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Wool, one of the oldest textile fibers, remains an important textile fiber today. However, wool has been in relative decline for more than 100 years, in the process, shifting from a commodity to a luxury good.

Nearly a quarter of a century has passed since the last two significant studies on wool consumption were published - Tisdell's (1977) review of the global wool market and Kirby and Dardis's (1992) analysis of demand for textile fibers in the United States textile industry. There is a need to expand and update the literature. In particular, research is needed that tests the association of a broader array of demand and supply-side variables with fiber consumption.

This research employs independent variable analysis and odds ratio analysis techniques to build upon previous studies' explorations of the associations between key independent variables and changes in global mill consumption of Australian wool from 1981 to 2001.

Results suggest that fiber prices have the strongest association with Australian wool consumption. Findings also suggest that the associations between the variables reviewed and Australian wool consumption vary greatly across changing periods of wool marketing programs.

A REVIEW OF THE EFFECTS OF AUSTRALIAN WOOL MARKETING INITIATIVES ON THE ASSOCIATIONS BETWEEN SELECTED VARIABLES IN THE GLOBAL WOOL MARKET

by

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Approved by

_____
Committee Chair

To my parents, George and Gaye, and my sister, Susan. My family has always been with me contributing their wisdom, love, and laughter. Without the love and support of my family I would have never come this far.

APPROVAL PAGE

This thesis has been approved by the following committee of the

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CHAPTER I

INTRODUCTION

Chapter I presents six sections: (1) The Importance of Wool Fiber; (2) Previous Reviews; (3) Research Questions; (4) Research Objectives; (5) Predicted Associations; and (6) Contribution of this Work.

The Importance of Wool Fiber

The production and trade of wool has a long history. Archeological finds date sheep domestication from at least 6500 BCE (Roche, 1995). There are records from 2500 BCE showing the earliest known international trade in wool by Sumerian merchants (Morris, 1996; Parker, 1996). Until the Middle Ages and the introduction of linen undergarments, wool was the primary fiber used in the temperate climates of Western Europe (Carter, 1992). Wool accounted for the largest percentage of fiber consumption in apparel until the processing and use of cotton expanded in the late 18th Century (Steele, 1996). Since that time, wool has been progressively displaced as a fiber for clothing by the growth in cotton and other fibers. With the advent of man-made fiber production at the turn of the 20th Century, wool began to lose its prominent position in the global fiber market (Year Book Australia, 2003).

Table 1 details global fiber production by principal fiber type between 1900 and 2000. Notable are the steady expansion of cotton output and the rapid rise of synthetic fibers after 1950. By comparison, wool production has shown comparatively modest expansion and, between 1990 and 2000, it fell sharply.

Table 1
Global Fiber Production 1900-2000 (000s Tons)

Year	Cotton	Wool*	Man-made Cellulosics	Synthetics	Total
1900	3,162	730	1		3,893
1910	4,200	803	5		5,008
1920	4,629	816	15		5,460
1930	5,870	1,002	208		7,080
1940	6,907	1,134	1,127	5	9,173
1950	6,647	1,057	1,608	69	9,381
1960	10,113	1,463	2,656	702	14,934
1970	11,784	1,659	3,585	4,812	21,840
1980	13,844	1,599	3,557	10,625	29,625
1990	18,714	1,964	2,912	14,869	38,459
2000	20,077	1,342	3,715	30,942	56,076

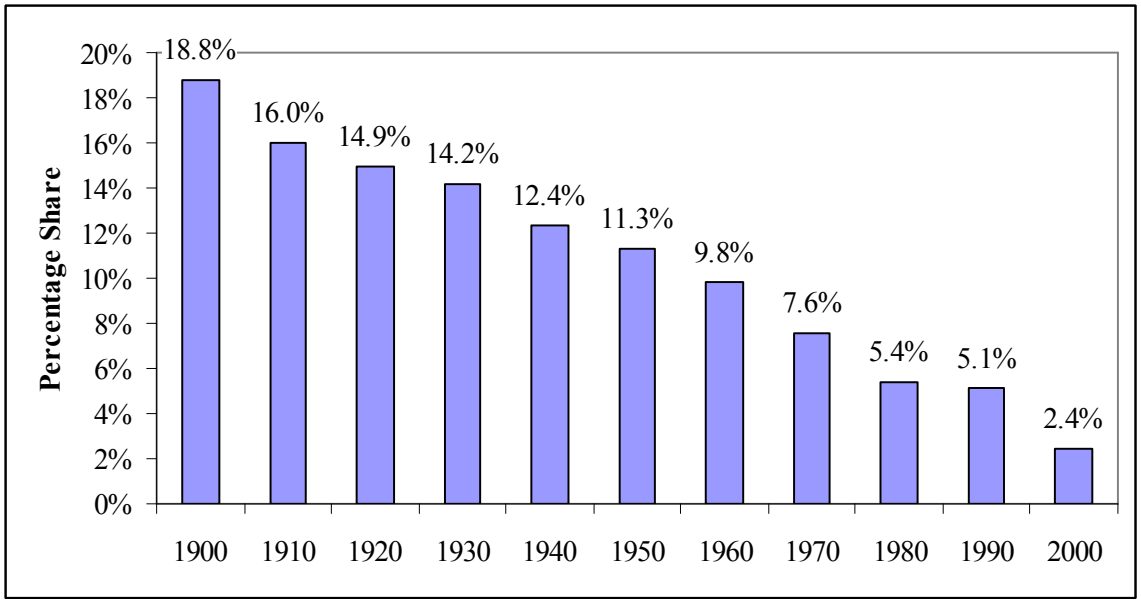
*Clean

Source: International Cotton Advisory Committee (2001) and Sauer (2001).

Figure 1 illustrates the steady decline of wool's market share between 1900 and 2000. Despite its decreasing market share, however, wool is still an economically important industry. In the 2001/2002 season, over 360,000 metric tons of clean wool were produced, worth an estimated A$1,473,652 (Australian Commodities Statistics, 2004).

Australia is the dominant global producer of raw wool. In 1997, Australia was responsible for 31% of the world's raw wool production and 67% of the world's total raw wool exports (USITC, 1998). Because Australia has such a position of prominence in the global wool fiber market, changes in the Australian wool industry often cause fluctuations in the global wool market. Because of their importance, Australian organizations and promotional efforts are frequently examined in order to analyze the changes in the global wool fiber market.

Figure 1
Share of Wool by Percentage Volume in Global Fiber Consumption 1900-2000



Sources: International Cotton Advisory Committee (2001) and International Wool Textile Organization (2001).

Previous Reviews

Academic research on the wool market has been limited. Tisdell and McDonald conducted a review of the changing associations between man-made and natural fibers, specifically wool, in 1977. This paper reviewed the effects that man-made fibers had on the natural fiber industry. Kirby and Dardis (1992) sought to analyze demand for textile fibers in four major end-use markets in the United States textile industry. The research examined wool, in addition to cotton, man-made cellulosic, and synthetic fibers. Based on multiple regression and multivariate analysis, both reviews point to the importance of growth in the man-made fiber industry in affecting changes in the consumption of natural textile fibers, including wool. However, the Tisdell review is more than a quarter of a century old, and Kirby's review focused only on the United States textile industry and is more than a decade old. In the more than 25 years since the Tisdell and McDonald study was published, no major academic papers have been published about the changing wool fiber industry, leaving a major gap in the literature.

Research Questions

The progressive decline of wool through substitution by cotton and synthetic fibers has been well documented. A combination of variables has been identified as contributing to the decline in wool's market share in apparel applications (Morris, 1996). Supply-side variables include the changing cost of wool, both in real terms and relative to substitute fibers. Demand variables have included shifting consumer needs, as demonstrated by changing consumer tastes and lifestyles. Also, the decline of wool has often been blamed in part on the inadequate response of the international wool industry,

led by the Australians, to the challenges of competition from other fibers and from changing consumer needs.

The measurement of variables influencing fiber demand is problematic due to the combination of demand and supply-side influences, a number of which, such as the impact of shifting consumer lifestyles, do not lend themselves to easy quantification. Existing research therefore tends to split into quantitatively or qualitatively-oriented studies. The former have sought to correlate certain variables, such as fiber prices, per capita incomes and population levels with fiber consumption and inter-fiber substitution (Tisdell, 1977; Kirby, 1992). Qualitatively-oriented research approaches have focused on relating observed consumption changes to consumer lifestyle trends and to marketing responses by the wool industry (Ashton, 2000; Ashton, 2002; Morris, 1996). Studies of both types have typically been narrowly based, using a limited number of variables to explain consumption and substitution changes. In the literature within the public domain, there has been no real attempt to integrate a wider range of key variables into a more unified understanding of wool consumption and substitution. Similarly, there has been no attempt to relate wool fiber industry responses to the variables shaping wool consumption and substitution.

There is, therefore, a need to update and expand the research literature on wool consumption and substitution. Specifically, this study will update the literature by reviewing developments in wool marketing, consumption and substitution between 1981 and 2001, seeking to better understand the variables associated with changing levels of Australian wool fiber consumption.

Research Objectives

The research objectives of the study include the following:

1. The first objective of this research was to review previous studies' results and explore the associations between chosen key independent variables and changes in Australian wool fiber consumption, as measured by imports of Australian wool fiber at the mill stage, in selected representative nations. Fibers were measured at the mill consumption stage of processing because, due to fiber-blending techniques and the multiple end-uses of fibers, it is difficult to obtain reliable consumption figures after this stage. Many previous studies have included independent variables such as economic growth, population growth, promotional activities, relative prices of competing fibers, and changing consumer tastes and social habits. This study will include similar variables, divided into four categories. The categories are: (1) consumption of other fibers; (2) fiber prices; (3) wool textile trade and processing variables; and (4) demand-side variables. Each of these categories contains three independent variables which are detailed in Table

2. The second objective of this study was to investigate the associations between the previously mentioned variables and Australian wool consumption based on representative nations. The five largest wool-consuming nations at the mill fiber consumption stage were chosen to represent a global sample of wool consuming nations. The identification of representative nations was based on average wool fiber imports, in million kilograms between 1990 and 1996, from data provided by the International Wool Textile Organization (IWTO). These countries were: (1) China; (2) Italy; (3) the United Kingdom; (4) France; and (5) Germany.

Table 2
Categories of Variables Associated with Wool Consumption

Variable Categories	Variables
Fiber Consumption	Other Wool Fiber Consumption (OWC)
	Cotton Fiber Consumption (CTN)
	Man-made Cellulosic Fiber Consumption (MMF)
Fiber Prices	Wool Fiber Prices (PWL)
	Cotton Fiber Prices (PCN)
	Man-made Cellulosic Fiber Prices (PMF)
Trade and Processing	Exchange Rate (XRT)
	Revealed Comparative Advantage (RCA)
	Wool Yarn Production (WYP)
Demand-Side	Gross National Income (GNI)
	Population Growth (POP)
	Energy Consumption (ENR)

3. The third objective of this research was to review the possible effects of marketing initiatives undertaken by the Australian Wool Industry on wool consumption. The study is divided into two distinct marketing periods. The first embraces 10 years of the Reserve Price Scheme marketing initiative from 1981 up to the point that is was dropped in 1991. The second covers the decade after the Reserve Price Scheme was abandoned, 1991-2001, when no major industry-wide marketing initiatives were enacted.

Each of the two periods is reviewed in order to investigate the nature of the associations between the variables reviewed and Australian wool consumption for each period. In addition, the two periods were combined into one 20-year review to determine the overall associations between the variables reviewed and Australian wool consumption.

Contribution of this Work

This research will provide a review of marketing initiatives undertaken by the Australian wool industry. In particular, it will examine the effects of these initiatives on the associations between Australian wool consumption and selected influencing variables. The in-depth analysis of these periods in Australian wool marketing will expand upon knowledge of the effects of marketing programs. This increased knowledge will provide a basis for conducting future research into possible marketing initiatives undertaken by the Australian wool industry.

The remainder of this research is structured as follows. Chapter 2 provides a brief history of the Australian wool industry, followed by a literature review, which focuses on variables related to fiber consumption and substitution. Chapter 3 details the methods developed and used to address the previously mentioned research questions. Chapter 4 presents the results of the data analysis. Chapter 5 reviews the findings, discusses them in the context of the history of the Australian wool industry, provides an outlook for the Australian wool industry, and suggests future avenues for research.

CHAPTER II

REVIEW OF LITERATURE

Chapter II presents four sections: (1) Introduction; (2) History of the Australian Wool Industry; (3) Responses by the Australian Wool Industry Since 1980; and (4) Fiber Consumption Literature.

Introduction

The literature on fiber consumption can be divided into two areas. The first area examines overall fiber consumption levels. The second analyzes inter-fiber substitutions. As noted previously, the obtainable literature in both of these research areas available in the public domain is very limited. In order to interpret the available academic literature on fiber consumption, however, it is imperative to know first the history of the Australian wool industry.

History of the Australian Wool Industry

British colonists first introduced sheep to the Australian continent in 1788 (Roche, 1995; Year Book Australia, 2003). It was not until the 1820s that the Australian wool fiber industry began its spectacular growth with the import of 5,000 Spanish merino sheep. These sheep were known for their high quality and fine wool, which was subsequently improved by selective herding and breeding (www.wool.about.com). By

1850, Australia established itself as the premier wool provider in the global market, a position it has maintained until the present.

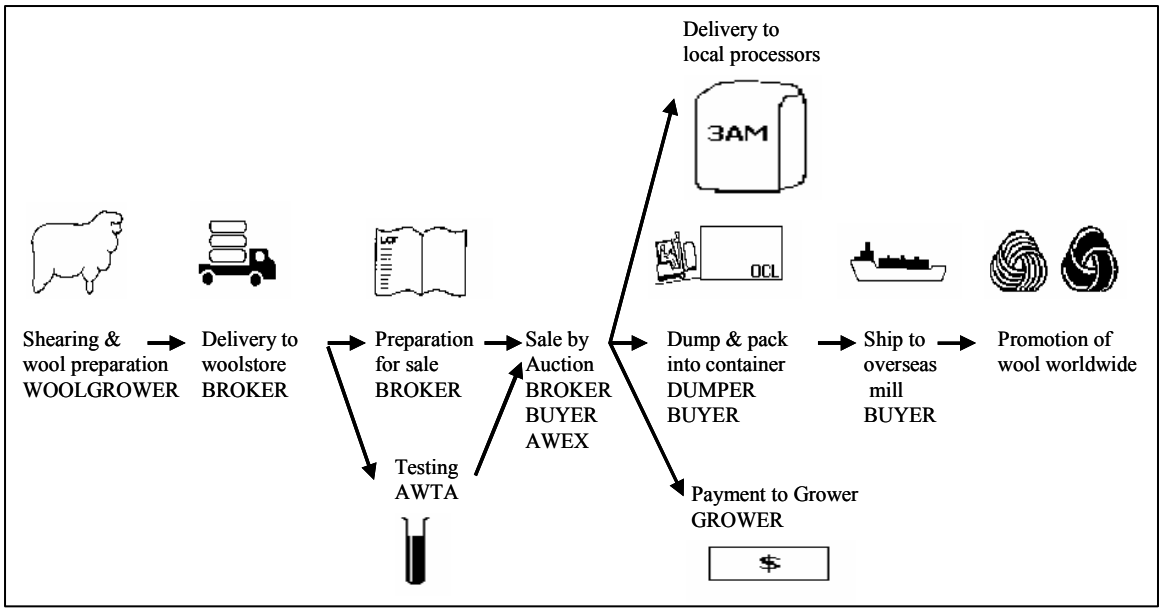
In the wool market, there are four options for selling wool: public auction, private merchants, abattoirs, or specialist lines (Roche, 1995; White, 2000; & Simpson, 2002). The majority of all wool sold is sold through auction. In the 1990s 60-70% was sold through auction, 20-25% through private merchants, and 10-15% through abattoirs as sheepskins. The remaining amount is sold as specialist lines by the specific type of wool produced by a particular breed of sheep (Roche, 1995).

Until the 1860s, most Australian wool was shipped to London, where it was marketed on the international wool exchange (Ville, 2002). However, over the years, buyers increasingly purchased wool directly from Australia. This cut out intermediary costs caused by shipment and resale in London (Ville, 2002). The Australian wool industry also eliminated the winter "off-season" and turned to a more stable year-round auctioning system (Ville, 2002). Thus by 1914, Australia had assumed a dominant position in wool marketing, selling almost 98% of its annual clip domestically for export (Ville, 2002; Year Book Australia, 2003). Figure 2 illustrates the wool production and marketing chain.

At the end of the 19th century, a severe drought damaged the Australian wool industry (Roche, 1995). Due to the low sheep population, large wool farms were unable to meet orders and buyers began to lose faith in the industry. In order to combat the effects of the drought, the wool marketing system underwent significant changes, which continue to shape the industry today (Year Book Australia, 2003). Because large farms

were unable to meet market demand, the market became increasingly reliant on smaller farms, whose individual clips were combined into larger lots with the aid of brokers who then sold the larger lots to interested buyers. By the turn of the 19th Century, the global wool trade was controlled by an oligopoly comprised of five British and Australian marketing and auctioning firms. Though the number of firms has expanded over time, the wool auctioning system stills remains tightly controlled by a small number of firms.

Figure 2
The Wool Production and Marketing Chain.



Source: White, 2000.

The primary market for Australian wool in the 19th Century was the United Kingdom. During the 1920s, British buyers purchased 50% of all Australian wool exports, up 30% from the pre-war figures. Along with the boom of British purchasing, international buyers became increasingly important to the wool industry. By the mid-

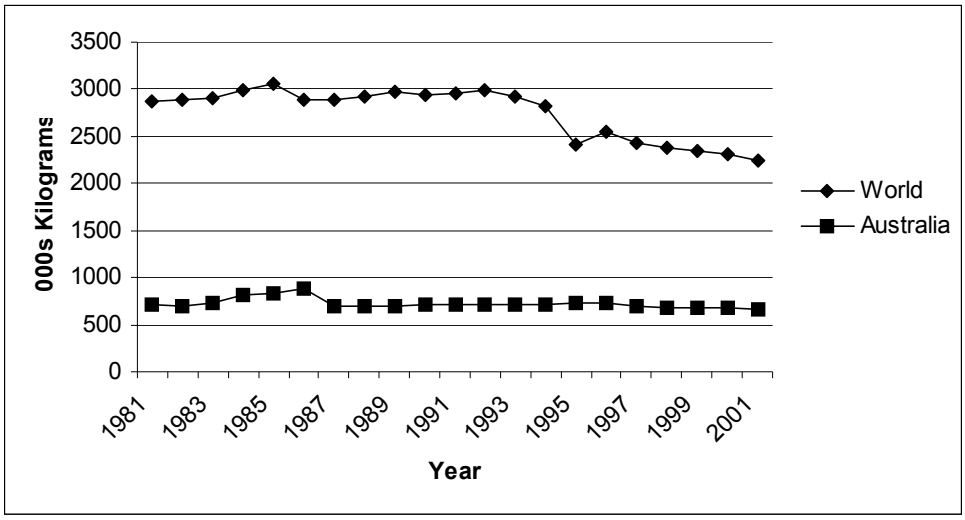
1920s, Japan was Australia's third largest wool consumer and the United States the fourth largest (Ville, 2002). However, the geographic market for Australian wool remained relatively concentrated by current market standards. The supply-side of the industry was also concentrated, dominated by a handful of major wool exporting nations, notably Australia, New Zealand, South Africa and Uruguay.

As an agricultural commodity, government intervention was a feature of production and, occasionally, of demand. The Australian Wool Corporation (AWC) acted as the major governmental representative of the numerous wool agencies, public and private, that formed throughout the development of the wool industry. In 1937, the AWC along with its counterparts in New Zealand and South Africa established the International Wool Secretariat (now known as the Woolmark company) to conduct research and development and to promote wool usage in a variety of global markets (Roche, 1995). On the demand side, government intervention was a feature during past wars. During both world wars, the British government guaranteed purchases of wool fiber in a move that encouraged high prices and the expansion of production (Ville, 2002). During the Korean War, large U.S. military purchases buoyed the market. Though this type of intervention has not been a feature of more recent wars, it helped establish a pattern of government involvement in wool marketing practices.

Figure 3 shows trends in world and Australian wool production since 1935. World output of wool expanded slightly more strongly between 1945 and 1980 than did Australia's wool output, with the Australian share of global wool output fluctuating from 26.9% in 1945-1949, to 32.5% in 1971, and then to 24.6% in 1980. As wool steadily lost

market share, the industry intensified initiatives designed to stabilize prices, promote awareness of wool and improve its processing and end-use characteristics.

Figure 3
World and Australian Wool Production 1981-2001

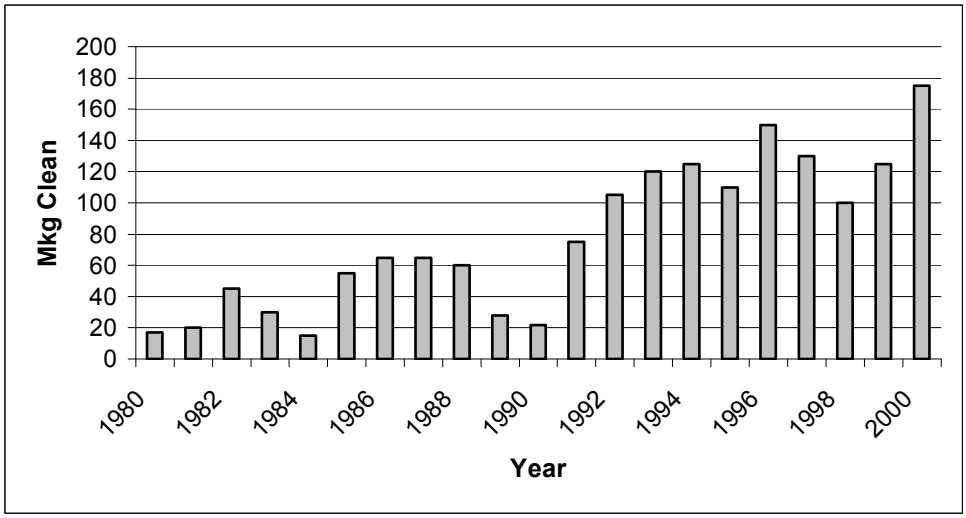


Source: *Fiber Organon*

The 1980s witnessed a strong surge in demand for wool related to the growth of the Chinese market (see Figures 4 and 5). Due to the relatively inelastic supply of wool, prices began to rise strongly. This acted to dampen demand, which was further diminished by economic setbacks in China and the international economic recession at the end of the decade. Simultaneously, additional supply entered the international market and, prices fell sharply. Due to market intervention strategies of regulatory bodies in the major wool producing nations, organizations stepped in to purchase the surplus output that failed to meet minimum price requirements. The result was the creation of a huge

stockpile and, with it, massive debts. This course of action was particularly evident in the Australian wool industry.

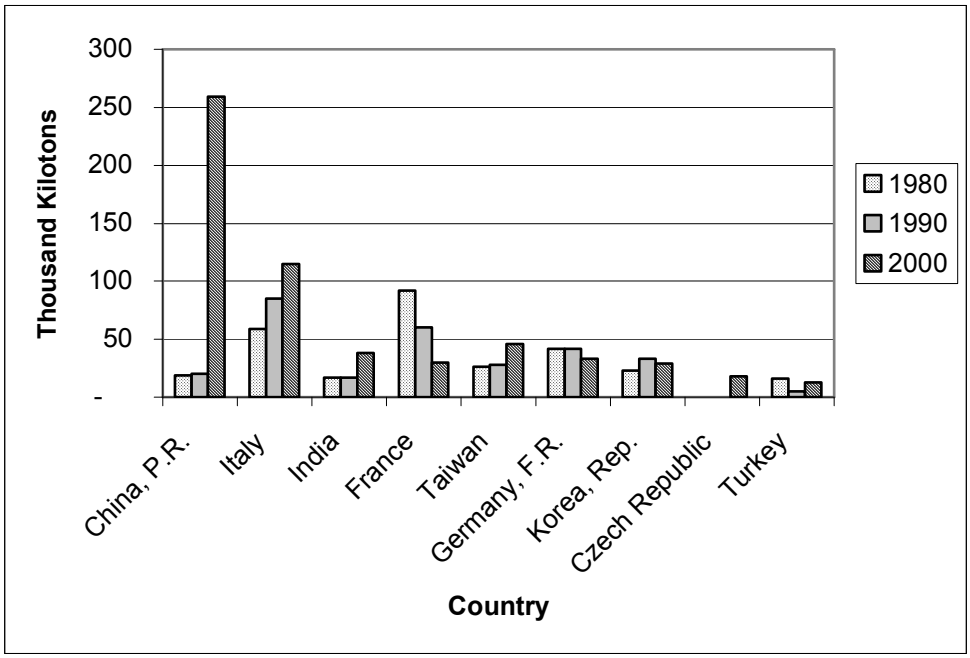
Figure 4
Australian Wool Exports to China 1980-2000



Source: White, 2000

Continuing weak demand and low prices through 1991 prompted the regulatory bodies to abandon market intervention schemes. As prices fell, output dropped and sheep populations declined. The most significant fall, however, was in the former Soviet Union where output fell against a background of sharp economic decline. The outcome was a sharp reduction in wool's fiber market share between 1990 and 2000. The situation was made worse by a steady flow of inexpensive wool from surplus stocks. The effects of the stockpile sell-off, in combination with drought conditions, caused the Australian sheep population to drop to its lowest levels since the Great Depression of the 1930s.

Figure 5
Top Export Destinations for Australian Wool



Source: Australian Wool Exchange

Responses by the Australian Wool Industry Since 1980

There are few major studies in the public domain that have described the responses by the wool industry to its declining fortunes over the last quarter century. Given that the strategies pursued by the industry during the 1980s were established in the 1960s and 70s, a brief review of developments affecting the industry decisions may provide some insight.

Australian Wool Industry Responses to Changing Demand and Supply Conditions Prior to 1990

Although demand for Australian wool continued to grow modestly after World War II, prices fell continuously after 1951. The industry worried that the decline in price

would continue indefinitely. Thus, by 1971, it was considering a number of options to stabilize wool prices (Year Book Australia, 2003). In that year, the government created the Wool Deficiency Payments Scheme, which was formed to identify a program that would address the problem of decreasing market share and the stagnating sales volume of Australian wool. It was believed that volatile wool prices were hurting the industry and, as a result, price stabilization was the primary issue addressed. The two most popular options considered by the government to stabilize prices were a compulsory acquisition program and a three part integrated marketing program that would include price stabilization, global promotion, and investment in research and development (Richardson, 2000). It was decided, in 1973, that the latter program would be carried out, and the Australian Wool Corporation (AWC) was formed to carry out the plan (Year Book Australia, 2003). A three-pronged strategy was introduced, which involved global promotion and marketing, research and development, and price stabilization.

The marketing aspect of this strategy, which involved emphasis on branding and promotion through consumer awareness, was headed by the IWS, now the Woolmark Company. The accepted strategy at the time was to promote wool in mass markets and chase the shift into lighter and casual wear markets, which would reduce the traditional dependence of wool on formalwear (Roche, 1995). In addition, product development and testing services were also established to support wool processors and manufacturers. Technical development focused on improving technical characteristics for wool, easy care properties, and wool products created through blending processes. Price management involved the creation of AWEX, designed to stabilize volatile wool prices.

Though AWEX was considered moderately successful, the price of wool in real terms continued to decline. Farmers perceived the futures market to be a speculator's forum rather than a hedging device. Despite the moderate success of the futures market, woolgrowers and brokers were still worried about price fluctuations. By the beginning of the 1970s, other price stabilization plans were being considered.

In September 1974, the Reserve Price Scheme (RPS) was introduced (Roche, 1995). The AWC set an annually predetermined price floor at which all Australian wool-clip would be sold. Any wool not sold at the set price would be purchased and stockpiled by the AWC to be sold later, when demand increased. The AWC occasionally withdrew large amounts of wool from the market, which caused significant difficulties in processing (Roche, 1995). Intervention purchases were financed by a levy on woolgrowers, by profits from trading or by borrowings that used the stockpile as collateral (Roche, 1995). After its implementation, the scheme was judged to have improved price stability. This was in part reflected by the decline of trading volumes on the AWEX after 1973. Because of the improved price stability (Roche, 1995), by 1990 the volume had fallen to near zero.

Prices began to rise sharply in the mid 1980s, due to increased demand, particularly in China where relaxing trade policies created a boom in textile demand. As a result, the floor price was raised in tandem. Higher prices encouraged the expansion of production, but also caused a sharp decrease in demand (see Figure 6). However, the removal of unsold wool from the open market led to distortions in market demand, which then caused further increased production. In a period of three years from 1987-1990 the

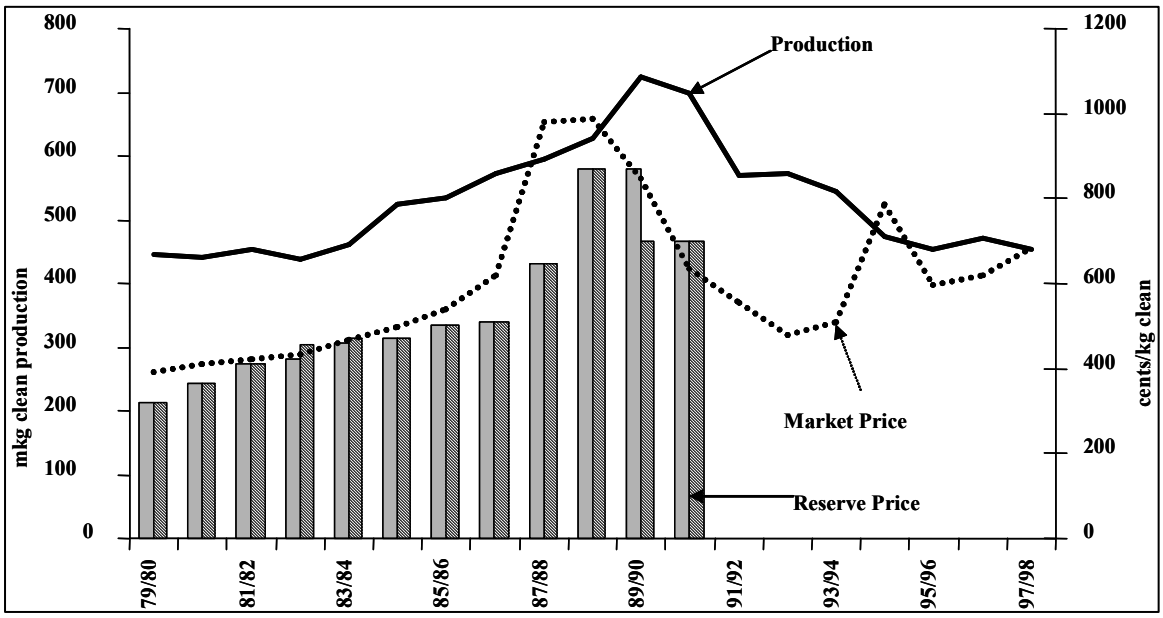
market price was raised by nearly 70% and the floor price was raised by nearly 40% in response. Although market prices dropped sharply, the floor price, being federally controlled, responded more slowly, and remained higher. Much output was bought-up and stocks rose sharply, peaking at 80% of the wool clip in 1990 (Roche, 1995). Further disrupting the market demand, the tightening of trade policies in China, the largest purchaser of wool at the time, and the instability of the Soviet Union, the third largest importer, led to an unexpected decrease in demand. Despite the boom in production and sales in the early 1980s, the overall decline led to inevitable market collapse, which resulted in demand for Australian wool decreasing by 10% between 1980 and 1989.

By 1991, 4.7 million bales of wool had been stockpiled and a A$469.8 million debt accrued. In February 1991, the Price Reserve Scheme was abandoned. Between 1993 and 2002, programs were initiated in order to liquidate the stockpile and manage the substantial debt that had been incurred (Richardson, 2000).

Industry Responses to Changing Demand and Supply Conditions Since 1990

From 1989 through 1999 demand continued to decline, decreasing by 35% overall. In the 2000-2002 seasons the rate of decline slowed in demand to a 12% decrease (Year Book Australia, 2003). Between 1993 and 2001, the stockpile was liquidated via a number of public and private companies, and the A$134.2 million debt was reconciled (Privatisation International, 1999). Though the companies responsible for the removal of the stockpile were able to eliminate the stockpile by August of 2001, their relative success is often questioned.

Figure 6
Australian Wool Production, Average Prices, and Price Reserve*

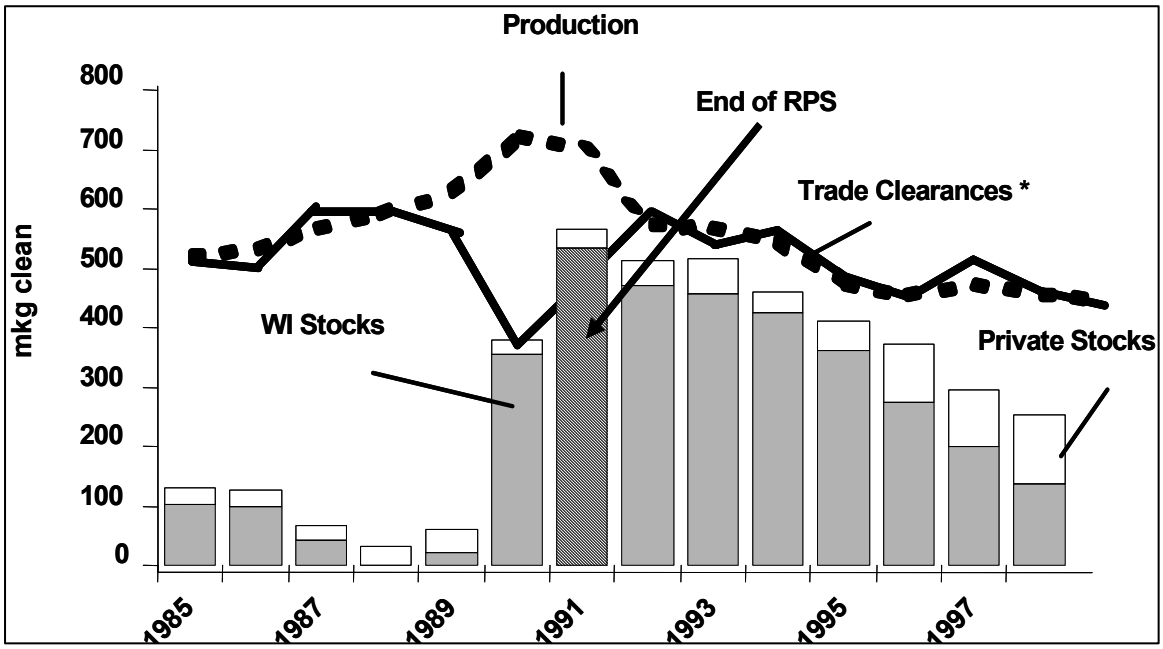


*Note: Reserve Price Scheme abandoned in 1991.
Source: White, 2000

The RPS period was also considered responsible for the destruction of AWEX. The floor price removed the necessity for purchasers to invest in futures, and by 1990, only one cash settlement contract was traded, a significant decrease from even a year earlier when 124 were traded (see Figure 8) (Lubulwa, 1998). With the removal of the floor price, wool prices once again became more volatile, and there was an increased interest in futures trading. Throughout the 1990s, increased varieties of contracts were introduced and sold on the market, with the exception of a decline in the number of futures sold in 1995. It is thought that as this trend continues, the contracts will provide an increased level of stability to the market price of wool (Lubulwa, 1998).

Because the organizations were solely focused on the elimination of the stockpile, research and promotional campaigns were all but abandoned, and woolgrowers were left to compete with the stockpile sales. Because woolgrowers could not compete

Figure 7
Australian Wool Production, Trade Clearances, and Stocks

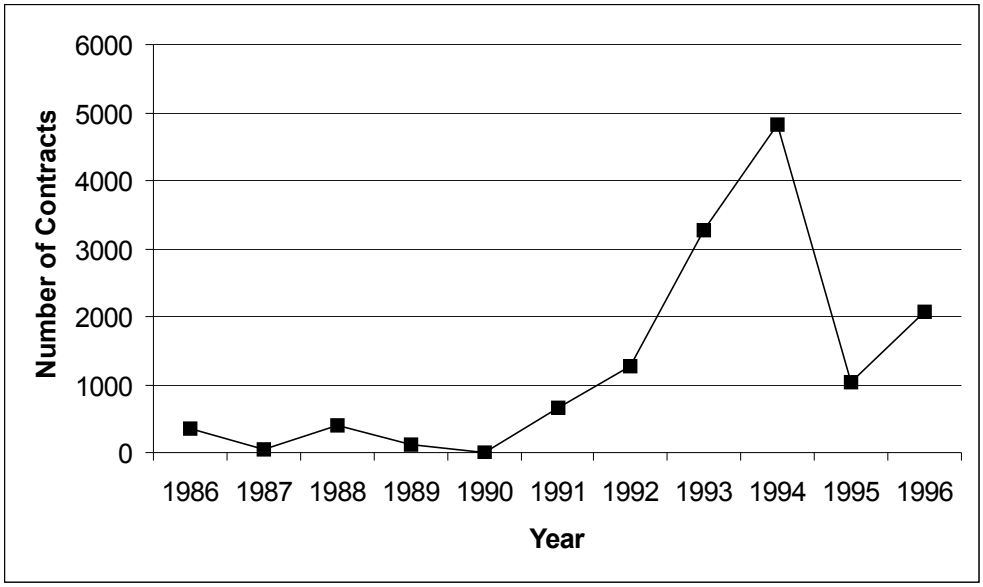


* Trade clearances = production + change in stocks
Source: White, 2000

with WI and AWC prices, investors were not interested in supporting companies that could not sell their goods. Stockpile wool prices undercut the fresh clip prices and artificially distorted the market. Despite the decreasing demand, the increased sale in stockpiled wool created an illusion of increasing demand. As a result, wool production increased in response, creating increased cost pressures on the market due to surplus clip.

The artificial increase in demand and production caused the market to react by dramatically reducing production. Because the market was flooded with inexpensive

Figure 8
Number of Wool Contracts Sold



Source: Lubulwa, 1998.

Australian wool throughout the 1990s, wool producers were left with a surplus clip after shearing. This situation led to a decrease in both Australian and global sheep populations. In 2000, the Australian sheep population dropped to its lowest levels since the depression of the 1930s.

Promotion & Research Funding

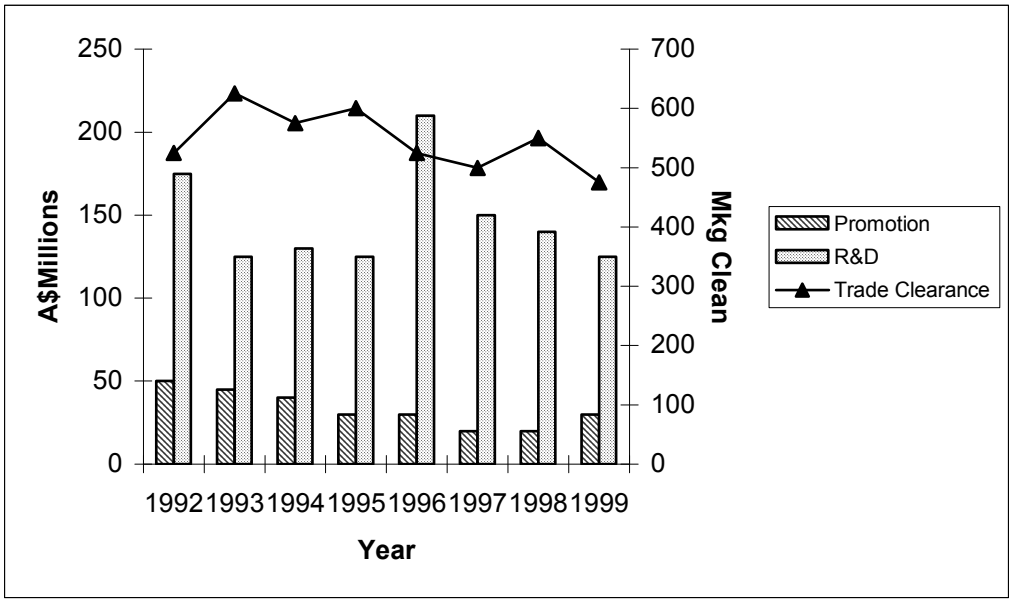
IWS, an integrated marketing organization created by New Zealand, South African, and Australian wool producers, was also affected by the removal of the floor price. IWS funding was cut back sharply between 1991 and 1993, as Australia diverted

funding from IWS into AWS and focused on the removal of the stockpile. In 1994, New Zealand and South Africa withdrew, and IWS became an Australian organization, renamed the Woolmark Company, headed by AWRAP. It was not until 1997 that the countries regrouped into the international organization that exists today, also known as the Woolmark Company.

Because the government placed sole interest in selling off the stockpile, funding for innovation and research was stalled. As shown in Figure 9, funding for research was cut significantly in the early 1990s. Promotional funding was also reduced, though at steadier pace. The trade clearance at the time also showed a general decline. The only periods of increase in the trade clearance coincide with periods of increase in research and development funding a year earlier. This would suggest that as funding for research increases, there is an increased confidence in the market, which leads to increased trade. Towards the end of the 1990s, there was an increased interest in promotional activities, while there had been a steady level of decline in R&D funding since its peak in 1996. Presently, two companies, Australian Wool Innovation Ltd. (AWI) and Woolmark, are responsible for nearly all Australian wool research and promotional activities. AWI is responsible for many research and development activities and for funding some promotional activities. Woolmark is predominantly responsible for marketing activities and is sometimes involved in research. These two companies work closely together to further future demand for wool. Research and promotional activities may be divided into a number of categories, either supply or demand-side improvements. Such improvements

benefit wool manufacturers, processors, or wool consumers. Table 4 provides examples of a number of developments in both supply and demand-side research.

Figure 9
Australian Wool Research, Promotion and Trade 1992-1999



Source: AWRAP Annual Report as cited in White, 2000.

Table 3
Wool Supply and Demand Marketing Developments

Supply & Quality Responses	Demand Process Developments
Improved fibre quality	Machine washable woven business shirt fabric
Pasture management - higher wool yields	Wool blend bi-layer fabric, comparative with synthetic fleece ("Sportswool")
Reduced chemical & packaging contamination	Conductive wool fabrics for use in electric blankets
New selling methods	Non-woven wool fabrics

Source: Australian Wool Innovation, 2004

As products and methods are researched, it is equally important that they are successfully promoted to possible consumers. Promotional activities, mainly carried out by Woolmark, can be divided into three categories: generic promotion, brand/retail promotion, and sub-branding promotion (AWI, 2004). Generic promotion of general market awareness of wool, such as the promotion of the Woolmark symbol, was previously done by the IWS. Cotton Inc. is a good example of an industry association that has used an extremely successful generic promotional campaign. Brand/retail promotion does not necessarily include the reference of wool or wool blend products and is carried out exclusively by retailers. Sub-branding promotional activities are targeted at specific end-use sectors and are often included as promotional information on products. Current sub-branding promotional activities sponsored by Woolmark include such wool products as Cool Wool and Australian Superfine Merino (AWI, 2004). Though AWI does not actively involve itself in promotional activities, it often aids in marketing activities such as yarn and fabric trials, consumer attitude surveys, market research, supply chain development, commercialization, and intellectual property management (AWI, 2004).

AWI, a public company, generates much of its money for research activities from a two percent levy placed on all wool-clip, as well as from funding from the Australian government. The role of AWI is to increase the long-term profitability, productivity, and sustainability of Australian woolgrowers (AWI, 2004). To achieve this, AWI works to increase the long-term demand for wool, and 40% (about A$27 million) of AWI's annual budget over the next five years has been allocated for this aim (AWI, 2004).

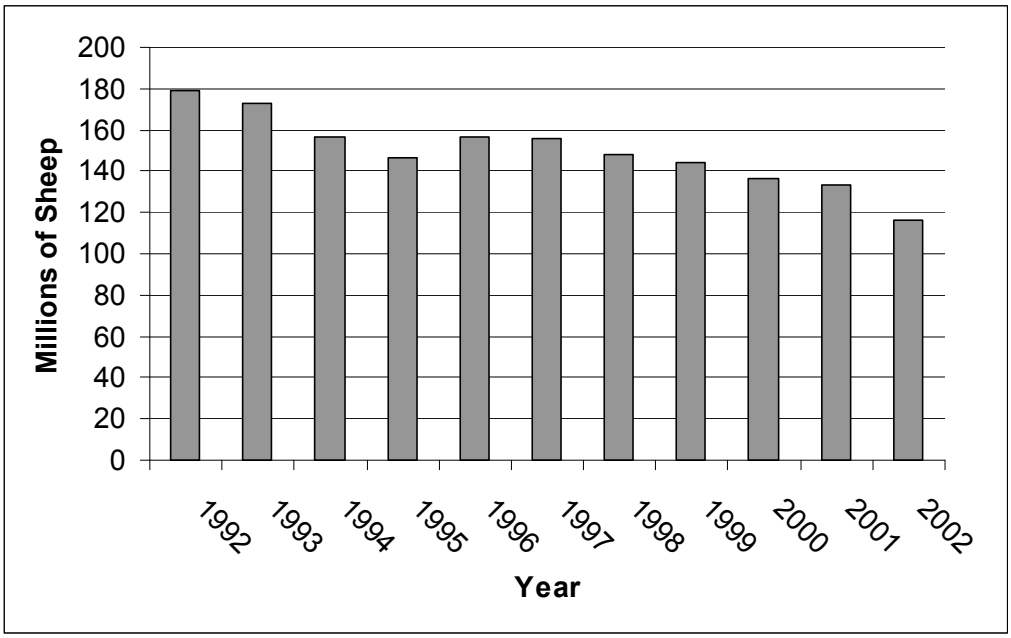
Current Market Conditions

In the past decade, the number of sheep shorn has decreased by nearly 60 million, as shown in Figure 10. The decline in the first half of the decade was greatly attributed to the removal of the floor price and then, in the late 1990s, to the sale of the stockpile. When the stockpile was sold in mid-2001, the previous estimates of increased fresh clip production were derailed by a severe drought. In the 2001-2002 season, the worst drought in 100 years cut into the sheep populations, a reduced size not seen since the Great Depression (ABS, 2003; Year Book Australia, 2003).

The September 11th attacks in 2001 caused the United States and, to a smaller extent, the global luxury markets to decline. However, the small decrease in demand was outweighed by the larger decrease in available wool clip. As availability decreased, prices spiked, as shown in Figure 11. The drought caused Australian wool prices to rise to nearly a third more than South African wool prices, and nearly two times as much as wool from New Zealand (Australian Commodity Statistics, 2003). This spike in price has started to place Australian wool out of the competitive wool market.

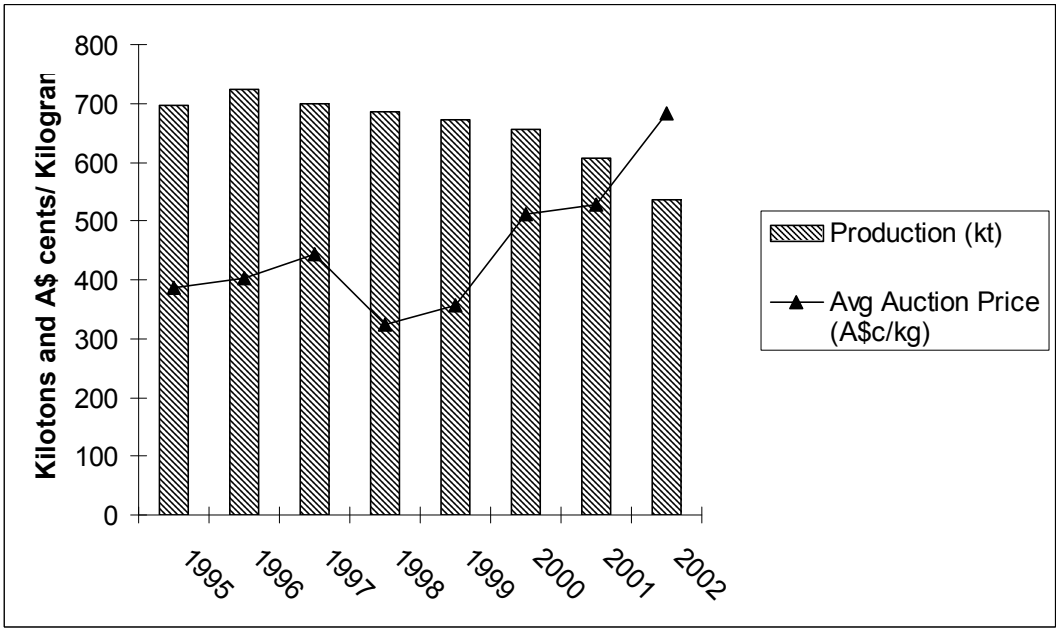
Despite these concerns, there was a 14% increase in wool exports to China due to an increase in quotas (AsiaPulse News, 01/08/2002). China has become increasingly important to the Australian wool industry. By 2000, nearly 30% of all Australian wool exports were destined for China. With the cessation of the drought and an increased interest in research and promotional spending, the Australian Wool Industry is looking forward to the lifting of tariff and quota restrictions in the elimination of the MFA in 2005. Increased international trade driven by increased availability and reduced prices

Figure 10
Number of Sheep Shorn



Source: Australian Commodity Statistics

Figure 11
Australian Wool Production and Sale Prices 1995-2002



Source: Australian Commodity Statistics

in combination with long-term marketing goals will continue to drive the market to future development.

Fiber Consumption Literature

Overview of Associated Variables

The variables associated with fiber consumption are complex and both qualitative and quantitative in nature. The key variables associated with overall demand for apparel include economic growth, consumer incomes, population growth, consumer tastes and the relative prices of finished goods (Kirby, 1993; Ashton, 2000). Secondary variables mentioned by Ashton (2000) include climate, social habits, and the promotional activities of textile and apparel manufacturers, and retailers. Quantitatively measured variables often include economic growth, population, income levels, and fiber prices. Variables generally measured through qualitative analysis include the effects of consumer tastes and social habits. While acknowledged as variables of interest, industry operational and marketing strategies have not been explicitly analyzed in the academic research literature. Analyses of overall consumption levels have typically been oriented towards demand-side variables, with supply-side considerations limited to the impact of final product prices on demand.

With regard to inter-fiber substitution, much of the work in this area focuses on cotton and synthetic fibers. Few studies incorporate wool, and fewer still have wool as their primary focus. Consumption of wool is difficult to measure because wool is used in a diverse range of products, many of which are blended with other fibers. Researchers have utilized the same variables influencing overall consumption levels in analyzing

demand for individual fiber types (Tisdell, 1977; Kirby, 1993; Ashton, 2000). These studies place more emphasis on supply-side variables, notably substitution effects arising from the different and changing technical properties of fibers and relative price changes. Production variables affecting supply conditions that are often studied include sheep population, effects of climatic conditions, competition from other land and resource uses, and the relative length and cost of supply chains of comparative fibers (Tisdell, 1977; Kirby, 1993; Ashton, 2000). Many researchers have reviewed the past efforts of industry organizations to stabilize prices and maintain wool fiber market share through product development and promotional campaigns. There is little recorded data on the strategies utilized in shaping the fiber production and marketing environment. On the demand-side, the impact of changing consumer lifestyles and preferences has been studied.

There is also a body of literature, mainly in applied business research, that has examined other variables that are associated with fiber consumption levels, such as energy consumption, mill fiber consumption or fiber availability in final stage production, and machinery capacity or new machinery shipments in the textile industry. Two other variables, the international competitiveness of a nation's textile and apparel industries and currency exchange rate movements, were identified as being potential influences on fiber consumption at the country level, although no previous work was found that had related these to wool fiber consumption.

Demand-side Variables Associated with Wool Consumption

Gross National Income

Gross national income per capita is a variable frequently used when measuring consumer purchasing power. The United Nations Food and Agriculture Organization (2004), the Woolmark Company (2000), and the International Cotton Advisory Committee (2003), among others, have used this comparison. It is generally concluded that as income per capita increases fiber consumption increases as well. However, these studies consistently show US consumption of fiber as being much higher than the corresponding income level would suggest. This disparity is believed to be a result of the difference between actual income and true purchasing power.

Energy Consumption

Energy consumption is considered a secondary indicator of income levels. Previous studies have shown that as energy consumption increases, overall fiber consumption also increases (Morris, 1996). However, improved heating and insulation in buildings and the increased use of cars and public transportation in developed nations reduces the need for heavier weight clothing that is typically made of wool (Ashton, 2000). Because of the popularity of wool fibers as a warm, insulating material, it is thought that in the past wool was more popular in colder regions. As indoor-heating usage has increased, people spend less time outdoors, and it is believed that the need for wool's warming properties are less compelling (Ashton, 2000).

Population Growth

In various studies, it has been shown that population growth is positively related to levels of fiber consumption (Ashton, 2000; Morris, 1996; & Tisdell, 1977). Researchers agree that, all other variables being equal, as population levels increase, total fiber consumption will increase at a similar rate due to levels of fiber consumption per capita remaining stable throughout changes in population levels (Morris, 1996). Population growth is often used as a forecasting measurement because it is generally more dependable than economic projections due to how slowly trends change (Morris, 1996).

Consumer Lifestyles

Underhill (1998, p.13) states that, "changing social structures have led to important shifts in final consumer demand for textile products. Less formal social relations, and changing occupational patterns in western societies from the 1960s led to new fashions and growing demand for new products." Some speculate that as consumers spend more money on apparel products, an increased amount of expenditure on wool products will also occur (Ashton, 2000).

In numerous past studies by the Bureau of Agricultural Economics, Clark, Gruen, Jenkins, and others cited in Tisdell's work (1977) have found that changing consumption demands by consumers were a significant variable in determining rates of fiber substitution. Tisdell (1977) argues that fashion changes towards the use of more casual clothing have been a result of suburbanization, higher standards of living, and more leisure time. Richardson (2000) notes that the casualization of society over the past four

decades has led to a decreasing public interest in wool fiber, which is viewed by many as a formal, stuffy material. In Ashton's study (2000, p. 4) "better heating in cars and public transport and improved space heating and insulation in buildings" is also noted as having an adverse effect on the need for heavy weight garments in developed nations. Consumers want convenient and versatile clothing that allows them to express themselves as individuals while still maintaining the importance of branding (AWI, 2003). Recent trends in consumer tastes are marked by an increased importance placed on value and ease of care. Wool, as a more expensive and difficult to care for fiber, scores negatively compared with cotton and man-made fibers on both these counts (Ashton, 2002). Retail sales data has shown that consumers in the 24-44 year age range consume more apparel products than those in older age groups. This study also found that this group has little interest in wool and are less aware of its properties (Woolmark Company, 2000).

Unfortunately, due to greater difficulty in quantifying consumer tastes and habits, these consumption variables are often analyzed through observational methods. Final consumption measurements are particularly difficult to analyze; therefore, a combination of qualitative and quantitative methods are often utilized in order to better identify underlying variables of consumption. Frequently measured quantitative variables include economic growth, population, and income levels. Variables generally measured through qualitative analysis are the effects of climate, consumer preferences, and social habits.

Climate

Climate directly affects consumption of wool. It is generally deemed that consumers living in colder climates consume more wool (Ashton, 2000).

Supply-side Variables Associated with Wool Consumption

Land use

An important consideration in analyzing the supply of natural fibers (and man-made cellulosic fibers) is the market for alternative land uses. Land that is used for the growing of cotton or pasturing of sheep for wool is often suitable for other agricultural pursuits. In the case of wool, these pursuits often include meat (sheep or cattle) or grain production. According to expected changes in levels of return on alternative land uses, sheep populations can fluctuate (Ashton, 2002; AWI, 2003; Morris, 1996). Due to the time involved in raising sheep, the rates of supply are inelastic with regard to meeting expansionary demand. However, supply is more elastic with regard to falling demand levels through the slaughtering of sheep for meat production.

The amount of pasture available for wool production has fluctuated according to the relative profitability of wool uses versus other uses (Tisdell, 1977; Morris, 1996). During the 1980's, wool prices rose, making wool production a more profitable industry, and sheep population peaked (Year Book Australia, 2003). When the level of return on wool fell during the 1990s, Australian woolgrowers sought other higher profit uses for the land they had once reserved for sheep pasturing (Morris, 1996).

Another constraint on wool has been improving the crop yield per acre and per animal. This has been an important aspect of wool research and, consequently, yields

have risen steadily. However, yields have also been adversely affected by climate variables, especially periodic severe drought conditions (AWI, 2003).

Competition from Substitute Fibers

Previous studies have indicated that technical properties of fibers, fiber prices, trade conditions and promotional variables influence changes in overall fiber consumption and inter-fiber substitution. Tisdell (1977) used correlation and regression analysis to review the economic inter-relationship between wool, cotton, and man-made fibers. He found that the principal substitutes for wool have been synthetic fibers such as polyester, nylon, and acrylic (Tisdell, 1977). As noted previously, however, consumer shifts in lifestyles and living standards that have favored lighter, casual clothing at the expense of heavier and formal wear products have favored cotton consumption over wool. While man-made fibers have expanded the overall fiber market, they have also substituted for natural fibers across the broad spectrum of end uses.

Porter (1980) notes that important substitutes are those subject to trends improving their price performance trade-off, or those, which are produced by industries earning high profits. Research into fiber consumption and inter-fiber substitution has focused on three dimensions, technical properties of competing fibers, fiber prices, and fiber marketing and promotional activities.

Technical Properties

Sault (1970), as cited in Tisdell (1977), suggests that a major variable in fiber competition and substitution has been technological advances in synthetic fiber properties. Even though man-made fibers have yet to become perfect substitutes for wool

and other natural fibers, their rapid expansion since the 1950's has been based largely on their superior technical properties in terms of ease of processing, better performance characteristics (e.g. durability), and ease of consumer care. For textile manufacturers, man-made fibers are considerably less costly to convert into textile products than wool (AWI, 2003). Wool products are especially difficult to care for compared with cotton and man-made fibers, requiring separate hand washing, professional laundering, or dry cleaning (Ashton, 2002).

An important aspect of this substitution dynamic has been how synthetic fibers, as a comparatively youthful technology, undergone continuous improvements in their technical capabilities. This has spurred their progressive substitution for other fibers and expanded the size of the overall fiber market. Cotton and wool fiber research and marketing organizations have invested heavily in order to compete. However, due to difficulties in measurement, no research in the public domain has attempted to quantify the impact of these efforts.

Fiber Prices

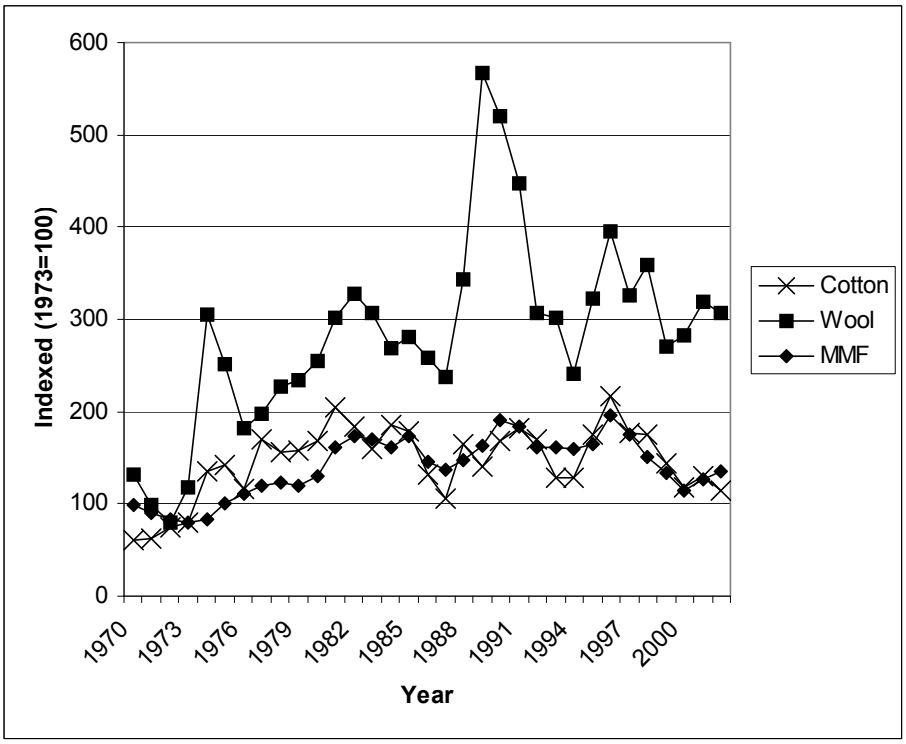
There are two aspects regarding fiber prices that influence substitution. These are absolute price level relative to other fibers and the extent to which prices fluctuate compared with other fibers. With regard to the former, the relative prices of competing fibers are often compared when analyzing the effects of inter-fiber competition on consumption levels of individual fibers. Emmerey's study (1967) cited by Tisdell (1977), of the wool end-use market in the United Kingdom, underlines the importance of relative prices. The study concluded that, with regard to supply, "the price elasticity (of wool)

has increased over the study period, because of the increased availability of synthetics as substitute fibres." In a regression analysis of inter-fiber competition in the United States, Kirby and Dardis (1993, p.1) found that substitution rates between fibers were closely related to price.

Wool is much more expensive to process than both cotton and man-made fibers (Year Book Australia, 2003). In the early years of synthetic fibers, their prices were higher than wool, but as the market expanded, growing economies of scale and intensified competition between synthetic fiber producers resulted in a progressive downward trend in prices. As noted by Ashton (2000, p.3), "apart from two price spikes in wool prices, the ratio of wool prices and synthetic fiber prices has been fairly flat since 1970, averaging slightly over three to one." A comparison of fiber prices for wool, cotton, and synthetic fibers between 1970 and 2002 is given in Figure 12. This steady price ratio reflects the close interdependence of wool and man-made fiber prices from a substitution perspective. It also suggests that variables other than the relative prices of fibers influence consumer choices, given the continued substitution of natural fibers by man-made fibers.

Fiber prices are believed to be sensitive to the relative levels of supply and demand in the international market. For synthetic fibers, movements in the supply of raw materials and intermediates are also critical. Apart from periodic price spikes caused by political upheavals affecting oil supply and prices, synthetic fiber prices have benefited from falling raw material prices. Concurrently, man-made fiber production capacity has expanded rapidly as nations have engaged in competitive capacity building to exploit

Figure 12
Prices of Textile Fibers 1970-2002



Source: International Cotton Advisory Committee

international markets. This has resulted in periodic excess capacity that has kept fiber prices comparatively low (Ashton, 2000). By contrast, natural fibers have been more constrained in expanding output, due to issues of land availability and greater difficulties in raising productivity. However, cotton has benefited from productivity improvements in cultivation and technical developments that have improved fiber quality. It should be noted that U.S. cotton has for many decades benefited from government subsidies. In 2004, these were estimated to be worth more than the value of the cotton crop harvested (Gary Raines, Cotton Incorporated, interviewed March 16th 2004). By contrast, wool productivity has remained flat due to drought in Australia. Changing market plans and

economic upheavals, including the collapse of the former Soviet Union, the Asian Crisis, and the creation of the European Union have strongly affected major wool producing countries.

As shown in Table 4, wool production has decreased significantly both in terms of actual output and in terms of production per sheep shearing. Cotton production has increased significantly in real volume terms and in terms of yield. Synthetic fiber capacity has also increased by nearly 30%. With regard to price stability, Tisdell (1977) notes that wool prices are subject to sharp fluctuations over time, because of variability in both supply and demand. He states that these fluctuations have a direct effect on fiber substitution rates, as they make it difficult for wool buyers to predict the market and acquire the quality and quantity of goods they need. This makes wool a less attractive fiber to manufacturers, who must maintain strict cost constraints on the production process. Tisdell (1977) further states that, "in the case of wool, the evidence strongly supports the hypothesis that the variability of wool prices is positively related to the utilization of production capacity in the synthetic fiber industry" (p. 37). As synthetic fibers dominate more of the market share in apparel, wool production patterns fluctuate at an increased rate, causing a strain on the stability of prices (Morris, 1996).

Fiber Marketing and Promotional Activities

The large promotional expenditures and establishment of brand names at the consumer level have also been important variables in inter-fiber substitution. Ashton (2000) and Tisdell (1977) discuss the effects of marketing and promotional activities of substitute fibers, particularly synthetics, on the wool industry. They note that, in part, as

Table 4
Productivity Improvements in Wool and Cotton Fibers 1981-2001

	1980-81 season	2000-01 season	Change %
Total Wool Production	4072 million tons	3064 million tons	-32.8
Total Wooled Sheep Population (Australia)	131.4 million	110.9 million	-18.5
Total Pasture (Australia)	N/A	23,814 ha	N/A
Total Wool Production per Sheep (Australia)	5.35 kg greasy	4.42 kg greasy	-21.0
Total Wool Production per Pasture (Australia)	N/A	25.49 kg/ha	N/A
Total Cotton Production	65.8 (000s bales)	88.1 (000s bales)	25.3
Total Cotton Acreage (United States)	13,215 (000s acres)	13,052 (000s acres)	-1.2
Total Cotton Yield per Hectare (United States)	177.19 kg/acre	277.19 lbs/acre	36.1
Growth of Synthetic Fiber Capacity	10,430 (000s metric tons)	14,698 (000s metric tons)	29

Source: International Wool Textile Organization; International Cotton Advisory Committee; *Fiber Organon*

synthetic fibers have advanced in promotional and branding activities that raise consumer awareness, the synthetic industry has experienced a continued rise in market share. Cotton in the United States appears to have benefited from high levels of consumer promotion since the 1970s (see Cotton, Inc. Website, http://www.cottoninc.com). However, there is no significant body of research that estimates the relationship between promotional activities and changing fiber consumption rates.

Climate

Climate is another commonly mentioned variable affecting wool production. Morris (1996) states that variations in yield can be accounted for in part by pasture quality, which is often dictated by climatic conditions. Frequent surveys, such as the report compiled by Chapman (1999), support the claim that climatic conditions,

particularly rainfall amounts, have an effect on wool quality and levels of production. These fluctuations are regarded as being greater than variations in cotton production due to climate, while synthetic fibers have no such impediments (AWI, 2003).

Trade Policies

Various studies have examined the effects of trade policies on wool consumption (Morris, 1996; Ashton, 2000 and 2002). Internationally traded wool products are subject to tariffs and quota restrictions that increase with each level of processing. With regard to the phasing-out of quotas under the Multi-Fiber Arrangement (MFA) the consequences are unclear. Ashton (2000) asserts that "synthetic and cotton producers are expected to benefit more than wool producers because the volume quotas under the arrangement encouraged trade in higher value products such as those made from wool" (p. 6). In a joint study conducted by the Centre for International Economics and the Trade Partnership in April of 2000 analyzed the effects of wool trade barriers on wool fiber products with regards to US consumers and Australian wool growers. An input-output model was used to estimate trade elasticities. This study found that changes in tariff and quota restrictions would make little difference to either U.S. wool consumption or Australian wool production.

Wool Consumption Indicators

Two other variables could be perceived as influencing wool consumption by specific countries. These include the competitiveness of that nation's textile and apparel manufacturing industries and the short and medium-term movements in currency exchange rates, which can act to distort prices and competitive cost positions.

The competitiveness of an industry should be directly linked with its consumption of raw materials. Revealed comparative advantage (RCA) is a widely accepted measurement for comparing the international competitiveness of nations. RCA, as introduced by Bela Belassa (1964), is an analysis of a nation's export performance in specific export commodities. However, no studies have incorporated the RCA rate in their analysis of wool industry performance at the global level.

Goods and services for particular nations become more or less attractive in the global market as their currency strengthens or weakens against those of other nations. Short and medium-term fluctuations in exchange rates are often not related to underlying changes in competitiveness, but owe much to the effect of speculative forces on international money markets. Thus, a relatively weak currency will promote exports, while a strong currency will promote increased import activity (Kilduff & Priestland, 2001). It is expected that as Australian currency exchange rates (regularly similar to those of the US$) strengthen, the volume of wool exported will increase.

Final Stage Availability

The volume of wool fiber consumed in the manufacture of finished products is closely linked to final demand for wool. A common measure of fiber consumption is mill consumption. Ideally, changes in fiber availability between the spinning stage and the final processing stage could be measured by international trade in yarns, fabrics, and garments. Unfortunately, due to fiber blending and the significant volume of trade in finished products, this method often provides an unreliable measurement of wool consumption in a particular country. Nevertheless, because fiber consumption at the final

processing stages is the closest available data for analyzing total fiber consumption at the consumer level, it is the best measurement available. Ashton (2000) has shown that final consumption trends reveal important information about overall demand and per capita consumption within a country.

Yarn Stage Measures

There are two measures of activity at the yarn stage. In his research, Tisdell (1977) found that analyzing wool fiber mill consumption was an accurate predictor of wool consumption in the global end use market. This is supported by the most recent publicly available retail wool fiber consumption statistics (IWS, 1994).

Another measure of fiber consumption at the spinning stage is yarn manufacturing capacity, as reflected by the number of spinning spindles installed. In the cotton spinning industry, a close relationship has been found between shipments of short staple spinning equipment and demand for cotton, given a 2-year lag (Gary Raines, Cotton Incorporated, interviewed March 16th 2004). The International Textile Manufacturer's Federation (ITMF) publishes the total number of spindles in major wool textile manufacturing nations, on an annual basis. However, this data cannot identify shifts in the proportion of wool and other (mainly man-made) fibers processed on this equipment.

Fabric Stage Measures

Similar estimates of wool textile processing capacity can also be made at the woven fabric stage. However, in addition to the shortcomings of estimating wool consumption at the spinning stage, a significant proportion of wool is consumed by the knitting sector.

Conclusions from the Literature Review

Overall, the literature on wool consumption reveals a number of variables associated with wool fiber consumption. These can be broadly divided into supply and demand-side, and categorized according to their relationship to change in consumption, positive, negative, and neutral or fluctuating. These variables are summarized in Table 5.

Table 5
Summary of Variables Associated With Fiber Consumption and Inter-fiber Substitution

	Demand Influences	Supply Influences
Positive	Incomes Population Consumer awareness	Land area/ sheep population
Negative	Consumer lifestyles Relative prices of finished goods	Improvements in competitiveness of substitute fibers Price of Wool Technical
Neutral or Fluctuating	Climate	Climate Trade barriers Exchange rates

Note: Based on literature review.

Previous studies, whether studying fiber consumption or inter-fiber substitution, have often restricted their inclusion of variables. This has resulted in limited findings, regardless of the qualitative or quantitative nature of the research. In both qualitative and quantitative studies, inter-fiber substitution is generally measured, most frequently using price as the main determinant. However, in the case of Australian wool, prices have remained relatively stable over time, while wool market share has continued to fall. This suggests that there are other variables, not fully addressed in previous studies that have an

effect on consumption of Australian wool and substitution of wool by other fibers. This study will include a broader range of supply and demand-side variables, to obtain a more comprehensive view of past marketing decisions made by the Australian wool industry.

CHAPTER III

METHODOLOGY

The methodology is divided into six sections: (1) Introduction; (2) Selection of Wool Consuming Nations; (3) Selection of Variables Reviewed; (4) Analysis; (5) Method of Variable Review; and (6) Organization of Results.

Introduction

A key objective of this study sought to discover what variables are associated with changing levels of Australian wool fiber consumption. Four specific questions of possible associations were tested.

Question 1: What is the likely association between each explanatory variable reviewed and AWL?
Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period?
Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period?

Australian wool consumption was measured in terms of imports of Australian wool (AWL) in five nations selected as a global representation of consumption. Twelve explanatory variables were selected to assess their influence on AWL. All of these variables were recorded on an annual basis from 1980-2001, except when certain years were unavailable. In order to review possible differences between periods of controlled wool consumption and less controlled consumption, these annual figures were divided

into two periods of review: the Reserve Price Scheme (RPS) period from 1980-1991 and the post Reserve Price Scheme (post-RPS) period from 1991-2001.

Selections of Wool Consuming Nations

Global data on a number of variables related to wool consumption and textile production were either incomplete or incompatible for use in the analysis. Therefore, it was decided to conduct the analysis at the level of individual nations for which data is available and reasonably compatible.

The top five nations, in terms of total wool fiber imports, were chosen to provide a representative sample of international wool demand (see Table 6). These were: China, Italy, the United Kingdom, France, and Germany. According to 1998 data from the Woolmark Company, throughout the 1990s, these countries were also among the top nine wool-consuming nations globally (see Table 7). The remaining four nations in the comparison of both fiber importation and retail consumption were excluded as, in combination these countries accounted for only 7.9% of Australian wool exported.

Selection of Variables Reviewed

The variables were chosen to represent a selection of supply and demand side variables that had a suspected possible association with AWL. Supply side variables were separated into three sections: fiber consumption; fiber prices; and trade and processing variables. Table 8 presents the 12 variables selected for review.

Table 6
Major Wool Fiber Importing Nations

Country	Million Kilograms	Percent	Cumulative Percent
China	239.5	24.7	24.7
Italy	137.3	14.2	38.9
United Kingdom	79.1	8.2	47.1
France	59.1	6.1	53.2
Germany	53.6	5.5	58.7
Japan	27.7	2.9	61.6
Korea, Republic of	23.2	2.4	64.0
United States	20.5	2.1	66.1
Former USSR	5.0	0.5	66.6
Other	323.2	33.4	100.0
World Total	967.7	100.0	N/A*

Source: International Wool Textile Organization
* Not Available

Table 7
Estimated Average Annual Retail Consumption of Wool 1990-1998 (Averaged)

Country	Total (000s kilograms.)	Per Person (kilograms)
China and Hong Kong	235	0.19
Japan	171	0.48
Former USSR	138	0.76
Germany	127	1.56
United States	124	1.64
Italy	94	1.39
United Kingdom	90	0.78
France	44	1.55
Korea, Republic of	35	0.48
Other	440	N/A*
Total	1586	N/A

* Not Available
Source: The Woolmark Company

Supply Side Variables

Numerical measures chosen to represent issues related to production and availability were: the level of consumption of substitute fibers (OWC, CTN, MMF),

prices of substitute fibers (PWL, PCN, PMF), the revealed comparative advantage of yarn (RCA), exchange rate movements (XRT), and wool yarn production (WYP).

Table 8
Variables Reviewed

Variable Categories	Variables
Fiber Consumption	Other Fiber Consumption (OTC)
	Cotton Fiber Consumption (CTN)
	Man-made Fiber Consumption (MMF)
Fiber Prices	Wool Fiber Prices (PWL)
	Cotton Fiber Prices (PCN)
	Man-made Fiber Prices (PMF)
Trade and Processing Variables	Exchange Rate (XRT)
	Revealed Comparative Advantage (RCA)
	Wool Yarn Production (WYP)
Demand Side Variables	Gross National Income (GNI)
	Population Growth (POP)
	Energy Consumption (ENR)

Consumption of Substitute Fibers

The volume of substitute fibers, reported in thousands of kilograms, in comparison to the volume of AWL establishes an association to total fiber consumption and the consumption of Australian wool fibers. As the volume of substitute fibers increases, the volume of AWL decreases. The volume of substitute fibers in comparison to the volume of AWL was reviewed in order to establish its association to total consumption of AWL. Total consumption of cotton and synthetic fibers was represented using data obtained from the ICAC and Fiber Organon in terms of thousands of kilograms. Wool fiber, not imported from Australia, was calculated from the NDA of wool at the spinning stage available for each nation less the amount of Australian wool imports for the same nation.

Prices of Substitute Fibers

The prices of wool and substitute fibers are determined by market conditions, demand and supply. Demand for wool is relatively stable with small shifts, so when available supply is reduced, PWL will rise to reduce market quantity. Therefore, it is expected that the price of non-wool fibers, to the extent they are substituted for wool, will be negatively related to AWL. Fiber prices were obtained from ICAC data presented in an indexed form of annual prices in the global market. As in the ICAC data, the price of U.S. polyester is used as a measurement for PMF, and the price of Australian wool is used for PWL. The price index provided for cotton is the average price of cotton fiber, from major producing nations, available for mill consumption at the fiber spinning stage (ICAC, 2003).

Wool Yarn Production

WYP is a measurement of the actual amount of wool yarn available to be used in the next stage of processing and is measured in thousands of metric tons (UN Statistical Yearbook; ITMF; CIRFS).

Revealed Comparative Advantage

Revealed comparative advantage, a measurement of a particular nation's comparative advantage in a commodity market, is reported as an index number in order to provide an easy system of cross-country comparison. The four intervals of RCA are: very high (RCA>2), high (2>RCA>1), low (1>RCA>0.5), and very low (RCA<0.5). This index number is obtained by using a formula to calculate the index number using country export data in a given commodity sector and the country's total exports at the world level. The formula is as follows:

$RCA_i = \{X_{ij} / (\Sigma_i X_{ij}) - X_{ij}\} / \{[(\Sigma_j X_{ij}) - X_{ij}] / [(\Sigma_j \Sigma_i X_{ij}) - (\Sigma_j X_{ij})] - [(\Sigma_i X_{ij}) - X_{ij}]\}$

Where,

X_{ij} = exports of sector "i" in country "j"

$\Sigma_i X_{ij}$ = total exports of country "j"

$\Sigma_j X_{ij}$ = world exports of sector "i"

$\Sigma_j \Sigma_i X_{ij}$ = total world exports

X_{ij} and $\Sigma_i X_{ij}$ data were obtained from UN Comtrade statistical information available online. $\Sigma_j X_{ij}$ data was obtained from the UN International Trade Statistics Yearbook, and $\Sigma_j \Sigma_i X_{ij}$ from WDI online.

Exchange Rate Movements

Exchange rate movements in the global economy have a significant impact on global trade patterns. Exchange rate (XRT) data was obtained from the UN Monthly Bulletin of Statistics and is reported in terms of the national currency values relative to the U.S. dollar.

Demand Side Variables

The demand side variables studied were gross national income (GNI), population growth (POP), and energy consumption (ENR). Previous research using these or similar variables suggest that they are positively related to wool fiber consumption.

Gross National Income (per capita)

Gross national income per capita (GNI) is a variable frequently used when measuring consumer purchasing power. Gross national income per capita is the total value added by all domestic producers plus any taxes on goods produced; it excludes any product value obtained overseas. Many previous studies have used basic GNI data. However, this ignores the differential purchasing power of identical incomes between nations. This distortion can be even further exaggerated by currency exchange rates when translated into U.S. currency for international comparisons. In order to permit more

accurate cross-national comparisons, the Purchasing Power Parity method of calculating GNI has been employed in this study. This method, used by the World Bank, converts GNI per capita into a global scale – an international dollar. An international dollar has the same purchasing power over GNI as a U.S. dollar has in the U.S. (World Bank, 2003).

Population Growth (annual %)

Population growth (POP) is often used to forecast demand changes because it is generally more accurate than economic projections due to how slowly population trends change (Morris, 1996). Population growth is measured in terms of annual percentage growth rate and counts all residents of a nation, regardless of legal citizenship.

Energy Consumption

Energy consumption (ENR) is often used as a secondary variable for measuring wealth, since wealthier nations typically use more energy. Energy consumption is believed to be positively related to fiber consumption. Energy consumption measures the production of power plants and combined heat, less distribution losses, and own use by heat and power plants (World Bank, 2003). As ENR is consumed domestically, it can be assumed that this is a relatively accurate figure in determining domestic energy consumption. Because the ENR figure was used as a secondary measurement of income, power plant consumption was measured rather than natural resource consumption (coal or oil) since power plant usage suggests a level of economic advancement that cannot be determined by natural resource energy consumption alone. Energy consumption was measured in terms of kilowatts per hour per capita used.

Analysis

Two different levels of analysis were performed in order to gain an independent understanding of the association between the consumption of Australian wool and the variables chosen for comparison. Firstly, an independent review of the actual levels of wool consumption and the variables were analyzed. Secondly, the variables were transformed into annual change proportions, and reviewed using binomial odds ratio analysis.

The first review provided a careful review of each variable in terms of the original metrics reported. This allowed for a thorough analysis of the individual variables. However, because different metrics were used for each variable, the measurement of associations between Australian wool consumption and the variables reviewed was not readily quantified.

The second review provided an analysis of association between Australian wool consumption and the explanatory variables reviewed. In order to utilize the odds ratio method of analysis, the individual metrics of each variable were converted into annual change proportions and then classified into either increased or decreased change. This provided a quantifiable associative figure between Australian wool imports and the variables reviewed. However, because the data was classified into binomial responses, the magnitude of change was neglected in the analysis.

By utilizing both of these review techniques, an independent variable review could be conducted in conjunction with a broader odds ratio analysis to provide more concrete, though less detailed, results. Each of these techniques is described in more detail below.

Independent Variable Analysis Technique

Comparison Points from Australian Wool Imports

For each of the countries analyzed for this study, notable changes in Australian wool consumption (hereafter referred to selection points) were identified for further analysis. Years chosen as selection points were identified if wool consumption either increased or decreased, by a variable of 0.25 over the previous year. The resultant comparison points are shown by year and nation (see Table 9). Actual percent change for each year (change rate) that met the selection criteria is presented.

Table 9
Selection Points by Nation and Change Indicators

	China	Italy	UK	France	Germany
1980-1981	0.2878		-0.4493		-0.3502
1981-1982	0.4819	-0.2531			
1982-1983	-0.4351				
1983-1984	-1.2612		0.322		
1984-1985	0.7692	0.2577	0.4092		
1985-1986					
1986-1987					
1987-1988					
1988-1989	-1.5813				
1989-1990	-0.3835		-0.8755	-0.3729	-0.3184
1990-1991	0.7723		0.2696	0.3066	
1991-1992			0.3415		
1992-1993					
1993-1994					
1994-1995				-0.2994	-0.2879
1995-1996				-0.2583	
1996-1997				0.3447	
1997-1998	-0.2738	-0.2599	-0.6281	-0.3063	
1998-1999			-0.6408	-0.2545	-0.9221
1999-2000	0.3197			-0.2801	0.3125
2000-2001			-0.7736		-0.3228

Table 9 indicates that China, Italy, UK, France, and Germany had 10, 3, 9, 8, and 6-comparison point years, respectively.

Method of Variable Review

Conversion of Influencing Variables for Association Analysis

To increase the interpretability of the values of the 13 variables tested for their association with Australian wool consumption, the variables were transformed into change variables in a similar fashion to the procedure used for Australian wool consumption. For each variable, change was calculated for each successive year relative to the preceding year. The absolute values were calculated and divided into quantiles. The resulting values were then coded into one of the following quantile categories.

Table 10
Quantile Categories

Code	Change	Range
3	0.75 - 1.0	3rd quantile – maximum
2	0.50 - 0.74	Median – 3rd quantile
1	0.25 - 0.49	2nd quantile – median
0	-0.24 - 0.24	+/- minimum - +/- median
-1	-0.25 - -0.49	-2nd quantile - -median
-2	-0.50 - -0.74	-median - -3rd quantile
-3	-0.75 - -1.0	-3rd quantile - -maximum

Variable changes with a code of +/- 2 or 3 were considered notable, changes of +/- 1 were not notable, and changes coded with a 0 were not measurable. The association for each variable was tabulated according to period and country reviewed and is shown in Appendices E-H.

For each period (RPS and post-RPS), the variable associations were averaged for all available countries. The averages were reported in the 'total' column. The RPS and post-

RPS scores available for each variable by country were then averaged into a single score for the 20-year period. The 'total' column was calculated in a similar manner as the country columns in the table. The preliminary analysis and the totaled tables are available in Appendix C. Strong positive associations were indicated by a '1', while weak positive associations were indicated with a '0.5'. Negative associations were indicated by a '-0.5' if the association was weak and '-1' if it was strong. A '0' indicated that no measurable association could be determined, and an N/A was used when data was not available.

Calculating the results in this manner created a universal scale on which all variables and countries could be compared easily. A positive number indicated the variable was more likely to increase during the RPS period; a negative number indicated the variable was more likely to increase during the post-RPS period. The association was more neutral as it approached zero and stronger as it approached the endpoints.

Binomial Odds Ratio Analysis

Once the variables reviewed were transformed into change rates, they were reviewed for normality and equal variance assumptions. Because the variables reviewed were neither normal nor had constant variance, nonparametric methods of analysis were investigated. Nonparametric binomial odds ratio tests were performed in order to determine the likelihood of these particular associations occurring (alpha-level=.10). An alpha-level of .10 was chosen, due to the expectation that associations among the reviewed variables might be small. A Fisher's p-value was calculated to determine the strength of dependence between AWL and the variable reviewed.

The research sought to discover associations between changes in AWL and the selected variables. In order to review this aspect of all variables, annual growth rates were calculated. These rates were grouped into either positive or negative growth -

annual growth rates of 0 growth were removed. Each variable reviewed was then divided into one of three possible categories, with eight possible occurrences, for review; by period, AWL growth, and variable growth. A count of the number of occurrences in each category was taken. The variable categorization of OWC is shown in Table 9, the remaining tables can be found in Appendices E-H.

Table 11
Categorization of OWC for Odds Ratio Analysis

Period	AWL Growth	Variable Growth	Count
RPS	Positive	Positive	5
RPS	Positive	Negative	6
RPS	Negative	Positive	2
RPS	Negative	Negative	2
Post-RPS	Positive	Positive	8
Post-RPS	Positive	Negative	16
Post-RPS	Negative	Positive	7
Post-RPS	Negative	Negative	19

Two by two odds ratio tables were constructed for the RPS and post-RPS period analyses. A Breslow-Day Test for Homogeneity was conducted on the combined 20-year review, to determine if a Mantel-Haenszel test was necessary. For results with a Breslow-Day χ^2 value of 0.10 or greater, the Mantel-Haenszel test was conducted in order to control for odds ratio variation between the periods reviewed. For results with a Breslow-Day χ^2 value of less than 0.10, the RPS and post-RPS variables were collapsed into a single 20-year variable. Forty-eight tables were created. The complete output tables can be found in Appendices E-H.

Organization of Results

The independent review results for each variable by nation are provided in Appendices F-I. The results of the twelve variables reviewed in the first analysis are combined with the odds ratio results and have been presented by variable. Asymptotic results were reviewed in coordination with Fisher's exact p-values. These were preferred to standard χ^2 p-values as χ^2 results are subject to irregularity due to small expected cell sizes (less than 5). The asymptotic results providing confidence intervals are also subject to errors due to small expected cell sizes. Variables that resulted in expected counts of less than five are noted in the results. A list of the variables and questions with expected counts of less than five is given in Table 12. These variable associations have an acceptable p-value; however, the ratio values and confidence intervals are subject to error.

Table 12
Variables with Expected Counts of Less than Five

Variable	Question
OWC	Question 2: During the RPS period, as AWL increases, which direction (positive or negative) is the variable most likely to grow?
WYP	Question 3: During the post-RPS period, as AWL increases, which direction (positive or negative) is the variable most likely to grow?
GNI	Question 2: During the RPS period, as AWL increases, which direction (positive or negative) is the variable most likely to grow?
GNI	Question 3: During the post-RPS period, as AWL increases, which direction (positive or negative) is the variable most likely to grow?
GNI	Question 1: As AWL increases, which direction (positive or negative) is the variable most likely to grow?
POP	Question 3: During the post-RPS period, as AWL increases, which direction (positive or negative) is the variable most likely to grow?

CHAPTER IV

RESULTS

Chapter IV presents the results in five sections: (1) review of Australian Wool Consumption; (2) fiber supply; (3) fiber prices; (4) trade and processing; and (5) demographic factors. Each of these sections includes a review of variable movement for each country reviewed, then each of the three research questions was reviewed:

Question 1: What is the likely association between each explanatory variable reviewed and AWL?
Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period?
Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period?

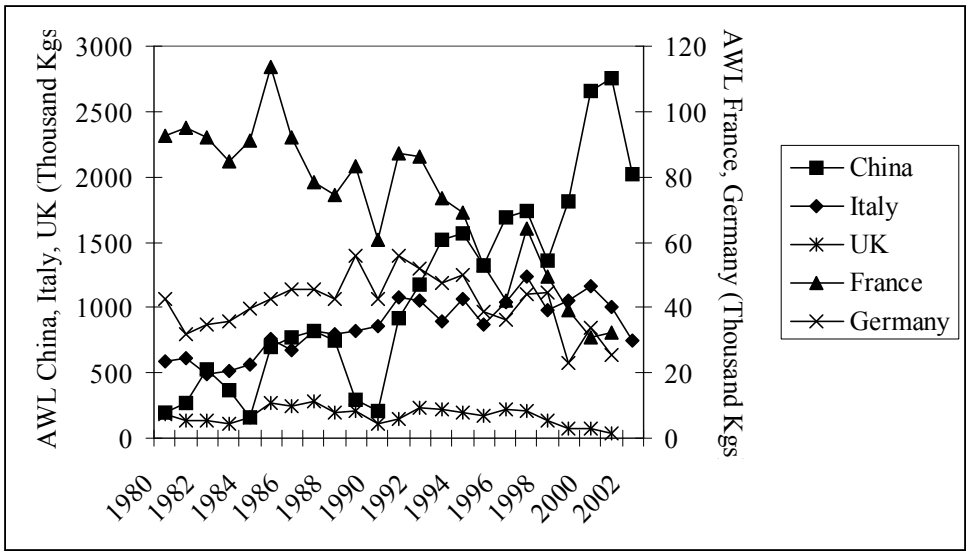
The findings were further categorized by variable. Each of the variables was then reviewed using each analysis technique. Each result, by question and variable is summarized in Tables 13-25 below.

Review of Australian Wool Consumption

The level of AWL consumption for each of the five countries reviewed is shown below in Figure 13.

Australian wool consumption in China has grown throughout the RPS and post-RPS periods, from 193,000kg in 1980 to 921,100kg in 1991 (378%) in the RPS period and from 921,100kg in 1991 to 2,024,000kg in 2002 (119%) during the post-RPS period.

Figure 13
Australian Wool Consumption in Five Review Countries: 1980-2002



Source: Australian Wool Exchange, 2003.

Despite these increases, and the 1,931,000kg (949%) increase in AWL from 1980-2002, the pattern of annual AWL change was volatile. During the RPS, there were four years of increased (1980-1981, 1981-1982, 1984-1985, and 1990-1994) and four years of decreased (1982-1983, 1983-1984, 1988-1989, and 1989-1990) change in AWL. Post-RPS, there was a single year of increased (1999-2000) and one year of decreased (1997-1998) change in AWL.

During the 20-year period reviewed, Australian wool consumption in Italy has grown by 25.87%, from 591,400kg in 1980 to 744,400kg in 2002. AWL had a general period of growth from 5,914,000kg in 1980 to 1,082,9,000kg in 1991 (83.04%), during the RPS period, and then declined by 31.25% in the post RPS period, from 1,082,900kg in 1991 to 744,400kg in 2002. These periods of growth and decline were volatile, with many changes in growth direction throughout the periods reviewed, as seen in Figure 13, above. During the RPS, there was one year (1984-1985) of increase, and one-year (1981-

1982) decrease in AWL of 25% or more. Post-RPS, there were no increases in AWL, and one year (1997-1998) of decreased AWL of greater than or equal to 25%.

During the 20-year period review, UK consumption of Australian wool was volatile, with little evidence of any cyclical trends. During RPS, AWL decreased overall from 187,100kg in 1980 to 150,600kg in 1991 (by 19.51%), but experienced growth from 1983-1986 and again in 1987-1988. Post-RPS, the overall decline, of 71.85%, in AWL continued, with AWL of 150,600kg in 1991 to 42,400kg in 2002, with small periods of increase in 1991-1993 and in 1996-1997. This resulted in an overall decline in AWL of 77.34% from 1980-2002. During RPS, there were three selection points of increased AWL (1983-1984, 1984-1985, and 1990-1991) and two selection points of decreased AWL (1980-1981 and 1989-1990) chosen. Post-RPS there was one point (1991-1992) of increased AWL and three selection points (1997-1998, 1998-1999, and 2000-2001) of decreased AWL chosen for review.

During the two time periods reviewed, AWL in France decreased by 65.26%, from 92,400kg in 1980 to 32,100kg in 2001. During RPS, AWL consumption decreased from 92,400kg in 1980 to 87,400kg in 1991 (5.41%), but experienced growth peaks in 1985 and 1990 and periods of large decline in 1983, 1988, and 1989. Of these years, 1988-1989 and 1989-1990 were chosen as selection points. Post-RPS there were fewer extreme growth changes. AWL consumption during the post-RPS period declined overall by 65.26%, from 87,400kg in 1991 to 32,100kg in 2001, experiencing rapid growth in 1997 and declining greatly in 1997 and 2001. During the post-RPS period, selection points, chosen for an increase or decrease of 25% or more, were 1994-1995, 1997-1998, and 1998-1999.

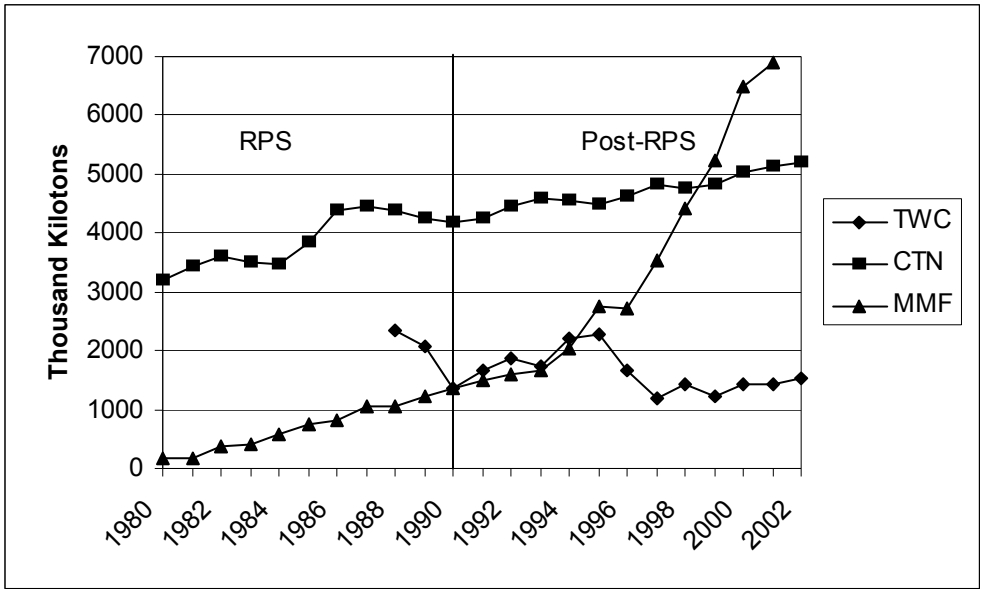
Australian wool consumption in Germany has declined in the 20-year period reviewed by 40.65%, from 42,800kg in 1980 to 25,400kg in 2001. Unlike the other nations reviewed, Germany's AWL was considerably more stable during the RPS with large declines in growth in 1981 and 1989. However, due to the steady growth in the remaining RPS years, AWL increased from 42,800kg in 1980 to 56,000kg in 1991 (by 30.84%) during the period. Post-RPS, AWL became increasingly more volatile than in previous years, and experienced a 40.65% decline in growth, from 56,000kg in 1991 to 25,400kg in 2001, for the period. During both the RPS and post-RPS periods, there were no years of increasing AWL chosen as selection point. During RPS, 1980-1981 and 1989-1990 were chosen as selection points of decreased AWL. Post-RPS, selection points for decreasing AWL chosen were, 1994-1995, 1998-1999, 1999-2000, and 2000-2001.

Fiber Supply

Variable Review

Fiber supply in China has shown increasing levels of cotton and synthetic fiber mill consumption, and decreasing levels of wool fiber consumption. The significant growth in MMF, from 170,000 kg in 1980 to 6,897,000 kg in 2000, is shown in Figure 14. OWC, in China, has increased for the last four years, from 1,219,800 kg in1998 to 1,545,000 kg in 2002. This suggests that while the wool textile industry may have experienced large decline in the mid-1990s, the level of OWC may be becoming less volatile and increasing steadily.

Figure 14
Fiber Supply in China: 1980-2001

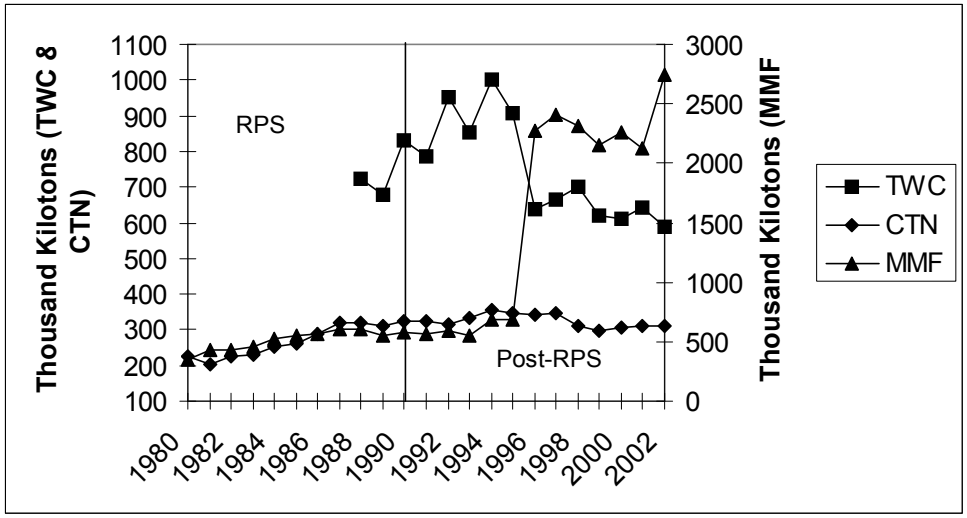


OWC = Total Wool Fiber Consumption
CTN = Cotton Fiber Consumption
MMF = Synthetic Fiber Consumption

In Italy, During the 20-year period under review, OWC decreased by 6.92%, from 723.3 '000kg in 1988 to 587.6 '000kg in 2002, while CTN and MMF increased by 39.73%, from 224 '000kg in 1980 to 313 '000kg in 2002, and 670.09%, from 355.8 '00kg in 1980 to 2740 '000kg in 2002, respectively. OWC had a volatile pattern of change; both CTN and MMF were steadier – displaying a more linear pattern of change in growth (see Figure 15).

The UK fiber supply has shown decreasing levels of mill consumption in all fibers examined. The significant growth in MMF, from 288.6 '000kg in 1980 to 2131.6 '000kg in 2002, shown in Figure 16 is artificial, as it is a result of changes in data recording methods. OWC, in the UK, has increased for the last four years, from 573.2 '000kg in

Figure 15
Mill Fiber Consumption in Italy: 1980-2002

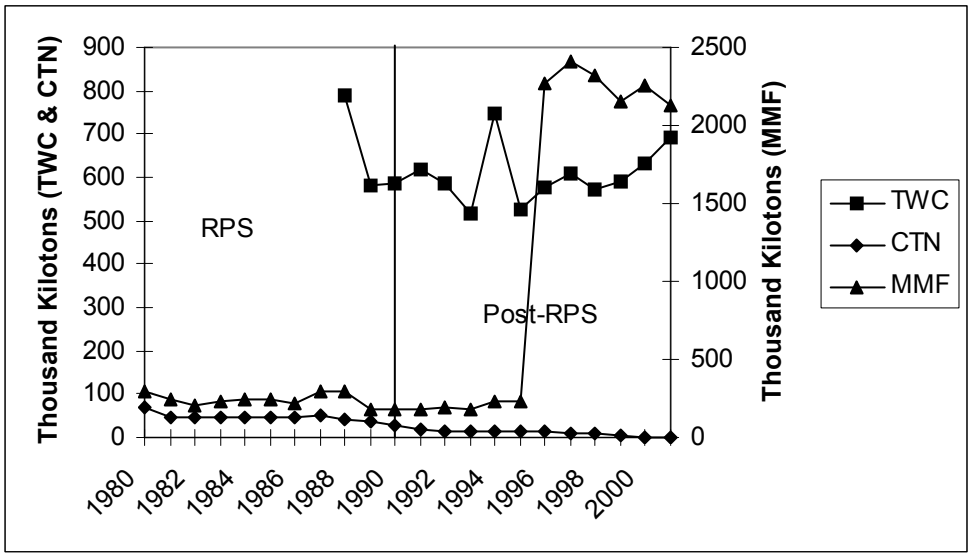


OWC=Total Wool Consumption
CTN = Total Cotton Fiber Consumption
MMF = Total Polyester (Synthetic) Fiber Consumption

1998 to 690.6 ‘000kg in 2002. This suggests that while the overall textile industry may be in decline, the level of OWC may be remaining fairly steady.

In France, of the three fibers – OWC, CTN, and MMF - reviewed OWC and CTN experienced a decline in mill fiber consumption, by 84.63% (from 168.5 ‘000kg in 1988 to 25.9 ‘000kg in 2001), 48.35% (from 182 ‘000kg in 1980 to 94 ‘000kg in 2001), and MMF and increase, by 1007.33% (from 192.5 ‘000kg in 1980 to 2131.6 ‘000kg in 2001), respectively. Though, the increase in MMF is difficult to interpret, as it may be due to the replacement of national figures with EU-wide data. If the EU figures are removed, all three fibers experienced decline – MMF the smallest, followed by CTN. OWC experience a more extreme and volatile decline than the other two fibers; experiencing a peak in 1990, bottoming out in 1998, and peaking again in 2001. (See Figure 16)

Figure 16
Fiber Supply in UK: 1980-2002

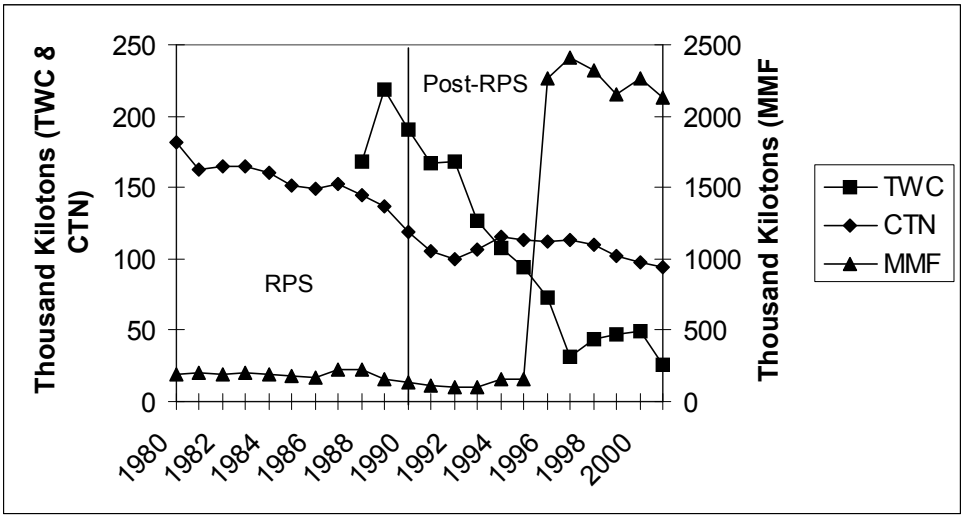


OWC = Total Wool Fiber Consumption
CTN = Cotton Fiber Consumption
MMF = Total Polyester (Synthetic) Fiber Consumption

During the RPS, OWC, CTN and MMF, all declined – by .53% (from 168.5 in 1988 to 167.6 in 1991), 42.31% (from 182 in 1980 to 105 in 1991), and 44.42% (from 192.5 in 1980 to 107 in 1991), respectively. Post-RPS, OWC and CTN decreased from 167.6 in 1991 to 25.9 in 2001 (84.55%) and from 105 in 1991 to 94 in 2001 (10.48%), while MMF increased from 107 in 1991 to 2131.6 in 2001 (1892.15%).

Like France, Germany experienced declining mill consumption levels in OWC and CTN – by 52.89% and 33.16% respectively – and increasing levels of MMF, by 195.44% for the 20-year period reviewed (see Figure 17). Changes in OWC were more volatile than changes in CTN and MMF. During the RPS period, all three fiber consumption levels increased – OWC by 7.33% (from 540.4 in 1988 to 580 in 1991),

Figure 17
Fiber Supply in France: 1980-2002



OWC = Total Wool Fiber Consumption
CTN = Cotton Fiber Consumption
MMF = Synthetic (Polyester) Fiber Consumption

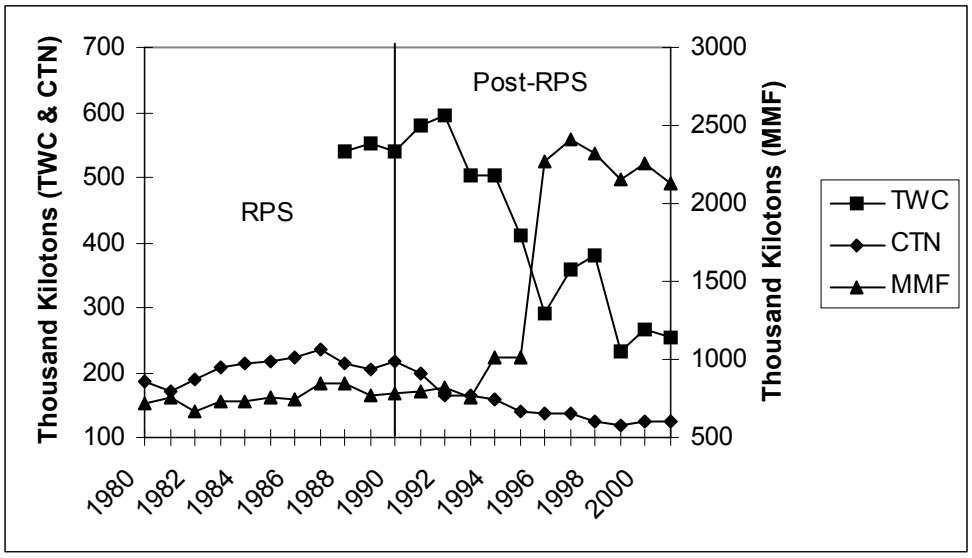
CTN by 5.88%(from 187 in 1980 to 198 in 1991), and MMF by 10.48% (from 721.5 in 1980 to 797 in 1991). Post-RPS, MMF continued to increase from 721.5 in 1991 to 2131.6 in 2001(167.45%), but CTN and OWC decreased, by 56.10% (from 198 in 1991 to 125 in 2001) and 36.87% (from 580 in 1991 to 254.6 in 2001), respectively.

Question 1: What is the likely association between each explanatory variable reviewed and AWL? (See Table 13)

Other Wool Consumption

The results of the independent variable review analysis suggested a weak to moderate positive association, with a score of .25, between OWC and AWL. Odds ratio results were calculated using the Mantel-Haenszel method (χ^2=0.8141), and suggested that AWL was 1.22% more likely to increase as OWC increased (p-value=0.7199).

Figure 18
Fiber Supply in Germany: 1980-2002



OWC = Total Wool Fiber Consumption
CTN = Cotton Fiber Consumption
MMF = Synthetic (Polyester) Fiber Consumption

Cotton Fiber Consumption

Independent variable review suggested a moderate positive association (score=0.45) between CTN and AWL. The odds ratio analysis (χ^2=0.0676), in contrast, suggested that AWL was 1% more likely to increase as CTN decreased (p-value=0.2963).

Synthetic Fiber Consumption

A moderate positive association, with a score of 0.40, was suggested throughout the independent variable review of MMF and AWL. The odds ratio analysis (χ^2=0.0460), in contrast, suggested AWL is 5.22% more likely to increase as MMF decreased (p-value=0.6814).

Table 13
Question 1 Fiber Supply Results

Variable	Independent Review	Odds Ratio		
		χ^2	Risk	P-value
OWC	0.75	0.7118	0.0133	0.7199
CTN	-0.70	0.0676	-0.01	1.0000
MMF	-0.50	0.0460	-0.0522	0.6814

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period? (See Table 14)

Other Wool Consumption

The independent variable review suggested a strong positive association between OWC and AWL, with a score of 0.75. The odds ratio analysis suggested a positive association, that AWL was 4.55% more likely to increase as OWC increased (p-value=1.0000).

Cotton Fiber Consumption

Independent variable analysis suggested a weak to moderate positive association (score=0.20) between CTN and AWL. These results were supported by the odds ratio analysis. The odds ratio analysis suggested that AWL was 20.63% more likely to increase as CTN increased (p-value=0.2461).

Synthetic Fiber Consumption

The results of the independent variable review suggested a weak to moderate positive association, with a score of 0.30, between MMF and AWL. The odds ratio analysis results were similar, suggesting that AWL was 13.66% more likely to increase as MMF increased (p-value=0.3887).

Table 14
Question 2 Fiber Supply Results

Variable	Independent Review	Odds Ratio			
		Risk	90% Confidence Limits		P-value
OWC	0.75	0.0455	-0.4342	0.5251	1.0000
CTN	0.20	0.2063	-0.0269	0.4394	0.2461
MMF	0.30	0.1366	-.0844	0.3517	0.3887

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period? (See Table 15)

Other Wool Consumption

The independent variable review suggested a weak negative association (Score= -0.15) between OWC and AWL. This is also supported by the odds ratio analysis, which suggests that AWL is 7.62% more likely to decrease as CTN increases (P-value=0.7598).

Cotton Fiber Consumption

CTN is suggested to have a moderate to strong positive association (score=0.70) with AWL, according to the independent variable review. The odds ratio analysis, in contrast, suggested that AWL was 17.43% more likely to decrease as CTN increased (P-value=0.3371).

Synthetic Fiber Consumption

Independent variable review results suggested a moderate positive association (score=0.50) between MMF and AWL. Odds ratio analysis results were contradictory, suggesting a negative association that AWL was 27.06% more likely to decrease as MMF increased (P-value=0.1127).

Table 15
Question 3 Fiber Supply Results

Variable	Independent Review	Odds Ratio			
		Risk	90% Confidence Limits		P-value
OWC	-0.15	-0.0762	-0.3293	0.1769	0.7598
CTN	0.70	-0.1743	-0.4203	0.0718	0.3371
MMF	0.50	-0.2706	-0.4912	-0.499	0.1127

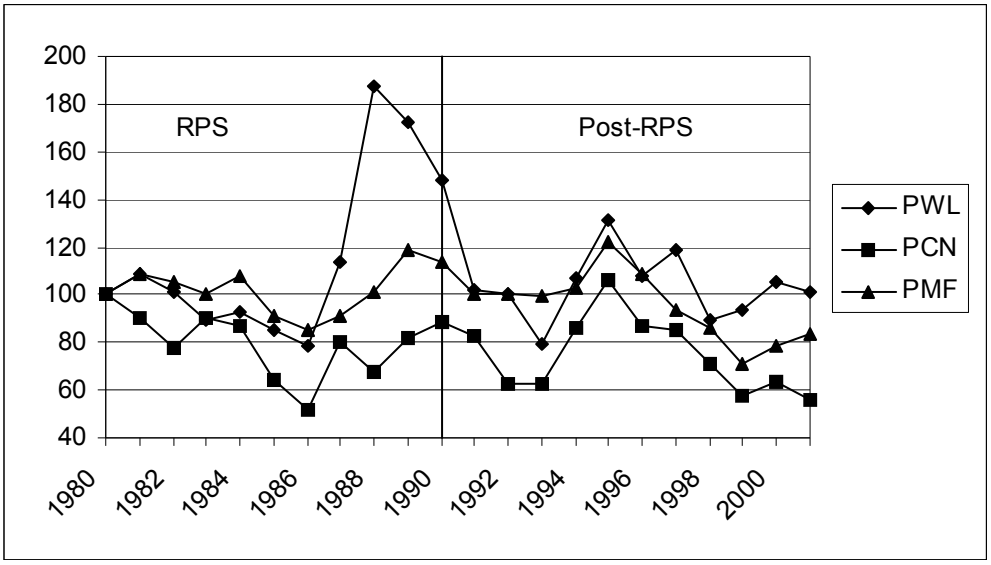
Fiber Prices

Variable Review

The data for fiber prices is provided as a globally indexed price (1980 price = 100), therefore is the same for all nations reviewed. Figure 19 shows the annual wool, cotton, and polyester fiber prices from 1980-2001. The data suggests a high level of volatility, particularly in PWL, during the RPS period. Post-RPS PWL became less volatile than in previous years; PCN and PMF remain fairly consistent throughout both the RPS and post-RPS periods.

PWL experienced the most change during the two periods reviewed, increasing from 100 in 1980 to 101.7 in 1991(1.7%) during the RPS, decreasing .3%, from 101.7 in 1991 to 101.4 in 2001 post-RPS, resulting in a 1.4% overall increase in PWL from 1980-2002. PMF was less volatile, experiencing a .7% increase from 100 in 1980 to 100.7 in 1991 and a 16.98% decrease from 100.7 in 1991 to 83.6 in 2001, resulting in an overall decline in PMF of 16.4%. CTN prices showed the least volatility, decreasing in both periods reviewed. During the RPS, PCN decreased from 100 in 1980 to 82.9 in 1991 by 17.1%, and decreased by 32.45% in the post-RPS period from 82.9 in 1991 to 56 in 2001. This resulted in a 44% decrease in PCN during the RPS and post-RPS periods reviewed.

Figure 19
Global Fiber Prices 1980-2001



PWL = Price of Wool Fiber (Australian)
PCN = Price of Cotton Fiber (US)
PMF = Price of Polyester Fiber (US)

Question 1: What is the likely association between each explanatory variable reviewed and AWL? (See Table 16)

Wool Fiber Prices

The results of the independent variable review analysis suggested a moderate positive association, with a score of 0.45, between PWL and AWL. Odds ratio results were calculated using the Mantel-Haenszel method (χ^2=0.7501), and suggested that AWL was 1.1923% more likely to increase as PWL increased (p-value=0.6917).

Cotton Fiber Prices

The independent variable review suggested a neutral association between PCN and AWL. In contrast, the odds ratio analysis (χ^2=0.0064) suggested a significant negative association, that AWL was 21.43% more likely to increase as PCN decreased (P-value=0.0589).

Synthetic Fiber Prices

Independent variable review results suggested a weak to moderate negative association between PMF and AWL, with a score of –0.30. The odds ratio analysis (χ^2=0.0764) suggested similar results. AWL was 11.54% more likely to increase as PMF decreased (p-value=0.3107).

Table 16
Question 1 Fiber Price Results

Variable	Independent Review	Odds Ratio		
		χ^2	Risk	P-value
PWL	0.45	0.7501	0.0119	0.6917
PCN	0.00	0.0064	-0.2143	0.0589
PMF	-0.30	0.0764	-0.1154	0.3107

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period? (See Table 17)

Wool Fiber Prices

The independent variable review of PWL suggested a weak to moderate positive association to AWL (score=0.30). The odds ratio analysis, in contrast, suggests a negative association, in which AWL was 6.67% more likely to increase as PWL decreased (p-value=0.7790).

Cotton Fiber Prices

Independent variable analysis suggested a weak to moderate negative association between PCN and AWL, with a score of –0.30. The odds ratio analysis also suggested a significant negative association. The results suggested that AWL was 46.43% more likely to decrease as PWL increased (p-value=0.0016).

Synthetic Fiber Prices

PMF results in the independent variable analysis suggested a moderate association with AWL (score= -0.50). Odds ratio analysis results agreed, suggesting a significant negative association. The odds ratio analysis suggested that AWL was 26.67% more likely to decrease as PMF increased (p-value=0.0609).

Table 17
Question 2 Fiber Price Results

Variable	Independent Review	Odds Ratio			
		Risk	90% Confidence Limits		P-value
PWL	0.30	0.0667	-0.2812	0.1478	0.7790
PCN	-0.30	-0.4663	-0.6671	-0.2615	0.0016
PMF	-0.50	-0.2667	-0.4812	-0.0522	0.0609

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period? (See Table 18)

Wool Fiber Prices

The independent variable review suggested a moderate positive association (score=0.60) between PWL and AWL. The odds ratio analysis suggested a neutral association.

Cotton Fiber Prices

A moderate positive association (score=0.30) was suggested by the independent variable review. This was supported by the odds ratio analysis, which suggested that AWL was 9.52% more likely to increase as PCN increased (p-value=0.7536).

Synthetic Fiber Prices

Independent variable review results suggested a weak negative association between PMF and AWL, with a score of –0.10. In contrast, the odds ratio analysis suggested that AWL was 9.52% more likely to increase as PMF increased (P-value=0.7536).

Table 18
Question 3 Fiber Price Results

Variable	Independent Review	Odds Ratio			
		Risk	90% Confidence Limits		P-value
PWL	0.60	0.0	-0.2908	0.2908	1.0000
PCN	0.30	0.0952	-0.1477	0.3382	0.7536
PMF	-0.10	0.0952	-0.1477	0.3382	0.7536

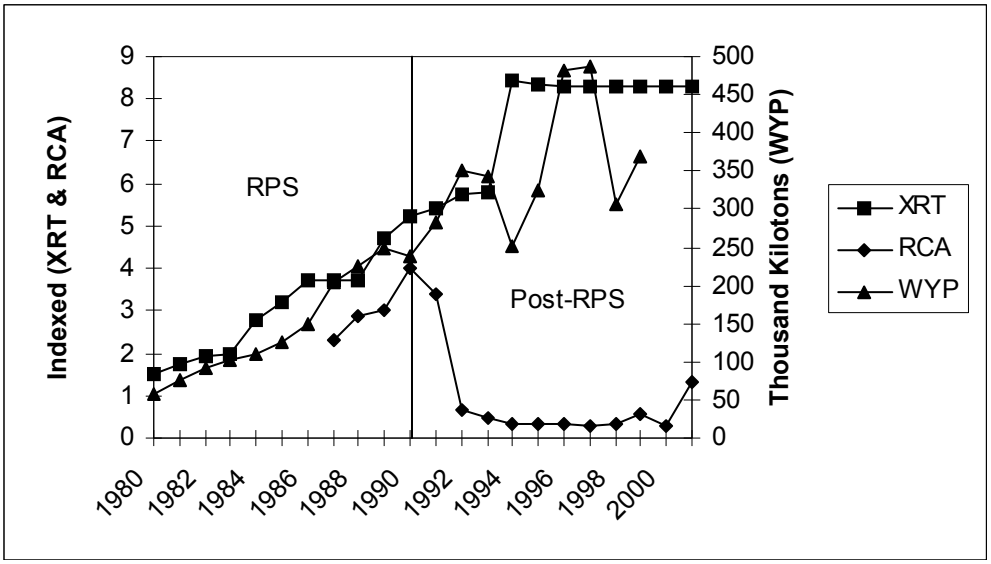
Trade and Processing Variables

Variable Review

The annual changes in XRT – in currency per USD, RCA – in the indexed score, and WYP – in '000kg, for China, from 1980-2001, are shown in Figure 20. RCA increased from 2.31 in 1987 to 3.38 in 1991 (255%) during the RPS period, from 1986-1991. During the RPS, XRT and WYP increased, from 1.53 in 1980 to 5.43 in 1991 (13.19%) from 57.3 in 1980 to 282.5 in 1991 and (393%), respectively. XRT and WYP continued to increase during the post-RPS period; from 5.43 in 1991 to 8.28 in 2002 (52.37%) and from 282.5 in 1991 to 368.4 in 1991 (30.41%), respectively. The RCA decreased in the post-RPS period by 61.24%. For the period from 1980-2001, the

available data showed XRT and WYP increased by 441% and 543% respectively, while RCA decreased by 43.35%.

Figure 20
China Trade and Processing Variables 1980-2001

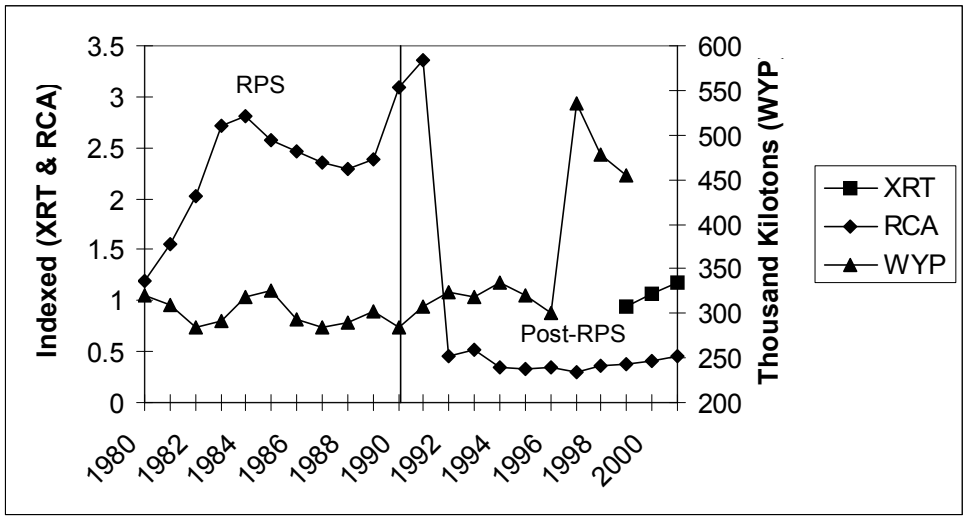


XRT = Exchange Rate
RCA = Revealed Comparative Advantage
WYP = Wool Yarn Production

Annual figures for XRT, RCA, and WYP are shown in Figure 21. During the 20-year period RCA declined by 61.99%, from 1.2 in 1980 to 0.46 in 2001, while XRT and WYP increased by 25.53%, from 391.5 '000kg in 1980 to 454.5 '000kg in 1999, and 42.25%, from 0.94 in 1999 to 1.18 in 2001, respectively. During the RPS, RCA was cyclical in nature, peaking approximately every 6 years, and experiencing a 179.65% growth from 1.2 in 1980 to 3.35 in 1991, for the period. Post-RPS, RCA experienced a large decline, from 3.35 in 1991 to 0.45 in 1992, and then continued in a fairly flat pattern of overall growth, throughout the remaining period. RCA experienced an overall decline of 86.41%, from 3.35 in 1991 to 0.46 in 2001, for the post-RPS period. WYP

decreased throughout the RPS, from 319.5 ‘000kg in 1980 to 306.9 ‘000kg in 1991 (3.94%) and increased during the post-RPS period, from 306.9 ‘000kg in 1991 to 454.5 ‘000kg in 1999 (48.09%). For the available years of XRT, from 2000-2002, the XRT increased by 25.53%, from 0.94 in 1999 to 1.18 in 2001.

Figure 21
Trade and Processing Variables in Italy: 1980-2002*, **

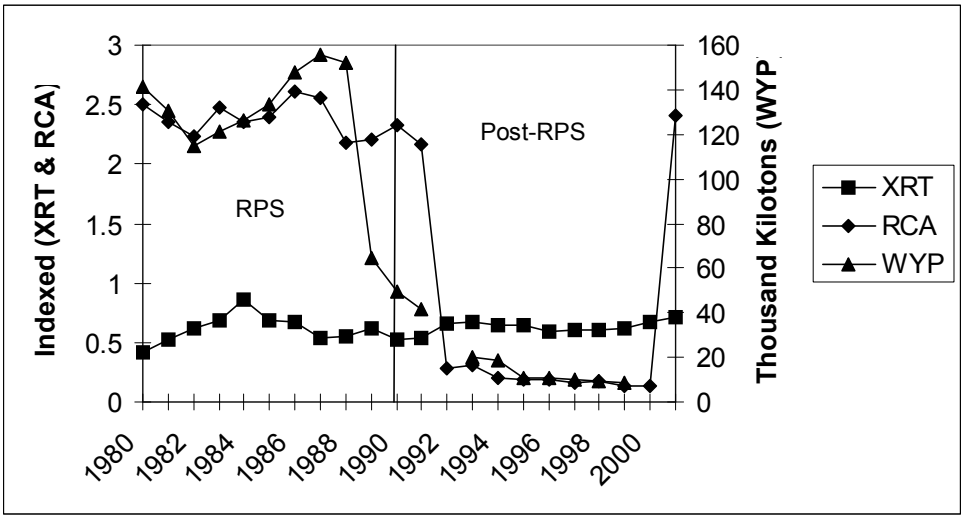


XRT = Exchange Rate
RCA = Revealed Comparative Advantage
WYP = Wool Yarn Production
* = 1998-2000 WYP figures for EU
** = 1993-2002 RCA figures calculated from EU figures

Trade and processing variables in the UK, seem to be closely associated to one another, as they all follow a similar patter of change in growth (see Figure 22). During the 20-year period, XRT, RCA, and WYP changed by 69.45% from 0.42 in 1980 to 0.71 in 2001, -3.77% from 2.5 in 1980 to 2.4 in 2001, and –93.83% from 141 ‘000kg in 1980 to 8.7 ‘000kg in 1999, respectively. Sharp declines in RCA and WYP are attributable to changes in available data from UK to EU data. All three variables seem to be more

volatile during the RPS, compared to the post-RPS patterns of growth. During the RPS period, XRT, RCA and WYP changed by 27.69% from 0.42 in 1980 to 0.54 in 1991, -13.76% from 2.5 in 1980 to 2.16 in 1991, and –70.43% from 141 '000kg in 1980 to 41.7 '000kg in 1991, respectively. However, for both periods under review, RCA seems to be the most volatile of the variables followed by WYP and XRT. Post-RPS, XRT and RCA increased –from 0.54 in 1991 to 0.71 in 2001 (32.71%) and from 2.16 in 1991 to 2.41 in 2001 (11.59%), respectively – and WYP decreased – from 41.7 '000kg in 1991 to 8.7 '000kg in 1999 (79.14%).

Figure 22
Trade and Processing Variables in UK: 1980-2002



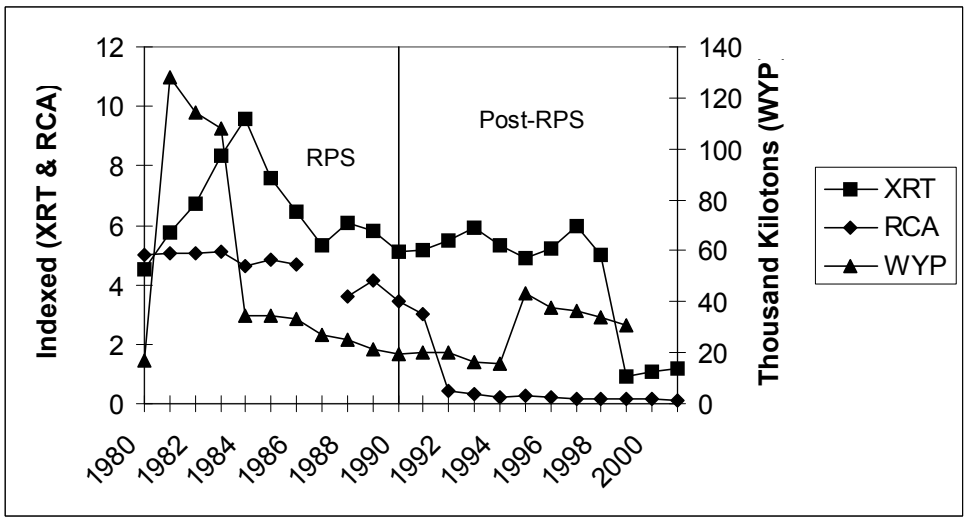
XRT = Exchange Rate
RCA = Revealed Comparative Advantage
WYP = Wool Yarn Production

During the two periods reviewed, XRT and RCA declined by 73.87% (from 4.52 in 1980 to 1.18 in 2001) and 97.36% (from 5.03 in 1980 to 0.13 in 2001), respectively, while WYP increased by 81.18% (from 17 '000kg in 1980 to 30.8 '000kg in 1999). XRT

grew during RPS from 4.52 in 1980 to 5.18 in 1991 14.70%, and declined by 77.22% in the post-RPS period, from 5.18 in 1991 to 1.18 in 2001 (see Figure 23). XRT was cyclical in nature, peaking every four to five years, until 1999, when the Franc was replaced by the Euro, and XRT dropped sharply. RCA declined fairly steadily throughout both periods – from 5.03 in 1980 to 2.99 in 1991,by 40.50% during RPS, and from 2.99 in 1991 to 0.13 in 2001, by 95.56% post-RPS – with a year of sharp decline in 1992. During RPS, WYP spiked in 1981, but decreased for the rest of the period, from 17 '000kg in 1980 to 20.2 '000kg in 1991. However, due to the size of the 1981 increase, the RPS period experienced an overall growth of 18.82%. WYP continued to decline during the post-RPS period, from 1991-1993. During the post-RPS period, WYP was 20.2 '000kg in 1991 to 30.8 '000kg in 1999; though, like the RPS period, a significant increase in WYP in 1996, led to the overall increase for the period of 52.48%.

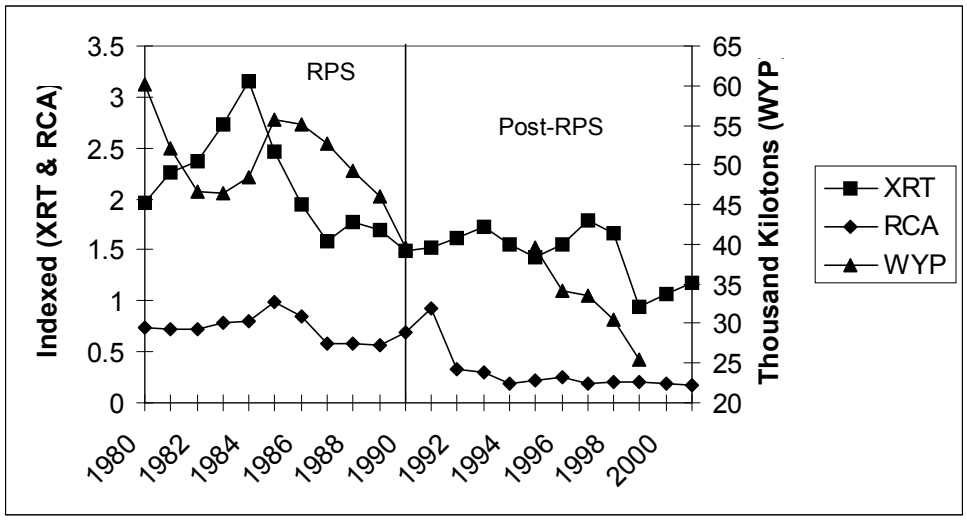
In Germany, during the 20-year period reviewed, RCA and WYP seemed to follow a similar pattern of growth. All three variables reviewed (XRT, RCA, and WYP) decreased over the two periods reviewed, by 39.77%, 75.55%, and 57.81% respectively. During the RPS period, XRT and WYP declined by 22.61% (from 1.96 in 1980 to 1.52 in 1991) and 34.22% (from 60.2 in 1980 to 39.6 in 1990) while RCA increased by 25.84% (from 0.74 in 1980 to 0.93 in 1991). During the post-RPS period, all three variables decreased, XRT by 22.16% (from 1.52 in 1991 to 1.18 in 2001), RCA by 80.57% (from 0.93 in 1991 to 0.18 in 2001) and WYP by 35.86% (from 39.6 in 1990 to 25.4 in 1999). (See Figure 24).

Figure 23
Trade and Processing Variables in France: 1980-2002



XRT = Exchange Rate
RCA = Revealed Comparative Advantage
WYP = Wool Yarn Production

Figure 24
Trade and Processing Variables in Germany: 1980-2002



XRT = Exchange Rate
RCA = Revealed Comparative Advantage
WYP = Wool Yarn Production

Question 1: What is the likely association between each explanatory variable reviewed and AWL? (See Table 19)

Exchange Rates

The results of the independent variable review analysis suggested a neutral association between XRT and AWL. Odds ratio results were calculated using the Mantel-Haenszel method (χ^2=0.6743), and suggested that AWL was 1.03% more likely to increase as XRT increased (p-value=0.9448).

Revealed Comparative Advantage

The independent variable review results suggested a moderate negative association (score= -0.60) between RCA and AWL. The odds ratio analysis, using the Mantel-Haenszel method (χ^2=0.3151), suggested a contrasting negative association. This method suggested AWL was 2% more likely to increase as RCA increased (P-value=0.1228).

Wool Yarn Production

A moderate to strong positive association, with a score of 0.70, was suggested through the independent variable review. Contrastingly, the odds ratio analysis suggested that AWL was 6.11% more likely to decrease as WYP increased (p-value=0.6597).

Table 19
Question 1 Trade and Processing Variable Results

Variable	Independent Review	Odds Ratio		
		χ^2	Risk	P-value
XRT	0.0	0.6743	0.0103	0.9448
RCA	-0.60	0.3151	0.0200	0.1228
WYP	0.70	0.0446	0.0611	0.6597

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period? (See Table 20)

Exchange Rate

The independent variable review suggested a neutral association between XRT and AWL. Odds ratio analysis results suggested that AWL was 3.20% more likely to increase as XRT increased (p-value=1.0000).

Revealed Comparative Advantage

A moderate negative association (score= -0.50) is suggested in the independent variable review. Similarly, the odds ratio analysis suggested AWL is 28.02% more likely to decrease as RCA increased (p-value=0.1167).

Wool Yarn Production

Independent variable review results suggested a moderate to strong association (score=0.70) between WYP and AWL. In contrast, odds ratio analysis suggested that AWL is 12.48% more likely to decrease as WYP increased (p-value=0.4170).

Table 20
Question 2 Trade and Processing Variable Results

Variable	Independent Review	Odds Ratio			
		Risk	90% Confidence Limits		P-value
XRT	0.0	0.032	-0.2077	0.2717	1.0000
RCA	-0.50	-0.2802	-0.5266	-0.0338	0.1167
WYP	0.70	-0.1248	-0.3480	0.0984	0.4170

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period? (See Table 21)

Exchange Rate

Independent variable review results suggested a neutral association between XRT and AWL. In contrast, the odds ratio analysis results suggested that AWL was 6.06% more likely to decrease as XRT increased (p-value=1.0000).

Revealed Comparative Advantage

The independent variable review results suggested a moderate to strong negative association (score= -0.70) between RCA and AWL. This was supported by odds ratio results, which suggested that AWL was 5.71% more likely to increase as RCA decreased (p-value=0.7536).

Wool Yarn Production

Independent variable review results suggested a moderate to strong positive association between AWL and WYP, with a score of 0.70. Similarly, the odds ratio analysis results suggested that AWL was 33.33% more likely to increase as WYP increased (p-value=0.1506).

Table 21
Question 3 Trade and Processing Variable Results

Variable	Independent Review	Odds Ratio			
		Risk	90% Confidence Limits		P-value
XRT	0.0	-0.0606	-0.3272	0.2060	1.0000
RCA	-0.70	-0.0571	-0.3128	0.1985	0.7536
WYP	0.70	0.3333	0.1841	0.4826	0.1506

Demographic Variables

All GNI results using the odds ratio analysis technique were subject to small-expected cell sizes. This causes an exaggerated error in the risk and confidence interval findings, and only the p-values can be considered reliable estimates of association.

Variable Review

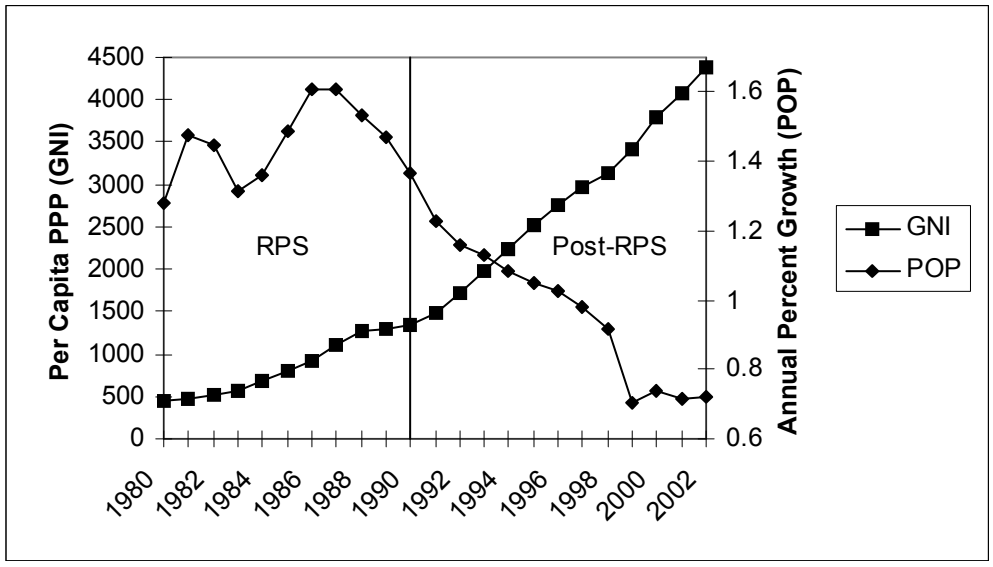
Figure 25 shows the annual levels of GNI (per capita PPP) and POP (annual percentage growth) from 1980-2001. Overall, GNI has increased as POP decreased throughout the 20-year period reviewed. GNI has grown steadily during the 20-year period; POP was more volatile from 1980-1991, and gained a measure of stability in 1991-2001. The change in GNI was 897% from 1980-2001, with a change from 440 in 1980 to 1480 in 1991 (236%) during RPS and an increase from 1480 in 1991 to 4390 in 2002 (197%) post-RPS. The POP decreased 4.38% from 1980-2001, the change in POP was –4.33% in RPS, from 1.28 in 1980 to 1.23 in 1991, and a change of –41.25% post-RPS, from 1.23 in 1991 to 0.72 in 2002.

Consumer Expenditure Variables

The annual levels of ENR (per capita kilowatt per hour) from 1980-2001 are shown in Figure 26. Overall, both variables show a pattern of increased levels of consumption. ENR increased steadily from 1980-1991. In the 1990s ENR became slightly more volatile than in the previous decade. Patterns of APX closely match the change patterns in ENR throughout the periods from 1991-2001. This suggests that as GNI increased and as China became more urban, there was an increased expenditure on consumer and apparel products. The change of ENR was 48.44% in 1980-2000, with a

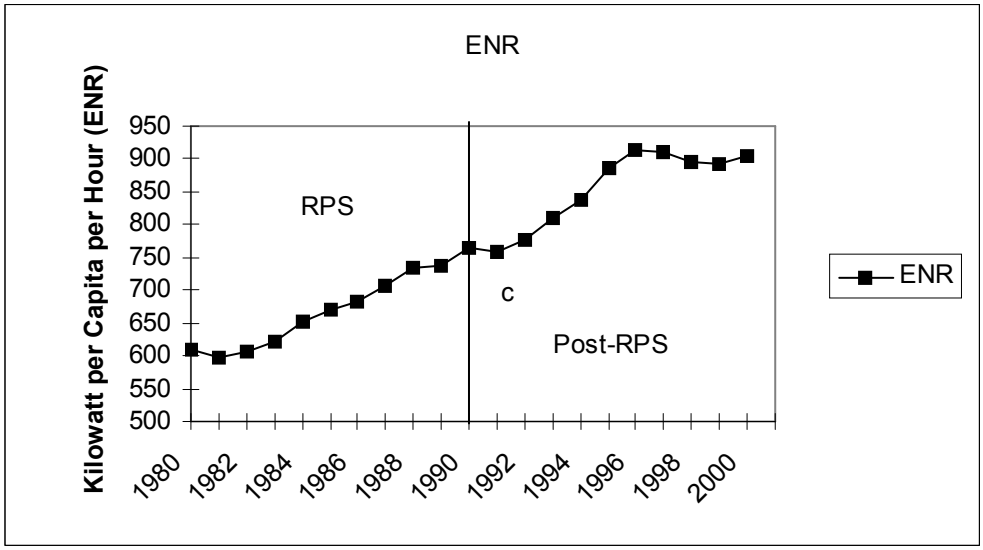
change of 24.47% from 609 in 1980 to 758 in 1991 and an increase of 19.26% from 758 in 1991 to 904 in 2000.

Figure 25
China Demographic Demand Side Variables



GNI = Gross National Income
POP = Population Growth

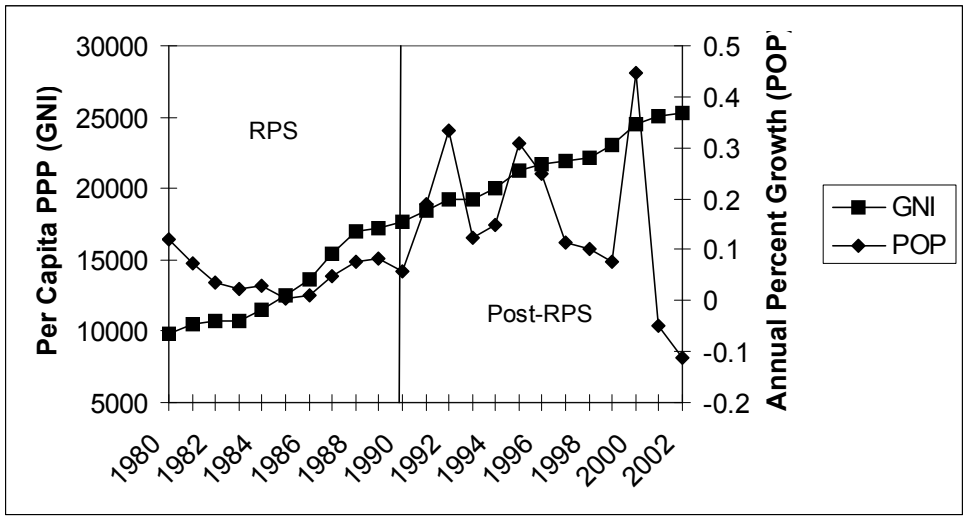
Figure 26
China Consumer Expenditure Demand Side Variables



ENR = Energy Consumption

Over the two review periods, GNI has increased from (157.32%) and POP has declined from (193.52%). The growth in GNI has been fairly linear during both the RPS, when GNI grew from 9,840 in 1980 to 18,410 in 1991 (87.09%), and the post-RPS period, when GNI grew from 18,410 in 1991 to 25,320 in 2002 (37.53%). The largest growth change in GNI occurred from 1983-1989 (see Figure 27). During the RPS period, POP showed an overall increase from 0.12 in 1980 to 0.19 in 1991 (57.89%). Post-RPS, POP became more volatile and cyclical, showing an overall decreasing pattern of 0.19 in 1991 to -0.11 in 2002 (159.23%), but peaking every 3-5 years - in 1993, 1996, and 2000.

Figure 27
Demographic Demand Variables in Italy: 1980-2002

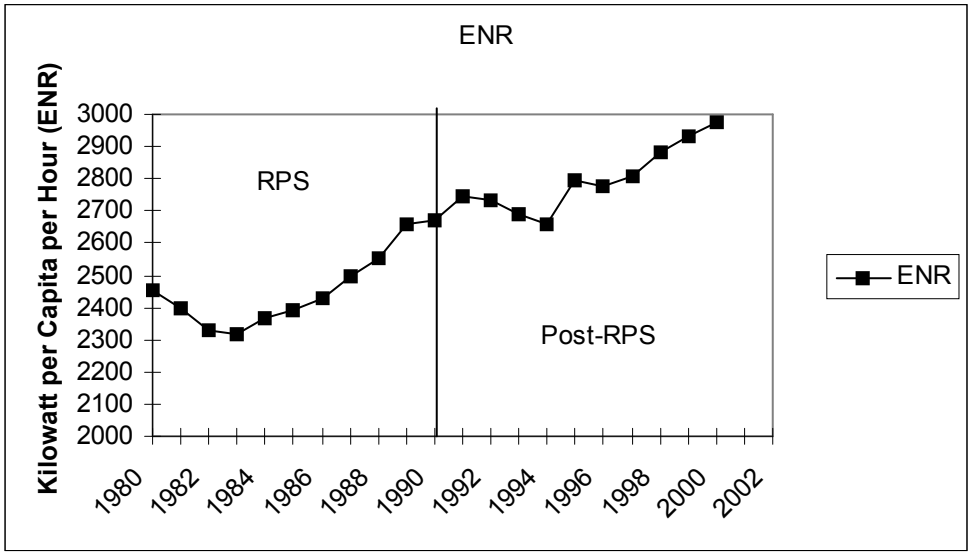


GNI = Gross National Income
POP = Population Growth

ENR increased over the available data for the two periods reviewed, by 21.05. ENR has increased during both the RPS period, from 2,456 in 1980 to 2,747 in 1991 (11.85%), and the post-RPS period from 2,747 in 1991 to 2,973 in 2000 (8.23%). The

pattern suggests a possible cyclical trend, but there are too few data points to draw any conclusions. (See Figure 28)

Figure 28
Consumer Expenditure Demand Variables in Italy: 1980-2002

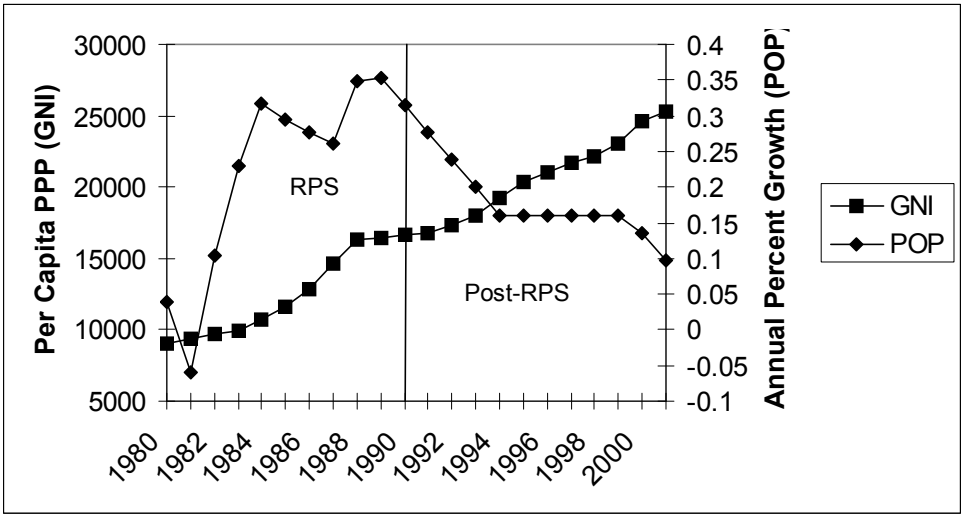


ENR = Energy Consumption

Throughout the periods reviewed, both GNI and POP in the UK have experienced overall growth, from 9,020 in 1980 to 25,330 in 2001 (180.82%) and from 0.039 in 1980 to 0.098 in 2001 (152.31%), respectively. Growth in GNI has been linear for the 20-year period, stagnating slightly from 1988-1992. During the RPS period, both demographic variables increased by 85.70% (from 9,020 in 1980 to 16,750 in 1991) and 608.72% (from 0.039 in 1980 to 0.276 in 1991), respectively. Post-RPS, GNI increased from 16, 750 in 1991 to 25,330 in 2001 (51.22%) while POP decreased from 0.276 in 1991 to 0.098 in 2001 (64.40%). POP has been more volatile than GNI during the review period. From 1981-1982 to 1984-1985, POP increased greatly, however, with the exception of an

increase in 1988-1989 and a stagnation of growth from 1994-1995 to 1999-2000, POP has been declining. (See Figure 29)

Figure 29
Demand-Side Demographic Variables in UK: 1980-2002

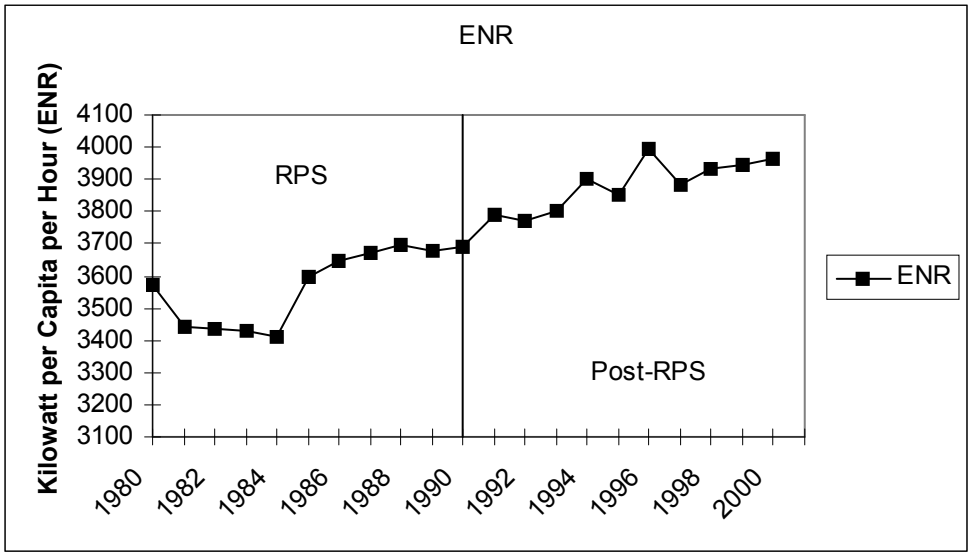


GNI = Gross National Income
POP = Population Growth

ENR increased, by 10.88% (from 3573.31 in 1980 to 3961.93 in 2000) during the periods of review. ENR has increased with more volatility post-RPS from 3788.29 in 1991 to 3961.93 in 2000 (4.58% overall) than during the RPS from 3753.31 in 1980 to 3788.29 in 1991 (6.02% overall). During the RPS, ENR experienced large decline in 1980-1981 and a large increase in 1985-1986, but the remaining years experienced fairly steady growth. Post-RPS, ENR changed by larger amounts, often with increases and decreases in growth lasting only one to two years. (See Figure 30)

During the 20-year period of review, GNI increased from 10,340 in 1980 to 25,850 in 2001(150%) steadily, with only one large spike in 1983. POP has declined (24.28%) over the two periods, from 0.56 in 1980 to 0.42 in 2001, with a cyclical trend

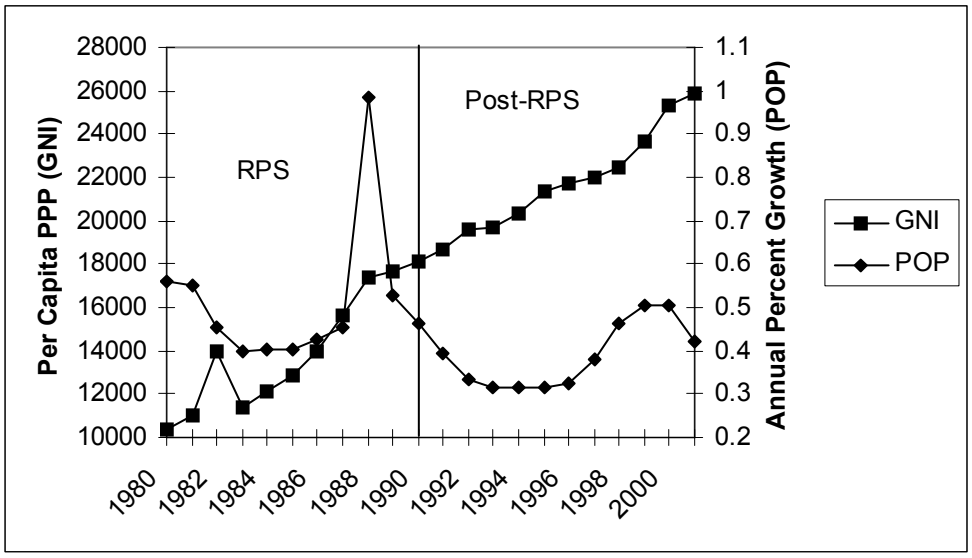
Figure 30
Consumer Expenditure Demand-Side Variables in UK: 1980-2002



ENR = Energy Consumption

that seems to peak every eight to ten years. Peaks in POP occurred in 1980, 1988, and 1999, with a particularly large peak in 1988. During the RPS period, GNI increased by 80.75%, from 10,340 in 1980 to 18,690 in 1991, while POP declined by 29.13%, from 0.56 in 1980 to 0.40 in 1991. Post-RPS, both variables increased, GNI from 18,690 in 1991 to 25,850 in 2001 (by 38.31%) and POP from 0.40 in 1991 to 0.42 in 2001 (by 6.84%). (See Figure 31).

Figure 31
Demographic Demand-side Variables in France: 1980-2002

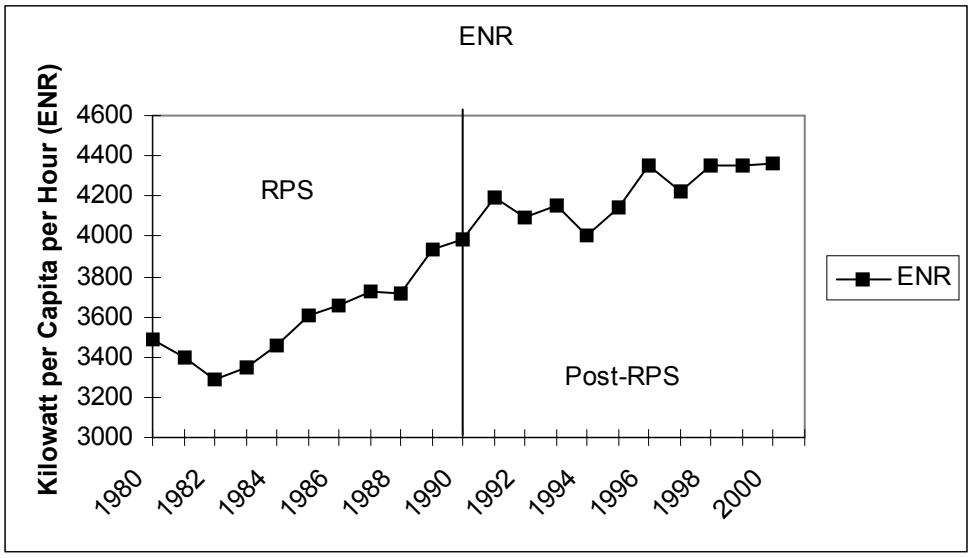


GNI = Gross National Income
POP = Population Growth

ENR had an overall increase, 25.30%, from 3483.36 in 1980 to 4366.02 in 2001, and 16.76% from 27,547 in 1990 to 32,165 in 2001, respectively, during the review periods. During RPS, ENR decreased from 1980-1983, but increased fairly steadily for the rest of the period, resulting in a 20.20% increase, from 3484.36 in 1980 to 4188.06 in 1991. During the post-RPS period, ENR continued to increase, but in a more volatile trend than in the RPS period, leading to an increase of 4.25%, from 4188.06 in 1991 to 4366.02 in 2000. (See Figure 32)

Throughout the 20-year period, GNI grew fairly steadily from 10,560 in 1980 to 26,040 in 2001 (146.59%), with its highest growth occurring from 1984-1990. During the RPS period, GNI grew by 85.23%, from 10,560 in 1980 to 19,560 in 1991, and grew by 33.13%, from 19,560 in 1991 to 26,040 in 2001, in the post-RPS period. POP grew by

Figure 32
Consumer Expenditure Demand-Side Variables in France: 1980-2002

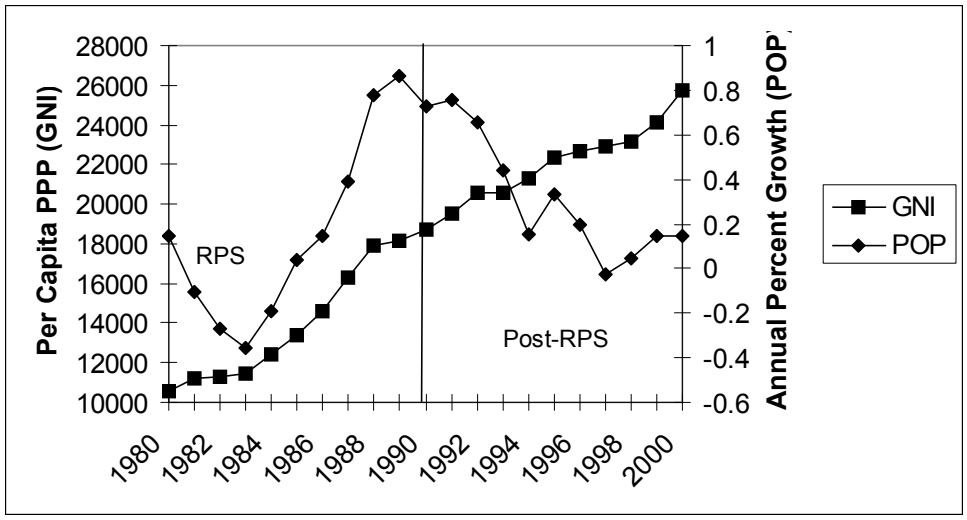


ENR = Energy Consumption

33.92%, from 0.15 in 1980 to 0.20 in 2001, for the two periods reviewed. POP declined rapidly from 1980-1984, but experienced even more extreme growth for the rest of the period, resulting in an overall RPS growth of 417.97%, from 0.15 in 1980 to 0.76 in 1991. During the post-RPS period, POP declined 74.12%, from 0.76 in 1991 to 0.20 in 2001, only increasing three times during the period. (See Figure 33)

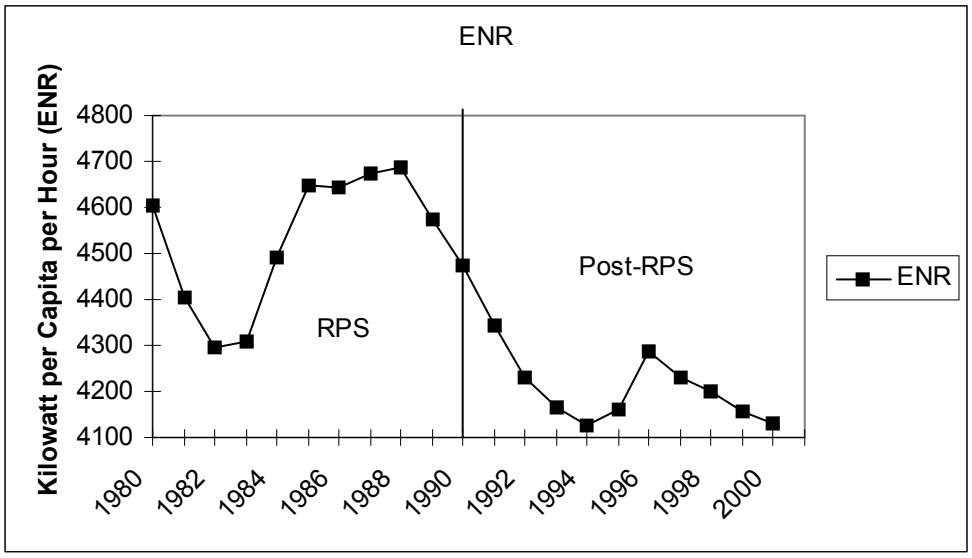
Over the 20 year period reviewed, ENR declined by 10.24%, from 4602.44 in 1980 to 4131.38 in 2000. ENR in Germany seemed to grow in a cyclical nature, peaking approximately every 8 years. In the RPS period, ENR declined by 5.67%, from 4602.44 in 1980 to 4341.4 in 1991. This decline continued in the post-RPS period, with an overall change of –4.84%, from 4341.4 in 1991 to 4131.38 in 2000. This reduction is unique when compared to the other countries reviewed, and may be a result of the considerable environmentally related laws enacted by the German government. (See Figure 34).

Figure 33
Demographic Demand Side Variables in Germany: 1980-2002



GNI = Gross National Income
POP = Population Growth

Figure 34
Consumer Expenditure Demand-Side Variables: 1980-2002



ENR = Energy Consumption

Question 1: What is the likely association between each explanatory variable reviewed and AWL? (See Table 22)

Gross National Income

The independent variable analysis results suggested a weak negative association between GNI and AWL, with a score of –0.20. Due to the sparse data, a χ^2 was unable to be calculated. However, the odds ratio analysis also suggested a weak negative association, showing AWL was 3.45% more likely to decrease as GNI increased (P-value=0.5007).

Population Growth

The independent variable review results suggested a very weak negative association (score= -0.05) between POP and AWL. The odds ratio analysis, using the Mantel-Haenszel method (χ^2=0.7164), also suggested a negative association. This method suggested AWL was 0.91% more likely to increase as POP decreased (P-value=0.8251).

Energy Consumption

The independent variable review results suggested a weak negative association (score= -0.10) between ENR and AWL. In contrast, the odds ratio analysis suggested a positive association. The Mantel-Haenszel method (χ^2=0.1106) suggested AWL was 0.78% more likely to increase as ENR increased (p-value=0.5484).

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period? (See Table 23)

Gross National Income

The independent variable review suggested a weak positive association between GNI and AWL, with a score of 0.10. In opposition, the odds ratio analysis suggested that AWL was 4.17% more likely to decrease as GNI increased (p-value=0.4364).

Table 22
Question 1 Demographic Variable Results

Variable	Independent Review	Odds Ratio		
		χ^2	Risk	P-value
GNI	-0.20	N/A	0.0345	0.5007
POP	-0.05	0.7164	0.0091	0.8251
ENR	-0.10	0.1106	0.0078	0.5484

Population Growth

POP seemed to have a weak negative association to AWL, with a score of –0.10. The odds ratio analysis results were conflicting, suggesting AWL was 5.63% more likely to increase as POP increased (p-value=0.7827).

Energy Consumption

Independent variable review results suggested a moderate to strong association (score=0.70) between ENR and AWL. Opposing odds ratio results suggested that AWL was 7.88% more likely to decrease as ENR increased (p-value=0.5772).

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period? (See Table 24)

Gross National Income

The independent variable analysis results suggested a weak to moderate negative association (score= -0.30) between GNI and AWL. Similarly, the odds ratio analysis suggested that AWL was 2.94% more likely to increase as GNI decreased (P-value=1.0000).

Table 23
Question 2 Demographic Variable Results

Variable	Independent Review	Odds Ratio			
		Risk	90% Confidence Limits		P-value
GNI	0.10	-0.0417	-0.1088	0.0254	0.4364
POP	-0.10	0.0563	-0.1718	0.2844	0.7827
ENR	0.70	-0.0788	-0.2937	0.1361	0.5772

Population Growth

Independent variable analysis results suggested a neutral association. Odds ratio analysis results suggested AWL was 1.84% more likely to increase as POP decreased (P-value=1.0000).

Energy Consumption

The independent variable analysis results suggested a moderate negative association (score= -0.50) between ENR and AWL. In contrast, the odds ratio analysis suggested AWL was 25.54% more likely to increase as ENR increased (p-value=0.1961).

Table 24
Question 3 Demographic Variable Results

Variable	Independent Review	Odds Ratio			
		Risk	90% Confidence Limits		P-value
GNI	-0.30	-0.0294	-0.0771	0.0182	1.0000
POP	0.0	-0.0184	-0.2483	0.2115	1.0000
ENR	-0.50	0.2554	0.0007	0.5109	0.1961

CHAPTER V

CONCLUSIONS

Chapter V contains five sections: (1) Summary Overview; (2) Conclusions from the Research Questions; (3) Conclusions from the Review of the RPS and Post RPS Periods; (4) General Conclusions; and (5) Limitations and Recommendations for Further Study.

Summary Overview

Previous research established a number of expected associations between AWL and the variables reviewed. A summary of these expected associations for all of the periods studied, is shown in Table 25, along with the associations observed.

Conclusions from the Research Questions

Fiber Supply Conclusions

The contradictory results, particularly in the RPS period, in the expected and observed association between fiber supply and AWL could be caused by the market-distorting activities of the Australian wool industry. These results may also be due to the variables having a weak association with AWL, such that in a growth market all fiber consumption will increase; while in a slower growth market, the forces of substitution will be more apparent and congruent with the expected negative associations.

Table 25
Summary of Expected and Observed Variable Results

Variable	Variable	Period	Independent Variable	Odds Ratio	Expected
Fiber Supply	OWC	20-year	*Positive*	*Positive*	Negative
		RPS	*Positive*	*Positive*	
		Post-RPS	Negative	Negative	
	CTN	20-year	*Positive*	*Positive*	
		RPS	*Positive*	Negative	
		Post-RPS	*Positive*	*Positive*	
	MMF	20-year	*Positive*	*Positive*	
		RPS	*Positive*	*Positive*	
		Post-RPS	*Positive*	Negative	
Fiber Prices	PWL	20-year	*Positive*	*Positive*	Negative
		RPS	*Positive*	Negative	
		Post-RPS	*Positive*	*Positive*	
	PCN	20-year	Neutral	*Negative*	Positive
		RPS	*Negative*	*Negative*	
		Post-RPS	Neutral	Positive	
	PMF	20-year	*Negative*	*Negative*	
		RPS	*Negative*	*Negative*	
		Post-RPS	*Negative*	Positive	
Trade and Processing	XRT	20-year	Neutral	*Positive*	Negative
		RPS	Neutral	Negative	
		Post-RPS	Neutral	*Positive*	
Demand	RCA	20-year	*Negative*	*Negative*	Positive
		RPS	*Negative*	*Negative*	
		Post-RPS	*Negative*	*Negative*	
	WYP	20-year	Positive	*Negative*	
		RPS	Positive	*Negative*	
		Post-RPS	Positive	Positive	
	GNI	20-year	*Negative*	*Negative*	Positive
		RPS	Positive	Positive	
		Post-RPS	*Negative*	*Negative*	
	POP	20-year	*Negative*	*Negative*	
		RPS	*Negative*	Positive	
		Post-RPS	Neutral	*Negative*	
	ENR	20-year	*Negative*	Positive	
		RPS	Positive	*Negative*	
		Post-RPS	*Negative*	Positive	

Shaded = Negative Expected Association

Fiber Prices

According to previous studies, competing fiber prices are expected to have a negative association with AWL, while wool fiber prices have an expected positive association (Ashton, 2000; Kirby, 1993; & Tisdell, 1997). These research findings were largely in contrast to the hypotheses. This is thought to be due to a lag effect between the explanatory and response variables. The results of PWL suggested a positive association, rather than the expected negative association. This may be due to increasing demand for AWL, despite an inelastic supply, causing upward pressure on PWL. The contradictory results of the PMF analysis may be due to a long-term trend effect. PMF may be impacting AWL by slowing consumption growth, but not by causing a negative association.

Trade and Processing Variables

Economic variables have been mentioned in previous studies (Ashton, 2000 & Kirby, 1993), as affecting AWL. However, no specific variables were mentioned in the research reviewed. This research sought to select and analyze specific variables that may be related to AWL. As XRT increases, a currency is devalued, which in turn decreases the purchasing power of the devalued currency (Kilduff and Priestland, 2000). This hypothesis, originally formulated in relation to synthetic fiber consumption, was expanded in this study to include AWL. It was expected that XRT and AWL would be negatively associated. RCA was also used to measure any possible association between economic variables and AWL. It was hypothesized that RCA and AWL would be positively related. The study also sought to discover any relationship between processing

variables and AWL. Tisdell's study (1977) results suggested that WYP and AWL were positively related.

XRT variables showed no evidence of an association. Contradictory RCA results may be due to the sampling method utilized by the research. Four of the five nations reviewed are maturing textile-processing markets. In particular, the declining wool textile industries of the United Kingdom, France, and Germany may have had a distorting effect on the results. The contradictory results between WYP and AWL are considered the most closely linked variables (Tisdell, 1977), are most likely a result of a lag between AWL and WYP.

Demographic Variables

Previous research (Ashton, 2000 & Kirby, 1993) suggests that consumer income and population growth are positively related to AWL. However, Ashton (2000) also notes that the association between income and AWL may weaken, as consumers are faced with a widening variety of purchasing options. In order to further study these findings, ENR was reviewed in addition to GNI and POP. ENR is often considered a secondary income analysis figure.

The contradictory results in the post-RPS and 20-year review periods between GNI and AWL, may be due to shifting consumer needs and declining consumer interest in wool, as was earlier suggested by Ashton (2000). The conflicting observed results in the independent variable analyses of POP and ENR may be due to a lack of sensitivity in the measurement. POP and ENR both tend to grow by small amounts, because the independent variable analysis looked only at change by a variable of ±0.25 or more, the

results may not have been able to distinguish these small changes. The odds ratio results may be due to the p-values of the analyses, suggesting the presence of sampling error.

Table 25 is a summary of the expected and observed results categorized by variable and by period. Observed results that conflicted with the expected results are italicized. This table illustrates the large disparity found between the expected and observed results for the majority of the research results.

Conclusions from Review of RPS and Post RPS Periods

From these results, it can be concluded that the RPS and post-RPS periods vary greatly. The post-RPS period had more expected result outcomes than those of the RPS period. These results may be due to the marketing initiatives undertaken by the Australian wool industry in the 1980s. This would suggest that, while they were moderately successful for a short period of time in sustaining AWL, it was a short-term solution, which then collapsed under changing external pressures on the market.

General Conclusions

During the 20-year period under review and throughout its history, the Australian wool industry has initiated a number of marketing plans that have been met with marginal success. In 1973, the RPS was undertaken in an effort to stabilize the absolute decline in wool fiber consumption.

Initially, the RPS was moderately successful. However, during the RPS and post-RPS periods the Australian wool industry made a number of marketing and organizational decisions that served to exacerbate the problem of falling market share.

For the first decade after its adoption, the RPS was considered successful in promoting wool and increasing consumer awareness while also increasing and stabilizing wool prices. However, in the mid-1980s, faced with limited supply and increasing demand combined with growing profit demands from wool producers, the industry increased prices dramatically. As shown in the research, the RPS period distorted market associations and indicators, causing the industry to overestimate rising demand for wool. In addition to the misinterpretation of market demand, the temporary collapse of demand by Australia's two largest wool importers (China and the U.S.S.R.) resulted in the collapse of the RPS and the accumulation of a 4.7 billion bale stockpile.

In an attempt to recover from the disastrous floor price scheme, the Australian wool industry cut funding for promotional and research activities in order to focus on selling off the stockpile. The neglect of research and promotion further damaged the industry by reducing consumer interest and demand for wool at the time of strong promotional support and technical advance in both cotton and man-made fibers. As a result, both wool market share and Australian share of the wool market fell significantly.

Due to its market distorting effects the price floor should have been utilized as a short-term solution while long-term promotional and research activities were developed. The failure to reduce or remove the floor price once the promotional and research campaigns proved successful contributed heavily to the collapse of the RPS.

A number of these poor marketing decisions could have been avoided had the Australian wool industry not responded to these problems as it had. The wool industry

has tended, once faced with a market problem, to dissolve any organizations related to the issue, and form new organizations to solve the problem. This has often caused a gap in knowledge and an inability to learn from previous mistakes made, as the shift of available information is rarely conducted as thoroughly as needed.

Due to changes in the structure of the global fiber market, the Australian wool industry may never regain its previous market share. The Australian, and global, wool fiber industries are in a state of decline. As wool shifts from a commodity to a luxury good, it is imperative that industry organizations consolidate and strengthen in order to gain the highest advantage in their niche market. Australian wool organizations must become stable and have open lines of communication so that lessons from the past can be utilized to improve the future. Also, an increased focus must be placed on research and promotion. Though price initiatives may have been successful in previous years, when wool was a commodity and supply-driven; its position as a luxury good has changed to a demand-driven market. In this type of environment it is imperative that wool is promoted heavily and new wool products are introduced, in order to increase consumer demand.

Limitations and Recommendations for Further Study

A number of the results showed a relatively small association between the explanatory and response variables. This may be due, in part, to the sensitivity levels of the independent variable analysis, which was reliant on a ±0.25 variable to variable change. Variables with smaller changes in trend may have been overlooked. Future research may use techniques that are more sensitive. The research was also focused on

reviewing short-term movements rather than long-term trends. Future work might combine both short and long-term analysis to gain a fuller understanding of wool fiber demand.

The research conducted was limited by the availability of data on the variables reviewed. Because of this, a limited selection of wool consuming nations was chosen to represent a global sample. This caused distortion in variable responses that were sensitive to the declining market of many of the nations chosen. The research also neglected to take into account nations with growing wool textile industries that are still relatively small, but projected to become dominant global wool producers. Future research using a larger sample or a truly global analysis is recommended to correct these failings.

In addition, the research did not address any possible time lag along the textile production chain. A number of results suggest a possible lag between the response and explanatory variables. Future research should include lag times in order more accurately determine the variable associations.

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APPENDIX A: DEFINITION OF TERMS

The following terms are defined in order to clarify constructs and concepts used in this research.

AWC: The Australian Wool Corporation is an organization devoted to the promotion of Australian wool through various marketing initiatives. Established January 1, 1973, the AWC replaced both the Australian Wool Commission and the Australian Wool Board. In 1991 the functions of the Corporation were divided between three newly established entities: the Australian Wool Realisation Commission, responsible for management of the wool stockpile; the AWC [II], responsible for administrative and promotional marketing activities; and the Wool Research and Development Corporation, a research and development-oriented organization. The AWC [II] was one of three organizations to replace the AWC [I] in July 1991. In December 1993 the AWC was replaced by the Australian Wool Research and Promotion Organization (AWRAP) (http://www.austehc.unimelb.edu.au).

AWEX: The Australian Wool Exchange Limited (AWEX) was founded in 1994 and provides the major industry framework for the exchange of ownership of wool in Australia. The membership of AWEX represents 95% of the first-hand wool traded in Australia each year and includes wool brokers, exporters, private treaty merchants, processors, wool producers and associates. The AWEX Board represents each of these classes of membership and is responsible for policy setting in relation to the implementation of functions (http://www.awex.com.au).

AWI: Australian Wool Innovation Limited (AWI) was established as a subsidiary of Australian Wool Services (AWS) to manage the proceeds from the wool levy and outsource R&D and intellectual property management (http://www.austehc.unimelb.edu.au).

AWS: Australian Wool Services Limited (AWS) was established in January 2001 when the AWRAP was converted into a Corporations Law company limited by shares. AWS is the holding company for two subsidiary companies, AWI and The Woolmark Company Limited (http://www.austehc.unimelb.edu.au).

AWTA: The Australian Wool Testing Authority (AWTA) was established in 1957 by the Commonwealth Government. AWTA Limited has played a major role in providing a bridge between the research and the commercial application of testing technology by facilitating further research and development, sponsoring and participating in practical trials, and developing and implementing relevant national and international standards, procedures, methods and technology, which provide major benefits to all segments of the wool industry in Australia and overseas (http://www.austehc.unimelb.edu.au).

Australian Wool Consumption (AWL): Australian wool consumption is defined as the amount, in thousand kilotons, of Australian wool fiber (clean) exported to selected nations for mill consumption (http://www.austehc.unimelb.edu.au).

IWS: The International Wool Secretariat (IWS) was an international organization; founded in 1937 by Australia, New Zealand, and South Africa, and devoted to increasing awareness and demand for wool textile products. In 1994, the activities of the IWS were merged with those of the Australian Wool Research and Promotion Organisation. They operated as one organization under the control of AWRAP. In 1997 The IWS changed its name, becoming the Woolmark Company (http://www.austehc.unimelb.edu.au).

Inter-fiber Substituiton: Inter-fiber substitution is the choice made between natural, man-made cellulosic, and man-made non-cellulosic fibers in the textile processing chain.

RPS: The Reserve Price Scheme (RPS) was a marketing initiative in which levies were used to promote marketing and research, as well as to finance the RPS for growers. In 1973, the AWC took a leading role in determining and operating the RPS for individual qualities of wools. It established the floor price in consultation with the Wool Council of Australia, which represents the 60,000 growers who funded the effort by contributing a percentage of their wool income as a levy. The AWC bought wool at auction when bidding was below the floor price and resubmitted the stockpiled wool to the market when prices improved or the agreed-upon price was reduced. Between July 1, 1990 and January 1991, Australian stocks peaked at 4,765,627 bales. As a result, the price scheme was abandoned (Tahia, 1991).

SFE: Sydney Futures Exchange Limited (SFE) is the 10th largest financial futures and options exchange in the world by volume turnover and the second largest in the Asia Pacific region. SFE provides futures and options on the four most actively traded markets, interest rates, equities, currencies and commodities, with a number of its products ranked in the world's top ten most actively traded products in their market sector. A comprehensive number of wool futures and options products provide market participants with the tools to protect themselves against adverse price movements in the often volatile physical wool market (http://www.sfe.com.au/).

Woolmark Company: The Woolmark Company is the global organization responsible for increasing demand for wool products throughout the world. Prior to 1997, Woolmark, an Australian company, was a subsidiary of the AWRAP, and later became a subsidiary of AWS responsible for marketing and promotional initiatives during the RPS (http://www.austehc.unimelb.edu.au). In 1997, the IWS changed its name to The Woolmark Company Limited and continues Woolmark's legacy of international wool promotion and marketing.

Wool, clean: Wool that has been through early stage processing. Wool has been scoured, removing lanolin and foreign bodies.

Wool, greasy: Also known as raw wool. This wool has been through only prelimnary cleaning to remove large foreign bodies. Lanolin and smaller foreign bodies still remain.

APPENDIX B: ABBREVIATIONS AND NOTATIONS AND SAS PROGAM

1. ABBREVIATIONS AND NOTATIONS

AWL: total Net Domestic Availability (NDA) of Australian wool at spinning stage
000s kg
source: the Australian Wool Exchange

OWC: total imports of non-Australian wool
000s kg
source: the Woolmark Company

CTN: total mill consumption of cotton fiber
000s kg
source: ICAC

MMF: total mill consumption of man-made fiber
000s kg
source: ICAC

PWL: price of Australian wool
Index: 1980 = 100
Source: ICAC

PCN: price of cotton fiber
Index: 1980 = 100
Source: ICAC

PMF: price of US polyester fiber
Index: 1980 = 100
Source: ICAC

RCA: Revealed Comparative Advantage
Wool Yarn (SITC Rev. 2: 6512)

$$RCA_i = \{X_{ij} / (\Sigma_i X_{ij}) - X_{ij}\} / \{[(\Sigma_j X_{ij}) - X_{ij}] / [(\Sigma_j \Sigma_i X_{ij}) - (\Sigma_j X_{ij})] - [(\Sigma_i X_{ij}) - X_{ij}]\}$$

Where,

X_{ij} = exports of sector "i" in country "j" source: UN Comtrade
$\Sigma_i X_{ij}$ = total exports of country "j" source: UN Comtrade
$\Sigma_j X_{ij}$ = world exports of sector "i"
*1992-2000 SITC 651
SITC 654

source: UN Yearbook of International Trade Statistics

$\Sigma_j\Sigma_i X_{ij}$ = total world exports

*1980-1992

source: WDI online

*1993-2001

source: UN Yearbook of International Trade Statistics

XRT: exchange rate

Index of selected currency values relative to US$

source: UN Monthly Bulletin of Statistics

WYP: wool yarn production

000s kg

source: *1980-1994: UN Yearbook of International Trade

1994-2001: IWTO

*Italy: 1980-2001: UN Yearbook of International Trade

GNI: gross national income

Purchasing power parity per capita

source: WDI online

POP: population growth

Annual percentage growth

source: WDI online

ENR: energy consumption

Kilowatt per hour per capita

Source: WDI online

2. SAS PROGRAMMING

Odds Ratio Analysis

```
proc freq;
weight count;
tables awld*dir/norow nocol chisq alpha=.1;
run;
quit;
proc sort;
by period;
run;
proc freq data=twc;
by period;
```

```
weight count;
tables awld*dir/norow nocol chisq alpha=.1;
run;

quit;
```

Mantel-Haenszel Analysis

```
proc freq;
weight count;
tables period*awld*dir/cmh alpha=.1;
run;
quit;

Code: 1=increased
     2=decreased
```

APPENDIX C: REAL VARIABLE TABLES

Table 26
China

	AWL	OWC	CTN	MMF	PWL	PCTN	PMF	XRT	RCA	WYP	GNI	POP	ENR
1980	193		3192	170	100	100	100	1.53		57.3	440	1.281	609
1981	271		3443	185	108.6	90.1	108.3	1.745		76.5	480	1.4727	597
1982	523.1		3601	384	101.3	78.1	105.2	1.923		92.5	530	1.4449	607
1983	364.5		3513	409.4	89.1	90.6	100	1.981		102.1	570	1.3121	622
1984	161.2		3458	563.4	93.1	87.2	108	2.796		110	680	1.3617	651
1985	698.4		3853	759	85.5	64.4	90.9	3.201		125.9	800	1.4874	669
1986	775.4		4379	831	78.7	51.6	85.4	3.722		149.1	910	1.6101	683
1987	814.5		4451	1061	113.7	80.5	91.1	3.722	2.31349	204.7	1100	1.6101	707
1988	749.6	2343.4	4373	1061	187.6	67.4	101.2	3.722	2.89499	225	1280	1.5332	734
1989	290.4	2083.6	4244	1223.2	172.3	81.8	118.5	4.722	3.02701	250	1300	1.4673	737
1990	209.9	1350.1	4194	1342.8	147.8	88.9	113.7	5.222	4.0151	238	1340	1.3644	766
1991	921.9	1649.1	4240	1488.9	101.7	82.9	100.7	5.434	3.38176	282.5	1480	1.2255	758
1992	1173.6	1864.4	4454	1586.7	100	62.4	100.7	5.752	0.66847	350.6	1730	1.1596	776
1993	1523.1	1739.9	4600	1652.9	79.5	62.5	99.3	5.8	0.46789	343.5	1970	1.1303	810
1994	1565.1	2204.9	4542	2034	106.9	85.9	102.7	8.45	0.34405	250.6	2230	1.0865	837
1995	1326.5	2270.5	4500	2736	130.9	105.9	121.7	8.32	0.32225	325.2	2520	1.0481	885
1996	1695.6	1676.4	4617	2729.6	107.7	86.8	109	8.3	0.33998	482.5	2760	1.0235	915
1997	1733.2	1196.8	4820	3527.2	118.8	85.3	94	8.28	0.30494	488	2960	0.9793	909
1998	1360.6	1436.4	4755	4413.7	89.4	70.6	86.2	8.28	0.33455	307	3140	0.9148	895
1999	1806.2	1219.8	4826	5237.9	93.6	57.2	70.8	8.28	0.57251	368.4	3410	0.7047	892
2000	2655.1	1435.9	5024	6496	105.6	63.6	78.2	8.28	0.27175		3790	0.741	904
2001	2760.1	1425.9	5134	6897	101.4	56	83.6	8.28	1.310655		4070	0.7149	
2002	2024	1545	5197								4390	0.72	

Table 27
Italy

	AWL	OWC	CTN	MMF	PWL	PCN	PMF	XRT	RCA	WYP	FST	GNI	POP	ENR
1980	591.4		224	355.8	100	100	100		1.19853	319.5		9840	0.1204	2456
1981	617.3		202	435.3	108.6	90.1	108.3		1.55297	309.9		10470	0.0743	2399
1982	492.6		224	428.7	101.3	78.1	105.2		2.02863	284.9		10700	0.0351	2327
1983	514.7		229	455.1	89.1	90.6	100		2.7141	290.8		10710	0.023	2319
1984	559.2		253	524.4	93.1	87.2	108		2.80515	317.7		11550	0.0283	2364
1985	753.3		260	558	85.5	64.4	90.9		2.56739	326.2		12470	0.0053	2394
1986	672.8		288	569	78.7	51.6	85.4		2.47037	294.1		13630	0.0106	2431
1987	823.6		321	609.7	113.7	80.5	91.1		2.36101	284.3		15370	0.0477	2495
1988	799.7	723.3	318	609.7	187.6	67.4	101.2		2.28897	290.5		17040	0.0759	2555
1989	821.3	676.7	313	547.7	172.3	81.8	118.5		2.38703	301.5	90.7	17270	0.0829	2661
1990	852.2	831.8	326	578.3	147.8	88.9	113.7		3.08692	284.7	94.3	17710	0.0564	2673
1991	1082.8	787.2	323	564.6	101.7	82.9	100.7		3.35163	306.9	107.3	18410	0.1901	2747
1992	1053.2	950.8	314	589.9	100	62.4	100.7		0.45342	323.6	123.3	19200	0.3336	2733
1993	896.8	853.2	333	551.6	79.5	62.5	99.3		0.5196	318.9	130.7	19290	0.1244	2691
1994	1065.5	1002.5	354	681.1	106.9	85.9	102.7		0.35094	335.4		20050	0.147	2658
1995	865.6	905.4	346	679.9	130.9	105.9	121.7		0.32834	320.6		21270	0.3072	2793
1996	1042.1	639.9	340	2269.5	107.7	86.8	109		0.34597	299.9		21660	0.2489	2775
1997	1237.1	663.9	348	2406.7	118.8	85.3	94		0.30132	535.4		21980	0.1129	2808
1998	981.9	702.1	313	2316.8	89.4	70.6	86.2		0.35488	478.3		22180	0.1007	2882
1999	1058	622	297	2148.2	93.6	57.2	70.8	0.94	0.38379	454.5		23010	0.0762	2931
2000	1158.5	609.5	307	2262	105.6	63.6	78.2	1.07	0.41246			24500	0.4462	2973
2001	999.9	643.1	310	2131.6	101.4	56	83.6	1.18	0.45557			25040	-0.0497	
2002	744.4	587.6	313	2740								25320	-0.1126	

Table 28
United Kingdom

	AWL	OWC	CTN	MMF	PWL	PCN	PMF	XRT	RCA	WYP	FST	GNI	POP	ENR
1980	187.1		69	288.6	100	100	100	0.419	2.50464	141		9020	0.039	3573.31
1981	129.1		46	249.3	108.6	90.1	108.3	0.524	2.35814	130.9		9390	-0.0604	3441.93
1982	129.2		45	204.3	101.3	78.1	105.2	0.619	2.23321	114.9		9730	0.1047	3433.69
1983	106.1		45	227.7	89.1	90.6	100	0.689	2.46919	121.2		9970	0.2286	3426.22
1984	156.5		44	237.5	93.1	87.2	108	0.865	2.35521	126.6		10710	0.3163	3411.56
1985	264.9		46	239.5	85.5	64.4	90.9	0.692	2.39374	133.6		11600	0.2942	3595.11
1986	250.6		47	217	78.7	51.6	85.4	0.678	2.61557	148		12810	0.2758	3646.07
1987	286.7		51	298	113.7	80.5	91.1	0.534	2.54952	155.6		14620	0.261	3669.56
1988	199.4	788.6	43	298	187.6	67.4	101.2	0.553	2.18273	152	98.1	16370	0.3493	3697.31
1989	206.3	582.7	39	178.5	172.3	81.8	118.5	0.623	2.20803	64.4	81.2	16430	0.3533	3678.67
1990	110	588	28	179.8	147.8	88.9	113.7	0.519	2.32484	49.8	69.9	16610	0.3149	3690.1
1991	150.6	616.4	20	179.3	101.7	82.9	100.7	0.535	2.15998	41.7	79	16750	0.2764	3788.29
1992	228.7	588.3	14	187.4	100	62.4	100.7	0.661	0.28504		83.2	17360	0.238	3772.12
1993	222.4	518.6	14	174.3	79.5	62.5	99.3	0.675	0.30369	19.8		18060	0.1995	3804.56
1994	194.5	749.5	14	227.4	106.9	85.9	102.7	0.64	0.19667	18.3		19200	0.1611	3904.08
1995	168.6	528.4	14	235	130.9	105.9	121.7	0.65	0.19096	10.8		20370	0.161	3850.13
1996	215.4	577.6	13	2269.5	107.7	86.8	109	0.59	0.1845	10.8		21080	0.1609	3993.02
1997	209.7	608.3	11	2406.7	118.8	85.3	94	0.6	0.15599	10		21710	0.1607	3882.26
1998	128.8	573.2	8	2316.8	89.4	70.6	86.2	0.6	0.17047	9.6		22160	0.1606	3931.72
1999	78.5	592.5	4	2148.2	93.6	57.2	70.8	0.62	0.14035	8.7		23090	0.1605	3944.26
2000	75.2	630.8	2	2262	105.6	63.6	78.2	0.67	0.12988			24610	0.1361	3961.93
2001	42.4	690.6	2	2131.6	101.4	56	83.6	0.71	2.4103			25330	0.0984	

Table 29
France

	AWL	OWC	CTN	MMF	PWL	PCN	PMF	XRT	RCA	WYP	FST	GNI	POP	ENR
1980	92.4		182	192.5	100	100	100	4.516	5.030353	17		10340	0.5589	3484.356
1981	94.8		162	201.3	108.6	90.1	108.3	5.748	5.071137	127.8		11000	0.5485	3393.77
1982	92		165	190.1	101.3	78.1	105.2	6.725	5.073228	114		14000	0.4542	3292.034
1983	84.6		165	198.3	89.1	90.6	100	8.347	5.118908	107.9		11400	0.3994	3351.702
1984	91		160	193.8	93.1	87.2	108	9.592	4.614564	34.6		12120	0.405	3458.699
1985	113.7		151	184.7	85.5	64.4	90.9	7.561	4.837732	34.3		12840	0.4052	3601.895
1986	92		149	167.2	78.7	51.6	85.4	6.455	4.67774	33.5		13960	0.4251	3655.077
1987	78.2		152	219	113.7	80.5	91.1	5.34		27		15610	0.4555	3726.366
1988	74.5	168.5	145	219	187.6	67.4	101.2	6.059	3.580376	25.1	48.3	17340	0.9829	3711.308
1989	83.2	218.8	137	152.1	172.3	81.8	118.5	5.788	4.134483	21.3	60.7	17640	0.5284	3939.112
1990	60.6	190.4	119	137.2	147.8	88.9	113.7	5.129	3.463058	19.3	50.9	18120	0.4637	3984.019
1991	87.4	167.6	105	107	101.7	82.9	100.7	5.18	2.99335	20.2	62.2	18690	0.3961	4188.059
1992	86.1	167.9	100	105.2	100	62.4	100.7	5.506	0.408504	19.9	66.9	19580	0.333	4096.556
1993	73.4	126.6	106	103.7	79.5	62.5	99.3	5.895	0.347022	16.5		19670	0.3165	4156.775
1994	69	108	116	159	106.9	85.9	102.7	5.35	0.241223	15.8		20370	0.3141	4002.812
1995	53.1	93.9	113	159	130.9	105.9	121.7	4.9	0.2593	43.1		21310	0.3132	4147.345
1996	42.2	72.8	112	2269.5	107.7	86.8	109	5.24	0.211656	37.6		21700	0.3259	4354.17
1997	64.4	31.6	113	2406.7	118.8	85.3	94	5.99	0.163479	36.6		21980	0.3794	4226.245
1998	49.3	43.7	110	2316.8	89.4	70.6	86.2	5.02	0.176438	34		22490	0.4646	4356.469
1999	39.3	46.7	102	2148.2	93.6	57.2	70.8	0.94	0.150132	30.8		23630	0.5041	4352.985
2000	30.7	49.3	97	2262	105.6	63.6	78.2	1.07	0.135497			25290	0.5041	4366.015
2001	32.1	25.9	94	2131.6	101.4	56	83.6	1.18	0.132809			25850	0.4232	

Table 30
Germany

	AWL	TWC	CTN	MMF	PWL	PCN	PMF	XRT	RCA	WYP	FST	GNI	POP	ENR
1980	42.8		187	721.5	100	100	100	1.959	0.73677	60.2		10560	0.1468	4602.44
1981	31.7		171	752.1	108.6	90.1	108.3	2.255	0.7239	52.1		11190	-0.1059	4403.12
1982	35		190	669	101.3	78.1	105.2	2.376	0.72134	46.7		11320	-0.2723	4297.52
1983	35.8		207	732.2	89.1	90.6	100	2.724	0.78695	46.4		11460	-0.3539	4309.92
1984	39.5		214	731	93.1	87.2	108	3.148	0.80769	48.5		12440	-0.1903	4491.18
1985	42.4		216	762	85.5	64.4	90.9	2.461	0.98288	55.7		13380	0.0386	4645.93
1986	45.5		224	746	78.7	51.6	85.4	1.941	0.85074	55.2		14620	0.144	4641.38
1987	45.4		235	842	113.7	80.5	91.1	1.581	0.5883	52.7		16260	0.3898	4673.03
1988	42.6	540.4	214	849	187.6	67.4	101.2	1.78	0.58123	49.3	118.2	17910	0.775	4687.43
1989	55.9	551.1	205	775	172.3	81.8	118.5	1.698	0.56502	46	116.7	18130	0.861	4575.82
1990	42.4	539.6	216	777	147.8	88.9	113.7	1.494	0.68675	39.6	119.2	18680	0.7288	4475.89
1991	56	580	198	797	101.7	82.9	100.7	1.516	0.92712		128.7	19560	0.7595	4341.4
1992	52.1	594.9	166	817.3	100	62.4	100.7	1.614	0.32636		137.3	20580	0.6577	4230.4
1993	47.4	502.6	165	758.8	79.5	62.5	99.3	1.726	0.30402			20570	0.4426	4165.32
1994	50.1	501.9	160	1015.9	106.9	85.9	102.7	1.55	0.18954			21340	0.1545	4125.62
1995	38.9	411.1	141	1017.5	130.9	105.9	121.7	1.43	0.22204	39.6		22380	0.3302	4162.93
1996	36.4	289.6	136	2269.5	107.7	86.8	109	1.55	0.2572	34.1		22710	0.1939	4288.64
1997	44	357	136	2406.7	118.8	85.3	94	1.79	0.18615	33.6		22910	-0.0292	4231.73
1998	44.4	380.6	124	2316.8	89.4	70.6	86.2	1.67	0.20554	30.5		23190	0.0487	4202.13
1999	23.1	230.9	118	2148.2	93.6	57.2	70.8	0.94	0.20309	25.4		24130	0.1497	4154.71
2000	33.6	267.4	124	2262	105.6	63.6	78.2	1.07	0.18844			25710	0.1495	4131.38
2001	25.4	254.6	125	2131.6	101.4	56	83.6	1.18	0.18016			26040	0.1966	

APPENDIX D: CHANGE RATE VARIABLE TABLES

Table 31
China

	AWL	OWC	CTN	MMF	PWL	PCN	PMF	XRT	RCA	WYP	FST	GNI	POP	ENR
80-81	0.287823		.07290154	.081081	0.07919	0.10988	.076639	.123209		0.25098		.083333	.130169	-0.0201
81-82	0.481935		0.0438767	.518229	0.07206	0.15365	0.02947	.092564		.172973		0.09434	0.01924	.016474
82-83	.4351166		0.0250498	.062042	0.13692	.137969	-0.052	.029278		.094025		.070175	0.10121	.024116
83-84	.2611663		0.0159051	0.27334	.042965	0.03899	.074074	.291488		.071818		.161765	.036425	.044547
84-85	0.769187		.10251752	.257708	0.08889	0.35404	0.18812	.126523		.126291		0.15	0.08451	.026906
85-86	0.099304		.12011875	.086643	-0.0864	0.24806	-0.0644	.139979		0.1556		.120879		.020498
86-87	0.048005		.01617614	.216777	.307828	.359006	.062569			.271617		.172727		.033946
87-88	.0865795		0.0178367	0	.393923	0.19436	.099802		.200864	.090222		.140625	0.05016	.036785
88-89	.5812672	-0.124688	0.0303959	.132603	-0.0888	.176039	.145992	.211775	.043614	0.1	1	.015385	0.04491	.004071
89-90	0.383516	0.5432931	0.0119218	.089068	0.16576	.079865	0.04222	.095749	.246093	0.05042	0.60793	.029851	0.07542	.037859
90-91	0.772318	.18131102	.01084906	.098126	0.45329	0.07238	-0.1291	.039014	0.18728	.157522	.407569	.094595	0.11334	0.01055
91-92	0.214468	.11547951	0.0480467	.061637	-0.017	0.32853	-0.1291	.055285	4.05896	.194238	.066964	.144509	0.05683	.023196
92-93	0.229466	0.0715558	.03173913	.040051	0.25786	0.0016	-0.0141	.008276	0.42869	0.02067		.121827	0.02592	.041975
93-94	0.026835	.21089392	0.0127697	.187365	.256314	0.27241	.033106	.313609	0.35995	0.37071		.116592	0.04031	.032258
94-95	.1798718	.02889231	0.0093333	.256579	.183346	.188857	.156122	0.01562	0.06765	.229397		.115079	0.03664	.054237
95-96	0.217681	0.3543904	.02534113	0.00234	0.21541	0.22005	0.11651	0.00241	0.05215	0.32601		.086957	0.02404	.032787
96-97	0.021694	0.4007353	.04211618	.226128	.093434	0.01758	0.15957	0.00242	0.11491	0.01127		.067568	0.04513	-0.0066
97-98	.2738498	0.1668059	0.0136698	.200852	0.32886	0.20822	0.09049		.088507	0.58958		.057325	0.07051	0.01564
98-99	0.246706	0.1775701	.01471198	.157353	.044872	0.23427	0.21751		.415643	.166667		.079179	0.29814	0.00336
99-2000	0.319724	.15049795	.03941083	.193673	.113636	.100629	.094629		1.10675			.100264	.048988	.013274
00-01	0.038042	0.0070131	.02142579	.058141	0.04142	0.13571	.064593		.792661			.068796	0.03651	

Table 32
Italy

	AWL	OWC	CTN	MMF	PWL	PCN	PMF	XRT	RCA	WYP	FST	GNI	POP	ENR
1980-81	0.041957		-0.10891	0.182633	0.07919	-0.10988	0.076639		0.228234	-0.03098		0.060172	-0.62046	-0.02376
1981-82	-0.25315		0.098214	-0.0154	-0.07206	-0.15365	-0.02947		0.234474	-0.08775		0.021495	-1.11681	-0.03094
1982-83	0.042938		0.021834	0.058009	-0.13692	0.137969	-0.052		0.252559	0.020289		0.000934	-0.52609	-0.00345
1983-84	0.079578		0.094862	0.132151	0.042965	-0.03899	0.074074		0.032458	0.084671		0.072727	0.187279	0.019036
1984-85	0.257666		0.026923	0.060215	-0.08889	-0.35404	-0.18812		-0.09261	0.026058		0.073777	-4.33962	0.012531
1985-86	-0.11965		0.097222	0.019332	-0.0864	-0.24806	-0.0644		-0.03927	-0.10915		0.085106	0.5	0.01522
1986-87	0.183099		0.102804	0.066754	0.307828	0.359006	0.062569		-0.04632	-0.03447		0.113208	0.777778	0.025651
1987-88	-0.02989		-0.00943	0	0.393923	-0.19436	0.099802		-0.03147	0.021343		0.098005	0.371542	0.023483
1988-89	0.0263	-0.06886	-0.01597	-0.1132	-0.0888	0.176039	0.145992		0.04108	0.036484		0.013318	0.084439	0.039835
1989-90	0.036259	0.186463	0.039877	0.052914	-0.16576	0.079865	-0.04222		0.226728	-0.05901	0.038176	0.024845	-0.46986	0.004489
1990-91	0.212966	-0.05666	-0.00929	-0.02426	-0.45329	-0.07238	-0.1291		0.078979	0.072336	0.121156	0.038023	0.703314	0.026938
1991-92	-0.0281	0.172066	-0.02866	0.042889	-0.017	-0.32853	0		-6.39189	0.051607	0.129765	0.041146	0.430156	-0.00512
1992-93	-0.1744	-0.11439	0.057057	-0.06943	-0.25786	0.0016	-0.0141		0.127367	-0.01474	0.056618	0.004666	-1.68167	-0.01561
1993-94	0.158329	0.148928	0.059322	0.190134	0.256314	0.27241	0.033106		-0.48059	0.049195		0.037905	0.153741	-0.01242
1994-95	-0.23094	-0.10725	-0.02312	-0.00176	0.183346	0.188857	0.156122		-0.06883	-0.04616		0.057358	0.521484	0.048335
1995-96	0.16937	-0.41491	-0.01765	0.700419	-0.21541	-0.22005	-0.11651		0.050958	-0.06902		0.018006	-0.23423	-0.00649
1996-97	0.157627	0.03615	0.022989	0.057008	0.093434	-0.01758	-0.15957		-0.14818	0.439858		0.014559	-1.20461	0.011752
1997-98	-0.2599	0.054408	-0.11182	-0.0388	-0.32886	-0.20822	-0.09049		0.150924	-0.11938		0.009017	-0.12115	0.025677
1998-99	0.071928	-0.12878	-0.05387	-0.07848	0.044872	-0.23427	-0.21751	1	0.075328	-0.05237		0.036071	-0.32152	0.016718
1999-2000	0.08675	-0.02051	0.032573	0.050309	0.113636	0.100629	0.094629	0.121495	0.06951			0.060816	0.829225	0.014127
2000-01	-0.15862	0.052247	0.009677	-0.06117	-0.04142	-0.13571	0.064593	0.09322	0.094629			0.021565	9.977867	

Table 33
United Kingdom

	AWL	OWC	CTN	MMF	PWL	PCN	PMF	XRT	RCA	WYP	FST	GNI	POP	ENR
1980-81	-0.44926		-0.5	-0.15764	0.07919	-0.10988	0.076639	0.200382	-0.06213	-0.07716		0.039404	1.645695	-0.03817
1981-82	0.000774		-0.02222	-0.22026	-0.07206	-0.15365	-0.02947	0.153473	-0.05594	-0.13925		0.034943	1.576886	-0.0024
1982-83	-0.21772		0	0.102767	-0.13692	0.137969	-0.052	0.101597	0.09557	0.05198		0.024072	0.541995	-0.00218
1983-84	0.322045		-0.02273	0.041263	0.042965	-0.03899	0.074074	0.203468	-0.04839	0.042654		0.069094	0.277268	-0.0043
1984-85	0.409211		0.043478	0.008351	-0.08889	-0.35404	-0.18812	-0.25	0.016096	0.052395		0.076724	-0.07512	0.051055
1985-86	-0.05706		0.021277	-0.10369	-0.0864	-0.24806	-0.0644	-0.02065	0.084811	0.097297		0.094457	-0.06672	0.013977
1986-87	0.125916		0.078431	0.271812	0.307828	0.359006	0.062569	-0.26966	-0.02591	0.048843		0.123803	-0.0567	0.006401
1987-88	-0.43781		-0.18605	0	0.393923	-0.19436	0.099802	0.034358	-0.16804	-0.02368		0.106903	0.252791	0.007505
1988-89	0.033446	-0.35336	-0.10256	-0.66947	-0.0888	0.176039	0.145992	0.11236	0.011458	-1.36025	-0.20813	0.003652	0.011322	-0.00507
1989-90	-0.87545	0.009014	-0.39286	0.00723	-0.16576	0.079865	-0.04222	-0.20039	0.050244	-0.29317	-0.16166	0.010837	-0.12194	0.003097
1990-91	0.269588	0.046074	-0.4	-0.00279	-0.45329	-0.07238	-0.1291	0.029907	-0.07632	-0.19424	0.11519	0.008358	-0.13929	0.025919
1991-92	0.341495	-0.04776	-0.42857	0.043223	-0.017	-0.32853	0	0.19062	-6.57781		0.050481	0.035138	-0.16134	-0.00429
1992-93	-0.02833	-0.1344	0	-0.07516	-0.25786	0.0016	-0.0141	0.020741	0.061411			0.03876	-0.19298	0.008527
1993-94	-0.14344	0.308072	0	0.233509	0.256314	0.27241	0.033106	-0.05469	-0.54416	-0.08197		0.059375	-0.23836	0.025491
1994-95	-0.15362	-0.41843	0	0.03234	0.183346	0.188857	0.156122	0.015385	-0.0299	-0.69444		0.057437	-0.00062	-0.01401
1995-96	0.21727	0.08518	-0.07692	0.896453	-0.21541	-0.22005	-0.11651	-0.10169	-0.03501	0		0.033681	-0.00062	0.035785
1996-97	-0.02718	0.050469	-0.18182	0.057008	0.093434	-0.01758	-0.15957	0.016667	-0.18277	-0.08		0.029019	-0.00124	-0.02853
1997-98	-0.62811	-0.06124	-0.375	-0.0388	-0.32886	-0.20822	-0.09049	0	0.084942	-0.04167		0.020307	-0.00062	0.01258
1998-99	-0.64076	0.032574	-1	-0.07848	0.044872	-0.23427	-0.21751	0.032258	-0.21461	-0.10345		0.040277	-0.00062	0.003179
1999-2000	-0.04388	0.060717	-1	0.050309	0.113636	0.100629	0.094629	0.074627	-0.08061			0.061764	-0.17928	0.00446
2000-01	-0.77358	0.086591	0	-0.06117	-0.04142	-0.13571	0.064593	0.056338	0.946115			0.028425	-0.38313	

Table 34
France

	AWL	OWC	CTN	MMF	PWL	PCN	PMF	XRT	RCA	WYP	FST	GNI	POP	ENR
1980-81	0.025316		-0.12346	0.043716	0.07919	-0.10988	0.076639	0.214335	0.008042	0.86698		0.06	-0.01896	-0.02669
1981-82	-0.03043		0.018182	-0.05892	-0.07206	-0.15365	-0.02947	0.145279	0.000412	-0.12105		0.214286	-0.20762	-0.0309
1982-83	-0.08747		0	0.041351	-0.13692	0.137969	-0.052	0.194321	0.008924	-0.05653		-0.22807	-0.13721	0.017802
1983-84	0.07033		-0.03125	-0.02322	0.042965	-0.03899	0.074074	0.129796	-0.10929	-2.1185		0.059406	0.013827	0.030936
1984-85	0.199648		-0.0596	-0.04927	-0.08889	-0.35404	-0.18812	-0.26862	0.046131	-0.00875		0.056075	0.000494	0.039756
1985-86	-0.23587		-0.01342	-0.10467	-0.0864	-0.24806	-0.0644	-0.17134	-0.0342	-0.02388		0.080229	0.046813	0.01455
1986-87	-0.17647		0.019737	0.23653	0.307828	0.359006	0.062569	-0.2088		-0.24074		0.105701	0.06674	0.019131
1987-88	-0.04966		-0.04828	0	0.393923	-0.19436	0.099802	0.118666		-0.0757		0.099769	0.536575	-0.00406
1988-89	0.104567	0.22989	-0.05839	-0.43984	-0.0888	0.176039	0.145992	-0.04682	0.134021	-0.1784	0.204283	0.017007	-0.86014	0.057831
1989-90	-0.37294	-0.14916	-0.15126	-0.1086	-0.16576	0.079865	-0.04222	-0.12849	-0.19388	-0.10363	-0.19253	0.02649	-0.13953	0.011272
1990-91	0.306636	-0.13604	-0.13333	-0.28224	-0.45329	-0.07238	-0.1291	0.009846	-0.15692	0.044554	0.181672	0.030498	-0.17066	0.048719
1991-92	-0.0151	0.001787	-0.05	-0.01711	-0.017	-0.32853	0	0.059208	-6.32759	-0.01508	0.070254	0.045455	-0.18949	-0.02234
1992-93	-0.17302	-0.32622	0.056604	-0.01446	-0.25786	0.0016	-0.0141	0.065988	-0.17717	-0.20606		0.004575	-0.05213	0.014487
1993-94	-0.06377	-0.17222	0.086207	0.347799	0.256314	0.27241	0.033106	-0.10187	-0.43859	-0.0443		0.034364	-0.00764	-0.03846
1994-95	-0.29944	-0.15016	-0.02655	0	0.183346	0.188857	0.156122	-0.09184	0.069715	0.633411		0.044111	-0.00287	0.03485
1995-96	-0.25829	-0.28984	-0.00893	0.929941	-0.21541	-0.22005	-0.11651	0.064885	-0.2251	-0.14628		0.017972	0.038969	0.0475
1996-97	0.34472	-1.3038	0.00885	0.057008	0.093434	-0.01758	-0.15957	0.125209	-0.2947	-0.02732		0.012739	0.141012	-0.03027
1997-98	-0.30629	0.276888	-0.02727	-0.0388	-0.32886	-0.20822	-0.09049	-0.19323	0.073448	-0.07647		0.022677	0.183384	0.029892
1998-99	-0.25445	0.06424	-0.07843	-0.07848	0.044872	-0.23427	-0.21751	-4.34043	-0.17522	-0.1039		0.048244	0.078357	-0.0008
1999-2000	-0.28013	0.052738	-0.05155	0.050309	0.113636	0.100629	0.094629	0.121495	-0.10801			0.065639	0	0.002984
2000-01	0.043614	-0.90347	-0.03191	-0.06117	-0.04142	-0.13571	0.064593	0.09322	-0.02024			0.021663	-0.19116	

Table 35
Germany

	AWL	OWC	CTN	MMF	PWL	PCN	PMF	XRT	RCA	WYP	FST	GNI	POP	ENR
1980-81	-0.35016		-0.09357	0.040686	0.07919	-0.10988	0.076639	0.131264	-0.01778	-0.15547		0.0563	2.386213	-0.04527
1981-82	0.094286		0.1	-0.12422	-0.07206	-0.15365	-0.02947	0.050926	-0.00355	-0.11563		0.011484	0.611091	-0.02457
1982-83	0.022346		0.082126	0.086315	-0.13692	0.137969	-0.052	0.127753	0.083373	-0.00647		0.012216	0.230574	0.002877
1983-84	0.093671		0.03271	-0.00164	0.042965	-0.03899	0.074074	0.134689	0.025678	0.043299		0.078778	-0.8597	0.040359
1984-85	0.068396		0.009259	0.040682	-0.08889	-0.35404	-0.18812	-0.27915	0.178241	0.129264		0.070254	5.930052	0.033309
1985-86	0.068132		0.035714	-0.02145	-0.0864	-0.24806	-0.0644	-0.2679	-0.15532	-0.00906		0.084815	0.731944	-0.00098
1986-87	-0.0022		0.046809	0.114014	0.307828	0.359006	0.062569	-0.2277	-0.4461	-0.04744		0.100861	0.63058	0.006773
1987-88	-0.06573		-0.09813	0.008245	0.393923	-0.19436	0.099802	0.111798	-0.01216	-0.06897		0.092127	0.497032	0.003072
1988-89	0.237925	0.019416	-0.0439	-0.09548	-0.0888	0.176039	0.145992	-0.04829	-0.02869	-0.07174	-0.01285	0.012135	0.099884	-0.02439
1989-90	-0.3184	-0.02131	0.050926	0.002574	-0.16576	0.079865	-0.04222	-0.13655	0.177255	-0.16162	0.020973	0.029443	-0.18139	-0.02233
1990-91	0.242857	0.069655	-0.09091	0.025094	-0.45329	-0.07238	-0.1291	0.014512	0.259265		0.073815	0.04499	0.040421	-0.03098
1991-92	-0.07486	0.025046	-0.19277	0.024838	-0.017	-0.32853	0	0.060719	-1.84079		0.062637	0.049563	-0.15478	-0.02624
1992-93	-0.09916	-0.18365	-0.00606	-0.0771	-0.25786	0.0016	-0.0141	0.06489	-0.07348			-0.00049	-0.48599	-0.01562
1993-94	0.053892	-0.00139	-0.03125	0.253076	0.256314	0.27241	0.033106	-0.11355	-0.60399			0.036082	-1.86472	-0.00962
1994-95	-0.28792	-0.22087	-0.13475	0.001572	0.183346	0.188857	0.156122	-0.08392	0.14637			0.04647	0.532102	0.008962
1995-96	-0.06868	-0.41954	-0.03676	0.551663	-0.21541	-0.22005	-0.11651	0.077419	0.136703	-0.16129		0.014531	-0.70294	0.029312
1996-97	0.172727	0.188796	0	0.057008	0.093434	-0.01758	-0.15957	0.134078	-0.38168	-0.01488		0.00873	7.640411	-0.01345
1997-98	0.009009	0.062007	-0.09677	-0.0388	-0.32886	-0.20822	-0.09049	-0.07186	0.094337	-0.10164		0.012074	1.599589	-0.00704
1998-99	-0.92208	-0.64833	-0.05085	-0.07848	0.044872	-0.23427	-0.21751	-0.7766	-0.01206	-0.20079		0.038956	0.674683	-0.01141
1999-2000	0.3125	0.1365	0.048387	0.050309	0.113636	0.100629	0.094629	0.121495	-0.07774			0.061455	-0.00134	-0.00565
2000-01	-0.32283	-0.05027	0.008	-0.06117	-0.04142	-0.13571	0.064593	0.09322	-0.04596			0.012673	0.239573	

APPENDIX E: INDPENDENT VARIABLE ANALYSIS DETERMINATION

Table 36
Percent Change and Quartile Coding of Influencing Variables Percent Change Conversions

Variable Groupings		Variables	3 (.75-1.0)	2 (.50-.74)	1 (.25-.49)	0 (-.24-.24)	-1 (-.25--.49)	-2 (-.50--.74)	-3 (-.75--1.0)
			>x<			NO MEASURABLE CHANGE	<x>		
		AWL	(.435-1.58)	(.247-.435)	(.099-.247)		(-.099--.247)	(-.247--.435)	(-.435--1.58)
Supply Side Variables	Fiber Supply	TWL	(.211-.543)	(.167-.211)	(.115-.167)		(-.115--.167)	(-.167--.211)	(-.211--.543)
		CTN	(.042-.120)	(.025-.042)	(.015-.025)		(-.015--.025)	(-.025--.042)	(-.042--.120)
		MMF	(.217-.518)	(.133-.217)	(.062-.217)		(-.062--.217)	(-.133--.217)	(-.217--.518)
	Fiber Price	PWL	(.256-.453)	(.114-.256)	(.079-.114)		(-.079--.114)	(-.114--.256)	(-.256--.453)
		PCN	(.234-.359)	(.176-.234)	(.101-.176)		(-.101--.176)	(-.176--.234)	(-.234--.359)
		PMF	(.129-.218)	(.077-.129)	(.052-.077)		(-.052--.077)	(-.077--.129)	(-.129--.218)
	Trade and Processing	XRT	(.123-.314)	(.029-.123)	(0.0-.029)		(0.0--.029)	(-.029--.123)	(-.123--.314)
		RCA	(.425-4.059)	(.223-.425)	(.095-.223)		(-.095--.223)	(-.223--.425)	(-.425--4.059)
		WYP	(.240-.590)	(.158-.240)	(.092-.158)		(-.092--.158)	(-.158--.240)	(-.240--.590)
Demand Side Variables	Demographic	GNI	(.122-.173)	(.095-.122)	(.070-.095)		(-.070--.095)	(-.095--.122)	(-.122--.173)
		POP	(.075-.298)	(.045-.075)	(.036-.045)		(-.036--.045)	(-.045--.075)	(-.075--.298)
		ENR	(.035-.054)	(.024-.035)	(.015-.024)		(-.015--.024)	(-.024--.035)	(-.035--.054)
		APX	(.156-.268)	(.092-.156)	(.059-.092)		(-.059--.092)	(-.092--.156)	(-.156--.268)

Table 37
Independent Variable Analysis Tables

Variable Category	Period	Variable	China	Italy	U.K.	France	Germany	Total
Fiber Supply	RPS	OWC	1.00	N/A	N/A	0.50	N/A	0.75
		CTN	1.00	-0.50	0.50	0.00	0.00	0.20
		MMF	0.50	0.50	1.00	0.00	-0.50	0.30
	Post-RPS	OWC	0.00	N/A	-0.50	-0.50	0.50	-0.15
		CTN	0.50	1.00	0.50	0.50	1.00	0.70
		MMF	0.00	0.50	0.50	0.50	1.00	0.50
	20-year period	OWC	0.50	N/A	-0.50	0.00	0.50	0.25
		CTN	0.75	0.25	0.50	0.25	0.50	0.45
		MMF	0.25	0.50	0.75	0.25	0.25	0.40
	Difference	OWC	1.00	N/A	N/A	1.00	N/A	0.90
		CTN	0.25	-1.50	0.00	-0.50	-1.00	-0.50
		MMF	0.50	0.00	0.25	-0.25	-1.50	-0.20
Fiber Prices	RPS	PWL	1.00	-0.50	0.00	0.00	1.00	0.30
		PCN	-1.00	-0.50	-0.50	0.00	0.50	-0.30
		PMF	1.00	-0.50	-1.00	-1.00	-1.00	-0.50
	Post-RPS	PWL	1.00	1.00	0.50	0.50	0.00	0.60
		PCN	0.50	1.00	0.00	0.50	-0.50	0.30
		PMF	1.00	-1.00	0.50	-0.50	-0.50	-0.10
	20-year period	PWL	1.00	0.25	0.25	0.25	0.50	0.45
		PCN	-0.25	0.25	-0.25	0.25	0.00	0.00
		PMF	1.00	-0.75	-0.25	-0.75	-0.75	-0.30
	Difference	PWL	0.00	-1.50	-.50	-.50	1.00	-0.30
		PCN	-.25	-1.50	0.25	-.50	1.00	-0.60
		PMF	0.00	0.50	-1.50	-.50	1.00	-0.40
Trade and Processing Variables	RPS	XRT	0.00	N/A	0.50	-0.50	0.00	0.00
		RCA	-1.00	-1.00	-0.50	-1.00	1.00	-0.50
		WYP	0.50	1.00	1.00	0.00	1.00	0.70
	Post-RPS	XRT	0.00	N/A	0.00	0.50	-0.50	0.00
		RCA	-1.00	-1.00	-1.00	0.00	-0.50	-0.70
		WYP	0.50	1.00	1.00	0.00	1.00	0.70
	20-year period	XRT	0.00	N/A	0.25	0.00	-0.25	0.00
		RCA	-1.00	-1.00	-0.75	-0.50	0.25	-0.60
		WYP	0.50	1.00	1.00	0.00	1.00	0.70
	Difference	XRT	0.00	N/A	0.50	-1.00	-0.50	0.00
		RCA	0.00	0.00	0.50	-1.00	1.50	0.20
		WYP	0.00	0.00	0.00	0.00	0.00	0.00
Demographic Variables	RPS	GNI	0.00	0.50	0.00	0.00	-1.00	0.10
		POP	1.00	0.00	-0.50	0.00	-1.00	-0.10
		ENR	-0.50	1.00	1.00	0.50	1.00	0.70
	Post-RPS	GNI	0.50	0.00	-0.50	-0.50	-1.00	-0.30
		POP	1.00	0.00	0.00	0.00	-1.00	0.00
		ENR	0.50	-1.00	-1.00	-1.00	0.00	-0.50
	20-year period	GNI	0.25	0.25	-0.25	-0.25	-1.00	-0.20
		POP	1.00	0.00	-0.25	0.00	-1.00	-0.05
		ENR	0.00	0.00	0.00	-0.25	0.50	-0.05
	Difference	GNI	-0.50	0.50	-0.50	-0.50	0.00	0.40
		POP	0.00	0.00	-0.50	0.00	0.00	-0.10
		ENR	1.00	2.00	2.00	0.25	1.00	0.90

APPENDIX F: FIBER SUPPLY

1. Independent Variable Analysis
   a. China

Table 38 shows the association of changes in rates of fiber supply for the identified years of increased and decreased total Australian wool consumption. The O (overall change) columns in the Change Count section of the table represent any comparison years of changes, whereas the N (notable change) columns represents only the years for which a notable change in the variable under review occurred. The plus (+), minus (-), 0, and N/A represent positive change, negative change, no change, and data not available, respectively.

RPS

From the Table 38, it can be seen that TWC, CTN, and MMF all increased for the years that AWL consumption increased by at least 25% from the previous year during the RPS. CTN was found to be associated with the strongest pattern of increased consumption. For the time points that AWC decreased by at least -25%, the pattern of associated decreases among the three fiber variables was less clear. In general TWC and CTN consumption decreased in relation to decreases in AWL, but MMF tended to increase.

Table 38
Coded Changes in Fiber Supply, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points				Change Count					
AWL Increases	1980-1981	1981-1982	1984-1985	1990-1991	+		-		0[A]	N/A[B]
					O[C]	N[D]	O	N		
TWC	N/a	N/a	N/a	2	1	1	0	0	0	3
CTN	3	3	3	0	3	3	0	0	1	0
MMF	1	3	3	1	4	2	0	0	0	0
AWL Decreases	1982-1983	1983-1984	1988-1989	1989-1990	+		-		0	N/A
					O	N	O	N		
TWC	N/a	N/a	-1	-3	0	0	2	1	0	2
CTN	-1	-1	-2	0	0	0	3	1	0	0
MMF	0	3	1	1	3	1	0	0	1	0

A - No Measurable Change
B - Data Not Available
C - Overall Change
D - Notable Change

Post-RPS

Table 39 indicates, there was only one selected year of a notable increase and decrease of at least 25% of AWC during the post-RPS period, from 1991-2001. For 1999-2000, when AWL increased consumption of all three fibers also increased. For the one year (1997-1998) in which a marked decrease in consumption was noted, TWC also registered a decrease, while CTN was unchanged, and MMF increased.

Table 39
Coded Changes in Fiber Supply, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points	Change Count					
AWL Increases	1999-2000	+		-		0	N/A
		O	N	O	N		
TWC	1	1	0	0	0	0	0
CTN	2	1	1	0	0	0	0
MMF	2	1	1	0	0	0	0
AWL Decreases	1997-1998	+		-		0	N/A
		O	N	O	N		
TWC	-1	0	0	1	0	0	0
CTN	0	0	0	0	0	1	0
MMF	2	1	1	0	0	0	0

These results suggest that TWC and CTN have a positive association with AWL, stronger in years of increasing, rather than decreasing, AWL. MMF findings indicate the increasing growth rate of MMF to be prevalent, regardless of changes in AWL.

b. Italy

RPS

In 184-1985, as AWL increased, all available fiber supply variables also increased. MMF had the strongest pattern of increased consumptions. During the period of decline, in 1981-1982, only CTN showed any measurable change – a notable increase in CTN consumption as AWL decreased. (see Table 40)

Table 40
Coded Changes in Fiber Supply, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points	Change Counts					
AWL Increases	1984-1985	+		-		0	N/a
		O	N	O	N		
TWC	N/a	0	0	0	0	0	1
CTN	1	1	0	0	0	0	0
MMF	2	1	1	0	0	0	0
AWL Decreases	1981-1982	+		-		0	N/a
		O	N	O	N		
TWC	N/a	N/A	0	0	0	0	1
CTN	3	1	1	0	0	0	0
MMF	0	0	0	0	0	1	0

Post-RPS

During the post-RPS year of decreased AWL consumption, 1997-1998, both CTN and MMF had decreased consumption levels, TWC showed no measurable change. CTN showed the strongest association to AWL consumption.

Table 41
Coded Changes in Fiber Supply, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points	Change Counts					
AWL Increases	N/a	+		-		0	N/a
AWL Decreases	1997-1998	+		-		0	N/a
		O	N	O	N		
TWC	0	0	0	0	0	1	0
CTN	-3	0	0	1	1	0	0
MMF	-1	0	0	1	0	0	0

These findings suggest that CTN and MMF had a slight positive association to AWL consumption. However, the MMF results may be misleading, due to the overall trend of increasing MMF throughout the 20-year period. TWC results were difficult to interpret, as only one year of data was available for review.

c. United Kingdom

RPS

As AWL increased during the RPS period, CTN decreased, with one year of measurable increase and two years of notable decreases. MMF increased measurably once – the remaining years had no measurable change. During the periods of decreasing AWL, both CTN and MMF decreased notably. CTN showed a slightly stronger association, decreasing notably both years while MMF only showed a notable decrease once. TWC was only available for one year each of increasing and decreasing AWL, and showed no measurable growth in either year.

Table 42
Coded Changes in Fiber Supply, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points			Change Counts					
AWL Increases	1983-1984	1984-1985	1990-1991	+		-		0	N/a
				O	N	O	N		
TWC	N/a	N/a	0	0	0	0	0	1	2
CTN	-1	1	-3	1	0	2	2	0	0
MMF	1	0	0	1	0	0	0	2	0
AWL Decreases	1980-1981	1989-1990		+		-		0	N/a
				O	N	O	N		
TWC	N/a	0		0	0	0	0	1	1
CTN	-3	-3		0	0	1	1	0	0
MMF	-3	0		0	0	1	1	1	0

Post – RPS

In 1991-1992, as AWL increased, TWC and CTN decreased, and MMF increased. CTN showed the strongest change of the variables, followed by the measurable but not notable change in TWC and MMF. For the three years of declining AWL, TWC shoed a slight decrease; CTN and MMF increased. CTN showed the strongest association to AWL, decreasing notably two out of three years. MMF also had a fairly strong positive association with AWL, decreasing all three years, one of them notably. TWC showed the weakest association, with one year of notable increase and one year of measurable decrease.

Table 43
Coded Changes in Fiber Supply, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points			Change Counts					
AWL Increases	1991-1992			+		-		0	N/a
				O	N	O	N		
TWC	-1			0	0	1	0	0	0
CTN	-3			0	0	1	1	0	0
MMF	1			1	0	0	0	0	0
AWL Decreases	1997-1998	1998-1999	2000-2001	+		-		0	N/A
				O	N	O	N		
TWC	-1	0	2	1	1	1	0	1	0
CTN	-2	-3	0	0	0	2	2	1	0
MMF	-1	-2	-1	0	0	3	1	0	0

These results suggest that for the two periods, MMF had the strongest, most stable association with AWL. MMF tended to have a positive association with AWL throughout the 20-year period regardless of the direction of AWL change. CTN seemed to have a fairly strong, but less stable association with AWL. During RPS, the data suggests CTN has a negative association with AWL; post-RPS CTN tended to have a positive association with AWL. Because TWC was limited during RPS, it was difficult to draw any conclusions during the period; however post-RPS TWCs seemed to have a weak negative association with AWL.

d. France

RPS

During RPS, mill consumption of all three fibers decreased. In the years reviewed, MMF and CTN declined notably, regardless of the direction of AWL growth. TWC showed no measurable change when AWL increased, and a non-notable decline when AWL increased.

Table 44
Coded Changes in Fiber Supply, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points	Change Counts					
AWL Increases	1990-1991	+		-		0	N/a
		O	N	O	N		
TWC	0	0	0	0	0	1	0
CTN	-3	0	0	1	1	0	0
MMF	-3	0	0	1	1	0	0
AWL Decreases	1989-1990	+		-		0	N/a
		O	N	O	N		
TWC	-1	0	0	1	0	0	0
CTN	-3	0	0	1	1	0	0
MMF	-3	0	0	1	1	0	0

Post-RPS

In 1996-1997, as AWL increased, TWC decreased notably. In this same year, MMF increased, though CTN showed no measurable change. As AWL decreased, TWC and CTN tended to decrease. TWC increased once notably; decreased twice notably; and twice showed no measurable change. CTN decreased four times, twice notably. MMF data resulted in indefinite findings: there were two years, one notable, of increased growth; two years, one notable, of decreased growth; and a year of no measurable change.

Table 45
Coded Changes in Fiber Supply, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points					Change Counts					
AWL Increases	1996-1997					+		-		0	N/a
						O	N	O	N		
TWC	-3					0	0	1	1	0	0
CTN	0					0	0	0	0	1	0
MMF	1					1	0	0	0	0	0
AWL Decreases	94-95	95-96	97-98	98-99	99-00	+		-		0	N/A
						O	N	O	N		
TWC	-1	-3	2	0	0	1	1	2	1	2	0
CTN	-1	0	-1	-3	-2	0	0	4	2	1	0
MMF	0	3	-1	-2	1	2	1	2	1	1	0

These findings suggest that regardless of AWL, fiber consumption levels are declining. CTN and MMF seems to be unaffected by the size or direction of AWL change. TWC seems to experience greater decline in years of increasing AWL.

e. Germany

RPS

During the RPS, CTN showed mixed results – increasing and decreasing notably once each – during the reviewed selection points. MMF results suggested a slight negative association to AWL – increasing non-notably in 1980-1981, as AWL decreased.

Table 46
Coded Changes in Fiber Supply, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points		Change Counts					
AWL Increases	N/a		+		-		0	N/a
			O	N	O	N		
AWL Decreases	1980-1981	1989-1990	+		-		0	N/a
			O	N	O	N		
TWC	N/a	0	0	0	0	0	1	1
CTN	-3	2	1	1	1	1	0	0
MMF	1	0	1	0	0	0	1	0

Post-RPS

In the post-RPS years of declining AWL, all three fibers reviewed displayed a positive association with AWL – the strongest from CTN and MMF, followed by TWC.

Over the 20-year period reviewed, the results suggest a slight positive association between AWL and the three fibers (TWC, CTN, and MMF) reviewed.

Table 47
Coded Changes in Fiber Supply, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points				Change Counts					
AWL Increases	N/a				+		-		0	N/a
					O	N	O	N		
AWL Decreases	94-95	98-99	99-00	00-01	+		-		0	N/A
					O	N	O	N		
TWC	-3	-3	2	-1	1	1	3	2	0	0
CTN	-3	-2	1	0	1	0	2	2	1	0
MMF	0	-2	1	-2	1	0	2	2	1	0

2. Odds Ratio Analysis

A. OWC

Question 1: What is the likely association between each explanatory variable reviewed and AWL?

Breslow-Day Test for Homogeneity of the Odds Ratios

Chi-Square	0.1365
DF	1
Pr > ChiSq	0.7118

Cochran-Mantel-Haenszel Statistics (Based on Table Scores)

Statistic	Alternative Hypothesis	DF	Value	Prob
3	General Association	1	0.1286	0.7199

Estimates of the Common Relative Risk (Row1/Row2)

Type of Study	Method	Value	90% Confidence Limits	
Case-Control	Mantel-Haenszel	1.2193	0.4968	2.9926

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period?

Table of awld by dir

awld / dir	dec	inc	Total
dec	2	2	4
	13.33	13.33	26.67
inc	6	5	11
	40.00	33.33	73.33
Total	8	7	15
	53.33	46.67	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	2
Left-sided Pr <= F	0.6615
Right-sided Pr >= F	0.7692
Table Probability (P)	0.4308
Two-sided Pr <= P	1.0000

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.5000	0.2500	0.0888	0.9112	0.0976	0.9024

Row 2	0.5455	0.1501	0.2985	0.7924	0.2712	0.8004
Total	0.5333	0.1288	0.3215	0.7452	0.3000	0.7563
Difference	-0.0455	0.2916	-0.5251	0.4342		

Difference is (Row 1 - Row 2)

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period?

awld dir

Frequency| Percent	dec	inc	Total
dec	19	16	35
	38.00	32.00	70.00
inc	7	8	15
	14.00	16.00	30.00
Total	26	24	50
	52.00	48.00	100.00

Fisher's Exact Test

Two-sided Pr <= P	0.7598

Column 1 Risk Estimates

			(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
	Risk	ASE				
Row 1	0.5429	0.0842	0.4044	0.6814	0.3917	0.6883
Row 2	0.4667	0.1288	0.2548	0.6785	0.2437	0.7000
Total	0.5200	0.0707	0.4038	0.6362	0.3954	0.6427
Difference	0.0762	0.1539	-0.1769	0.3293		

Difference is (Row 1 - Row 2)

B. CTN

Question 1: What is the likely association between each explanatory variable reviewed and AWL?

Breslow-Day Test for
Homogeneity of the Odds Ratios

Chi-Square	3.3392
DF	1
Pr > ChiSq	0.0676

awld dir

Frequency| Percent	dec	inc	Total
dec	28	21	49
	30.43	22.83	53.26
inc	25	18	43
	27.17	19.57	46.74

Total	53	39	92
	57.61	42.39	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	28
Left-sided Pr <= F	0.5460
Right-sided Pr >= F	0.6206
Table Probability (P)	0.1665
Two-sided Pr <= P	1.0000

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.5714	0.0707	0.4551	0.6877	0.4442	0.6920
Row 2	0.5814	0.0752	0.4576	0.7051	0.4448	0.7092
Total	0.5761	0.0515	0.4913	0.6608	0.4850	0.6634
Difference	-0.0100	0.1032	-0.1798	0.1598		

Difference is (Row 1 - Row 2)

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period?

Table of awld by dir

awld / dir	dec	inc	Total
dec	9	13	22
	18.75	27.08	45.83
inc	16	10	26
	33.33	20.83	54.17
Total	25	23	48
	52.08	47.92	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	9
Left-sided Pr <= F	0.1280
Right-sided Pr >= F	0.9573
Table Probability (P)	0.0853
Two-sided Pr <= P	0.2461

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.4091	0.1048	0.2367	0.5815	0.2327	0.6048
Row 2	0.6154	0.0954	0.4584	0.7723	0.4357	0.7743
Total	0.5208	0.0721	0.4022	0.6394	0.3935	0.6461
Difference	-0.2063	0.1417	-0.4394	0.0269		

Difference is (Row 1 - Row 2)

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period?

Table of awld by dir

awld / Frequency / Percent	dec	inc	Total
dec	19	8	27
	43.18	18.18	61.36
inc	9	8	17
	20.45	18.18	38.64
Total	28	16	44
	63.64	36.36	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	19
Left-sided Pr <= F	0.9317
Right-sided Pr >= F	0.1978
Table Probability (P)	0.1295
Two-sided Pr <= P	0.3371

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.7037	0.0879	0.5592	0.8482	0.5286	0.8432
Row 2	0.5294	0.1211	0.3303	0.7285	0.3108	0.7399
Total	0.6364	0.0725	0.5171	0.7556	0.5014	0.7569
Difference	0.1743	0.1496	-0.0718	0.4203		

Difference is (Row 1 - Row 2)

C. MMF

Question 1: What is the likely association between each explanatory variable reviewed and AWL?

Breslow-Day Test for Homogeneity of the Odds Ratios

Chi-Square	3.9817
DF	1
Pr > ChiSq	0.0460

Table of awld by dir

awld / Frequency / Percent	dec	inc	Total
dec	22	33	55
	21.78	32.67	54.46
inc	16	30	46
	15.84	29.70	45.54

Total	38	63	101
	37.62	62.38	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	22
Left-sided Pr <= F	0.7716
Right-sided Pr >= F	0.3703
Table Probability (P)	0.1419
Two-sided Pr <= P	0.6814

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.4000	0.0661	0.2913	0.5087	0.2886	0.5198
Row 2	0.3478	0.0702	0.2323	0.4633	0.2318	0.4792
Total	0.3762	0.0482	0.2969	0.4555	0.2956	0.4625
Difference	0.0522	0.0964	-0.1064	0.2108		

Difference is (Row 1 - Row 2)

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period?

Table of awld by dir

awld	dir		
Frequency| Percent	dec	inc	Total
dec	6	15	21
	11.54	28.85	40.38
inc	13	18	31
	25.00	34.62	59.62
Total	19	33	52
	36.54	63.46	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	6
Left-sided Pr <= F	0.2468
Right-sided Pr >= F	0.8998
Table Probability (P)	0.1466
Two-sided Pr <= P	0.3887

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.2857	0.0986	0.1236	0.4479	0.1324	0.4874
Row 2	0.4194	0.0886	0.2736	0.5651	0.2688	0.5820
Total	0.3654	0.0668	0.2555	0.4752	0.2542	0.4886
Difference	-0.1336	0.1326	-0.3517	0.0844		

Difference is (Row 1 - Row 2)

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period?

Table of awld by dir

awld dir

Frequency| Percent	dec	inc	Total
dec	16	18	34
	32.65	36.73	69.39
inc	3	12	15
	6.12	24.49	30.61
Total	19	30	49
	38.78	61.22	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	16
Left-sided Pr <= F	0.9852
Right-sided Pr >= F	0.0680
Table Probability (P)	0.0532
Two-sided Pr <= P	0.1127

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.4706	0.0856	0.3298	0.6114	0.3218	0.6234
Row 2	0.2000	0.1033	0.0301	0.3699	0.0568	0.4398
Total	0.3878	0.0696	0.2733	0.5022	0.2709	0.5152
Difference	0.2706	0.1341	0.0499	0.4912		

Difference is (Row 1 - Row 2)

APPENDIX G: FIBER PRICES

1. Independent Variable Analysis

a. China

RPS

For the RPS period, the data suggests mixed, but strong results. During years of increasing AWL, PMF, and to a lesser extent, PWL, are positively related to AWL consumption. PCN decreased during these years, suggesting a negative association to increasing AWL. As AWL decreased, PWL decreased. PMF, and to a lesser degree, PCN increased. These findings suggest a positive association between PWL and AWL, and a negative association between PCN and PMF in regards to AWL.

Table 48
Coded Changes in Fiber Price, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points				Change Count					
AWL Increases	1980-1981	1981-1982	1984-1985	1990-1991	+		-		0[A]	N/A[B]
					O[C]	N[D]	O	N		
PWL	0	0	0	3	1	1	0	0	3	0
PCN	-1	-1	-3	0	0	0	3	1	1	0
PMF	1	0	3	2	3	2	0	0	1	0
AWL Decreases	1982-1983	1983-1984	1988-1989	1989-1990	+		-		0[A]	N/A[B]
					O[C]	N[D]	O	N		
PWL	-2	0	-1	-2	0	0	3	2	1	0
PCN	1	0	1	0	2	0	0	0	2	0
PMF	0	1	3	0	2	1	0	0	2	0

A - No Measurable Change
B - Data Not Available
C - Overall Change
D - Notable Change

Post-RPS

As AWL increased, in 1999-2000, PMF increased notable and PWL increased measurably; PCN showed no measurable change. In 1997-1998, as AWL decreased, all three fiber prices decreased notably.

These findings suggest that throughout the two periods reviewed, PWL and PMF had a positive association with AWL. PCN had a slightly positive association during, and a negative association post-RPS with AWL; resulting in a slight negative association for the overall period reviewed.

Table 49
Coded Changes in Fiber Supply, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points	Change Count					
AWL Increases	1999-2000	+		-		0	N/A
		O	N	O	N		
PWL	1	1	0	0	0	0	0
PCN	0	0	0	0	0	1	0
PMF	2	1	1	0	0	0	0
AWL Decreases	1997-1998	+		-		0	N/A
		O	N	O	N		
PWL	-3	0	0	1	1	0	0
PCN	-2	0	0	1	1	0	0
PMF	-2	0	0	1	1	0	0

b. Italy

RPS

All three fiber prices decreased, PCN and PMF notably, as AWL increased in 1984-1985. In 1981-1982, as AWL decreased CTN decreased; PWL and PMF showed no measurable change. This suggests a negative association between AWL and fiber prices – the strongest association with PMF followed by PCN and PWL.

Table 50
Coded Changes in Fiber Price, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points	Change Counts					
AWL Increases	1984-1985	+		-		0	N/a
		O	N	O	N		
PWL	-1	0	0	1	0	0	0
PCN	-3	0	0	1	1	0	0
PMF	-3	0	0	1	1	0	0
AWL Decreases	1981-1982	+		-		0	N/a
		O	N	O	N		
PWL	0	0	0	0	0	1	0
PCN	-1	0	0	1	0	0	0
PMF	0	0	0	0	0	1	0

Post – RPS

In 1997-1998, as AWL decreased PWL and PCN decreased, and PMF increased, all notably. The most notable of these changes was PWL.

Table 51
Coded Changes in Fiber Supply, and Count of Changes During Selected Points 1991-2001

AWL Increases	N/a	+		-		0	N/a
AWL Decreases	1997-1998	+		-		0	N/a
		O	N	O	N		
PWL	-3	0	0	1	1	0	0
PCN	-2	0	0	1	1	0	0
PMF	2	1	1	0	0	0	0

These results suggest a negative association between PWL, PCN and AWL. PMF seems to have a slightly positive association to AWL.

c. United Kingdom

RPS

During the RPS, as AWL increased, all three fiber prices declined. PMF had the strongest association, with two notable changes, followed by PCN and PWL, each with one notable change. In years of decreased AWL, PMF maintained a negative, but weaker association, with only one year of notable change. PCN showed no association, with one year of non-notable change in each, positive and negative, direction. PWL had a very weak positive association with AWL, decreasing, non-notably once.

Post-RPS

As AWL increased, post-RPS, neither PWL nor PMF showed any measurable change. PCN had a negative association, decreasing notably, as AWL increased. During years of decreasing AWL, all three fiber prices seemed to have a positive association with AWL – the strongest being PCN, followed by PMF, then PWL.

Table 52
Coded Changes in Fiber Price, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points			Change Counts					
AWL Increases	1983-1984	1984-1985	1990-1991	+		-		0	N/a
				O	N	O	N		
PWL	0	1	-3	1	0	1	1	1	0
PCN	0	-3	0	0	0	1	1	2	0
PMF	1	-3	-3	1	0	2	2	0	0
AWL Decreases	1980-1981	1989-1990		+		-		0	N/A
				O	N	O	N		
PWL	0	-1		0	0	1	0	1	0
PCN	-1	1		1	0	1	0	0	0
PMF	1	3		2	1	0	0	0	0

Table 53
Coded Changes in Fiber Supply, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points			Change Counts					
AWL Increases	1991-1992			+		-		0	N/a
				O	N	O	N		
PWL	0			0	0	0	0	1	0
PCN	-3			0	0	1	1	0	0
PMF	0			0	0	0	0	1	0
AWL Decreases	1997-1998	1998-1999	2000-2001	+		-		0	N/A
				O	N	O	N		
PWL	-3	0	0	0	0	1	1	2	0
PCN	-2	-2	-1	0	0	3	2	0	0
PMF	-2	-3	1	1	0	2	2	0	0

These results suggest a shift from a negative association between AWL and fibers prices during the RPS to a positive one post-RPS.

d. France

RPS

In 1990-1991, as AWL increased, PWL and PMF both decreased notably. As AWL decreased, in 1989-1990, PWL decreased.

Table 54
Coded Changes in Fiber Price, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points	Change Counts					
AWL Increases	1990-1991	+		-		0	N/a
		O	N	O	N		
PWL	-3	0	0	1	1	0	0
PCN	0	0	0	0	0	1	0
PMF	-2	0	0	1	1	0	0
AWL Decreases	1989-1990	+		-		0	N/A
		O	N	O	N		
PWL	-2	0	0	1	1	0	0
PCN	0	0	0	0	0	1	0
PMF	0	0	0	0	0	1	0

Post-RPS

In 1996-1997, as AWL increased, PWL increased, though not notably, while PMF decreased notably. In years of decreasing AWL, TWC showed mixed results, while PCN and PMF tended to decrease. PCN seemed to have the strongest positive association with AWL, decreasing notably three times and increasing twice – once notably. PMF had a weaker positive association with AWL, decreasing notably three times and increasing notably twice. PWL results were mixed – growing notably and equally in both the positive and negative directions.

Table 55
Coded Changes in Fiber Supply, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points					Change Counts					
AWL Increases	1996-1997					+		-		0	N/a
						O	N	O	N		
PWL	1					1	0	0	0	0	0
PCN	0					0	0	0	0	1	0
PMF	-3					0	0	1	1	0	0
AWL Decreases	94-95	95-96	97-98	98-99	99-00	+		-		0	N/A
						O	N	O	N		
PWL	2	-2	-3	0	2	2	2	2	2	1	0
PCN	2	-2	-2	-2	1	2	1	3	3	0	0
PMF	3	-2	-2	-3	2	2	2	3	3	0	0

These results suggest a negative association between AWL and PMF. PCN data provided limited measurable data points making it difficult to draw any specific conclusions. PWL data provided mixed results regardless of the period reviewed or of the direction of AWL growth.

e. Germany

RPS

PWL and PCN results suggested a positive association with AWL during the RPS period, PCN to a lesser degree than PWL. PMF seemed to have a negative association with AWL for the same period.

Table 56
Coded Changes in Fiber Price, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points		Change Counts					
AWL Increases	N/a		+		-		0	N/a
			O	N	O	N		
AWL Decreases	1980-1981	1989-1990	+		-		0	N/A
			O	N	O	N		
PWL	0	-2	0	0	1	1	1	0
PCN	-1	0	0	0	1	0	1	0
PMF	2	0	1	1	0	0	1	0

Post-RPS

During the post-RPS period, both PCN and PMF results suggested slight negative association with AWL. PWL results were inconclusive, increasing and decreasing once each, and showing no measurable changes during the remained selection points chosen.

Table 57
Coded Changes in Fiber Supply, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points				Change Counts					
AWL Increases	N/a				+		-		0	N/a
					O	N	O	N		
AWL Decreases	94-95	98-99	99-00	00-01	+		-		0	N/A
					O	N	O	N		
PWL	0	0	2	-2	1	1	1	1	2	0
PCN	2	-2	1	0	2	1	1	1	1	0
PMF	2	-3	2	-1	2	2	2	1	0	0

These findings suggest a slightly positive association between PWL and AWL. PCN results were mixed, making it difficult to determine any possible associations. PMF results suggest a negative association to AWL.

2. Odds Ratio Analysis

a. PWL

Question 1: What is the likely association between each explanatory variable reviewed and AWL?

```
Summary Statistics for awld by dir
     Controlling for period

 Breslow-Day Test for
Homogeneity of the Odds Ratios
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
Chi-Square              0.1014
DF                           1
Pr > ChiSq              0.7501
```

Cochran-Mantel-Haenszel Statistics (Based on Table Scores)

Statistic	Alternative Hypothesis	DF	Value	Prob
3	General Association	1	0.1573	0.6917

Estimates of the Common Relative Risk (Row1/Row2)

Type of Study	Method	Value	90% Confidence Limits	
Case-Control	Mantel-Haenszel	1.1923	0.5783	2.4584

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period?

Table of awld by dir

awld dir

Frequency| Percent	dec	inc	Total
dec	20	10	30
	36.36	18.18	54.55
inc	15	10	25
	27.27	18.18	45.45
Total	35	20	55
	63.64	36.36	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	20
Left-sided Pr <= F	0.7862
Right-sided Pr >= F	0.4082
Table Probability (P)	0.1945
Two-sided Pr <= P	0.7790

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.6667	0.0861	0.5251	0.8082	0.5006	0.8067
Row 2	0.6000	0.0980	0.4388	0.7612	0.4168	0.7644
Total	0.6364	0.0649	0.5297	0.7431	0.5169	0.7444
Difference	0.0667	0.1304	-0.1478	0.2812		

Difference is (Row 1 - Row 2)

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period?

Table of awld by dir

awld	dir		
Frequency| Percent	dec	inc	Total
dec	20	20	40
	40.00	40.00	80.00
inc	5	5	10
	10.00	10.00	20.00
Total	25	25	50
	50.00	50.00	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	20
Left-sided Pr <= F	0.6374
Right-sided Pr >= F	0.6374
Table Probability (P)	0.2748
Two-sided Pr <= P	1.0000

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.5000	0.0791	0.3700	0.6300	0.3611	0.6389
Row 2	0.5000	0.1581	0.2399	0.7601	0.2224	0.7776
Total	0.5000	0.0707	0.3837	0.6163	0.3762	0.6238
Difference	0.0000	0.1768	-0.2908	0.2908		

DIFFERENCE IS (ROW 1 - ROW 2)

b. PCN

Question 1: What is the likely association between each explanatory variable reviewed and AWL?

Breslow-Day Test for Homogeneity of the Odds Ratios

Chi-Square	7.4231
DF	1
Pr > ChiSq	0.0064

Table of awld by dir

awld / dir	dec	inc	Total
dec	45	25	70
	42.86	23.81	66.67
inc	15	20	35
	14.29	19.05	33.33
Total	60	45	105
	57.14	42.86	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	45
Left-sided Pr <= F	0.9892
Right-sided Pr >= F	0.0301
Table Probability (P)	0.0193
Two-sided Pr <= P	0.0589

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.6429	0.0573	0.5487	0.7371	0.5382	0.7381
Row 2	0.4286	0.0836	0.2910	0.5662	0.2858	0.5808
Total	0.5714	0.0483	0.4920	0.6509	0.4865	0.6533
Difference	0.2143	0.1014	0.0475	0.3810		

Difference is (Row 1 - Row 2)

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period?

Table of awld by dir

awld	dir		
Frequency | Percent	dec	inc	Total
dec	25	10	35
	45.45	18.18	63.64
inc	5	15	20
	9.09	27.27	36.36
Total	30	25	55
	54.55	45.45	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	25
Left-sided Pr <= F	0.9999
Right-sided Pr >= F	0.0010
Table Probability (P)	9.223E-04
Two-sided Pr <= P	0.0016

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.7143	0.0764	0.5887	0.8399	0.5637	0.8360
Row 2	0.2500	0.0968	0.0907	0.4093	0.1041	0.4556
Total	0.5455	0.0671	0.4350	0.6559	0.4262	0.6609
Difference	0.4643	0.1233	0.2615	0.6671		

Difference is (Row 1 - Row 2)

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period?

Table of awld by dir

awld	dir		
Frequency | Percent	dec	inc	Total
dec	20	15	35
	40.00	30.00	70.00
inc	10	5	15
	20.00	10.00	30.00
Total	30	20	50
	60.00	40.00	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	20
Left-sided Pr <= F	0.3798
Right-sided Pr >= F	0.8271
Table Probability (P)	0.2070
Two-sided Pr <= P	0.7536

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.5714	0.0836	0.4338	0.7090	0.4192	0.7142
Row 2	0.6667	0.1217	0.4665	0.8669	0.4226	0.8583
Total	0.6000	0.0693	0.4860	0.7140	0.4739	0.7169
Difference	-0.0952	0.1477	-0.3382	0.1477		

Difference is (Row 1 - Row 2)

c. PMF

Question 1: What is the likely association between each explanatory variable reviewed and AWL?

Breslow-Day Test for Homogeneity of the Odds Ratios

Chi-Square	3.1389
DF	1
Pr > ChiSq	0.0764

Table of awld by dir

awld dir

Frequency| Percent	dec	inc	Total
dec	40 38.10	25 23.81	65 61.90
inc	20 19.05	20 19.05	40 38.10
Total	60 57.14	45 42.86	105 100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	40
Left-sided Pr <= F	0.9135
Right-sided Pr >= F	0.1692
Table Probability (P)	0.0827
Two-sided Pr <= P	0.3107

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.6154	0.0603	0.5161	0.7146	0.5060	0.7166
Row 2	0.5000	0.0791	0.3700	0.6300	0.3611	0.6389
Total	0.5714	0.0483	0.4920	0.6509	0.4865	0.6533
Difference	0.1154	0.0995	-0.0482	0.2790		

Difference is (Row 1 - Row 2)

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period?

Table of awld by dir

awld dir

Frequency / Percent	dec	inc	Total
dec	20	10	30
	36.36	18.18	54.55
inc	10	15	25
	18.18	27.27	45.45
Total	30	25	55
	54.55	45.45	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	20
Left-sided Pr <= F	0.9881
Right-sided Pr >= F	0.0437
Table Probability (P)	0.0318
Two-sided Pr <= P	0.0609

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.6667	0.0861	0.5251	0.8082	0.5006	0.8067
Row 2	0.4000	0.0980	0.2388	0.5612	0.2356	0.5832
Total	0.5455	0.0671	0.4350	0.6559	0.4262	0.6609
Difference	0.2667	0.1304	0.0522	0.4812		

Difference is (Row 1 - Row 2)

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period?

Table of awld by dir

awld dir

Frequency / Percent	dec	inc	Total
dec	20	15	35
	40.00	30.00	70.00
inc	10	5	15
	20.00	10.00	30.00
Total	30	20	50
	60.00	40.00	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	20
Left-sided Pr <= F	0.3798
Right-sided Pr >= F	0.8271
Table Probability (P)	0.2070
Two-sided Pr <= P	0.7536

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.5714	0.0836	0.4338	0.7090	0.4192	0.7142
Row 2	0.6667	0.1217	0.4665	0.8669	0.4226	0.8583
Total	0.6000	0.0693	0.4860	0.7140	0.4739	0.7169
Difference	-0.0952	0.1477	-0.3382			

Difference is (Row 1 - Row 2)

APPENDIX H: TRADE AND PROCESSING VARIABLES

1. Independent Variable Analysis

a. China

RPS

XRT, and to a lesser extent, WYP, results suggested a positive association with AWL. RCA results pointed towards a slight negative association with AWL. During years of decreased AWL, all three variables – XRT, followed by RCA, then WYP – results seem to have a negative association with AWL.

Table 58
Coded Changes in Trade Variables, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points				Change Count					
AWL Increases	1980-1981	1981-1982	1984-1985	1990-1991	+		-		0[A]	N/A[B]
					O[C]	N[D]	O	N		
XRT	2	2	3	2	4	4	0	0	0	0
RCA	N/a	N/a	N/a	-1	0	0	1	0	0	3
WYP	0	2	1	1	3	1	0	0	1	0
AWL Decreases	1982-1983	1983-1984	1988-1989	1989-1990	+		-		0[A]	N/A[B]
					O[C]	N[D]	O	N		
XRT	1	3	3	2	4	3	0	0	0	0
RCA	N/a	N/a	0	2	1	1	0	0	1	0
WYP	1	0	1	0	2	0	0	0	2	0

A - No Measurable Change
B - Data Not Available
C - Overall Change
D - Notable Change

Post-RPS

Neither XRT nor WYP shows any measurable change as AWL increased in 1999-2000. During the same year, RCA decreased notably, suggesting a negative association with AWL. XRT remained immeasurable as AWL decreased in 1997-1998, WYP showed a notable positive association with AWL. RCA findings suggested a slightly smaller, but still measurable, negative association to AWL.

For the two periods reviewed, the data suggests that RCA has a negative and WYP a positive association with AWL. XRT results were conflicting during and not measurable post-RPS, so it was difficult to draw conclusions.

Table 59
Coded Changes in Trade Variables, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points	Change Count					
AWL Increases	1999-2000	+		-		0	N/A
		O	N	O	N		
XRT	0	0	0	0	0	1	0
RCA	-3	0	0	1	1	0	1
WYP	0	0	0	0	0	0	1
AWL Decreases	1997-1998	+		-		0	N/A
		O	N	O	N		
XRT	0	0	0	0	0	1	0
RCA	1	1	0	0	0	0	0
WYP	-3	0	0	1	1	0	0

b. Italy

RPS

During the period of increased AWL, in 1984-1985, RCA experienced a notable decreased change. Data on WYP was not measurable. As AWL decreased, in 1981-1982, RCA experienced a notable increase and WYP a notable decrease. No XRT data was available for the reviewed consumption points.

Table 60
Coded Changes in Trade Variables, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points	Change Counts					
AWL Increases	1984-1985	+		-		0	N/a
		O	N	O	N		
XRT	N/A	0	0	0	0	0	1
RCA	-2	0	0	1	1	0	0
WYP	0	0	0	0	0	1	0
AWL Decreases	1981-1982	+		-		0	N/a
		O	N	O	N		
XRT	N/A	0	0	0	0	0	1
RCA	3	1	1	0	0	0	0
WYP	-3	0	0	1	1	0	0

Post-RPS

In 1997-1998, as AWL decreased, RCA increased and WYP decreased, both notably. XRT data wasn't available for this selection point.

Table 61
Coded Changes in Trade Variables, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points	Change Counts					
AWL Increases	N/a	+		-		0	N/a
AWL Decreases	1997-1998	+		-		0	N/a
		O	N	O	N		
XRT	N/A	0	0	0	0	0	1
RCA	2	1	1	0	0	0	0
WYP	-3	0	0	1	1	0	0

These results suggest a negative association between AWL and RCA during the review periods, and a positive association between AWL and WYP. Due to the limited availability of XRT data, it was difficult to make any conclusion about the association between XRT and AWL.

c. United Kingdom

RPS

As AWL increased, during RPS, WYP and to a lesser degree XRT, showed a positive association to AWL, RCA data suggested a negative association. In years of decreasing AWL, WYP data suggested a positive association. XRT and RCA results were indeterminate, both with equal numbers of positive and negative changes.

Table 62
Coded Changes in Trade Variables, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points			Change Counts					
AWL Increases	1983-1984	1984-1985	1990-1991	+		-		0	N/a
				O	N	O	N		
XRT	3	-3	1	2	1	1	1	0	0
RCA	-1	0	-1	0	0	2	0	1	0
WYP	1	1	3	3	1	0	0	0	0
AWL Decreases	1980-1981	1989-1990		+		-		0	N/A
				O	N	O	N		
XRT	3	-3		1	1	1	1	0	0
RCA	-1	1		1	0	1	0	0	0
WYP	-2	-3		0	0	2	2	0	0

Post-RPS

In 1991-1992, as AWL increased, XRT increased and RCA decreased, both notably. In years of decreasing AWL, XRT and RCA data suggested a negative association with AWL. XRT experienced two non-notable positive changes; RCA had two positive notable changes, and one notable negative change. WYP had a positive association with AWL; WYP decreased two times, once notably during the three years of decreasing AWL.

Table 63
Coded Changes in Trade Variables, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points			Change Counts					
AWL Increases	1991-1992			+		-		0	N/a
				O	N	O	N		
XRT	3			1	1	0	0	0	0
RCA	-3			0	0	1	1	0	0
WYP	N/a			0	0	0	0	0	1
AWL Decreases	1997-1998	1998-1999	2000-2001	+		-		0	N/A
				O	N	O	N		
XRT	0	1	1	2	0	0	0	1	0
RCA	2	-3	3	2	2	1	1	0	0
WYP	-1	-2	N/a	0	0	2	1	0	1

These findings suggest a fairly neutral association between XRT and AWL. RCA results suggest a negative association between RCA and AWL, which strengthens post-RPS. WYP has a strong positive association with AWL that occurs throughout the two periods of review, regardless off AWL growth or decline.

d. France

RPS

As AWL increased, in 1990-1991, all three trade and processing variables decreased notably. In 1989-1990, when AWL decreased, RCA increased and WYP decreased, both notably, while XRT showed no measurable change.

Table 64
Coded Changes in Trade Variables, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points	Change Counts					
AWL Increases	1990-1991	+		-		0	N/a
		O	N	O	N		
XRT	-2	0	0	1	1	0	0
RCA	-3	0	0	1	1	0	0
WYP	-2	0	0	1	1	0	0
AWL Decreases	1989-1990	+		-		0	N/A
		O	N	O	N		
XRT	0	0	0	0	0	1	0
RCA	2	1	1	0	0	0	0
WYP	-2	0	0	1	1	0	0

Post-RPS

In 1996-1997, as AWL increased, RCA and WYP decreased notably. During years of decreased AWL, XRT, RCA, and WYP all decreased three times (twice notably). XRT had the strongest association, followed by RCA and WYP.

Table 65
Coded Changes in Trade Variables, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points					Change Counts					
AWL Increases	1996-1997					+		-		0	N/a
						O	N	O	N		
XRT	0					0	0	0	0	1	0
RCA	-3					0	0	1	1	0	0
WYP	-2					0	0	1	1	0	0
AWL Decreases	94-95	95-96	97-98	98-99	99-00	+		-		0	N/A
						O	N	O	N		
XRT	-1	0	-2	-3	1	1	0	3	2	1	0
RCA	1	-3	1	-2	-1	2	0	3	2	0	0
WYP	3	-2	-1	-2	N/a	1	1	3	2	0	1

These findings suggest a slight negative association between RCA and AWL. The results of XRT suggest a slightly negative association during the RPS and a slightly positive one post-RPS. However, due to the limited data availability, it is difficult to draw any conclusions as to the possible overall association of XRT and AWL. WYP data suggests a declined trend in the variable, regardless of the direction of intensity of AWL growth.

e. Germany

RCA

As AWL decreased, during the RPS period, both RCA and WYP results suggested a positive association to AWL – WYP stronger than RCA. XRT results were mixed – increasing and decreasing notably once each during the selected years of review.

Post-RPS

During the post-RPS period, WYP continued to suggest a positive association with AWL. XRT, and to a lesser degree, RCA results suggested a slight negative association to AWL.

Table 66
Coded Changes in Trade Variables, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points		Change Counts					
AWL Increases	N/a		+		-		0	N/a
			O	N	O	N		
AWL Decreases	1980-1981	1989-1990	+		-		0	N/A
			O	N	O	N		
XRT	2	-3	1	1	1	1	0	0
RCA	0	-2	0	0	1	1	1	0
WYP	-3	-3	0	0	2	2	0	0

Table 67
Coded Changes in Trade Variables, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points				Change Counts					
AWL Increases	N/a				+		-		0	N/a
					O	N	O	N		
AWL Decreases	94-95	98-99	99-00	00-01	+		-		0	N/A
					O	N	O	N		
XRT	3	-3	2	1	3	2	1	1	0	0
RCA	-1	0	-1	-1	3	0	0	0	1	0
WYP	-2	-3	N/a	N/a	0	0	2	2	0	2

These results suggest XRT has a slight negative association to AWL; RCA has a slight and WYP a stronger positive association to AWL.

2. Odds Ratio Analysis

a. XRT

Question 1: What is the likely association between each explanatory variable reviewed and AWL?

Summary Statistics for awld by dir
Controlling for period

Breslow-Day Test for
Homogeneity of the Odds Ratios

Chi-Square	0.1766
DF	1
Pr > ChiSq	0.6743

Cochran-Mantel-Haenszel Statistics (Based on Table Scores)

Statistic	Alternative Hypothesis	DF	Value	Prob
3	General Association	1	0.0048	0.9448

Estimates of the Common Relative Risk (Row1/Row2)

Type of Study	Method	Value	90% Confidence Limits	
Case-Control	Mantel-Haenszel	1.0360	0.4535	2.3670

Total Sample Size = 80

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period?

Table of awld by dir

awld Frequency| Percent	dir dec	 inc	 Total
dec	6 14.29	13 30.95	19 45.24
inc	8 19.05	15 35.71	23 54.76
Total	14 33.33	28 66.67	42 100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	6
Left-sided Pr <= F	0.5449
Right-sided Pr >= F	0.7068
Table Probability (P)	0.2517
Two-sided Pr <= P	1.0000

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.3158	0.1066	0.1404	0.4912	0.1475	0.5300
Row 2	0.3478	0.0993	0.1845	0.5112	0.1863	0.5405
Total	0.3333	0.0727	0.2137	0.4530	0.2141	0.4711
Difference	-0.0320	0.1457	-0.2717	0.2077		

Difference is (Row 1 - Row 2)

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period?

Table of awld by dir

awld dir

Frequency| Percent	dec	inc	Total
dec	9	18	27
	23.68	47.37	71.05
inc	3	8	11
	7.89	21.05	28.95
Total	12	26	38
	31.58	68.42	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	9
Left-sided Pr <= F	0.7692
Right-sided Pr >= F	0.5164
Table Probability (P)	0.2856
Two-sided Pr <= P	1.0000

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.3333	0.0907	0.1841	0.4826	0.1862	0.5095
Row 2	0.2727	0.1343	0.0519	0.4936	0.0788	0.5644
Total	0.3158	0.0754	0.1918	0.4398	0.1934	0.4609
Difference	0.0606	0.1621	-0.2060	0.3272		

DIFFERENCE IS (ROW 1 - ROW 2)

b. RCA

Question 1: What is the likely association between each explanatory variable reviewed and AWL?

Summary Statistics for awld by dir
Controlling for period

Breslow-Day Test for
Homogeneity of the Odds Ratios

Chi-Square	1.0090
DF	1
Pr > ChiSq	0.3151

Cochran-Mantel-Haenszel Statistics (Based on Table Scores)

Statistic	Alternative Hypothesis	DF	Value	Prob
3	General Association	1	2.3818	0.1228

Estimates of the Common Relative Risk (Row1/Row2)

Type of Study	Method	Value	90% Confidence Limits	
Case-Control	Mantel-Haenszel	2.0013	0.9567	4.1867

Total Sample Size = 94

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period?

Table of awld by dir

awld	dir		
Frequency| Percent	dec	inc	Total
dec	10	6	16
	22.22	13.33	35.56
inc	10	19	29
	22.22	42.22	64.44
Total	20	25	45
	44.44	55.56	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	10
Left-sided Pr <= F	0.9834
Right-sided Pr >= F	0.0672
Table Probability (P)	0.0506
Two-sided Pr <= P	0.1167

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.6250	0.1210	0.4259	0.8241	0.3910	0.8222
Row 2	0.3448	0.0883	0.1996	0.4900	0.2005	0.5143
Total	0.4444	0.0741	0.3226	0.5663	0.3173	0.5773
Difference	0.2802	0.1498	0.0338	0.5266		

Difference is (Row 1 - Row 2)

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period?

Table of awld by dir

awld / dir	dec	inc	Total
dec	22	13	35
	44.90	26.53	71.43
inc	8	6	14
	16.33	12.24	28.57
Total	30	19	49
	61.22	38.78	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	22
Left-sided Pr <= F	0.7579
Right-sided Pr >= F	0.4773
Table Probability (P)	0.2352
Two-sided Pr <= P	0.7536

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.6286	0.0817	0.4942	0.7629	0.4756	0.7644
Row 2	0.5714	0.1323	0.3539	0.7890	0.3250	0.7939
Total	0.6122	0.0696	0.4978	0.7267	0.4848	0.7291
Difference	0.0571	0.1554	-0.1985	0.3128		

DIFFERENCE IS (ROW 1 - ROW 2)

c. WYP

Question 1: What is the likely association between each explanatory variable reviewed and AWL?

Breslow-Day Test for Homogeneity of the Odds Ratios

Chi-Square	4.0333
DF	1
Pr > ChiSq	0.0446

Table of awld by dir

awld / Frequency / Percent	dec	inc	Total
dec	32	18	50
	36.36	20.45	56.82
inc	22	16	38
	25.00	18.18	43.18
Total	54	34	88
	61.36	38.64	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	32
Left-sided Pr <= F	0.7893
Right-sided Pr >= F	0.3582
Table Probability (P)	0.1475
Two-sided Pr <= P	0.6597

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.6400	0.0679	0.5283	0.7517	0.5142	0.7528
Row 2	0.5789	0.0801	0.4472	0.7107	0.4331	0.7152
Total	0.6136	0.0519	0.5283	0.6990	0.5206	0.7007
Difference	0.0611	0.1050	-0.1116	0.2337		

Difference is (Row 1 - Row 2)

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period?

Table of awld by dir

awld / Frequency / Percent	dec	inc	Total
dec	14	9	23
	25.93	16.67	42.59
inc	15	16	31
	27.78	29.63	57.41
Total	29	25	54
	53.70	46.30	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	14
Left-sided Pr <= F	0.8823
Right-sided Pr >= F	0.2636
Table Probability (P)	0.1459
Two-sided Pr <= P	0.4170

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.6087	0.1018	0.4413	0.7761	0.4168	0.7784
Row 2	0.4839	0.0898	0.3362	0.6315	0.3267	0.6434
Total	0.5370	0.0679	0.4254	0.6486	0.4168	0.6541
Difference	0.1248	0.1357	-0.0984	0.3480		

Difference is (Row 1 - Row 2)

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period?

Table of awld by dir

awld / dir	dec	inc	Total
dec	18	9	27
	52.94	26.47	79.41
inc	7	0	7
	20.59	0.00	20.59
Total	25	9	34
	73.53	26.47	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	18
Left-sided Pr <= F	0.0894
Right-sided Pr >= F	1.0000
Table Probability (P)	0.0894
Two-sided Pr <= P	0.1506

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.6667	0.0907	0.5174	0.8159	0.4905	0.8138
Row 2	1.0000	0.0000	1.0000	1.0000	0.6518	1.0000
Total	0.7353	0.0757	0.6108	0.8597	0.5835	0.8544
Difference	-0.3333	0.0907	-0.4826	-0.1841		

APPENDIX I: DEMOGRAPHIC VARIABLES

1. Independent Variable Analysis

a. China

RPS

During the RPS, as AWL increase, all three of the available variables (GNI, POP, and ENR) results suggested a positive association with AWL. As AWL decreased, only POP seemed to remain positively associated to AWL. GNI and POP results, as AWL declined, suggested a negative association with AWL.

Table 68
Coded Changes in Demand Side Variables, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points				Change Count					
AWL Increases	1980-1981	1981-1982	1984-1985	1990-1991	+		-		0[A]	N/A[B]
					O[C]	N[D]	O	N		
GNI	1	1	3	1	4	1	0	0	0	0
POP	3	0	3	-3	2	2	1	1	1	0
ENR	0	1	2	0	2	1	0	0	2	0
AWL Decreases	1982-1983	1983-1984	1988-1989	1989-1990	+		-		0[A]	N/A[B]
					O[C]	N[D]	O	N		
GNI	0	3	0	0	1	1	0	0	3	0
POP	-3	0	-1	-2	0	0	3	2	1	0
ENR	1	3	0	3	3	2	0	0	1	0

A - No Measurable Change
B - Data Not Available
C - Overall Change
D - Notable Change

Post-RPS

In 1999-2000, as AWL increased, GNI and POP increased while ENR and APX showed no measurable change. When AWL decreased, in 1997-1998, POP and to a lesser degree, ENR decreased; GNI and APX showed no measurable change.

Table 69
Coded Changes in Demand Side Variables, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points	Change Count					
AWL Increases	1999-2000	+		-		0	N/A
		O	N	O	N		
GNI	2	1	1	0	0	0	0
POP	2	1	1	0	0	0	0
ENR	0	0	0	0	0	1	0
AWL Decreases	1997-1998	+		-		0	N/A
		O	N	O	N		
GNI	0	0	0	0	0	1	0
POP	-2	0	0	1	1	0	0
ENR	-1	0	0	1	0	0	0

Overall, these results suggest a positive association between POP, and to a lesser extent, GNI and ENR.

b. Italy

RPS

In 1984-1985, as AWL increased, GNI and ENR increased, while POP decreased. GNI and POP results suggests strong, notable associations to AWL. The association between AWL and ENR was measurable, but not notable. POP and ENR both decreased notably as AWL decreased in 1981-1982. GNI increased by a measurable amount during the same selection point year.

Post – RPS

As AWL decreased, in 1997-1998, ENR and APX both increased notably, ENR by a slightly larger amount than APX. GNI and POP showed no measurable change.

Table 70
Coded Changes in Demand Side Variables, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points	Change Counts					
AWL Increases	1984-1985	+		-		0	N/a
		O	N	O	N		
GNI	3	1	1	0	0	0	0
POP	-3	0	0	1	1	0	0
ENR	1	1	0	0	0	0	0
AWL Decreases	1981-1982	+		-		0	N/a
		O	N	O	N		
GNI	1	1	0	0	0	0	0
POP	-3	0	0	1	1	0	0
ENR	-3	0	0	1	1	0	0

Table 71
Coded Changes in Demand Side Variables, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points	Change Counts					
AWL Increases	N/a	+		-		0	N/a
AWL Decreases	1997-1998	+		-		0	N/a
		O	N	O	N		
GNI	0	0	0	0	0	1	0
POP	0	0	0	0	0	1	0
ENR	3	1	1	0	0	0	0

These findings suggest a slightly positive association between GNI and ENR in association with AWL. The POP results were inconclusive in determining any association between POP and AWL.

c. United Kingdom

RPS

As AWL increased, GNI and ENR data suggested a positive association to AWL. GNI showed the strongest association, with two years of notable change. ENR had one year of notable increase and one year of non-notable decrease. POP showed a fairly

neutral association to AWL, with two years of non-notable increase balanced by a year of notable decrease in growth. As AWL decreased, GNI and POP increased, while ENR decreased. GNI showed the strongest negative association, increasing once notably followed by POP that also increased once notably, but that also experienced a year of non-notable decrease. ENR decreased notably once.

Table 72
Coded Changes in Demand Side Variables, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points			Change Counts					
AWL Increases	1983-1984	1984-1985	1990-1991	+		-		0	N/a
				O	N	O	N		
GNI	3	3	0	2	2	0	0	1	0
POP	3	-1	-1	1	1	2	0	0	0
ENR	-1	3	0	1	1	1	0	1	0
AWL Decreases	1980-1981	1989-1990		+		-		0	N/A
				O	N	O	N		
GNI	2	0		1	1	0	0	1	0
POP	3	-1		1	1	1	0	0	0
ENR	-2	0		0	0	1	1	1	0

Post-RPS

During the year of increased AWL, POP and ENR decreased and GNI increased. The only variable to have a notable change was POP. As AWL decreased, GNI and ENR increased, POP decreased. All four variables experienced one year of notable change, with the remaining years showing no measurable change.

The findings suggest that both GNI and APX grew positively regardless of AWL levels. POP results were difficult to interpret due to drawing conclusions from different selection points. ENR seemed to be important, but difficult to determine for the whole 20-year period, as the results trend towards a positive association during RPS and a negative association post-RPS.

Table 73
Coded Changes in Demand Side Variables, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points			Change Counts					
AWL Increases	1991-1992			+		-		0	N/a
				O	N	O	N		
GNI	1			1	0	0	0	0	0
POP	-2			0	0	1	1	0	0
ENR	-1			0	0	1	0	0	0
AWL Decreases	1997-1998	1998-1999	2000-2001	+		-		0	N/A
				O	N	O	N		
GNI	0	2	0	1	1	0	0	2	0
POP	0	0	-3	0	0	1	1	2	0
ENR	2	0	N/a	1	1	0	0	1	1

d. France

RPS

As AWL increased in 190-1991, POP, and to a lesser degree, GNI decreased, while ENR increased. In 1989-1990, as AWL decreased, GNI increased slightly and POP decreased.

Table 74
Coded Changes in Demand Side Variables, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points	Change Counts					
AWL Increases	1990-1991	+		-		0	N/a
		O	N	O	N		
GNI	1	1	0	0	0	0	0
POP	-2	0	0	1	1	0	0
ENR	3	1	1	0	0	0	0
AWL Decreases	1989-1990	+		-		0	N/A
		O	N	O	N		
GNI	1	1	0	0	0	0	0
POP	-2	0	0	1	1	0	0
ENR	0	0	0	0	0	1	0

Post-RPS

In 1996-1997, as AWL increased, POP increased and ENR decreased, both notably; GNI and APX showed no measurable change. In the years of decreasing AWL, all four demand-side variables increased – suggesting a negative association to AWL.

Table 75
Coded Changes in Demand Side Variables, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points					Change Counts					
AWL Increases	1996-1997					+		-		0	N/a
						O	N	O	N		
GNI	0					0	0	0	0	1	0
POP	2					1	1	0	0	0	0
ENR	-2					0	0	1	1	0	0
AWL Decreases	94-95	95-96	97-98	98-99	99-00	+		-		0	N/A
						O	N	O	N		
GNI	1	0	1	2	3	4	2	0	0	1	0
POP	0	1	2	1	0	3	1	0	0	2	0
ENR	2	3	2	0	0	3	3	0	0	2	0

The results of the demand side variables reviewed suggest that GNI and POP growth occurs independently of AWL. ENR seems to have a small negative association with AWL.

e. Germany

RPS

During the RPS, GNI, and to a lesser degree, POP results suggested a negative association to AWL. ENR results suggested a positive association.

Post-RPS

As AWL decreased during the post-RPS period, GNI, APX, and POP seemed to have a negative association with AWL. ENR results were mixed, increasing and decreasing and equal number of times.

Table 76
Coded Changes in Demand Side Variables, and Count of Changes During Selected Points 1980-1991

Variable	Selection Points		Change Counts					
AWL Increases	N/a		+		-		0	N/a
			O	N	O	N		
AWL Decreases	1980-1981	1989-1990	+		-		0	N/A
			O	N	O	N		
GNI	2	1	2	1	0	0	0	0
POP	3	0	1	1	0	0	1	0
ENR	-3	-2	0	0	2	2	0	0

Table 77
Coded Changes in Demand Side Variables, and Count of Changes During Selected Points 1991-2001

Variable	Selection Points				Change Counts					
AWL Increases	N/a				+		-		0	N/a
					O	N	O	N		
AWL Decreases	94-95	98-99	99-00	00-01	+		-		0	N/A
					O	N	O	N		
GNI	2	2	2	1	4	3	0	0	0	0
POP	1	2	0	1	3	1	0	0	1	0
ENR	1	-1	0	N/a	1	0	1	0	1	1

Overall, these findings suggested a negative association between GNI, POP and AWL; and a slightly positive association between ENR and AWL.

2. Odds Ratio Analysis

a. GNI

Question 1: What is the likely association between each explanatory variable reviewed and AWL?

Breslow-Day Statistic not computed--the data are too sparse.
Total Sample Size = 105

Table of awld by dir

awld / Frequency / Percent	dec	inc	Total
dec	2	56	58
	1.90	53.33	55.24
inc	0	47	47
	0.00	44.76	44.76
Total	2	103	105
	1.90	98.10	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	2
Left-sided Pr <= F	1.0000
Right-sided Pr >= F	0.3027
Table Probability (P)	0.3027
Two-sided Pr <= P	0.5007

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.0345	0.0240	0.0000	0.0739	0.0062	0.1046
Row 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0618
Total	0.0190	0.0133	0.0000	0.0410	0.0034	0.0587
Difference	0.0345	0.0240	-0.0049	0.0739		

Difference is (Row 1 - Row 2)

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period?

Table of awld by dir

awld	dir		
Frequency / Percent	dec	inc	Total
dec	1	23	24
	1.82	41.82	43.64
inc	0	31	31
	0.00	56.36	56.36
Total	1	54	55
	1.82	98.18	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	1
Left-sided Pr <= F	1.0000
Right-sided Pr >= F	0.4364
Table Probability (P)	0.4364
Two-sided Pr <= P	0.4364

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.0417	0.0408	0.0000	0.1088	0.0021	0.1829
Row 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0921
Total	0.0182	0.0180	0.0000	0.0478	0.0009	0.0834
Difference	0.0417	0.0408	-0.0254	0.1088		

Difference is (Row 1 - Row 2)

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period?

Table of awld by dir

awld	dir		
Frequency / Percent	dec	inc	Total
dec	1	33	34
	2.00	66.00	68.00
inc	0	16	16
	0.00	32.00	32.00
Total	1	49	50
	2.00	98.00	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	1
Left-sided Pr <= F	1.0000
Right-sided Pr >= F	0.6800
Table Probability (P)	0.6800
Two-sided Pr <= P	1.0000

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.0294	0.0290	0.0000	0.0771	0.0015	0.1321
Row 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.1707
Total	0.0200	0.0198	0.0000	0.0526	0.0010	0.0914
Difference	0.0294	0.0290	-0.0182	0.0771		

Difference is (Row 1 - Row 2)

b. POP

Question 1: What is the likely association between each explanatory variable reviewed and AWL?

Summary Statistics for awld by dir
Controlling for period

Breslow-Day Test for
Homogeneity of the Odds Ratios

Chi-Square	0.1319
DF	1
Pr > ChiSq	0.7164

Cochran-Mantel-Haenszel Statistics (Based on Table Scores)

Statistic	Alternative Hypothesis	DF	Value	Prob
3	General Association	1	0.0489	0.8251

Estimates of the Common Relative Risk (Row1/Row2)

Type of Study	Method	Value	90% Confidence Limits	
Case-Control	Mantel-Haenszel	0.9093	0.4500	1.8371

Total Sample Size = 104

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period?

Table of awld by dir

awld / dir	dec	inc	Total
dec	9	12	21
	16.67	22.22	38.89
inc	16	17	33
	29.63	31.48	61.11
Total	25	29	54
	46.30	53.70	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	9
Left-sided Pr <= F	0.4512
Right-sided Pr >= F	0.7525
Table Probability (P)	0.2038
Two-sided Pr <= P	0.7827

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.4286	0.1080	0.2509	0.6062	0.2450	0.6281
Row 2	0.4848	0.0870	0.3417	0.6279	0.3326	0.6393
Total	0.4630	0.0679	0.3514	0.5746	0.3459	0.5832
Difference	-0.0563	0.1387	-0.2844	0.1718		

Difference is (Row 1 - Row 2)

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period?

Table of awld by dir

awld / dir	dec	inc	Total
dec	24	10	34
	48.00	20.00	68.00
inc	11	5	16
	22.00	10.00	32.00
Total	35	15	50
	70.00	30.00	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	24
Left-sided Pr <= F	0.6824
Right-sided Pr >= F	0.5720
Table Probability (P)	0.2545
Two-sided Pr <= P	1.0000

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.7059	0.0781	0.5773	0.8344	0.5524	0.8309
Row 2	0.6875	0.1159	0.4969	0.8781	0.4517	0.8679
Total	0.7000	0.0648	0.5934	0.8066	0.5763	0.8051
Difference	0.0184	0.1398	-0.2115	0.2483		

Difference is (Row 1 - Row 2)

c. ENR

Question 1: What is the likely association between each explanatory variable reviewed and AWL?

Summary Statistics for awld by dir
Controlling for period

Breslow-Day Test for
Homogeneity of the Odds Ratios

Chi-Square	2.5454
DF	1
Pr > ChiSq	0.1106

Cochran-Mantel-Haenszel Statistics (Based on Table Scores)

Statistic	Alternative Hypothesis	DF	Value	Prob
3	General Association	1	0.3601	0.5484

Estimates of the Common Relative Risk (Row1/Row2)

Type of Study	Method	Value	90% Confidence Limits	
Case-Control	Mantel-Haenszel	0.7775	0.3874	1.5604

Total Sample Size = 100

Question 2: What is the likely association between each explanatory variable reviewed and AWL, during the RPS period?

Table of awld by dir

awld dir

Frequency| Percent	dec	inc	Total
dec	9	14	23
	16.36	25.45	41.82
inc	10	22	32
	18.18	40.00	58.18
Total	19	36	55
	34.55	65.45	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	9
Left-sided Pr <= F	0.8144
Right-sided Pr >= F	0.3735
Table Probability (P)	0.1879
Two-sided Pr <= P	0.5772

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.3913	0.1018	0.2239	0.5587	0.2216	0.5832
Row 2	0.3125	0.0819	0.1777	0.4473	0.1804	0.4721
Total	0.3455	0.0641	0.2400	0.4509	0.2394	0.4645
Difference	0.0788	0.1307	-0.1361	0.2937		

Difference is (Row 1 -2)

Question 3: What is the likely association between each explanatory variable reviewed and AWL, during the post-RPS period?

Table of awld by dir

awld dir

Frequency| Percent	dec	inc	Total
dec	12	19	31
	26.67	42.22	68.89
inc	9	5	14
	20.00	11.11	31.11
Total	21	24	45
	46.67	53.33	100.00

Fisher's Exact Test

Cell (1,1) Frequency (F)	12
Left-sided Pr <= F	0.1021
Right-sided Pr >= F	0.9727
Table Probability (P)	0.0749
Two-sided Pr <= P	0.1961

Column 1 Risk Estimates

	Risk	ASE	(Asymptotic) 90% Confidence Limits		(Exact) 90% Confidence Limits	
Row 1	0.3871	0.0875	0.2432	0.5310	0.2408	0.5504
Row 2	0.6429	0.1281	0.4322	0.8535	0.3904	0.8473
Total	0.4667	0.0744	0.3443	0.5890	0.3379	0.5988
Difference	-0.2558	0.1551	-0.5109	-0.0007		

Difference is (Row 1 - Row 2)