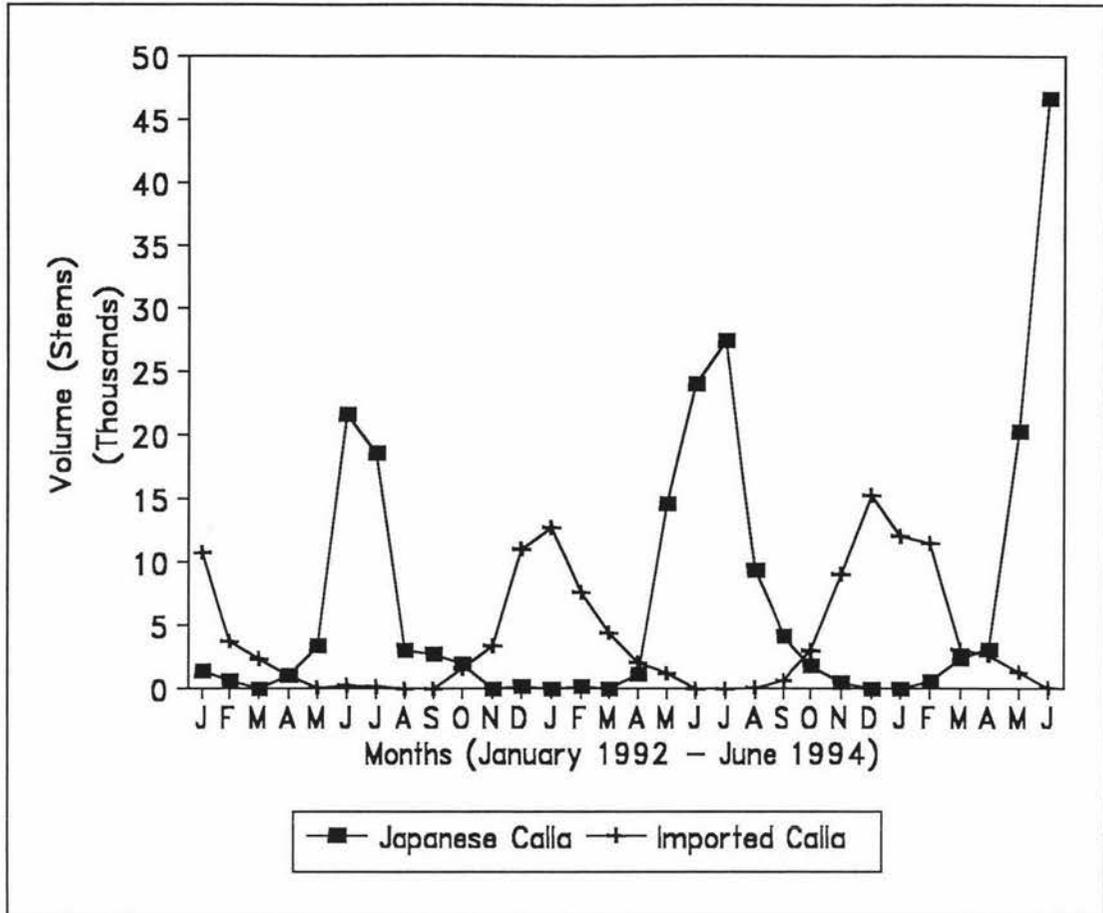
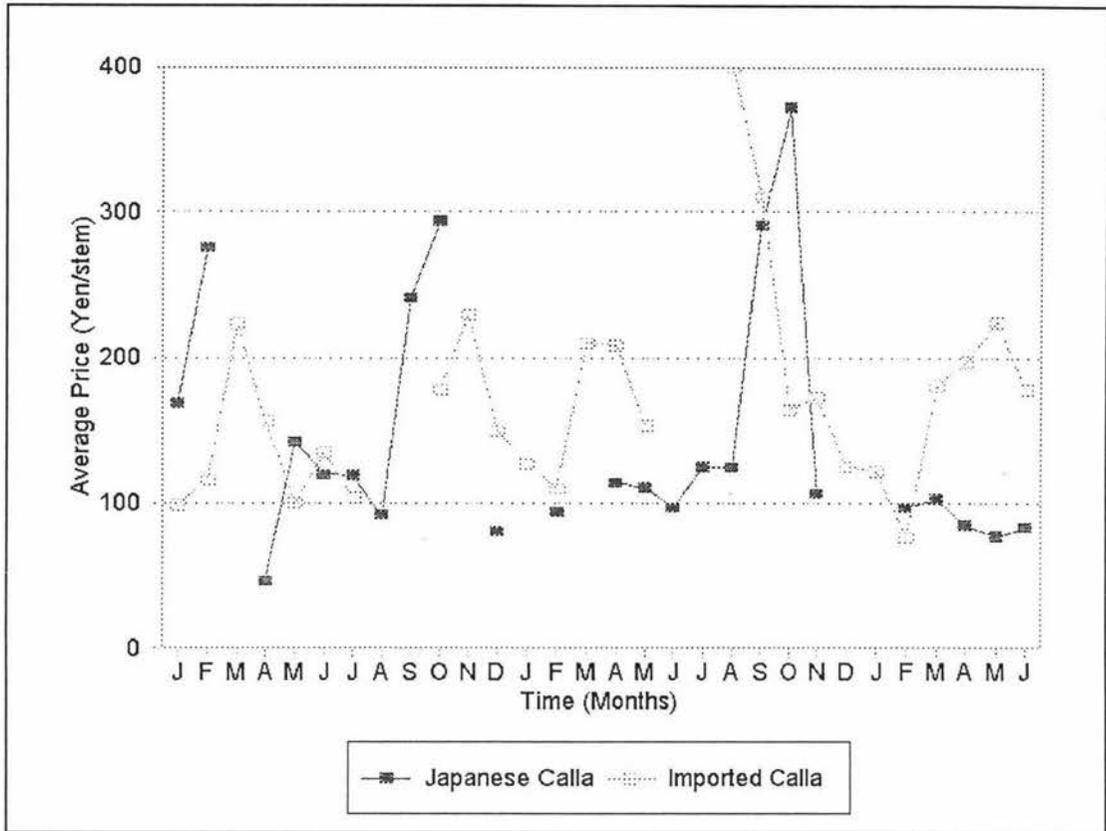


Figure 4.8 shows the trends in supply of both imported and Japanese coloured Calla at the Umeda wholesale auction market in Osaka Prefecture. The first difference to note between Japanese coloured Calla supply and Japanese white Calla supply, is the total volume relative to the equivalent volume imported Calla. Imported coloured Calla account for approximately 40 per cent of the total coloured Calla market at Umeda. Imported coloured Calla dominate the Umeda coloured Calla auction market from November through to March each year. In April and October the supply of coloured Calla is approximately half imports and half Japanese, while from May through to September Japanese suppliers dominate the Umeda Coloured Calla market.

Figure 4.9 shows how the average auction price at the Umeda wholesale auction market varies over time for both imported and Japanese coloured Calla flowers. The missing points in Figure 4.9 indicate months in which there were no coloured Calla, from either Japan or the rest of the world, sold at the Umeda wholesale auction

market. In terms of price trends, Figure 4.9 shows that the average price for a single stem of imported coloured Calla declines from a pre import season high in October down to a late import season low in February. The average per unit price for imported coloured Calla rises during the off season for imported coloured Calla.

Figure 4.9 Trends in the average price for imported and Japanese coloured Calla at the Umeda wholesale auction market.



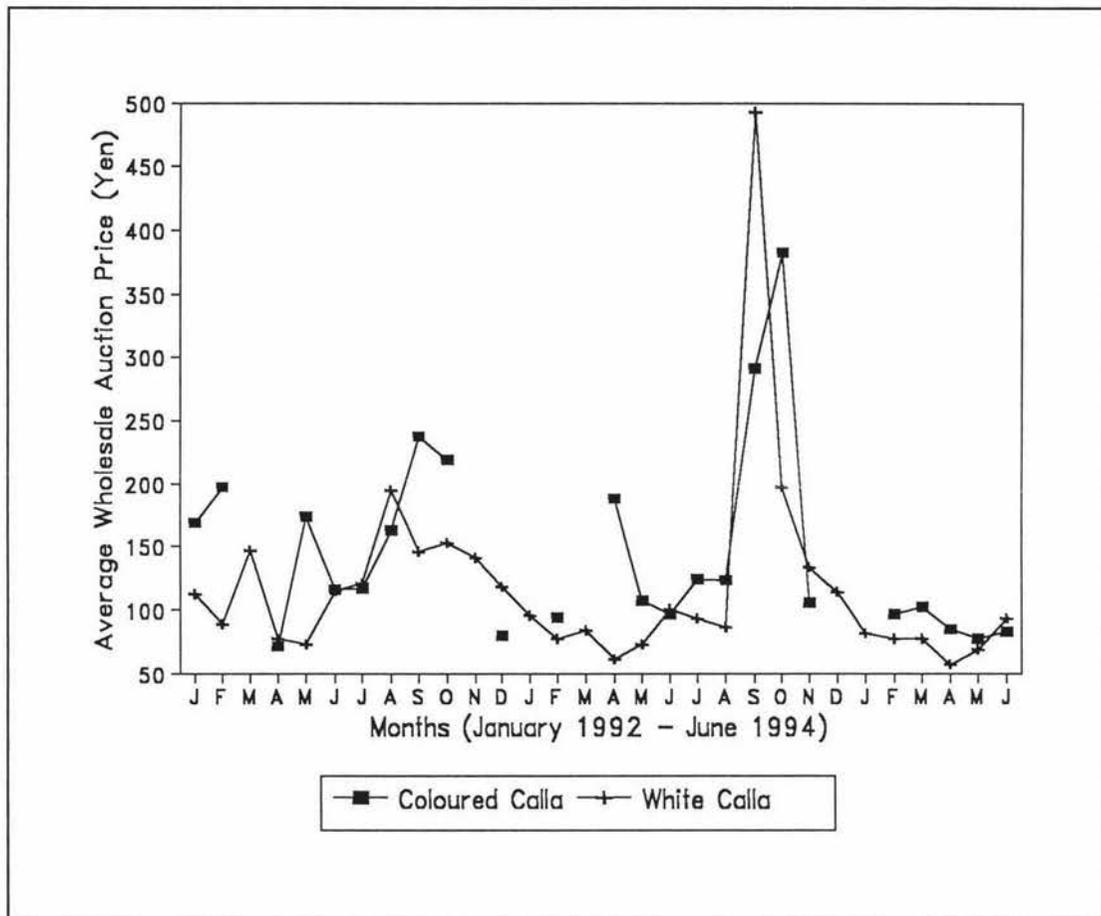
As for Japanese coloured Calla, the average per stem price tends to fluctuate about the pre-season price and trend up towards a post-season high in the latter part of the Japanese coloured Calla season. In comparison the reduction in the per stem average price of imported coloured Calla over the imported coloured Calla season is much larger than the fluctuation in the Japanese coloured Calla price.

Because it appears that there are four different Calla products involved in the Osaka Prefecture Calla lily market, much of the variation in the average price for Japanese and imported white and coloured Calla appears to be dependent on the actual volume of supply of each product. This leads to the expectation that for each product, the average price is dependent on the supply volume of that particular product and seasonal dummy variables. These figures also show that the volume of supply of a

particular product relative to the supply of total coloured, total white or even total Calla supply could explain the price trend of each product.

4.5.3 Comparison of White Calla and Coloured Calla

Figure 4.10 Comparison of average prices at the Umeda wholesale auction for Japanese white and coloured Calla flowers.



Figures 4.10 and 4.11 compare the average auction prices of coloured and white Calla from Japan (Figure 4.10) and from the rest of the world (Figure 4.11). These two figures are an attempt to present the differences in price of coloured and white Calla supplied by Japan and the rest of the world.⁴

⁴ New Zealand supplies approximately 93 per cent of the 'rest of the worlds' supply of fresh Calla Lily flowers to Japan.

Figure 4.10 shows that the average wholesale auction price of Japanese coloured Calla is often higher than the average wholesale auction price of Japanese white Calla. However Figure 4.10 does not indicate that there is a premium paid for Japanese coloured Calla during the whole year.

Figure 4.11 Comparison of average prices at the Umeda wholesale auction for imported white and coloured Calla lily flowers.

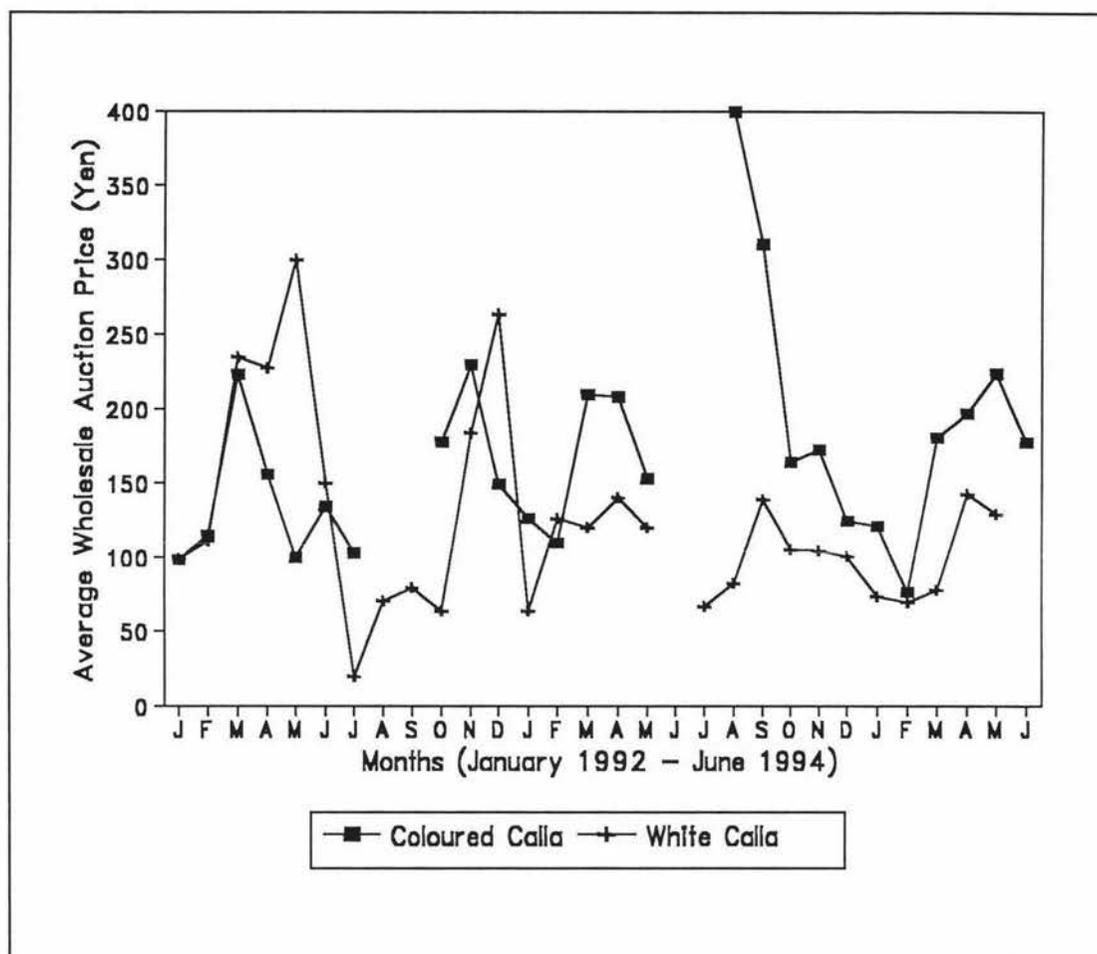


Figure 4.11 shows that in the 1993/94 import season, imported coloured Calla generally received a premium over and above the average price for imported white Calla. However there is little evidence of such a premium in the 1992/93 season or the latter half of the 1991/92 season. New Zealand is a pioneer in terms of coloured Calla cultivar breeding. New import colours in the Japanese market have enabled imported coloured Calla to maintain a higher average price than Japanese coloured Calla and the two white Calla supplies. This is easily seen in the 1993/94 season

when you compare the average auction price for imported coloured Calla in Figure 4.11 with the average auction price for Japanese coloured Calla in Figure 4.10.

4.6 Comparisons of Price and Volume Data

This section presents the findings of simple correlation analysis. To do this the variable names need defining. Therefore:

Pjc = The average per unit price of Japanese coloured Calla at the Umeda wholesale auction market;

Pjw = The average per unit price of Japanese white Calla at the Umeda wholesale auction market;

Pzc = The average per unit price of imported coloured Calla at the Umeda wholesale auction market; and

Pzw = The average per unit price of imported white Calla at the Umeda wholesale auction market.

Table 4.2 is a correlation matrix of these four variables.

Table 4.2 Correlation matrix of Pjc, Pzc, Pjw, and Pzw.

	Pjc	Pjw	Pzc	Pzw
Pjc	1.00000 ⁵ 0.0 24	0.61477 0.0014 24	0.14779 0.534 20	-0.14215 0.5280 22
Pjw		1.00000 0.0 30	0.37532 0.0588 26	-0.02109 0.9152 28
Pzc			1.00000 0.0 26	0.04484 0.8315 25
Pzw				1.00000 0.0 28

⁵ First Number: Pearson Correlation Coefficient
 Second Number: level of Significance (Probability > |R| under Ho: Rho=0)
 Third Number: Number of Observations

The price of Japanese white Calla is closely related to the price of Japanese coloured Calla, as evidenced by the 0.14 per cent level of significance. The price of Japanese white Calla is also related to the price of imported coloured Calla, however this relationship is not as strong as the relationship between Pjw and Pjc, as it only holds at the 0.059 level of significance. The other correlations show little evidence of any relationship between the four Calla products.

The volumes of each Calla product are measured in terms of the number of stems per month. Therefore Xjc is the volume of Japanese coloured Calla. The volume of the other three Calla products sold at the Umeda wholesale auction market are represented by Xjw, Xzc, and Xzw. Table 4.3 presents some simple statistics for the prices and volumes of the four Calla products.

Table 4.3 Simple statistics for Pjc, Pjw, Pzc, Pzw, Xjc, Xjw, Xzc and Xzw.

Var.	N	Mean	Std Dev	Sum	Min	Max
Pjc	24	145.70	76.33	3497	71.76	382.40
Pjw	30	118.34	79.45	3550	56.79	493.30
Pzc	26	170.95	70.51	4445	76.79	400.00
Pzw	28	123.81	65.61	3467	20.00	300.00
Xjc	30	6991	11181	209736	0.0	46617
Xzc	30	4007	4725	120214	0.0	15275
Xjw	30	31570	25415	947093	741.0	95165
Xzw	30	1950	2472	58502	0.0	9190

Importers tend to believe that Japanese Calla generally receive a higher price than imported Calla. However this belief is not supported by the statistical evidence presented in Table 4.3. However, this belief may still be true as Table 4.3 does not account for quality differences between imported and Japanese Calla. Given the possibility of such quality differences, imported coloured Calla received the highest mean auction price over the data period, at ¥170.95 per stem, or approximately

NZ\$2.80 per stem.⁶ Japanese coloured Calla received the second highest auction price of ¥145.70, or approximately NZ\$2.39. Imported white Calla receive a higher price than Japanese white Calla. Imported white Calla received a mean auction price of ¥123.81, or approximately NZ\$2.03, compared with Japanese white Calla at ¥118.34, or NZ\$1.94.

The minimum and maximum prices for imported coloured Calla also exceed the minimum and maximum prices for Japanese coloured Calla. As for white Calla, Japanese suppliers have a higher minimum and maximum price. However the high maximum price for Japanese white Calla occurred in September 1993, at a time of very short supply of white Calla. The very low minimum price for imported white Calla also occurred at a time of low volume of supply, however the quality of the imported white Calla was poor.⁷

As can be seen by the 'Sum' column of Table 4.3 Japanese supply of white Calla is by far the largest volume of Calla sold at the Umeda wholesale auction market. The next largest supply of Calla at Umeda is Japanese coloured Calla selling just under 210,000 stems during the data period. Import supplies differ to Japanese supplies in two respects. Firstly imported coloured Calla outnumber imported white Calla by a factor of two to one, whereas Japanese supplies of white Calla far exceed the supply volume of Japanese coloured Calla. Secondly total imported Calla account for approximately fifteen per cent of the total Calla market at Umeda. Other major wholesale auction markets in Osaka Prefecture show a similar figure for imported supply of Calla over total supply. It seems that similar results are the case in other regions of Japan.

Table 4.4 presents the correlations between the auction prices of the four Calla products and the volumes of each of the four Calla products. The purpose of Table 4.4 is to give an indication of which volumes the auction price is most closely related to. Assuming that each of the four Calla products are independent products, one would expect the price of one product to be correlated with the volume of that calla product. On Table 4.4 this would be represented by downward sloping diagonal line of low levels of significance. However if the products are related products, then Table 4.4 would show low levels of significance throughout the table.

⁶ Auction prices in New Zealand Dollars are calculated at 61 Yen per Dollar.

⁷ Statement was implied by a number of importers in Osaka Prefecture.

Table 4.4 Correlation matrix of Pjc, Pzc, Pjw, and Pzw against Xjc, Xzc, Xjw, and Xzw.

	Pjc	Pzc	Pjw	Pzw
Xjc	-0.36682 ⁸ 0.1190 24	0.07979 0.6984 26	-0.11033 0.5616 30	-0.21853 0.2639 28
Xzc	-0.16339 0.4455 24	-0.45814 0.0186 26	-0.15271 0.4205 30	-0.10881 0.5815 28
Xjw	-0.42113 0.0404 24	-0.10472 0.6107 26	-0.51714 0.0034 30	0.33305 0.0833 28
Xzw	0.30867 0.1422 24	-0.17326 0.3973 26	0.11456 0.5466 30	-0.30070 0.1200 28

The most important concept to gain from Table 4.4 is that the price of imported coloured Calla and Japanese white Calla appear to be most closely related to the volume of imported coloured Calla and Japanese white Calla respectively. The relationship between the price and volume of Japanese white Calla is strongest, with a significance level of 0.0034 assuming that this price and volume series are not related. Imported coloured Calla have a low significance level of 0.0186 assuming that the price and volume series are not related. All other volumes appear not to be related to these two prices.

The price of Japanese coloured Calla is most closely correlated to the volume of Japanese white Calla. However it is also somewhat correlated to both the volume of Japanese coloured Calla and imported white Calla. The volume of imported coloured Calla appears not to be related to the price of Japanese coloured Calla. Therefore it is likely that the Japanese coloured Calla price is reliant on the volume of Japanese white Calla, Japanese coloured Calla and imported coloured Calla.

⁸ First Number: Pearson Correlation Coefficient
 Second Number: Level of Significance (Probability > |R| under Ho: Rho=0)
 Third Number: Number of Observations

The price of imported white Calla is most closely related to the volume of Japanese white Calla, with the volume of imported white Calla being the second most closely correlated volume. The auction price of imported white Calla is not correlated with either the Japanese or imported coloured Calla volumes. Therefore it is likely that the price of imported white Calla is dependent on the volume of Japanese white Calla supply and the supply of imported white Calla.

Regression analysis was undertaken with the dependant variables being the average auction price of imported coloured Calla, imported white Calla, Japanese coloured Calla and Japanese white Calla. The exploratory data analysis suggests that the best fit will occur when each dependent variable (price) is dependent on the following independent variables (volumes):

$$P_{jc} = \alpha_0 + \alpha_1 X_{jw} + \alpha_2 X_{jc} + \alpha_3 X_{zw} \quad (4.1)$$

$$P_{zc} = \beta_0 + \beta_1 X_{zc} \quad (4.2)$$

$$P_{jw} = \gamma_0 + \gamma_1 X_{jw} \quad (4.3)$$

$$P_{zw} = \delta_0 + \delta_1 X_{jw} + \delta_2 X_{zw} \quad (4.4)$$

These four equations (4.1 to 4.4) are suggested on the basis that the full 30 months of data is used to estimate the coefficients.

CHAPTER FIVE

METHODOLOGY AND DATA

The purpose of this chapter is to present the research design and methods used to undertake the study. More specifically, this chapter discusses the general method, including econometric regression analysis, optimisation of the supply schedule to maximise total revenue, and Constant Market Shares Analysis.

5.1 General Methodology

This thesis is of an exploratory nature. For this reason, two different methods are employed to explore wholesale cut-flower auction market data. The first method is traditional econometric analysis of prices. From this, price models are chosen, and total revenue models are determined. Total revenue was then maximised given the constraint on the total volume supplied in each season. The second method deals with the competitiveness of New Zealand Calla in Osaka. This is done by employing Constant Market Shares Analysis, which attempts to explain changes in market shares to measure changing competitiveness.

Before any analysis was undertaken, there was a perceived need to describe the Japanese cut-flower market, focusing on Calla lilies sold at wholesale auctions in Osaka. This description is presented as Chapter Two. Also before the formal analyses were conducted, exploratory data analysis was undertaken. The purpose of this exploratory data analysis was to provide a numerical background of the Osaka wholesale auction markets for Calla. The exploratory data analysis also explains the selection of one market, *Osaka Kaki Engei Chiho Oroshi Ichiba, Umeda Kaki Ichiba* (Umeda), for all further analysis. The exploratory data analysis chapter (Chapter Four) provides a graphical analysis which begins to test Hypothesis One, regarding the independence of the four Calla products.

Hypothesis Two is tested by optimising the supply schedule, thereby maximising total revenue. This is conducted so as to develop a 'map', which shows where total revenue for New Zealand (import) supply of each of the two imported Calla products was in the 1992/3 and 1993/4 seasons.

Hypothesis Three and Four are tested by applying Constant Market Shares Analysis to the data collected from the Umeda wholesale auction market for cut-flowers. Hypothesis Three is specifically tested using the Umeda market data because there are only 30 observations. This was because the Japanese auction markets tend to keep monthly data for only two, to two and a half, years. Hypothesis Four is tested due to the assumption that imported white Calla are a different product to imported coloured Calla, and that both of these products are different from Japanese white and coloured Calla. This assumption is based on the exploratory data analysis, which suggests that Hypothesis One is true. This will test the appropriateness of Constant Market Shares Analysis on data sets of different products, as the literature always refers to commodities.

5.2 Regression Analysis

In the light of the interviews and the exploratory data analysis it became evident that the off-season supply of New Zealand Calla lily flowers (approximately 93 per cent of the total import supply in Japan) is a major reason for the "success" of imported Calla lilies in the Japanese Calla lily market. Regression analysis was employed because it measures the influence of changing volumes on the auction price. Regression analysis also allows for the introduction of monthly dummy variables to cater for shifts in demand at the Umeda wholesale auction market.¹

5.2.1 Formation of the Regression Models

Exploratory data analysis indicated that the Umeda Calla lily market was made up of four different products: imported white Calla; imported coloured Calla; Japanese white Calla; and Japanese coloured Calla. Therefore the data set was disaggregated into white and coloured Calla supplied by Japan and imported into Japan. The average wholesale auction prices of the four Calla products sold at the Umeda wholesale auction market are all nominal values, and therefore needed to be adjusted for inflation. This was done by taking each monthly average price and dividing it by the monthly Osaka Prefecture wholesale price index for agricultural and horticultural products and then multiplying the answer by 100. The base period for this wholesale price index was an average for the twelve months of 1990 (Osaka Chamber of Commerce and Industry publication, July and December 1992, July and December 1993 and July 1994).

This led to the formation of four dependent variables: the average real auction price of: Japanese white calla (RPjw); Japanese coloured calla (RPjc); imported white Calla (RPzw); and imported coloured Calla (RPzc). Initially these four dependent price variables were regressed against the four independent volume variables (equations 3.1 through to equation 3.4).

$$RPjc = \alpha_0 + \alpha_1 Xjc + \alpha_2 Xjw + \alpha_3 Xzc + \alpha_4 Xzw \quad (3.1)$$

¹ The Umeda wholesale auction market is formally known as 'Osaka Kaki Engei Chiho Oroshi Ichiba, Umeda Kaki Ichiba'.

$$RP_{jw} = \beta_0 + \beta_1 X_{jc} + \beta_2 X_{jw} + \beta_3 X_{zc} + \beta_4 X_{zw} \quad (3.2)$$

$$RP_{zc} = \gamma_0 + \gamma_1 X_{jc} + \gamma_2 X_{jw} + \gamma_3 X_{zc} + \gamma_4 X_{zw} \quad (3.3)$$

$$RP_{zw} = \delta_0 + \delta_1 X_{jc} + \delta_2 X_{jw} + \delta_3 X_{zc} + \delta_4 X_{zw} \quad (3.4)$$

Where X_{jc} = volume of Japanese Coloured Calla,
 X_{jw} = volume of Japanese White Calla,
 X_{zc} = volume of Imported Coloured Calla, and
 X_{zw} = volume of Imported White Calla.

As well as equations 3.1 through to 3.4 each dependent variable was regressed against two alternative sets of independent variables. These alternative variable sets are relative proportions of each Calla product. The purpose of these regressions was to further explore the inter-relationships of the four Calla product volumes on the prices variables. For imported coloured Calla these two alternative sets of independent variables are defined as:

- | | | |
|----|---|--|
| 1. | $XC = X_{zc} + X_{jc}$
$XW = X_{zw} + X_{jw}$ | $relX_{zc} = X_{zc} / XC$
$relX_{zw} = X_{zw} / XW$ |
| 2. | $TOT = X_{zc} + X_{zw} + X_{jw} + X_{jc}$
$zwT = X_{zw} / TOT$ | $zcT = X_{zc} / TOT$
$jcT = X_{jc} / TOT$ |

Therefore each Calla product had three linear models explaining the price. Semilogarithmic (linear dependent variable and logarithmic independent variables) and double logarithmic functional forms were also applied to the Umeda wholesale auction market data.

SAS, release 6.03², a statistical programme was employed to regress each of the 36 regression models. For this round of regressions all 30 observations were included in the models. Where there was no supply of a Calla product, the price was recorded as zero for the linear and semilogarithmic regressions. However for the double

² The SAS Institute Inc., Cary, North Carolina, United States of America.

logarithmic regressions, the price where no supply occurred could not be set to zero. This is because the natural logarithm of zero is undefined, and SAS interprets this as a missing value, which renders previously comparable models, incomparable as they no longer would have the same number of observations. Therefore one stem was added to all the volumes. This meant that when the model took the natural logarithm of a month of no supply, it got zero, as the natural logarithm of one is zero. This resulted in all models maintaining a full set of 30 observations.

However it soon became apparent that the full data set required some modification to improve the fit of the regression models. The principal problem with the full data set was the apparent randomness of auction prices at times when the supply volume of that particular Calla product is small. This was because at times of little supply, the price appeared to depend on other variables than in the main season for that particular Calla product. Therefore the models focused on the on-season supplies. Hence the prices in the off-season tended to have large errors when included in the models. This problem was remedied by regressing each Calla product price against the on-season data for that particular Calla product. Table 5.1 gives the months included in the on-season for each of the four Calla products.

Table 5.1 'On-Season' for each Calla Product in Japan.

Calla Product	Months included in the on-season for each Calla Product
Japanese Coloured Calla	March through to September (seven months)
Japanese White Calla	November through to July (nine months)
Imported Coloured Calla	October through to April (seven months)
Imported White Calla	August through to April (nine months)

5.2.2 Introduction of Dummy Variables to the Regression Models

These initial regressions had the sole purpose of determining which month was to become the 'base' month for each of the 36 regression models. The base month was identified by plotting the errors of each of these initial regressions against the month in which the error occurs. The month where the errors were closest to zero, compared to the other months, became the base month.

Once the base month for each equation had been identified, dummy variables were added to each regression equation. A dummy variable was allocated for each month of the supply season, except for the base month. These dummy variables were set to zero for all observations, except those observations for the month to which the dummy variable pertained, where a one was inserted instead of a zero.

5.2.3 Stepwise Regression

Following the identification of the base month and the introduction of monthly dummy variables, each equation was stepwise regressed at the five per cent level of significance. This means that each model had 'n-1' monthly dummy variables added to them (where n is the number of months in a season), and then each full model was regressed. The stepwise regression procedure removed any independent variables that were non-significant at the five per cent level of significance.

Once a non-significant variable had been removed, the model was regressed again. This procedure was repeated until all the independent variables were significant at the five per cent level of significance, hence the stepwise nature of these regressions. This process of reducing the equations in a stepwise custom was considered complete when the R^2 is 'optimised' and all the explanatory and dummy variables are significant at the five per cent level of significance.

Once the stepwise regression procedure had finished, i.e. the resultant equation had no non-significant coefficients, the dummy variables were checked to see if any could be combined. This procedure involved comparing the coefficients of different monthly dummy variables. If two, or more, dummy variable coefficients were similar, then they were combined and the combined model was regressed. The R^2 of the combined model and the R^2 of the pre-combined model were compared using the

standard Chow test. If the Chow test found that combining the dummy variables had no significant impact on the R^2 then the combined model was chosen above the pre-combined model. However, if the Chow test found that the R^2 of the pre-combined model was significantly better than for the combined model, then the pre-combined model was chosen. This procedure was repeated until the minimum number of dummy variables in the combined model was reached.

5.2.4 Comparing the Fit of Price Models

In order to determine which price model best fits the data for each Calla product, the equations for each Calla product need to be compared with each other. Direct comparison of the R^2 s can only be undertaken where the dependent variable is the same for both equations. Therefore comparing the linear models for each Calla product is possible. However some of these linear models have a different number of explanatory variables. This means that some linear price models have different degrees of freedom than other linear price models for the same Calla product.

The R^2 is not an adequate comparison of the fit of two models where the degrees of freedom are different, even though the dependent variable is the same. For this reason the Adjusted R^2 is used to directly compare models with the same dependent variable. The Adjusted R^2 can be directly compared between any models, so long as the dependent variable is the same.

Comparing the Adjusted R^2 s of equations is strictly limited to models with the same dependent variable. However, each Calla product has either the price or the natural logarithm of the price as the dependent variable. Therefore the Adjusted R^2 can not be directly compared to determine which functional form best fits the data. To directly compare the fit of a linear model and the fit of a double logarithmic model, for each Calla product, the Comparable Adjusted R^2 needs to be calculated.

The Comparable Adjusted R^2 is calculated by taking the predicted values of the natural logarithm of the estimated price, for the double logarithm models. The exponential of these natural logarithms of the estimated price are next calculated, thereby enabling the correlation between these estimated prices and the actual original observations for the real price to be computed (Gujarati, 1988). The Comparable R^2 is obtained by taking the square of this correlation. The Comparable Adjusted R^2 was then computed from the corresponding Comparable R^2 .

5.3 Determining the Optimum Timing of Supply

Given the explanatory nature of this thesis, the Lagrangian method of optimisation was employed as a quick and simple method. Optimisation was only conducted for imported Calla, as the purpose of this was to test Hypothesis Two. This is done by maximising total revenue by optimising the supply schedule.

The Lagrangian expression allows constraints to be placed on the results. For each optimisation, the results were constrained to the total supply volume in each season. This required the chosen price models for each imported Calla product to be multiplied by volume (X) to give total revenue (TR) models.

The problem of optimally allocating total supply (Q) for a given season over months (i) of that season can be defined as:

$$\text{Maximise } TR = \sum TR_i \quad (5.6)$$

$$\text{where } \sum X_i = Q \quad (5.7)$$

Where the price model is a linear function, total revenue is a quadratic function of the monthly quantity values (X_i).³ Dummy variables were added to, or subtracted from the intercept of the total revenue first derivatives (marginal revenue equations) in months in which they were applied in the price models. Given that the second order conditions for a maximum are satisfied, the standard Lagrangian can be used to solve for the optimum allocation of total supply.⁴

³ This assumes that the values for the monthly quantities are fixed.

⁴ The second order conditions for a maximum are that the coefficient for the volume in the price model is less than zero.

The Lagrangian equation is:

$$\text{Maximise } L = TR - \lambda[\sum X_i - Q] \quad (5.8)$$

where λ is the Lagrangian multiplier

The solution X_i values are obtained by simultaneously solving the set of $(n + 1)$ differential equations:

$$\frac{dL}{dX_i} = 0 \quad (5.9)$$

where $i = 1, \dots, n$ and there are n months in the supply season.

$$\frac{dL}{d\lambda} = 0 \quad (5.10)$$

The solution value for λ (the Lagrangian multiplier) is:

$$\lambda = \frac{dTR}{dQ} \quad (5.11)$$

i.e. the increase in total revenue from a marginal increase in the overall supply of the imported Calla product in question.

5.4 Constant Market Shares Analysis

Traditional Constant Market Shares Analysis (traditional CMSA) was applied to the Osaka wholesale cut-flower auction markets. This form of analysis explains a change in the market share value of imported Calla lily flowers in terms of a structural effect, a second order effect and a competitiveness residual. The generic traditional CMSA equation is presented as equation A2.1 in Appendix Two, while equation 5.1 (below) is the multi-market, multi-commodity version of the traditional CMSA identity;^{5,6}

$$\Delta Z \equiv \sum_i^n \sum_j^n S_{ij0} \Delta J_{ij} + \sum_i^n \sum_j^n J_{ij0} \Delta S_{ij} + \sum_i^n \sum_j^n \Delta S_{ij} \Delta J_{ij}$$

structural effect
competitiveness effect
second order effect
(5.11)

where: ΔZ = change in import value ($Z_1 - Z_0$)
 S_{ij0} = initial period share (Z_0/J_0)
 ΔS_{ij} = change in share (Z_1/J_1)-(Z_0/J_0)
 J_{ij0} = initial period supply from Japan
 ΔJ_{ij} = change in Japanese supply ($J_1 - J_0$)

i denotes one of the 'n' different commodities

j denotes one of the 'n' different markets.

The multi-market, multi-commodity traditional CMSA equation was modified in order to apply the identity to the Japanese Calla lily market, based on the Umeda wholesale cut-flower auction market. When written for a single market, equation 5.11 becomes:

$$\Delta Z \equiv \sum_i^{n-4} S_{i0} \Delta J_i + \sum_i^{n-4} J_{i0} \Delta S_i + \sum_i^{n-4} \Delta S_i \Delta J_i$$

structural effect
competitiveness residual
second order effect
(5.12)

⁵ For a discussion on the transformation of the generic traditional CMSA equation to the multi-market and multi-commodity equation see Appendix Two, or for a more detailed exposition of the traditional CMSA identity and theory see Leamer and Stern (1970, chapter 7).

⁶ This equation is equivalent to equation 7.11 in Leamer and Stern (1970, p174), with the notation changed to suit this analysis.

With respect to Calla lilies sold at the Umeda wholesale auction market, the structural effect, measures the portion of the change in import supply explained by an overall rise in the supply of Calla lilies to the Umeda wholesale cut-flower auction market. The second order effect measures the portion of the change in import supply by the interaction of changes in wholesale market shares with changes in auction demand. The second order effect is the difference between the hypothetical gain in the second period (from the second period), where the overall period one market share is held constant, and where the period one market shares in each market are held constant. The competitiveness residual measures the portion of a change in import supply by an overall improvement in the competitiveness of imported Calla lilies over Japanese Calla lilies. The competitiveness residual is calculated as the residual between the total gain and the second order effect and structural effect.

Equation 5.12 was applied to the Osaka Prefecture wholesale Calla lily auction market data. It was first applied to total value data as this is standard practice for Constant Market Shares Analysis. Then in the light of Richardson's (1971b) comment that the traditional CMSA model could be improved by simply applying the identity to volume data, equation 5.12 was also applied to the Osaka Prefecture wholesale Calla lily market volume data. The initial period was June 1992 through to May 1993 and the final period was the following twelve months, that is from June 1993 through to May 1994. The results of traditional CMSA are included under section 6.1 of this thesis.

Improved CMSA arose because of the index and order problems associated with the traditional CMSA equation (equation 5.11).⁷ The main reason for the employment of improved CMSA in this research is the qualitative interpretation required to explain the competitiveness residual. Because of the traditional CMSA competitiveness residual definition (stated earlier in this section) it is beneficial to further explain this effect.

Equation 5.13 is a simplified version of the improved CMSA identity presented in Appendix 2. The decomposition that is utilised here is similar to the decomposition of the improved CMSA equation as described by Ahmadi-Esfahani (1993). Equation 5.13 is the improved CMSA identity decomposition that was applied to the Osaka Prefecture Calla lily wholesale auction data;

⁷ The order and index problems of traditional CMSA are fully explained in Appendix Two

$$\begin{aligned}
\Delta Z \equiv & S_0 \Delta J + \left(\sum_i^n S_{i0} \Delta J_i - S_0 \Delta J \right) + J_0 \Delta S + \left(\sum_i^n J_{i0} \Delta S_i - J_0 \Delta S \right) \\
& \text{Growth Effect} \quad \text{Commodity effect} \quad \text{Pure Residual} \quad \text{Static Structural Residual} \\
& + \left[\left(\frac{J_1}{J_0} - 1 \right) \sum_i^n J_{i0} \Delta S_i \right] + \left[\sum_i^n \Delta S_i \Delta J_i - \left(\frac{J_1}{J_0} - 1 \right) \sum_i^n J_{i0} \Delta S_i \right] \\
& \text{Pure Second Order Effect} \quad \text{Dynamic Structural Residual} \quad (5.13)
\end{aligned}$$

In terms of the Osaka Calla lily wholesale auction market, the six components of the modified version of the improved CMSA identity are (in order) the growth effect, the market effect, the pure residual, the static structural residual, the pure second order effect and the dynamic structural residual.

Each of these effects are defined as:

Growth effect:	The portion of the change in import supply explained by a rise in the supply of Calla Lilies to the Umeda wholesale cut-flower market;
Commodity effect:	The portion of the change in import supply measuring the extent to which imported Calla lilies are concentrated in the value of imported Calla Lilies.
Pure residual:	The increase in the competitiveness of Calla lily imports relative to Japanese supply, assuming that the import structures remains unchanged.
Static Structural Residual	The impact of changes in import structure on import performance (the import share of the Umeda Calla Lily Market).
Pure second order effect	The portion of change in import supply of Calla lilies indicative of the impact of changes in demand for Calla Lilies at the Umeda market, given that the structure of Calla trade remains unchanged;
Dynamic Structural Residual	The portion of the change in import supply explained by the interaction of the exporter's market share with changes in the structure of demand for Calla Lilies at the Umeda auction.

5.4.1 The Principal Weaknesses of CMSA

The weaknesses of CMSA pertain to the limitations of the model. Because the CMSA model is an identity it can only be applied in an *ex post* manner. CMSA can not forecast, nor does it attempt to estimate coefficients. However CMSA has one major strength, that is the sheer simplicity of the model. The CMSA identity attempts to explain a change in the supply of the focus country, in this paper, that is the export supply of New Zealand Calla flowers to the Umeda wholesale auction market.

A second weakness stems from the limited explanatory power of the CMSA identity. With traditional CMSA the definitions of the three components is arbitrary. It is impossible to directly claim, that because the competitiveness residual is large and positive, that the focus country's export policy is responsible for the benefits, or drawbacks, that the industry faces. Traditional CMSA simply does not explain why, nor does it describe the factors that led to the competitiveness effect may be large.

Improved CMSA was developed in an attempt to correct the index and order problems of traditional CMSA (see Appendix Two). At the same time improved CMSA is thought to provide clearer interpretations of the traditional CMSA components. Improved CMSA does, in some respects, achieve this, however, it is still limited to a deterministic identity.

CMSA explanations for changes in market share or supply are also limited to the commodities on which the identity is applied. It has no way of explaining an impact on market share from outside forces. For this reason it is strongly advised that CMSA results should be complemented with an analysis of non-price factors of changes in market shares (Ahmadi-Esfahani, 1933, and Stevens and Moore, 1980).

CHAPTER SIX

ANALYSIS AND FINDINGS

The purpose of this chapter is to present the optimal supply schedule for imported coloured Calla and for imported white Calla. The second purpose of this chapter is to present the results of Constant Market Shares Analysis and explain the apparent shortcomings of this deterministic form of analysis.

6.1 Results for Imported Coloured Calla.

6.1.1 The Regression Model for the Price of Imported Coloured Calla.

Upon comparing the linear, semilogarithmic and double logarithmic price models for imported coloured Calla, it was found that the linear models best explained the real auction price at the Umeda wholesale auction market. Of the three linear models, Equation 6.1 had the highest adjusted R^2 (0.9620) of all the models, comparable adjusted R^2 s were used to compare different functional forms. Equation 6.1 was the chosen model for explaining the real auction price for imported coloured Calla sold at the Umeda wholesale auction market.

$$RP_{zc} = 202.344 - 0.007 X_{zc} - 0.014 X_{jc} + 28.160 D_{2367} - 45.232 D_5$$

(0.0001) (0.0001) (0.0002) (0.0001) (0.0001) (6.1)

where: RP_{zc} is the real auction price of imported coloured Calla at the Umeda wholesale market (¥ / stem),

X_{zc} is the monthly imported volume of coloured Calla sold at Umeda (Stems),

X_{jc} is the monthly Japanese volume of coloured Calla sold at Umeda (Stems),

D_{2367} is the monthly dummy variable for November, December, March and April, and

D_5 is the monthly dummy variable for February.

Figures in brackets are standard errors of the estimates.

Both the supply volume for imported Coloured Calla and Japanese coloured Calla have negative coefficients. This was consistent with economic theory for 'normal' goods, as one would have expected the price to fall when the volume increases. The dummy variable D_{2367} increases the intercept value in November, December, March and April. In such situations, positive dummy variables refer to times of strong demand, as represented by a higher price. In terms of the Japanese cut-flower market, December is a month of strong demand for floral products, due to Christmas and other festivals occurring. November is also a month of strong demand for flowers such as Calla, as November signals the start of winter in Japan, and is also a time of festivals. Japanese festivals tend to have a large influence on the volume

of Calla and other flowers demanded. March and April are late winter months and once again a time of strong demand for flowers from festivals. Therefore it is quite conceivable that the price for imported coloured Calla would increase in these months at the Umeda wholesale auction market.

The negative dummy variable for February is also consistent with perceived demand patterns in Japan for Calla flowers. This is because February is the height of winter in Japan, and people tend to stay home more. Therefore retail purchases of flowers tend to slump in February. The two dummy variables account for a large portion of the fit of Equation 6.1. This was demonstrated by removing the dummy variables and running the regression again. An analysis of variance showed that the removal of the dummy variables increased the root mean square error from 8.55 to 30.45 and almost halved the adjusted R^2 to 0.5176 (c.f. 0.9620). The analysis of variance for Equation 6.1 is presented as Table 6.1.

Table 6.1 Analysis of variance for Equation 6.1.

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	4	29883.83010	7470.95752	102.164	0.0001
Error	12	877.52319	73.12693		
C Total	16	30761.76394			
Root MSE		8.55143	R-Square	0.9715	
Dep Mean		148.17491	Adj R-SQ	0.9620	
C.V.		5.77117			

6.1.2 Optimal allocation of the Supply Volume of Imported Coloured Calla Stems

The reason for allocating the total supply volume in a season over the season is to maximise total revenue. Monthly total revenue is obtained from Equation 6.1, by multiplying the quantity of imported coloured Calla by the price model. Equation 6.2 is the monthly total revenue equation for imported coloured Calla.

$$TR_{zc} = (202.344 + D_i) X_{zc} - 0.007 X_{zc}^2 - 0.014 X_{jc} X_{zc} \quad (6.2)$$

where D_i represents the monthly dummy variables D_{2367} and D_5 .

Total revenue is maximised when the marginal revenue is equal for all months in the import season, and the total supply constraint for the season is met. The marginal revenue equation is obtained by differentiating Equation 6.2 with respect to X_{zc} to form Equation 6.3.

$$Mr_{zc} = (202.344 + D_i) - (0.014) X_{zc} - 0.014 X_{jc} \quad (6.3)$$

Table 6.2 shows the actual volume for imported coloured Calla in each month of the season and the associated marginal revenues, as calculated from Equation 6.3. Table 6.2 shows that the marginal revenues in each month differ. This indicates that total revenue was not being maximised by the New Zealand coloured Calla industry. This table shows that coloured Calla are oversupplied in December, January and February. This is seen by the low marginal revenues in these months. To increase the marginal revenues in these months, the quantity needed to be reduced.

Table 6.2 Actual volume supplied in each month of the imported coloured Calla season and the associated marginal revenues for each month.

Month	1992/3 Season		1993/4 Season	
	Actual Volume (stems)	Marginal Revenue (¥ per stem)	Actual Volume (stems)	Marginal Revenue (¥ per stem)
October	1540	151.94	2995	133.84
November	3340	181.48	9013	91.88
December	10948	68.39	15275	6.30
January	12705	15.86	12015	25.99
February	7610	43.14	11482	-19.25
March	4350	166.65	3037	153.35
April	2075	184.90	2555	148.90
Total for Season	42568		56372	

The optimal (maximum total revenue) pattern of imported coloured Calla supply for the 1992/93 and 1993/94 seasons (42,568 and 56,372 stems respectively) was found using the constrained optimisation procedure described in Chapter 5. Results presented in Figures 6.1 and 6.2 compare the actual with the optimal pattern of supply. Actual and maximum monthly total revenues for each season are given in Table 6.3.

For the 1992/93 season, marginal revenue equals ¥116.05/stem in each month for the optimal supply schedule. The corresponding marginal revenue for the 1993/4 season is ¥77.29/stem. This reduction in marginal revenue for the optimal supply schedule corresponds with a 147 per cent increase in the supply of Japanese coloured Calla, and a 32 per cent increase in the supply of imported coloured Calla over the two seasons.

In the 1992/3 imported coloured Calla season the actual supply of imported coloured Calla peaked in January. The remainder of the season follows a distorted bell shaped curve. In comparison to this, the optimum supply schedule for imported coloured

Calla shows two peaks. The first of these supply peaks is the largest and occurs in December, at the height of the New Zealand export season for coloured Calla. The second peak occurs in March, however this peak is not as dominant as the December peak. The principle reason for the March peak is that March is essentially prior to the natural peak of Japanese coloured Calla supply.

Figure 6.2 shows that the New Zealand coloured Calla industry has only attempted to reallocate supply to the Umeda wholesale auction market during the height of the season, by shifting supply peak from January to December. This also resulted in increased supplies in November (from 3,340 stems to 9,013 stems), another high demand month. However the industry appears to have failed to recognise that February, and to a lesser extent, January, are months of sluggish demand, as represented by the lower marginal revenues in these two months.

The optimum supply schedule for the 1993/4 imported coloured Calla season is similar to that of the 1992/3 season. The major difference is that the 1993/4 optimal allocation is approximately 2,000 stems more in each month, due to the increase in total supply over the whole season from 1992/3 to 1993/4 (an increase of 1,3804 stems). A second difference is that the difference between the two optimal allocations are less in March and April due to large increases in the volume of Japanese coloured Calla sold at the Umeda market during these months in 1994.

The total revenue predicted by Equation 6.2 is shown in Table 6.3. Table 6.3 show the total revenues for both the actual allocation of imported coloured Calla and the optimal allocation. Overall the total revenue model (Equation 6.2) predicted an increase of 20.4 per cent and 16.0 per cent, for the 1992/3 and 1993/4 seasons respectively, by optimally allocating the total supply over the imported coloured Calla season.

The optimum total revenue model predicted that large increases in revenue were possible in the shoulders of the imported coloured Calla season. For instance, Table 6.3 shows large percentage increases in total revenue in October, November and April in the 1992/3 season. The optimal allocation reduces total revenue in December, January and February. Whereas in the 1993/4 season, large increases would have occurred in October, March and April if the supply schedule was optimally allocated.

Figure 6.1

Comparison of the actual and optimum supply schedule for the 1992/3 imported coloured Calla Season.

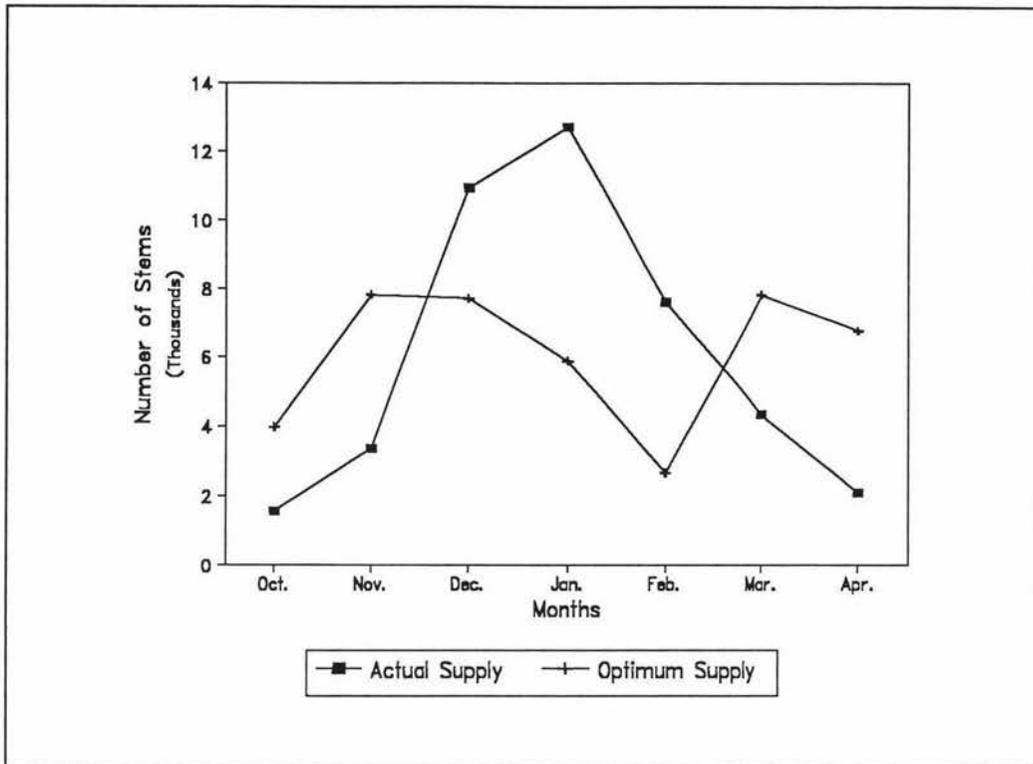


Figure 6.2

Comparison of actual and the optimum supply schedule for the 1993/4 imported coloured Calla season.

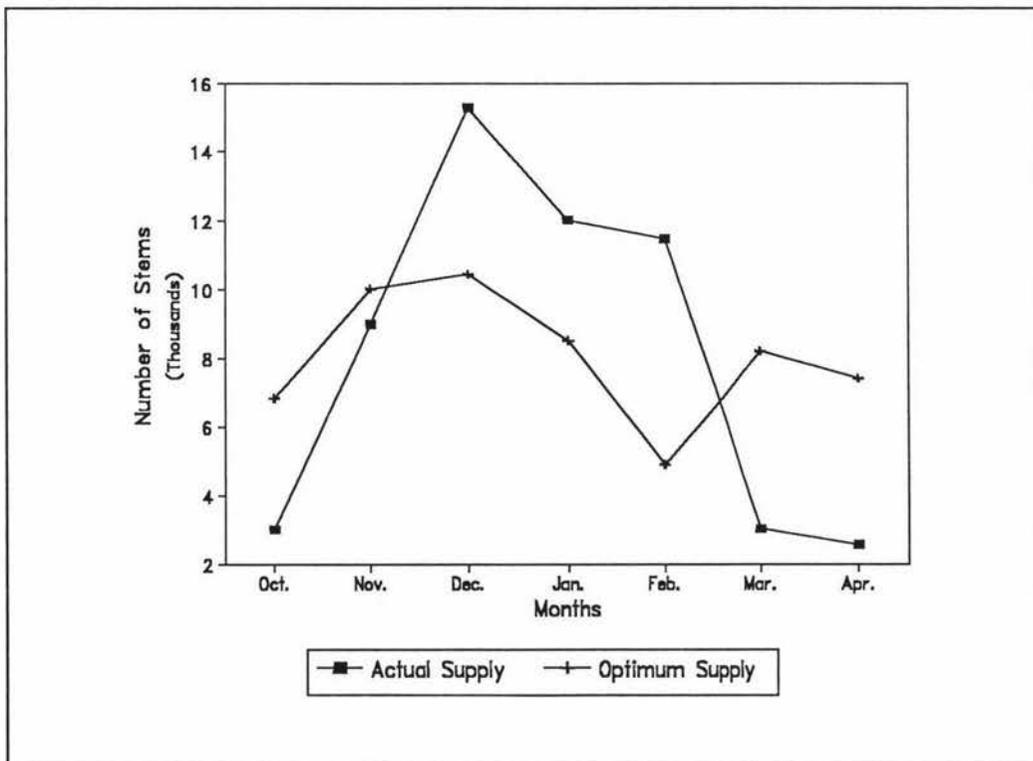


Table 6.3

Comparison of Actual Total Revenue and Maximum Total Revenue for the imported coloured Calla supplied in each month of the season.

Month	Actual Total Revenue for Imported Coloured Calla (¥'000)	Maximum Total Revenue, given the Quantity Constraint (¥'000)	Per Cent Change
1992/3 Imported Coloured Calla Season			
October	251.4	650.6	185.8
November	688.0	1,606.3	133.5
December	1,628.3	1,145.4	-29.7
January	1,386.1	641.4	-53.7
February	753.3	261.6	-65.3
March	863.8	1,548.5	79.3
April	415.3	1,353.9	226.0
Total for Season	5,986.3	7,207.5	20.4
1993/4 Imported Coloured Calla Season			
October	466.7	1,067.1	128.7
November	1,424.3	1,581.4	11.0
December	1,808.6	1,235.9	-31.7
January	1,371.7	972.7	-29.1
February	746.6	318.9	-57.3
March	533.4	1,443.6	170.6
April	428.4	1,246.3	191.0
Total for Season	6,779.6	7,866.0	16.0

Table 6.4 presents a 'map' of optimum marginal revenues (Lagrangian multiplier values). Each number was calculated using Equation 5.11 given the total supply of imported coloured calla (Q_{zc}) and the total supply of Japanese coloured Calla (Q_{jc}). In the 1992/3 season, the optimum solution of the lagrangian multiplier was ¥116.05, while for the 1993/4 season this figure was reduced to ¥77.29. On the map (Table 6.7) the 1992/3 value occurs where Q_{zc} was 42,568 and Q_{jc} was 3,279 (point A). Point B refers to the optimum solution value for the Lagrangian multiplier in the 1993/4 season as Q_{zc} was 56,372 and Q_{jc} was 8,110.

The transition from point A to point B (on Table 6.4) highlights a considerable problem for the New Zealand Calla industry. This problem is that Japanese coloured Calla supply during the imported coloured Calla season increased by a factor of 1.47. This increase is pushing the marginal revenue for each individual optimally allocated imported coloured Calla down the table to lower optimal solutions for the Lagrangian multiplier.

From Table 6.4, it is easily seen that the marginal revenue of imported coloured Calla is almost equally sensitive to changes in the supply of Japanese coloured Calla as it is to imported coloured Calla. This is seen by increasing Q_{zc} by 5,000 stems and holding Q_{jc} constant, the resultant decrease in marginal revenue is ¥10.48, whereas if Q_{zc} was held constant and Q_{jc} was increased by 5,000 stems, the marginal revenue for imported coloured Calla would decrease by ¥10.16. The same message can be gained from Equation 6.3, where say an increase in the number of stems supplied by either Japan or New Zealand has the same effect on the marginal revenue of imported coloured Calla.

Table 6.4 clearly shows New Zealand suppliers what increasing supply (when optimally scheduled) would have done to marginal revenue under different scenarios of Japanese supply schedules. This could enable New Zealand suppliers of coloured Calla to use their own estimates of marginal cost and expectations about Japanese supply to make decisions about their supply strategy for the Umeda wholesale auction market.

Table 6.4

Map of optimal solutions for the Lagrangian multiplier for imported coloured Calla.

		Qzc (Total supply of imported coloured Calla in an imported coloured Calla season)						
		35000	40000	45000	50000	55000	60000	65000
Qjc	2000	134.52	124.04	113.55	103.07	92.58	82.10	71.61
	4000	130.46	119.97	109.50	99.00	88.52	78.03	67.66
	6000	126.39	115.91	105.42	94.94	84.45	73.97	63.48
	8000	122.33	111.84	101.36	90.87	80.39	69.90	59.42
	10000	118.26	107.78	97.29	86.81	76.32	65.84	55.36
	12000	114.20	103.71	93.23	82.74	72.26	61.77	51.29
	15000	108.10	97.62	87.13	76.65	66.16	55.68	45.19
	20000	97.94	87.45	76.97	66.49	56.00	45.52	35.03
	25000	87.78	77.29	66.81	56.32	45.84	35.36	24.87

6.2 Results for Imported White Calla

6.2.1 The Regression model for the Price of Imported White Calla

The comparable adjusted R^2 showed that the best fitting model had a double logarithmic functional form and was a complex model involving relative proportions of the different Calla products. The comparable adjusted R^2 of this model was 0.7570. However, due to the exploratory nature of this paper, it was decided to use a much simpler linear model for the optimisation of the supply schedule. The loss in comparable adjusted R^2 was 0.1577, i.e. the adjusted R^2 of the best fitting linear model was 0.5993. This linear equation for the real price of imported white Calla (RP_{zw}) is presented as Equation 6.4.

$$\begin{aligned} RP_{zw} = & 213.396 - 0.001 X_{zw} - 0.002 X_{jw} - 90.716 D_{123} + 70.011 D_{58} \\ & (0.0001) \quad (0.0017) \quad (0.0016) \quad (0.0030) \quad (0.0045) \\ & + 157.457 D_9 \\ & (0.0013) \end{aligned} \tag{6.4}$$

where: RP_{zw} is the real auction price of imported white Calla at the Umeda wholesale market (¥ / stem),
 X_{zw} is the monthly imported volume of white Calla sold at Umeda (Stems),
 X_{jw} is the monthly Japanese volume of white Calla sold at Umeda (Stems),
 D_{123} is the monthly dummy variable for August, September and October,
 D_{58} is the monthly dummy variable for December and March, and
 D_9 is the monthly dummy variable for April.
Figures in brackets are standard errors of the estimates.

The coefficient for the volume of imported white Calla is negative, indicating the imported white Calla were normal products. The negative coefficient for the quantity of Japanese white Calla indicates that the two white Calla products are related. The dummy variables all make logical sense as they tend to be positive when the expected price is high and negative when the expected price is low. D123 is highly negative because August, September and October (months 1,2 and 3) are a time of extended low demand. These months correspond to late summer and autumn. In these months, especially August and September, Japanese production of many cut-flowers (including Calla) is at an annual minimum. As is expected the price is high in these months. This is because Japanese are not accustomed to buying Calla during late summer.

D58 refers to December and March, where white Calla are in high demand. This is because flower giving is very popular during festivals in March and December. The dummy coefficient for April (D9) is positive and relatively large. April marks the commencement of (enormous) supplies of Japanese white Calla. The positive value for the D9 coefficient indicates a marked shift in Japanese market demand for white Calla. This is consistent with the time of year when Japanese consumers traditionally purchase white Calla.

The analysis of variance for Equation 6.4 is presented as Table 6.5.

Table 6.5 Analysis of Variance for Equation 6.4.

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	5	44187.92278	8867.58456	7.280	0.0010
Error	16	19422.19235	1213.88702		
C Total	21	63610.11512			
Root MSE		34.84088	R-Square	0.6947	
Dep Mean		114.51637	Adj R-SQ	0.5993	
C.V.		30.42437			

The analysis of variance in Table 6.5 shows that Equation 6.4 explains approximately 70 per cent of the real auction price of imported white Calla sold at the Umeda wholesale auction market.

6.2.2 Optimal Allocation of the Supply Volume of Imported White Calla Stems

Equation 6.4 was used to obtain the monthly total revenue equation for imported white Calla. This was done by multiplying Equation 6.4 by the volume of imported white Calla;

$$TR_{zw} = (213.396 + D_i) * X_{zw} - 0.001 X_{zw}^2 - 0.002 X_{jw} * X_{zw} \quad (6.5)$$

where D_i represents the appropriate monthly dummy variable.

Hypothesis Two was tested by comparing maximum total revenue, subject to the total quantity of imported white Calla in each season, and actual total revenue. Maximum total revenue occurs when all the monthly marginal revenues are equal, therefore the marginal revenue equation was required (Equation 6.6).

$$MR_{zw} = (213.396 + D_i) - 0.002 X_{zw} - 0.002 X_{jw} \quad (6.6)$$

Equation 6.6 was used to calculate the marginal revenues in Table 6.6 for imported white Calla. Table 6.6 presents the actual volume supplied in each month along with each respective marginal revenue. From Table 6.6 one can see that the marginal revenues for the 1992/3 season are low in October and January. This means that for the total volume of imported white Calla sold at the Umeda wholesale auction market in the 1992/3 season, the market is oversupplied in October and January. Meanwhile imported white Calla were undersupplied in December, 1992 and April, 1993. The marginal revenues in the other five months indicated that smaller adjustments were required in those months, to optimally allocate imported white Calla in the 1992/3 season.

Table 6.6

Actual volume supplied in each month of the imported white Calla season and the associated marginal revenues for each month.

Month	1992/3 Season		1993/4 Season	
	Actual Volume (stems)	Marginal Revenue (¥ per stem)	Actual Volume (stems)	Marginal Revenue (¥ per stem)
August	460	107.33	680	88.95
September	1405	75.43	2240	60.39
October	4045	-8.50	4075	4.96
November	2345	104.69	7800	-23.39
December	685	221.09	9190	2.03
January	5240	16.03	7200	-43.40
February	1685	61.47	2590	45.60
March	800	85.62	1710	92.61
April	270	162.07	1260	110.22
Totals	13935		36745	

During the 1993/4 season, imported white Calla had low marginal revenues in October, November, December and January. On average the marginal revenues in the 1993/4 season were all less than half the equivalent value for the 1992/3 season. This occurred because the import supply of white Calla more than doubled in volume from 1992/3 to 1993/4.

The optimal (maximum total revenue) pattern of imported white Calla supply for the 1992/3 and 1993/4 seasons (12,935 and 36,745 stems respectively) was found using the constrained optimisation procedure described in Section 5.3 of Chapter 5. Comparison of actual and optimal patterns of supply are presented in Figures 6.3 and 6.4. Actual and maximum monthly total revenues for each season are given in Table 6.7

For the 1992/3 season, marginal revenue equals ¥91.69/stem in each month for the optimal supply pattern. The corresponding marginal revenue for the 1993/4 season is ¥37.55/stem. This reduction in marginal revenue for the optimal supply pattern corresponds with a 165 per cent increase in the supply of imported white Calla over the two seasons and a 7.8 per cent decrease in the supply of Japanese white Calla over the same seasons.

Figures 6.3 and 6.4, together with Table 6.7 indicate that the pattern of actual supplies of imported white Calla relative to the optimal supply pattern was much closer for the 1993/4 season than was the case in 1992/3. In 1992/3, the optimal supply pattern is estimated to result in a 68.8 per cent increase in total revenue, compared with only a 8.6 per cent increase for the 1993/4 season. It is suspected that during the 1992/3 season, a considerable volume of imported white Calla was sold at alternative cut-flower markets in Japan, perhaps resulting in a much less than optimal pattern of supply to the Umeda market.

Figure 6.3

A comparison of the actual supply schedule and the optimum supply schedule for imported white Calla in the 1992/3 season.

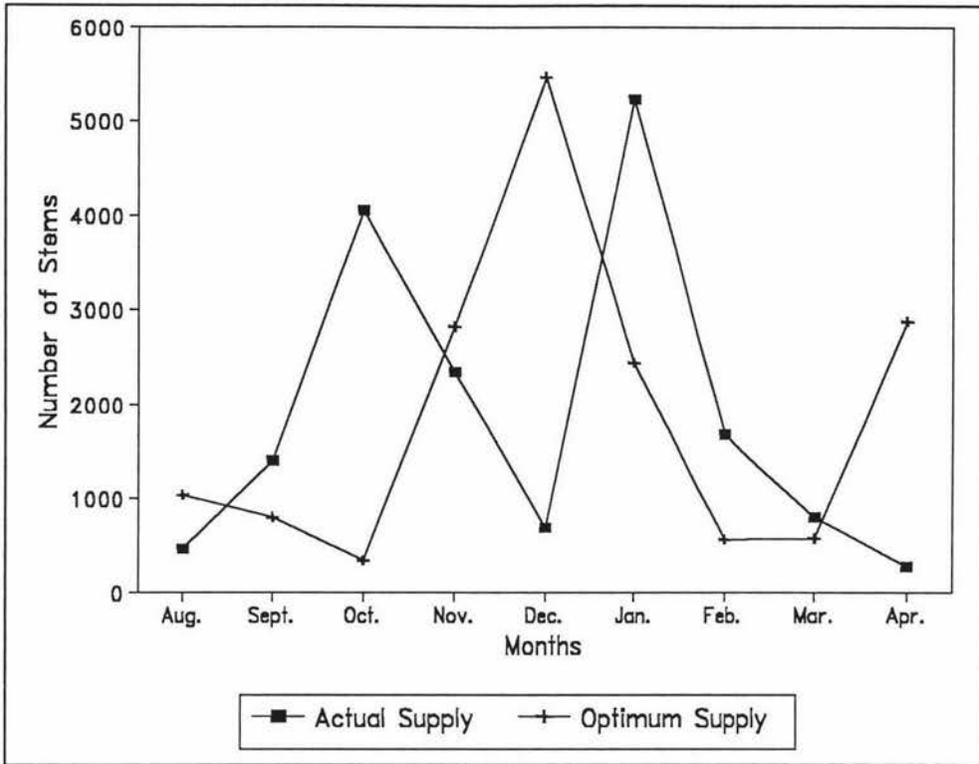


Figure 6.4

A comparison of the actual supply schedule and the optimum supply schedule for imported white Calla in the 1993/4 season.

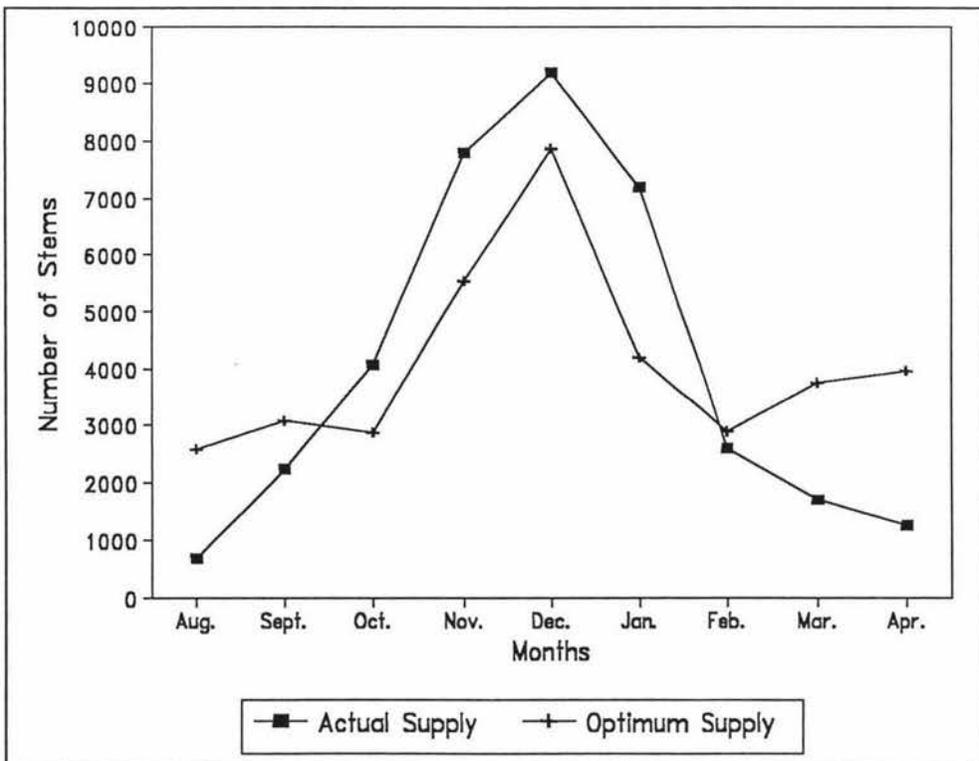


Table 6.7 Comparison of actual and maximum total revenues for the 1992/3 and 1993/4 imported white Calla seasons.

Month	Actual Total Revenue for Imported White Calla (¥000)	Maximum Total Revenue given the Quantity Constraint (¥000)	Percentage Change (%)
1992/3 Season			
August	52.2	118.0	125.8
September	132.7	75.8	-42.8
October	186.7	15.6	-91.7
November	319.8	385.4	20.5
December	157.8	1,260.9	699.1
January	455.0	211.8	-53.4
February	141.9	47.7	-66.4
March	77.1	55.5	-28.1
April	44.7	476.4	964.7
Total	1,567.9	2,647.0	68.8
1993/4 Season			
August	66.7	253.4	297.7
September	203.1	279.7	37.7
October	244.6	172.2	-29.6
November	639.5	454.6	-28.9
December	1,160.0	993.9	-14.3
January	388.0	226.6	-41.6
February	208.7	232.7	11.5
March	197.9	433.6	119.1
April	160.3	502.5	213.4
Total	3,268.5	3,549.1	8.6

The New Zealand white Calla industry needs to reallocate more stems away from the peak of the season (November, December and January) and then supply them in both early and late season months (August, March and April). However the increased total

revenues that could have been attained by optimally allocating imported white Calla in the 1993/4 season are small, at only \$4,600 or 8.6 per cent (New Zealand \$ value calculated at ¥61 = NZ\$1.00). The total revenue predicted from the Umeda wholesale auction market using Equation 6.5 with actual and optimum monthly supply volumes are presented above in Table 6.7.

Table 6.7 shows that large increases in total revenue could have been made at the Umeda wholesale auction market in December 1992, this increase resulted from allocating a further 5000 stems of imported white Calla to December. The Japanese market was expecting a much larger supply in December, this was demonstrated by the relative insensitivity of the December 1992 marginal revenue to smaller changes in supply. The comparatively small gains that were possible for the 1993/4 season show that the 1993/4 season was well allocated, in terms of maximising revenue.

Table 6.8 is a simple table which would enable New Zealand white Calla suppliers to easily see the implications of increasing their supply (when optimally scheduled) on marginal revenues under different Japanese supply scenarios. This is because table 6.8 presents a 'map' of different marginal revenues or optimal solutions for the Lagrangian multiplier. New Zealand suppliers of white Calla to the Umeda wholesale auction market could use their own estimates of marginal cost and expectations about Japanese supply of white Calla to make their own decisions about their supply strategy to the Umeda wholesale auction market.

In 1992/3 the optimised marginal revenue for imported white Calla was ¥91.68 (point A), where the total supply of imported white Calla was equal to 16,935 stems and the total supply of Japanese white Calla was 278,469 stems. Point B represents the optimised marginal revenue for imported white Calla in the 1993/4 season, where there were 36,745 imported white Calla stems and 258,300 Japanese white Calla stems supplied to the Umeda wholesale auction market.

Table 6.8 clearly shows that further increases in the supply volume of imported white Calla would be detrimental to the imported white Calla optimised marginal revenue, assuming the total revenue models are reliable for seasons after the 1992/3 and 1993/4 seasons. The supply of Japanese white Calla from the 1992/3 season to the 1993/4 season appears to be more or less stable. However, this statement must be accepted with caution, as it is only based on two and a half years of data. Moving from point A to B shows that imported white Calla approached being oversupplied to the Umeda Wholesale auction market in the 1993/4 season.

Table 6.8

Map of optimal solutions for the Lagrangian multiplier for imported white Calla.

		Qzw (Total supply of imported white Calla in an imported white Calla season)							
		15000	20000	25000	30000	35000	40000	45000	50000
Qjw (000 stems)	225	111.65	96.64	81.62	66.61	51.60	36.59	21.58	6.56
	250	105.03	90.02	75.01	60.00	44.99	29.97	14.96	-0.05
(Total supply of Japanese white Calla in an imported white Calla season)	275	98.42	73.41	68.40	53.38	38.37	23.36	8.35	-6.66
	300	91.81	76.79	61.78	46.77	31.76	16.75	1.73	-13.28
	325	85.19	70.18	55.17	40.16	25.14	10.13	-4.88	-19.89
	350	78.58	63.57	48.55	33.54	18.53	3.52	-11.49	-26.51

Legend: Qjw = Total supply of Japanese white Calla in a season.
Qzw = Total supply of imported white Calla in a season.

As long as the optimised marginal revenue is positive, then total revenue can be increased, by optimally allocating the given season's supply. In this respect it is possible for the New Zealand Calla industry to increase the volume of imported white Calla, however the allocation would be critical to that increase, as marginal revenues are close to zero, or negative, where the total supply of imported white Calla (Q_{zw}) is larger than 35,000 stems. But one important point to note is that if that total revenue is maximised where the optimised marginal revenue is zero, and oversupply occurs where the optimised marginal revenue is negative.

The map also shows that the optimised marginal revenue for imported white Calla is much more sensitive to changes in the season supply volume of imported white Calla than for Japanese white Calla. If the season supply of imported white Calla increased from 35,000 to 40,000 stems, then the resultant drop in marginal revenue is approximately ¥15 per stem. Whereas if the season supply of Japanese white Calla increased from 275,000 to 300,000 the optimised marginal revenue for imported white Calla (the optimal solution for λ , the Lagrangian multiplier), would fall by approximately ¥6.6.

6.3 Constant Market Shares Analysis Results

The results of Constant Market Shares Analysis (CMSA) focus on both traditional CMSA and improved CMSA. The actual supply season of imported white Calla and imported coloured Calla were focused on for carrying out Constant Market Shares Analysis. Therefore for imported coloured Calla, results are presented for the months of October through to April, while the results for imported white Calla are presented from August through to April. Since CMSA is utilised for examining the change of supplies between seasons, the results only present the difference between the 1993/4 season and the 1992/3 season for both imported Calla products.

6.3.1 Results of CMSA for Imported Coloured Calla

Table 6.9 displays the monthly CMSA results for each of the seven months of the imported coloured Calla season. These results are based on the difference between period II (October 1993 - April 1994) and period I (October 1992 - April 1993), at the Umeda wholesale auction market for cut-flowers. From the first row of Table 6.9 it can be seen that total value of imported coloured Calla increased from period I to period II in all months except for January and March. In January the 1993/4 price for imported coloured Calla was marginally lower than in 1992/3, also the volume was nearly 700 stems less than in the 1993/4 season. The average monthly price for imported coloured Calla at the Umeda wholesale auction market decreased from ¥223 in period I to ¥196 in period II. This reduction in price was accompanied by a reduction in the volume of imported coloured Calla at Umeda in March 1994 by 1300 stems. The other five months saw increases ranging from ¥44,000 in February to ¥785,300 in November.

The competitiveness residual is the most important determinant of changes in the import supply of coloured Calla. Using traditional CMSA, April is the only month when the structural effect is the largest effect, outweighing the competitiveness residual by ¥18,200. Compared with the competitiveness residual, the traditional CMSA second order effect, which captures the interaction between changes in market share and changes in demand, is small in all months of the imported coloured Calla season. All three traditional CMSA components reach an absolute maximum in November. This is also the month in which the largest increase in the value of imported coloured Calla at the Umeda wholesale auction market from the 1992/3 season to the 1993/4 season.

Table 6.9

Results for CMSA of Imported Coloured Calla.

	October	November	December	January	February	March	April
Change in import value	219.0	785.3	274.8	-147.6	44.3	-363.9	70.5
The CMSA decomposition							
Structural effect	-65.5	-207.8	96.9	52.1	-60.7	-177.8	43.1
Competitiveness residual	374.0	1362.2	168.0	-193.4	113.2	-231.1	24.9
Second- order effect	-89.5	-369.0	10.0	-6.3	-8.2	45.0	2.5
Growth effect	-120.6	-1010.6	-1487.0	-827.8	-230.7	-61.6	-44.0
Commodity effect	55.2	802.7	1583.9	879.9	170.0	-116.2	87.2
Pure residual	-142.7	-1040.4	-1448.8	-800.2	-226.8	-59.4	-43.3
Static structural residual	516.7	2402.5	1616.8	606.7	340.1	-171.7	68.2
Pure second-order effect	-316.3	-1323.1	-172.4	200.1	-115.2	239.7	-25.3
Dynamic structural residual	226.8	954.1	182.3	-206.4	106.9	-194.7	27.8

All values in Table 6.9 are expressed in ¥'000.

Table 6.9 shows that the structural effect was negative in October, November, February and March. This indicates that the demand for imported coloured Calla decreased in these months. This was because either Japanese Calla and imported white Calla supplies had increased, thereby reducing the market price, or, less imported coloured Calla were exported to the Umeda wholesale auction market. However, the actual data, Table A3.1b in Appendix Three, shows that the supply of imported coloured Calla increased in each of these months. But each month was characterised by a lower price at the Umeda wholesale cut-flower auction market. This supports the concept that the price was depressed by higher volumes of imported white Calla and other competing products.

The competitiveness residual reflects changes in the composition of imported coloured Calla (i.e. new cultivars), differences in grades / quality and other differences within the group of Calla cultivars, which are represented by the general term 'imported coloured Calla'. As the competitiveness residual is the largest, absolute, traditional CMSA component, it is the most important explanation of the change in total value of imported coloured Calla at the Umeda wholesale cut-flower auction.

Since the competitiveness residual was the most important factor in traditional CMSA, improved CMSA was employed in an attempt to further explain the residual. Improved CMSA divides each of the traditional CMSA effects into smaller portions. The traditional CMSA structural effect is equal to the improved CMSA growth effect and commodity effect added together. The improved CMSA pure residual and static structural residual are components of the traditional CMSA competitiveness residual, while the pure second order effect and the dynamic structural residual sum together to equal the traditional CMSA second order effect.

In all months of the imported coloured Calla season, the static structural residual is, in absolute terms, greater than the pure residual. This is useful, because the pure residual is the part of the competitiveness residual which caters for a change in the general competitiveness of imported coloured Calla. As the pure residual is negative in every month, it means that imported coloured Calla have generally become less competitive than the three competing products accounted for in this analysis, i.e. imported white Calla, Japanese white Calla and Japanese coloured Calla. In contrast to this, the static structural residual is positive, except for March. The static structural residual represents the influence of structural changes on supply performance, as measured by market share. Structural change accounted for the actions of the Japanese government in simplifying the marketing and distribution channels for

imported Calla by forcing the auction markets to be fairer to imported flowers.

6.3.2 Results of CMSA for Imported White Calla

The results of CMSA on imported white Calla are presented in Table 6.10. These results are based on the difference between the 1993/4 season (August 1993 - April 1994) and the 1992/3 season (August 1992 - April 1993). The first row of Table 6.10 shows that the total value of imported white Calla sold at the Umeda wholesale auction market increased in every month except February. The reduction of total value in February resulted from an increase of 1,000 white Calla stems sold at an average price of ¥65 less than in the previous season, see Table A3.1b, in Appendix Three.

Table 6.10 shows that the competitiveness residual is the most important determinant of the change in the supply volume of imported white Calla. This is so for all months of the imported white Calla season except for August, where both the structural effect and the second order effect outweigh the competitiveness residual. The structural effect is also large in September, this is because the volume of Japanese white Calla in August and September of the 1993/4 season was significantly less than for the 1992/3 season. Whereas the supply volume of imported white Calla remained almost constant from season to season in August and September.

In August and February the competitiveness residual is negative, this means that in a general sense, imported white Calla were less competitive than the other three Calla products. Improved CMSA apportions the competitiveness residual to two new components, the pure residual and the static structural residual. For both of these components the values are also negative, however the static structural residual outweighs the pure residual in both of these months. This means that changes to the Umeda wholesale auction market and other markets, have restricted the competitiveness of imported white Calla at the Umeda wholesale auction market in August and September.

Table 6.10

Results for CMSA of Imported White Calla.

	August	September	October	November	December	January	February	March	April
Change in import value	23.5	199.4	171.8	386.7	747.7	193.0	-31.7	36.7	142.1
The CMSA decomposition									
Structural effect	77.5	61.2	-32.6	-8.2	18.7	-5.1	-10.5	-21.3	4.0
Competitiveness residual	-16.0	89.1	233.8	402.6	660.5	201.2	-22.3	74.4	125.1
Second-order effect	-38.0	49.1	-29.5	-7.7	68.5	-3.1	1.1	-16.4	13.1
Growth effect	1.5	16.7	17.7	42.2	33.7	15.4	-1.5	0.5	0.9
Commodity effect	76.0	44.5	-50.3	-50.4	-15.0	-20.5	-9.0	-21.8	3.0
Pure residual	-1.0	7.5	24.1	43.9	29.8	16.0	-1.1	1.0	0.8
Static structural residual	-14.9	81.7	209.8	385.7	630.7	185.2	-21.3	73.4	124.2
Pure second-order effect	-11.5	160.0	155.4	362.1	2735.9	116.6	3.3	28.3	467.7
Dynamic structural residual	-26.5	-110.9	-184.9	-369.8	-2667.4	-119.7	-2.2	-44.7	-454.6

All values in Table 6.9 are expressed in ¥'000.

However, all the other months of the imported white Calla season, the static structural residual also outweighs the pure residual but is positive. Because the traditional CMSA competitiveness residual is the largest component in these months, this indicates that imported white Calla sold at the Umeda wholesale auction market have benefited from structural change at auction markets in Japan. This structural change has not seriously changed operations at Umeda, but other, competing markets have undergone considerable structural change. Data restraints make validating this statement impossible in this study.

The comparatively large traditional CMSA competitiveness residual values in October, November, December, and January show that in each of these months imported white Calla became much more competitive than the other three Calla products. By dissecting the competitiveness residual into improved CMSA components, it is clear that these large increase in competitiveness were chiefly derived from structural change in the markets for imported white Calla. This structural change resulted in imported white Calla becoming more competitive at the Umeda wholesale auction market during October, November, December, and January. These increases in competitiveness resulted in sizeable gains in total revenue from the Umeda market for white Calla imported from New Zealand.⁸

⁸ Approximately 93 per cent of all Calla imported into Japan are exported from New Zealand. This is an average over white and coloured Calla, therefore it is possible for less than 90 per cent of the white Calla imported into Japan to come from New Zealand.

CHAPTER SEVEN

CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

The purpose of this chapter is to present the conclusions of this study and to discuss the applicability of Constant Market Shares Analysis to this form of research. This chapter also identifies the limitations of this research and suggests appropriate further research on imported Calla supplies to the Japanese Calla market.

7.1 Conclusions and Implications Pertaining to Imported Coloured Calla

Coloured Calla are the mainstay of the New Zealand Calla industry. In terms of exporting Calla stems to Japan, coloured Calla account for over 60 per cent of total Calla exports to Japan by volume, and account for approximately 80 per cent of total revenues from Japan for Calla. New Zealand coloured Calla maintain a favoured position in the Japanese market. This is because imported coloured Calla are the source of the majority of new coloured Calla cultivars. Wholesalers of Japanese coloured Calla also support the off-season supply of coloured Calla by New Zealand. This is because they believe that high-quality off-season supplies facilitate the establishment of a more stable auction price throughout the whole year.

However the purpose of this study is to suggest how revenues accruing to the New Zealand Calla industry can be improved. With respect to imported coloured Calla the results provide the basis of a strategy for enhancing total revenues by rescheduling the timing of supply. This strategy begins with the price model, which leads on to optimising the supply schedule, thereby providing a strategy for maximising total revenues.

Firstly the price model states that given a certain volume of total coloured Calla, then the constant (the intercept plus any monthly dummy variables) of the price model is highest in November, December and March, whereas in February the price is lowest. But this does not directly indicate that the volume of imported coloured Calla should be increased when the price model constant is highest, and reduced in February. This would only be the case if the total supply of coloured Calla did not change from month to month through the season.

The marginal revenue for varied from month to month for the actual data for the two imported coloured Calla seasons. Total revenue is maximised, given the quantity constraint detailed in section 5.3, when the marginal revenues in each month are equal. Therefore it is concluded that total revenues were not being maximised given the quantity constraint.

To maximise total revenues, given the quantity constraint, the supply volume in each month needs to be reallocated. The normal peak of the imported coloured Calla season needs to be spread out to enable supply increases at the beginning and at the end of the imported coloured Calla season. Specifically this means reducing the

volume of coloured Calla exported to Japan during December, January and February and redistributing supplies to early in the season (October and November), and in March and April, late in the imported coloured Calla season.

Such redistribution would have improved total revenue for the New Zealand Calla Industry by ¥ 1,221,000 (NZ\$20,000) in the 1992/3 season and ¥ 1,086,000 (NZ\$17,800) in the 1993/4 season.⁹ It is important to note that these figures pertain only to the Umeda wholesale cut-flower auction. However these improvements are the principle justification for suggesting that the supply volume of coloured Calla to the whole of Japan should be redistributed away from the normal peak supply months to the early and late season shoulder months.

It is essential that the limitations implicit in the above recommendation be considered. The data period is only 30 consecutive months, from January 1992 through to June 1994, and only the data points in the season of each Calla product are utilised to form the models for each Calla product. For this reason no attempt has been made to forecast future optimum supplies. But rather actual past supplies have been analysed and the resultant optimum supply volumes solely apply to these past seasons.

Given these limitations, there is still evidence to support the recommendation that imported coloured Calla should be supplied to the Japanese market in a pattern similar to the optimum supply schedules. The only significant difference is the 'intercept' value. In the analysis, this 'intercept' value is the quantity constraint, whereas in future imported coloured Calla seasons, the 'intercept' is equal to estimates of total supply of imported coloured Calla for the whole season. The other important point to note is that the price model, and therefore the optimal supply schedule, is dependent on the supply of Japanese coloured Calla as well as imported coloured Calla. Therefore if there are any significant changes in the volume of Japanese coloured Calla during the imported coloured Calla season, the appropriateness of the price model is doubtful, as it was based on a set volume.

Table 6.4 presented a map of marginal revenues based on various total season supplies from Japanese and imported coloured Calla. The map shows that the marginal revenue attributable to imported coloured Calla, is almost equally dependent on the total volume of Japanese coloured Calla as it is on imported coloured Calla. This means that the New Zealand coloured Calla industry must be fully aware of

⁹ The New Zealand Dollar values were calculated at 61 Yen (¥) per Dollar.

production trends of Japanese coloured Calla. It is equally important for the New Zealand coloured Calla industry to understand the dynamics of the Japanese wholesale auction markets. By this it is meant that the marginal revenue of imported coloured Calla sold at the Umeda market is heavily influenced by the decision of Japanese coloured Calla suppliers on which markets to supply. Obviously if they decide to supply the Umeda market then the marginal revenue for imported coloured Calla sold at Umeda will fall. This point is highlighted by the growth in Japanese supply of coloured Calla to the Umeda market from 1992/3 to 1993/4, and the respective fall in marginal revenue.

For this reason, it is strongly recommended that Japanese importers, New Zealand exporters and growers all become familiar with a wide range of markets in Japan. At the same time it is important that the growers and exporters know which market they are supplying. Only then will the New Zealand coloured Calla industry be able to maximise profit from the Japanese Calla lily market.

If imported coloured Calla are supplied to markets with high volumes of Japanese coloured Calla, it is expected, based on the findings of the Umeda wholesale cut-flower auction market, that the marginal revenue will be low (near the point at which total revenue is at a maximum). By extending table 6.4 to larger volumes of Japanese coloured Calla over the imported coloured Calla season, the marginal revenue could be negative, thereby indicating an oversupply of imported coloured Calla. For this reason it is important that the New Zealand coloured Calla industry become informed of changes occurring at individual wholesale markets in Japan.

7.2 Conclusions and Implications Pertaining to Imported White Calla

Imported white Calla have a longer season than imported coloured Calla. The reason for this is that it is possible to harvest and export white Calla stems up to two months earlier than coloured Calla, and white Calla are still available in April, at the end of the import season. White Calla account for approximately 40 per cent of the total volume of Calla imported to the Umeda wholesale auction market. However they account for only 20 per cent of the total revenue for the New Zealand Calla industry from the Japanese market. This indicates that imported white Calla are a lower value product, when compared with imported coloured Calla. So why are imported white Calla of importance to the New Zealand Calla industry?

Interviews with Japanese importers, wholesalers of Japanese cut-flowers, and the auctioneers and New Zealand exporters, indicated that imported white Calla play a vital role in the Japanese Calla market. For Japanese white Calla suppliers, the presence of imported white Calla is minimal, see Figure 4.6. Even though the majority of imported white Calla are supplied during the off-season and pre-peak shoulder of the Japanese white Calla season, imported white Calla seldom account for over half of the market. For this reason and the sheer enormity of the Japanese white Calla supply, the Japanese do not consider imported white Calla much of a threat to the Japanese white Calla industry.

As for the imported coloured Calla industry, the market presence of imported white Calla is beneficial. Significant volumes of imported white Calla at the Japanese auctions up to two months prior to the beginning of the imported coloured Calla season, helps to annually educate the Japanese buyers that imported Calla are good value and high quality products.

Total revenue was maximised subject to a total volume constraint for the two imported Calla products. This was done by constraining the total supply volume in each season to the actual supply volume in that season, and then rescheduling supply volumes within each season, subject to the total season volume constraint. Marginal revenue was calculated for each month during the supply season. When the marginal revenues in each month of a season were the same the supply schedule was optimised for that season and total revenue was at the maximised for that season.

Since the actual supply schedule in the 1992/3 season is so different to the supply schedule in the 1993/4 season, each season is discussed separately. For the 1992/3 season, the results show that supply volumes in October, January and February should all be reduced. Meanwhile the months of November, December, March and April were all under-supplied in the 1992/3 season.

However the 1993/4 season shows significant improvements over the 1992/3 season. Over-supply only occurred in January and under-supply occurred in just two months, March and April. Figure 6.3 and Table 6.7, suggest that if the optimal supply schedule had been followed, total revenue for imported white Calla could have been increased by ¥ 108,000 (NZ\$ 17,700).¹⁰ This shows that the imported white Calla suppliers supplied the optimum number of white Calla stems for two thirds of the season. This could be due to New Zealand Calla suppliers being able to control the supply timing of white Calla to the Umeda wholesale auction market, or due to favourable natural factors, such as the weather during the growing season.

Therefore in conclusion the imported white Calla supply schedule was almost at the optimum level throughout the 1993/4 season. The reallocation suggested in the results, Figure 6.4 and Table 6.7, reveals that improvements of ¥ 281,000 (NZ\$4,600) could have been made¹¹. Therefore provided that the volume or timing of other Calla products, both imported and Japanese, remain at relatively constant levels over time for each month of the imported white Calla season, future supply patterns should follow the 1993/4 season. The only logical changes are to reduce supply in January by half and reschedule the supply of these imported white Calla so that they are equally distributed in March and April.

Once again it is important to assert that these recommendations pertain only to the Umeda wholesale cut-flower auction market. However the Umeda wholesale cut-flower auction market is representative of other major wholesale cut-flower markets in Japan. Because the gain in total revenue from optimally allocating supplies over the imported white Calla season to the Umeda wholesale auction market are minor in the 1993/4 season (\$4,600). The cost of modifying the supply schedule should be considered before any modifications are undertaken. This is because the cost could easily outweigh the gain in total revenue, especially if future supply schedules are as close to the optimum as the 1993/4 season.

¹⁰ The New Zealand dollar amount was calculated at ¥61 to the dollar.

¹¹ The New Zealand dollar amount was calculated at ¥61 to the dollar.

Table 6.8 showed the large volume of Japanese white Calla as compared to the volume of imported white Calla supplied to the Umeda wholesale auction market. Table 8 shows that the marginal revenue for imported white Calla is more sensitive to the changes in the volume of imported white Calla, than changes in the supply volume of Japanese white Calla over the imported white Calla season. This means that any large increase in the volume of Japanese white Calla sold at Umeda between August and April, though unlikely to occur, will have only a small impact on the marginal revenue for imported white Calla.

However further expansion of the supply volume of imported white Calla is expected to quickly lead to oversupply, as the marginal revenues are negative for larger supplies (45,000 - 50,000 stems) of imported white Calla. For this reason it is vital that the New Zealand white Calla industry be fully aware of why they export white Calla to Japan. If the reason for exporting white Calla only applies to white Calla, then the industry should be cautioned that they for the 1993/4 season they were close to the total revenue maximising supply schedule. Therefore total revenue could not have been increased by more than \$4,600 during the 1993/4 season. The industry, therefore, needs to be extremely cautious about supplying more white Calla to the Umeda market.

If however, the key reason for supplying white Calla to the Umeda market is to increase market awareness of imported Calla, then oversupply of imported white Calla may not be such a major issue. This is because imported coloured Calla are a high value product. The extra gains for imported coloured Calla made by supplying imported white Calla to the Umeda market before the imported coloured Calla season, could easily outweigh the cost to imported white Calla of oversupply.

7.3 Conclusions and Implications Pertaining to Constant Market Shares Analysis

Applying Constant Market Shares Analysis to data from Calla lily auctions at the Umeda wholesale cut-flower auction in Japan is essentially a test of CMSA on how appropriate it is as a tool for analysing changes over time in small data sets. This is because the data set has a maximum of 30 observations for each variable. These 30 observations account for only two and a half years.

Adding to this test is the second and far more important question, is CMSA an appropriate tool for analysing changes in product supply where the product is differentiated and the market along with the supply is expanding rapidly? The chief reason for this question lies in the application of CMSA in the literature. In the past CMSA has been chiefly applied to commodities as opposed to differentiated products.

Alias and Sulieman (1993a) applied traditional CMSA to a commodity, natural rubber. Other articles on applying CMSA also focus on a commodity. Ahmadi-Esfahani (1993), on the other hand, applied improved CMSA to the Egyptian wheat import market. In some ways the Umeda wholesale auction market for Calla is similar to the Egyptian wheat market, in that both commodities (Calla and wheat) can easily be argued to be differentiated products, as wheat and Calla both have a number of different grades and varieties.

As for applying CMSA to test how appropriate it is in markets showing very strong growth, this has been done before. An example of similar research is Brownie and Dalziel (1993). Their research investigated why exports from New Zealand had increased by only 95.3 per cent from 1970 to 1989, while world trade had expanded 152.9 per cent. Unlike the case of changing differentiated products CMSA has been found to provide useful information in times of rapid growth.

From a theoretical perspective CMSA should provide useful information regarding the change between two time periods, provided that the product(s) on which the analysis is being carried out remain the same from the initial time period to the end. In many cases this problem could easily be solved by taking the difference between two time periods closer to each other.

However Calla lilies are a changing differentiated horticultural product. The cultivar mix in 1992/3 is different from the cultivar mix in the 1993/4 season. This is

confirmed by the competitiveness residual being large, outweighing both the structural effect and the second order effect. Where this is case, CMSA suggests that the time periods are too different, or too far apart. Since CMSA had to initially be applied to two consecutive seasons, due to data limitations, the theoretical advice indicates using CMSA on a month to month basis.

How can one compare the change in export supply of Calla stems from one month to the next. For a start, the market shows seasonal demand fluctuations, and secondly Calla are a horticultural product whose production is highly seasonal. One should expect changes on a month to month basis.

Hypothesis Four was rejected. CMSA is not an appropriate tool for analysing differentiated products. This is especially the case where the underlying product composition is continually changing. This conclusion may not have been reached, however, had the data set been larger and more comprehensive, If data on individual Calla cultivars sold at the Umeda wholesale auction market was available, then Hypothesis Four may have been accepted as true. However such detailed data is not available.

The limitations of CMSA have been pointed out in section 5.4.1. The attempt to employ CMSA on the small data set gathered from the Umeda wholesale auction market resulted in insufficient results to confidently explain the factors that influenced the change in supply volume. For this reason Hypothesis Three was also rejected, as the results fail to adequately explain the change in supply of imported Calla at the Umeda auction market. Therefore it is concluded that CMSA is not an appropriate tool for analysing changes in small data sets. This conclusion is supported by implication by Jepma (1986), Ahmadi-Esfahani (1993), and Richardson (1970, 1971a and 1971b), however it is never directly stated.

To further explain the change in market share of both imported Calla products, an analysis on both price and non-price factors is required. Such analyses were not attempted in this paper. Non-price analysis is seen as an essential complement to Constant Market Shares Analysis (Jepma, 1986).

7.4 Limitations of the Study

Recent years of economic reorganisation in New Zealand have resulted in more internationally competitive industries. One such industry is the New Zealand floricultural industry, which is now widely diversified, supplying many different floral products to a diverse number of markets. Calla are one such 'new' floral product. From the original white Calla cultivars through to the newly developed coloured Calla cultivars, New Zealand's natural off-season supply ensures that New Zealand is competitive in both white Calla and coloured Calla in Japan.

However, there is a second reason for the New Zealand Calla industry's success, this pertains to the investment that the New Zealand Calla industry has made into new cultivar breeding. The Japanese approve of imported supplies of Calla for both of these two reasons. Firstly the Japanese growers can only supply significant volumes during the Japanese season (much of which is the New Zealand off-season). Therefore, they believe that without imported supplies the price for Japanese Calla, both white and coloured, would be less stable and lower at the beginning of their season. This is because the Japanese consumers of floral products would soon forget about Calla and purchase any of the wide number of alternative flowers. Imported Calla, available during the Japanese off-season maintains the presence of Calla all year round, and therefore helps to stabilise the auction price of Calla.

The ability of the New Zealand Calla industry to consistently add new cultivars to the range of available Calla also interests the Japanese Calla industry. New cultivars enter the Japanese market at a low price, but soon they begin to attract a premium as their popularity grows. The following import season sees the availability of the tubers of these new Calla cultivars. The Japanese Calla industry then imports these tubers and begins production of the new cultivar. The Japanese Calla industry can auction stems from a new Calla cultivar after only 18 months from the product release in New Zealand, or anywhere else in the world for that matter. New cultivars are extremely important to the New Zealand Calla industry. This is because new cultivars soon attract premium prices which increase the average price of all imported coloured (and to a lesser extent white) Calla, the Japanese wholesale cut-flower auctions.

The availability of only 30 consecutive months of data made analysing such a 'cultivar hypothesis' difficult. Moreover the form of the data set made such analysis impossible, as the data set did not differentiate between Japanese and imported

supplies at the individual cultivar level of specification. Because of this limitation all reference to the impacts of new cultivars was based on interviews with New Zealand grower representatives and exporters and Japanese importers, wholesalers and auctioneers.

Similarly the impact of quality differences was also unable to be adequately addressed in the research. Data set constraints meant that differences in quality levels (grades) between each of the four Calla products were also unavailable. Therefore any reference to quality differences between import and Japanese supply is totally reliant on the statements of Japanese auctioneers, wholesalers and importers and New Zealand exporters.

For these reasons the analysis carried out for this research is based on the hypothesis that " New Zealand's off-season supply is the principle reason for the success of imported Calla in the Japanese wholesale auction markets."

7.5 **Suggestions for Further Research**

As this research was limited by the short data period it is recommended that data for the 1994/5 and 1995/6 seasons should be collected. The purpose of this is to provide more observations for each month. An increased number of observations will improve the predictive accuracy of the regenerated price models. Upon replication, it may be possible to forecast market trends into the future.

The reliability of the forecasts with such a limited data set is questionable. This is because there are insufficient observations to, with certainty, determine what the trends really are. However if more data was collected from the same auction markets (principally the Umeda wholesale cut-flower auction market) such trends would become evident and forecasting would be more appropriate as the forecasts became more reliable.

This recommendation does however imply that data collection will be required in June 1996 and again in June 1998. For continuing the possible forecasts, data will need to be collected every second year from then on. The reason for repeating data collection every two years is because the Japanese wholesale cut-flower markets only retain market data for a period of two years. Therefore to gain a full and comprehensive database of the Japanese wholesale Calla lily market, or an even wider scale, the Japanese wholesale cut-flower market, repeated data collection is required.

Further research also needs to be undertaken into why the New Zealand Calla industry does not appear to be receiving market information through normal channels. Such research would hopefully resolve the lack of market information that New Zealand Calla growers presently have. This would better enable them to improve their relative competitiveness in the Japanese, and other markets.

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APPENDIX ONE

LIST OF INTERVIEWEES

Including: New Zealand grower representatives, New Zealand exporters and marketers, Japanese wholesalers and importers, a Japanese tuber importer, Japanese wholesale cut-flower auction houses, New Zealand and Japanese Government representatives, and academics in Japan and in New Zealand.

New Zealand Grower Representatives

Theo Muller, representative,
New Zealand Calla Council.

Tony Georgetti, representative,
New Zealand Calla Growers Association.

Bruce Harvey, representative,
New Zealand Floriculture Federation.

Rene Vonhume, representative,
New Zealand Flower Council.

Doug Naulls, representative,
Northland Zantedeschia Association.

New Zealand Exporters and Marketers

Sandra Baldwin, Marketing Executive, Flower Exports,
Chiquita Brands New Zealand Ltd.

Mike Desmond, Export Manager,
Eastern and Global (NZ) Ltd.

Carol Jacobs, Marketing Manager, Japan,
Flower Zone International Ltd.

Theo Muller, Managing Director,
Muller Marketing Ltd.

Stephen Arnet, Export Manager,
United Flower Auction Ltd.

Japanese Importers and Wholesalers

Hiroshi Nobayashi, Managing Director,
Art Vahno Corp.

T. Kayano, President,
Create Co., Ltd.

Kawasaki Megumi, Merchandising Division Manager,
Create Co., Ltd.

Susumu Kimoto, Director, General Manager, Cut-Flower Division,
Corunum Corp.

Sugiyama-san, Director,
Flora-International Co., ltd.

Takako-san, Senior Trader,
Flora-International Co., ltd.

Albert Wetzler, President,
Florimex Tokyo, Ltd.

Vincent Zwijsen, Senior Trader,
Florimex Tokyo, Ltd.

Emoko Watanabe, Assistant Manager of Floriculture,
Kirin Brewery Co., Ltd.

Miyako Hazama, Chief Assistant to General Manager
of Agribio Business Division,
Kirin Brewery Co., Ltd.

Y. Hanano, Deputy General Manager, Horticulture Department,
Mitsui O.S.K. Kogyo Co., Ltd.

Hirokazu Sasamura, Horticulture Department,
Mitsui O.S.K. Kogyo Co., Ltd.

Sugiyama-san, Chairman,
Japanese Cut-Flower Import Association

Takashi Shibata, Cut-Flower and Horticulture Section,
Sales Department, Second Division,
Ocean Trading Co., Ltd.

Kazuhide Ishikawa, Chief, Section 3 (Cut-Flowers), Provisions Department,
International Division,
Showa Boeki Co., Ltd.

Shuji Ono, Section 3 (Cut-Flowers), Provisions Department,
International Division,
Showa Boeki Co., Ltd.

Keiji Maeda, Sales Manager,
Toa Trading Co., Ltd.

Chikako Yoshimoto, Senior Trader,
Toa Trading Co., Ltd.

Yoko Sakamoto, President,
YMS Co., Ltd.

Satoshi Oyagi, Trader,
YMS Co., Ltd.

Japanese Calla Tuber Importer

Kazuya Tojo, International Business Section, International Department,
Dai-Ichi Seed Co., Ltd.

Japanese Wholesale Cut-Flower Auctioneers

Yamamoto Kaiichi, Senior Auctioneer,
Nishi-Nihon Co., Ltd.
(Nishi-Nihon - Osaka)

Tomihiro Masuda, Director,
Osaka Seika Oroshi Kabushiki Kaisha, Daini Eigyo Sho
(Osaka Number 2)

Yuzo Mori, President,
Osaka Kaki Engei Chiho Oroshi Ichiba, Umeda kaki Ichiba
(Umeda - Osaka)

Yuzo Mori, Chairman,
Nippon Kaki Oroshi Shijohi Kyokai Co., Ltd.
(Orta - Tokyo)

New Zealand and Japanese Government Representatives

Matsuo Maruyama, Senior Marketing Manager,
New Zealand Trade Development Board
(New Zealand Embassy Tokyo)

Michio Sugimoto, Managing Director,
Osaka Chamber of Commerce and Industry.

Kenji Toyooka, Manager, Secretary Division,
Osaka Chamber of Commerce and Industry.

Academics

Prof. Toshiaki Kawano, Faculty of Economics,
Hitotsubashi University.

Dr. Keith Funnell, Department of Plant Science,
Faculty of Agriculture and Horticulture,
Massey University.

Ewen Cameron, Department of Agricultural and
Horticultural Systems Management,
Massey University.

Prof. Hideo Imanishi, Professor of Ornamental Horticulture,
College of Agriculture,
University of Osaka Prefecture.

Dr. Motoaki Doi, Laboratory of Floriculture, College of Agriculture,
University of Osaka Prefecture.

APPENDIX TWO

A BRIEF OVERVIEW OF CONSTANT MARKET

SHARES ANALYSIS

- A2.1 Review of Literature Pertaining to Constant Market Shares Analysis
- A2.2 Philosophy of Constant Market Shares Analysis
- A2.3 Choice of a Standard
- A2.4 Application of CMSA to Volumes or Values
- A2.5 The Order Problem of Traditional CMSA
- A2.6 The Index Problem of Traditional CMSA
- A2.7 The Improved CMSA Identity

A2.1 Review of the Literature Pertaining to Constant Market Shares Analysis

The Constant Market Shares approach has been utilised for analysing trade flows and export performance on both manufactured products (amongst others, Tyszinski, 1951) and agricultural commodities (amongst others, Rigaux, 1971, Sprott, 1972 and Durham and Lee, 1987). Constant Market Shares Analysis (CMSA) is a frequently employed deterministic technique for quantifying changes in supplies. CMSA can only operate as an *ex post* method of quantifying such supply changes (Jepma, 1986). The reason for using the rather ambiguous word 'supplies' is because CMSA has been applied to both export trade flows (e.g. Rigaux, 1971, Balassa, 1978 and Alias and Suleiman, 1993a), and to import trade flows (e.g. Jepma, 1986, and Ahmadi-Esfahani, 1993). Constant Market Shares Analysis is equivalent to Shift and Share Analysis, which has been widely used in regional economic analysis, both within a single country and across international borders. The articles of Berzeg (1978), Hoare (1986), and Brownie and Dalziel (1993) are all examples of Shift and Share Analysis.

Constant Market Shares Analysis quantifies the portion of a change in supply, which over a period of time can be attributed to the specific characteristics of the commodity and market composition of the supply, and which part is attributable to the competitiveness of the supply (Jepma, 1986). Because CMSA is based on a very simple identity and has proven to be a simple technique for identifying the source of a change in supply, it quickly grew in popularity since it was first employed by Tyszinski in 1951. Due to the ability of CMSA to provide useful information on the nature of trade flows and supply performance, it has frequently been used to examine both these points (Ahmadi-Esfahani, 1993).

A2.2 Philosophy of Constant Market Shares Analysis

As Constant Market Shares Analysis is based on a simple identity, the philosophy is rather simple. The basic CMSA identity is based on the derivation of a change in a country's exports (imports) into two parts. The country for which this analysis is being conducted is known as the 'focus country'. The first part is a hypothetical change in the focus country's exports (imports) assuming the share of the focus country's exports (imports) remain unchanged relative to the exports (imports) of a standard (Jepma, 1986). This begs the question of what is an appropriate standard (Richardson, 1971a). The choice of an appropriate standard is discussed fully in section A2.1.2 below. The second part, according to Jepma, (1986) and Ahmadi-Esfahani (1993) is a residual which indicates the difference between the actual change and the hypothetical change with regard to the focus country's exports (imports).

Since the point of reference (the standard) is based on the constancy of market shares, the hypothetical change is the reference level (Jepma, 1986). This is because the actual change that would have occurred if the focus country's competitiveness in the market remained unchanged throughout the entire period of investigation (Ahmadi-Esfahani, 1993). Therefore the size of the residual indicates the change in the competitiveness of the focus country's exports (Richardson, 1971b). This is why the residual is sometimes also termed to competitiveness residual (CR).

$$\Delta F \equiv S \Delta V + V \Delta S \quad (\text{A2.1})$$

SE CR

Where ΔF = the change in exports from the focus country,
 V = the supply from other countries (the standard),
 S = the focus country's market share ($S=F/V$),
 Δ = the change from one time to another.

However equation A2.1 is seldom used in CMSA, as the CMSA technique is usually applied at discrete time intervals. Allowing for discrete time intervals modifies equation A2.1 into equation A2.2 below.

$$\Delta F \equiv S_0 \Delta V + V_0 \Delta S + \Delta S \Delta V \quad (\text{A2.2})$$

SE CR SOE

For both equations A2.1 and A2.2 the SE is the structural effect, and expresses the reference point. The difference between equation A2.1 and A2.2 is that equation 2.2 has a third component, the second order effect (SOE). The SOE represents the dynamic changes in market share with changes in demand (Ahmadi-Esfahani, 1993). Both equations A2.1 and A2.2 clearly show the CMSA decomposition is conducted *ex post*. This renders CMSA a "system of categorisation and classification" (Richardson, 1970). This means that the CMSA identity is a descriptive technique and, therefore, can give no insight into the factors underlying fluctuations in market shares (Jepma, 1986).

As the purpose of CMSA is to indicate the influence of the structure of exports of the focus country on export performance, equations A2.1 and A2.2 are normally unsuitable. This is because they fail to account for separate products by accounting for an aggregate of a group of products (Jepma, 1986). This means that equation A2.1 and A2.2 treat the focus country's exports and the export flows from the standard (competitors) as one homogeneous trade flow (Richardson, 1970). In terms of actual data, such an assumption would seldom hold.

Therefore it is implied that CMSA should be conducted on disaggregate data. This allows for heterogeneous trade flows to be considered, as opposed to homogeneous trade flows. This implies that the interplay of export structure and changes in the patterns of demand for international trade influence the focus country's export performance (Jepma, 1986). For a multi-commodity, multi-market world, such disaggregation of trade flows is determined by the number of products (or product groups) and markets distinguished for the exported commodity of the focus country

Trade flow disaggregation redefines the point of reference (SE) as being the increase in the focus country's exports, where the market shares of all its disaggregated trade flows are kept constant (Jepma, 1986). This modification results in equation A2.3, the multimarket, multicommodity equivalent of equation A2.2.

$$\Delta F \equiv \sum_i^n \sum_j^n S_{ij0} \Delta V_{ij} + \sum_i^n \sum_j^n V_{ij0} \Delta S_{ij} + \sum_i^n \sum_j^n \Delta S_{ij} \Delta V_{ij}$$

Structural Effect competitiveness effect second order effect (A2.3)

where: ΔF = change in exports from the 'focus country' (values or volumes)

S_{ij0} = initial period share (F_0/V_0)

ΔS_{ij} = change in share ($F_1/V_1 - F_0/V_0$)

V_{ij0} = initial period exports from other countries

ΔV_{ij} = change in other countries exports ($V_1 - V_0$)

i denotes one of the 'n' different commodities

j denotes one of the 'n' different markets.

(Equation A2.3 is sourced from Ahmadi-Esfahani, 1993 and Jepma, 1986)

The CMSA equation for the flow of various commodities into various markets (equation A2.3) differs from equation A2.2 as the structural effect no longer has the same definition (Jepma, 1986). This results from equation A2.3's structural effect being defined assuming that the focus country's exports differ from the exports of the standard, whereas the Structural Effect of equation A2.2 is based on the assumption that the focus country's exports are representative of the standard (Jepma, 1986).

The exact definition of a standard is arbitrary, as it is entirely dependent on the commodity, market and focus country under investigation. This is a short coming of CMSA as different standards can result in very different results and conclusions. For this reason section A2.1.2 is devoted to debating the applicability of different standards. Other problems with CMSA are also discussed in the following sections. Section A2.1.3 describes the debate over whether CMSA should be applied to volume data or to rather to value data. Section A2.1.4 explains and resolves the order problem of traditional CMSA (that is, pertaining to equation A2.3). Finally section A2.1.5 explains the index problem of traditional CMSA and introduces improved CMSA which has accounted for both the index and order problems.

A2.3 Choice of a Standard

Choosing an appropriate standard for CMSA is very important as different standards have the potential of generating very different results.¹² This is because the standard is involved in the calculation of each and every component of equations A2.1, A2.2 and A2.3. Many studies have used world growth rates as a standard to compare the growth rates of individual countries against (Leamer and Stern, 1970). However as Richardson (1971a) points out, in simply choosing a world wide standard and applying it to the focus country, the researcher ignores the fact that CMSA examines competitiveness. Richardson explains that many previous studies made this mistake by not taking the standard to be the sum of all the competitors of the focus country. Jepma (1986) and Leamer and Stern (1970) also point out that mis-specification of the standard seriously influences CMSA results.

To illustrate this point, consider a small Pacific Island with a limited range of products. If CMSA was undertaken on this Island, it would be misleading to compare it's export performance with the export performance of diverse and highly industrialised countries, or even a global standard. Instead it would be more beneficial, in terms of the results, to compare the small Pacific Island with other Islands. Therefore limiting the standard to being the sum of the exports from small Pacific Islands, with similarly a limited range of products. This illustration is analogous to that presented the article "Constant-Market-Shares Analysis of Export Growth" (Richardson, 1971a)

However the selection of a specific standard for each focus country, and for each commodity seriously limits the comparability of different CMSA results. This is because each CMSA result is likely to have been conducted on a different standard. This, therefore, implies that no such comparison could be made (Richardson, 1971a and Jepma, 1986). Richardson continues to argue that a global standard should not be selected simply for the sake of comparing results. This is because Richardson believes that a global standard sacrifices the meaning of the results, as they would be difficult to interpret (Richardson, 1971a). For this reason most CMSA research is conducted on more specific standards (e.g. Rigaux, 1971, Berzeg, 1978, Ahmadi-Esfahani, 1993 and Brownie and Dalziel, 1993).

¹² For further information on the possible differences in CMSA results from the choice of different standards see the following two journal articles, "Constant-market-shares analysis of export growth" (Richardson, 1971a) and "Some sensitivity tests for a "constant-market-shares" analysis of export growth" (Richardson, 1971b).

A2.4 Constant Market Shares Analysis Application to Volumes or Total Values

Traditionally Constant Market Shares Analysis has been applied to total value (or revenue) data. The main reason for this is that reliable quantity data has often been impossible to obtain (Richardson, 1971a). The vast majority of CMSA research has been applied to total value data, examples range from Tyszynski (1951), to Leamer and Stern (1970), Rigaux (1971) to Ahmadi-Esfahani (1993). The notable exception to applying CMSA to total value data is Richardson (1970, 1971a and 1971b). Richardson (1971a) argues that the application of CMSA to total value data is fundamentally incorrect, and that instead volume data should have been sought and utilised.

Richardson's argument follows that if total values are used, an increase in the focus country's relative competitiveness is measured by a fall in the relative price of the focus country's commodities. Therefore, this could lead to a decrease in the export market share, as measured by the total value, given an elasticity of substitution of less than absolute one. Where relative prices are taken as the measure of competitiveness, the elasticity of substitution is related and is often less than absolute one (Richardson, 1971a).

Richardson continues by stating that the CMSA Competitiveness Residue directly depends on the change in export market shares. Therefore both a positive and a negative Competitiveness Residual are consistent with rising competitiveness (as defined by a falling relative price). If CMSA was applied to both total value and volume data, it would be quite possible for the CMSA results to contradict one another, in terms of sign (Richardson 1971a, 1971b). For these reasons Richardson believes that applying CMSA to total value data is totally erroneous.

However traditional CMSA has been applied to total value data. Even today, following Richardson's arguments against applying CMSA to total value data, the vast majority of CMSA research focuses on market shares and export performance in terms of total values and not by volumes.

A2.5 The Order Problem of the Traditional Constant Market Shares Analysis Identity

Traditional Constant Market Shares Analysis has two further components to that stated in equation A2.3. These two components are the market effect and the commodity effect and are derived from derivations of the structural effect of equation A2.3. Symbolically the structural effect can be defined in two ways. Both definitions are shown below as equations A2.4 and A2.5.

$$\sum_i^n \sum_j^n S_{ij0} \Delta V_{ij} \equiv S_0 \Delta V + \left(\sum_i^n S_{i0} \Delta V_i - S_0 \Delta V \right) + \left(\sum_i^n \sum_j^n S_{ij0} \Delta V_{ij} - \sum_i^n S_{i0} \Delta V_i \right)$$

structural effect growth effect commodity effect market effect (A2.4)

$$\sum_i^n \sum_j^n S_{ij0} \Delta V_{ij} \equiv S_0 \Delta V + \left(\sum_j^n S_{j0} \Delta V_j - S_0 \Delta V \right) + \left(\sum_i^n \sum_j^n S_{ij0} \Delta V_{ij} - \sum_j^n S_{j0} \Delta V_j \right)$$

structural effect growth effect market effect commodity effect A(2.5)

Both equations A2.4 and A2.5 are adapted from "Extensions and Application Possibilities of the Constant Market Shares Analysis: The Case of the Developing Countries' Exports" (Jepma, 1986). The Growth Effect expresses the reference level for the increase in the focus country's exports if the export structure of the focus country equals that of the standard. In both equations A2.4 and A2.5 the growth effect expresses the same reference level as the structural effect in equation A2.2 does. Whereas the two commodity effects and the two market effects differ from each other under normal conditions. (Richardson, 1971a).

Constant Market Shares Analysis is conducted on the second level by choosing either equation A2.4 or equation A2.5 and then substituting one of them into equation A2.3. the results of CMSA depend on which of the two structural effect equations is chosen. In the first level decomposition of the CMSA identity (equations A2.1 and A2.2) the structural effect can not be dissected into equations A2.4 and A2.5 because the trade flow is assumed to be homogeneous (Jepma, 1986). However at the second level of CMSA decomposition (equation A2.3) trade flows are assumed to be heterogeneous and therefore equations A2.4 and A2.5 equate to the structural effect in equation A2.3. This means that the sum of the commodity effect and the market

effect in equation A2.4 is equal to the sum of the market effect and the commodity effect in equation A2.5 (Jepma, 1986). However this does not mean that the market effect in equation A2.4 is equal to the market effect in equation 2.5, nor does it mean that the two commodity effects are necessarily equal either (Richardson, 1971b).

This arbitrary nature of the commodity effect and the market effect is known as the order problem of second level traditional Constant Market Shares Analysis. Richardson (1971b) tested the sensitivity of second level traditional CMSA results to the alternative forms of the commodity effect and the market effect. In his analysis, Richardson found that each effect varied significantly depending on which form of the two effects was employed (Richardson, 1971a and 1971b).

Over the years three systems have been utilised to solve the order problem. The first was simply to ignore the problem. However this makes little sense as in only very special circumstances do the market effects and the commodity effects of the two formulations equal each other. The second method was to take the arithmetic average of the two market effects to give an average market effect and likewise for the commodity effects. Taking the arithmetic average presents new problems in terms of interpreting the CMSA results. The arithmetic average merges the two market effects and the two commodity effects, thereby confusing the issue and making interpretation difficult (Richardson, 1971b, and Jepma, 1986).

The third remedy involves taking the market effect from equation A2.4 and the commodity effect from equation A2.5 and then adding a new component to correct and complete the identity (Jepma, 1986). This new component is known as the structural interaction effect (Ahmadi-Esfahani, 1993). The structural interaction effect modifies the traditional CMSA identity to form equation A2.6 below.

$$\begin{aligned}
 \Delta Z \equiv & S_0 \Delta V + \underbrace{\left(\sum_i^n \sum_j^n S_{ij0} \Delta V_{ij} - \sum_j^n S_{i0} \Delta V_i \right)}_{\text{market effect}} + \underbrace{\left(\sum_i^n \sum_j^n S_{ij0} \Delta V_{ij} - \sum_j^n S_{j0} \Delta V_j \right)}_{\text{commodity effect}} \\
 & + \underbrace{\left[\left(\sum_i^n S_{i0} \Delta V_i - S_0 \Delta V \right) - \left(\sum_i^n \sum_j^n S_{ij0} \Delta V_{ij} - \sum_j^n S_{j0} \Delta V_j \right) \right]}_{\text{structural interaction effect}} \\
 & + \underbrace{\sum_i^n \sum_j^n V_{ij0} \Delta S_{ij}}_{\text{competitiveness residual}} + \underbrace{\sum_i^n \sum_j^n \Delta S_{ij} \Delta V_{ij}}_{\text{second order effect}}
 \end{aligned} \tag{A2.6}$$

A2.6 The Index Problem of the Traditional Constant Market Shares Analysis Identity

The index problem relates to the selection of which weights to use in the various components of the traditional CMSA identity. Richardson identified the index problem in 1971 (Ahmadi-Esfahani, 1993). Richardson argues that since CMSA is applied over a discrete time period, the second level CMSA identity must be rewritten (Richardson, 1971b). However there are two possible revisions of the second level CMSA identity (equation A2.3). In order to revise the basic CMSA identity, weights need to be applied to account for the discrete time period. While all previous research (prior to Richardsons' work of 1970, 1971a and 1971b) has seen these weights refer to only the beginning of the discrete time period. Richardson explains that while this is valid, applying weights to the end of the discrete time period is also valid. Yet the difference between the two results has been described as "quite sizeable" (Jepma, 1986) and even "substantial" (Richardson, 1970 and 1971b).

Despite the index problem, to date only Jepma, Richardson and Lichtenberg have discussed the theoretical implications of the index problem (Jepma, 1986, Richardson, 1970 and 1971b, n.b. Lichtenberg's article was unavailable). The crux of the index number problem is that beginning, middle nor end of discrete time period weights are superior over each other or any other weights applied during the time period (Richardson 1971a). Richardson goes on to state that it is wasteful to perform CMSA on only one weighting period.

Instead multiple weights throughout the discrete time period are prescribed (Richardson, 1971b). This would then enable the researcher to make preliminary conclusions about structural change between the two discrete time periods, based on the market effect and the commodity effect (Richardson, 1971a). However, such comparisons need only be made where the time period between the two discrete time points is long and the traditional CMSA structural effect is large (Jepma, 1986).

A2.7 The Improved Constant Market Shares Analysis Identity

Jepma's 1986 book on CMSA develops a new form of CMSA, improved CMSA. It starts with equation A2.6, where the traditional CMSA Structural Effect has been divided into four components, the growth effect, the market effect, the commodity effect and the structural interaction effect to solve the order problem. Jepma also solved the index problem and further developed the CMSA model at the same time. He did this by introducing a new decomposition of the traditional CMSA identity (Ahmadi-Esfahani, 1993). This new decomposition is known as improved CMSA. Proponents of improved CMSA claim that the components of the improved CMSA model are easier to interpret in terms of economic variables than the traditional forms of CMSA.

Taking equation A2.6, Jepma's next step was to determine how to solve the index problem. He concluded that the index problem was especially involved with the traditional CMSA competitiveness residue and the second order effect. For these reasons, Jepma's research concentrated on these two traditional CMSA components (Jepma, 1986).

The competitiveness effect in traditional CMSA indicates the competitiveness of the focus commodity / focus country relative to the standard (the competitors) (Ahmadi-Esfahani, 1993). This measure of competitiveness is based on the relative prices, which includes quality differences, different financial and marketing arrangements as well as exporter and importer distortions. For these reasons, Jepma concluded that the competitiveness residual should be split into two parts. The first part, the pure residual, measures the influence of the general change in the focus country's competitiveness, given that the export structure of the focus country remains unchanged from the beginning of the discrete time period through to the end (Jepma, 1986). Whereas the second part, the static structural residual, reflects the impact of changes in the focus country's export structure on its export performance (Ahmadi-Esfahani, 1993).

In terms of symbols, the two parts of the competitiveness residual are;

$$\sum_i^n \sum_j^n V_{ij0} \Delta S_{ij} = V_0 \Delta S + \left(\sum_i^n \sum_j^n J_{ij0} \Delta S_{ij} - J_0 \Delta S \right)$$

competitiveness residual pure residual static structural residual (A2.7)

When the static structural residual is large and positive, the focus country's trade flows are growing relative to their competitors, and the general level of demand in the market is large. On the other hand, if the static structural residual is negative, then the focus country's trade flows are shrinking relative to their competitors (the standard) (Jepma, 1986).

The second order effect also attracts Jepma's attention. This is because the second order effect distinguishes the dynamic component from the partially static structural effect and competitiveness residual. The second order effect does this by capturing the interaction of changes in market share with changes in demand (Ahmadi-Esfahani, 1993). In contemporary CMSA work the second order effect was often included in either the structural effect or the competitiveness residual (e.g. Leamer and Stern, 1970, Rigaux, 1971 and Sprott, 1972).

Jepma argues that the second order effect is ineffective at identifying whether or not the increases (decreases) in the market share of the focus country are large (small) in trade flows where demand is growing relatively rapidly (slowly). This is because the second order effect is confusing, as it is effectively showing two contradictory aspects of the dynamic nature of the trade flow (Jepma, 1986).

The first aspect, the pure second order effect, expresses the changes in the scale of international demand on the exports of the focus country, given a constant structure of world (standard) demand (Ahmadi-Esfahani, 1993). Whereas the second aspect is the dynamic structural residual. The dynamic structural residual indicates changes in the market shares of the focus country where they interact with changes in the structure of world (standard) demand (Jepma, 1986). This means that a positive value for the dynamic structural residual indicates that world (standard) demand is growing relatively rapidly (slowly) for those commodities that are characterised by rapidly (slowly) growing shares of the focus country's export flow (Jepma, 1986). These two parts of the second order effect are presented as equation A2.7 below.

$$\sum_i^n \sum_j^n \Delta S_{ij} \Delta V_{ij} = \left(\frac{V_1}{V_0} - 1\right) \sum_i^n \sum_j^n V_{ij0} \Delta S_{ij} + \sum_i^n \sum_j^n \Delta S_{ij} \Delta V_{ij} - \left(\frac{V_1}{V_0} - 1\right) \sum_i^n \sum_j^n v_{ij0} \Delta S_{ij}$$

second order effect pure second order effect dynamic structural residual (A2.8)

Equations A2.6 combined with equations A2.7 and A2.8 form Jepma's improved CMSA model.

$$\begin{aligned}
 \Delta Z \equiv & S_0 \Delta J + \underbrace{\left(\sum_i^n \sum_j^n S_{ij0} \Delta J_{ij} - \sum_j^n S_{i0} \Delta J_j \right)}_{\text{market effect}} + \underbrace{\left(\sum_i^n \sum_j^n S_{ij0} \Delta J_{ij} - \sum_j^n S_{j0} \Delta J_j \right)}_{\text{commodity effect}} \\
 & + \underbrace{\left[\left(\sum_i^n S_{i0} \Delta J_i - S_0 \Delta J \right) - \left(\sum_i^n \sum_j^n S_{ij0} \Delta J_{ij} - \sum_j^n S_{j0} \Delta J_j \right) \right]}_{\text{structural interaction effect}} + J_0 \Delta S \\
 & + \underbrace{\left(\sum_i^n \sum_j^n J_{ij0} \Delta S_{ij} - J_0 \Delta S \right)}_{\text{static structural residual}} + \underbrace{\left[\left(\frac{J_1}{J_0} - 1 \right) \sum_i^n \sum_j^n J_{ij0} \Delta S_{ij} \right]}_{\text{pure second order effect}} \\
 & + \underbrace{\left[\sum_i^n \sum_j^n \Delta S_{ij} \Delta J_{ij} - \left(\frac{J_1}{J_0} - 1 \right) \sum_i^n \sum_j^n J_{ij0} \Delta S_{ij} \right]}_{\text{dynamic structural residual}}
 \end{aligned} \tag{A2.9}$$

APPENDIX THREE

ACTUAL DATA

- A3.1 Actual Data Collected from the Umeda Wholesale Cut-Flower Auction Market
- A3.2 Actual Data Collected from the Osaka Number Two Wholesale Cut-Flower Auction Market
- A3.3 Actual Data Collected from the Nishi-Nihon Wholesale Cut-Flower Auction Market

A3.1 Actual Data Collected from the Umeda Wholesale Cut Flower Auction Market

Table A3.1a Japanese Calla data for Umeda wholesale auction market.

Month	Xjc (Stems)	RPjc (Yen)	Xjw (Stems)	RPjw (Yen)
Jan92	1380	174.712	19955	116.172
Feb92	575	286.403	34970	92.862
Mar92	0	-	37941	153.005
Apr92	1010	49.280	76515	81.451
May92	3325	150.614	49700	77.562
Jun92	21600	126.042	27043	122.020
Jul92	18549	124.908	13570	126.814
Aug92	2943	96.431	1225	205.402
Sep92	2687	255.039	3899	155.099
Oct92	1954	311.676	9187	162.031
Nov92	0	-	19040	149.929
Dec92	100	84.720	18397	125.690
Jan93	0	-	23425	100.878
Feb93	160	98.906	44685	81.272
Mar93	0	-	73990	88.921
Apr93	1065	121.454	84621	65.154
May93	14580	118.383	42975	78.623
Jun93	24034	103.890	25860	107.853
Jul93	27418	133.718	22303	100.245
Aug93	9297	133.839	6449	93.536
Sep93	4086	315.436	741	535.179
Oct93	1725	403.237	3196	213.904
Nov93	445	114.067	10927	143.611
Dec93	0	-	13877	123.088

Month	X _{jc}	RP _{jc}	X _{jw}	PR _{jw}
Jan94	0 -		26137	87.790
Feb94	550	103.495	41080	82.851
Mar94	2290	110.901	60728	83.872
Apr94	3100	92.298	95165	61.896
May94	20240	84.010	36320	75.622
Jun94	46617	90.582	23172	101.485

Where:

X=Volume

j=Japanese Supply

c=Coloured Calla

w=White Calla

RP=Real Price

Table A3.1b

Imported Calla data for the Umeda wholesale cut-flower auction market.

Month	Xzc (Stems)	RPzc (Yen)	Xzw (Stems)	RPzw (Yen)
Jan92	10699	102.101	1880	103.424
Feb92	3681	119.594	665	115.618
Mar92	2325	233.048	630	245.257
Apr92	1005	165.436	270	241.217
May92	50	106.100	115	318.300
Jun92	230	142.870	120	159.000
Jul92	145	108.828	100	21.040
Aug92	0 -		460	74.538
Sep92	0 -		1405	83.819
Oct92	1540	188.431	4045	67.804
Nov92	3340	243.942	2345	194.738
Dec92	10948	157.979	685	279.050
Jan93	12705	133.241	5240	66.981
Feb93	7610	115.648	1685	132.924
Mar93	4350	222.615	800	127.983
Apr93	2075	222.816	270	150.452
May93	1135	164.648	100	128.880
Jun93	0 -		0 -	
Jul93	0 -		45	71.867
Aug93	25	432.800	680	89.106
Sep93	630	336.867	2240	150.398
Oct93	2995	178.583	4075	114.676
Nov93	9013	186.031	7800	113.082
Dec93	15275	134.653	9190	108.879
Jan94	12015	130.616	7200	78.608
Feb94	11482	82.173	2590	74.890

Month	Xzc	RPzc	Xzw	RPzw
Mar94	3037	195.703	1710	84.360
Apr94	2555	214.587	1260	155.801
May94	1255	244.765	895	140.923
Jun94	90	194.133	0	-

Where:

X=Volume

z=Import Supply

c=Coloured Calla

w=White Calla

RP=Real Price

A3.2 Actual Data Collected from the Osaka Number Two Wholesale Cut-Flower Auction Market

Table A3.2 Data from Osaka Number Two wholesale cut-flower auction market.

Month	Xz (Stems)	RPz (Yen)	Xj (Stems)	RPj (Yen)
Jun92	480	119.78	36210	142.587
Jul92	470	89.42	53870	119.401
Aug92	90	110.775	12710	175.451
Sep92	1560	124.02	22640	177.057
Oct92	3020	131.564	25070	160.137
Nov92	3260	115.758	31370	119.265
Dec92	12870	99.546	34890	95.274
Jan93	14030	102.238	34410	86.679
Feb93	4770	102.335	46830	84.938
Mar93	4790	112.466	67030	85.535
Apr93	350	69.485	77410	69.525
May93	80	76.254	56760	95.421
Jun93	0	-	41450	134.824
Jul93	90	23.716	67650	127.828
Aug93	210	133.086	16020	136.389
Sep93	1740	120.435	18030	172.081
Oct93	4070	118.374	19210	214.673
Nov93	10280	192.24	24480	116.791
Dec93	26650	127.204	32000	107.953
Jan94	15610	121.588	48640	72.396
Feb94	17030	89.142	72770	62.462
Mar94	7100	126.711	97060	72.661
Apr94	4260	196.2	92910	59.122
May94	2560	256.62	67540	78.815

Where:	X=Volume
	z=Imported Calla
	j=Japanese Calla
	RP=Real Price

A3.3 Actual Data Collected from the Nishi-Nihon Wholesale Cut-Flower Auction Market

Table A3.3 Data for Nishi-Nihon wholesale cut-flower auction market.

Month	Xz (Stems)	RPz (Yen)	Xj (Stems)	RPj (Yen)
Oct93	4902	80.41983	1600	246.3863
Nov93	13062	114.1847	10754	138.6907
Dec93	20806	71.96684	11411	131.2192
Jan94	13619	89.19921	35792	96.32052
Feb94	17458	63.79528	63446	71.28289
Mar94	4540	127.1452	81295	68.02138
Apr94	1343	216.7014	72078	58.85679
May94	690	368.7478	36078	71.31083

Where:	X=Volume
	z=Imported Calla
	j=Japanese Calla
	RP= Real Price
