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# The relationship between temperature and sales

## Sales data analysis of a retailer of branded women's business wear

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### Abstract

**Purpose** – The influence of weather on business activities and human behaviour has been explored in several fields (e.g. finance and psychology), but little research about weather and retail sales is found in the retail or fashion literature. The purpose of the study is to analyse the relationship between temperature, one aspect of weather, and retail sales of seasonal garments.

**Design/methodology/approach** – The researchers collected sales data from a retailer of branded women's business wear in the Seoul-Kyunggi area in South Korea. Along with the sales data for seasonal basic styles, corresponding daily and weekly average temperature data were collected and evaluated. The analysis for the study was drawn using descriptive statistics including graphical evaluations, correlation analysis and paired samples *t*-test. Interviews with the retailer's merchandisers were used to supplement interpretation of the statistical data.

**Findings** – Results of this study provide strong evidence that fluctuations in temperature can impact sales of seasonal garments. During sales periods when drastic temperature changes occurred, more seasonal garments were sold. However, the temperature changes from day to day or week to week did not affect the number of garments sold for the whole season. Of the seasonal garments expected to sell within the same season, the selling periods of each product category differed depending on type of fabric and design. For some seasonal garments, the actual sales dates were one week to two weeks in variance from the merchandisers' forecasts.

**Research limitations/implications** – Limitations in the sample (i.e. product category) and location of stores (i.e. geographic region) prevent the generalization of results to all seasonal garments or retailers. In spite of these limitations, this study can be a pilot study that supports the significant relationship between temperature and sales of seasonal basic products by quantifying the temperature effects on sales of particular products. Therefore, future studies are needed to establish generalized conclusions with a larger sample.

**Originality/value** – As little academic research is available about weather's effect on sales of garments, the present study contributes to the field of clothing and retail distribution by providing evidence of significant relationships between temperature and sales of seasonal clothing.

**Keywords** Weather, Sales, Temperature, Retail, Clothing

**Paper type** Research paper

### Introduction

The sale of seasonal products is a major characteristic of many consumer goods and an important activity for the retailers who promote, sell and service these goods. A



seasonal good is defined as a product that experiences drastic change in sales based on the evolving seasons of the year (Kincade and Gibson, 2010). Inherent in the seasonal aspect of consumer goods is a reflection of the seasonal changes as measured in correspondence to the calendar seasons (i.e. Spring, Summer, Fall, Winter). This seasonality is compounded by the demand in the fashion industry for frequent and continuous change (Bhardwaj and Fairhurst, 2010).

One of the characteristics of fashion markets is the ephemerality of the seasonal items, which means selling periods of the products are likely to be very short, estimated in months or weeks (Christopher *et al.*, 2004). Careful timing of the sale of seasonal merchandise is of concern for retailers who handle these products. If the product is presented to consumers too early, the product will not sell. If offered too late, the demand may also be low and the consumers may need price reductions in order to be motivated to buy. Unless retailers take seasonal planning into careful consideration and co-ordinate through supply chain management, end-of-season stock will remain unsold (Al-Zubaidi and Tyler, 2004). Systematic assortment planning of when to present seasonal products in the stores could affect initial sales and final sell-through. In order to control production and inventory effectively and ultimately to maximize sales and profit, the exact selling period of each item needs to be forecasted scientifically by retailers. These retail strategies are strongly held in the industry but are rarely tested empirically in the academic literature.

This careful preparation of assortment planning related to seasons may be further complicated with abrupt or unusual changes in the weather. Although weather has always changed as a result of various natural causes in the past, recently non-natural causes (e.g. green house gas) have been blamed for unpredictable weather fluctuations. Predicting the exact date for the beginning of a season (e.g. Fall) is a meteorological event but predicting the exact date for the first cool days becomes more difficult. For this reason, a number of retailers are currently working in conjunction with the Meteorological Office to develop models, which enable them to use weather changes and adjust inventory levels of some seasonal products (Rowley, 1999). Some clothing retailers have hired climatologists to better time the shipments of seasonal garments or set up a climate team to provide advice on what kind of clothing to sell all around the year. A survey undertaken by Datamonitor for the Meteorological Office indicates that in the UK grocery and clothing sectors, applying weather forecast information to merchandise planning could increase sales by £4.5 bn per year (Curtis, 2003). As the weather information offered by forecast services has become more accurate, retailers need to learn about the relationship between weather and sales of their products to utilize the information in merchandise planning. Although the retail industry is beginning to consider and test long held theories about weather and sales, limited academic work appears about retail issues and the weather.

The purpose of the study is to analyse the relationship between weather and the sales of seasonal garments. The specific areas of interest in this study lie in recent temperature fluctuations and sales of seasonal clothing, relationships between temperature changes and sales patterns of each seasonal garment made of specific fabric, and selling periods of each seasonal garment determined by temperature ranges and traditional dates. From extensive work experience in the clothing industry, the researchers acknowledge that temperature often affects consumers' purchasing behavior for seasonal goods and many retailers will state that an early frost will help

sweater sales or a late Spring will slow the sales of light coloured dresses. For this reason, temperature was selected as the weather variable for this study instead of other weather variables (e.g. precipitation, humidity).

The overall objective of this study is to analyse the relationship between temperature and sales of seasonal clothing items. Research questions to be addressed in this study are as follows:

- RQ1.* What is the relationship between sales of all selected seasonal garments and changes in temperature?
- RQ2.* What are the relationships between sales patterns of each seasonal garment made of specific fabrics and weekly average temperatures?
- RQ3.* What is the difference between the selling periods related to temperatures found from this research study and the selling periods generally established by clothing retailers?

### **Literature review**

#### *Temperature fluctuations*

Weather and fluctuations in weather are acknowledged by major segments of the US economy as important influences often determining the level of success or failure for running businesses (Ellithorpe and Putnam, 2000). In some industries such as agriculture and energy, weather is such a major risk factor that it is documented, tracked and traded through risk management strategies. To hedge the risk resulting from weather variations in the energy industry, weather derivatives have been traded since 1996, when Aquila Energy structured a dual-commodity hedge for a consolidated Edison Co. Weather derivative contracts include three of the non-energy industries: agriculture, resort, and clothing (Ellithorpe and Putnam, 2000). Leggio (2007) reported that a firm could reduce its revenue volatility up to 80 percent by adding weather derivatives to a firm's portfolio of risk management tools.

A number of weather derivative contracts in the market are temperature-related (Ellithorpe and Putnam, 2000). The reasons are:

- the existence of abundant historical temperature data; and
- the initial demand for the weather product from end-users whose businesses have been affected by temperature.

The weather derivative market has grown considerably in the early years of 2000. Part of the increased interest in weather derivatives is the interest in global warming. Global warming is generally known as a gradual rise in temperature of the surface of the earth and atmosphere. According to an assessment report in 2000, by the Intergovernmental Panel on Climate Change (IPCC), globally averaged surface temperatures have increased by  $0.6 \pm 0.2$  °C over the twentieth century, and it further predicts that temperatures will warm between 1.4° and 5.8°C by 2100 compared to 1990.

#### *Weather and general consumer behavior*

Although weather has received limited attention in the retail, or clothing, field, this topic has been studied in several related fields. The influence of weather on business

activities and human behavior has been explored in finance and psychology. Several researchers have investigated the impact of weather variables (e.g. sunlight and temperature) on stock trading activities, and they reported mixed results (e.g. Goetamann and Zhu, 2005; Kang *et al.*, 2009; Lee and Wang, 2010; Levy and Galili, 2008; Symeonidis *et al.*, 2010). In addition, early weather and consumer behavior studies examined weather variables, the mood of consumers, and their related behaviors. Many of these studies appeared in the psychology field in contrast to the consumer behavior, clothing, or retail literature. For example, Persinger and Levesque (1983) found that 40 percent of mood evaluations could be explained by a combination of meteorological events such as temperature, humidity, wind speed, and sunshine hours. Howarth and Hoffman (1984) reported that ten mood variables (e.g. anxiety, concentration) were associated with eight weather variables (e.g. hours of sunshine, temperature). In more recent research studies, several researchers found that high ambient temperatures would facilitate aggression and other psychological or mood changes (e.g. Keller *et al.*, 2005; Rind and Strohmetz, 2001; Rotten and Cohn, 2000; Wissmath *et al.*, 2009). Although results are mixed, many of these psychological-based researchers found that a curvilinear relationship between mood and temperature exists and recommended additional studies with more variables.

In a study focusing on consumer shopping behavior, the linkage among weather, mood, and purchase behavior was discussed in Parsons' (2001) study, which followed the research track of several previous consumer studies (e.g. Babin and Darden, 1996; Groenland and Schoormans, 1994; Swinyard, 1993). Parson's (2001) examined the impact that weather has on daily shopping behavior by counting the number of daily pedestrian shoppers for a shopping center in New Zealand. He used a multiple regression analysis with the weather variables of rainfall and temperature and provided information about consumers' shopping decisions. He found that the weather variables (i.e. rainfall and temperature) are associated with the number of shoppers who visited the shopping center with the evidence that other independent variables (e.g. holidays, day-of-the-week) also have an impact on the traffic. As rainfall or the maximum temperature increased, shopper count decreased.

In various retail venues, some researchers have found associations between weather and retail store traffic (Fox, 1993), ski lift ticket sales (Shih *et al.*, 2009), car sales (Ibrahim and McGoldrick, 2006), and the number of visitors to a tourism web site (Lim *et al.*, 2010). These studies provide some insight on consumer shopping behaviors but were not focused on clothing.

#### *Weather and retail sales of clothing*

Although some general weather and shopping studies show that consumers are more concerned about precipitation (i.e. snow or rain) than temperature (i.e. cold or hot), clothing shopping may be one exception. Precipitation may affect consumers' trips to retail stores, but retailers have long suspected that temperatures affect actual clothing purchases (Rowley, 1999). The classic example used in the clothing industry to show the impact of temperature is the holiday of Easter. The placement of Easter varies in the calendar according to the cycles of the moon. If Easter occurs early in March rather than later in April, retailers report that consumers tend to purchase less Spring clothing products. The assumption is that the cooler temperatures generally experienced in March versus April delay consumer purchasing of Spring clothing (Souvenirs, Gifts, and

Novelties, 2005). In another example of weather and clothing industry changes, a harsh Winter that is colder than average is far better for clothing sales than a Winter with mild temperatures. In some parts of the US in September of 2006, the temperature was 10 percent (7° Fahrenheit) below the normal average for the month, while in September 2007, in many regions temperatures remained significantly above the average temperature. This relatively warm weather in September of 2007 caused a sharp drop in the seasonal clothing sales of many retailers (Chain Store Age, 2007).

Even with the trade evidence of the impact of weather on consumers' clothing spending, (Souvenirs, Gifts, & Novelties, 2005), only a few research studies about weather and consumer shopping behavior for clothing are found in the academic literature. Stoltman *et al.* (1999) used weather condition as one of six factors that affect behavioral reactions while shopping for clothes. They found that unpleasant weather conditions are associated negatively with consumers' purchasing behavior. Conlin *et al.* (2007) found evidence of weather-related projection bias of catalogue sales. The relationship identified in their study was that the colder the temperature on the order date of cold-weather fashion items from a catalogue, the more likely the items were returned.

In one of the few academic studies of weather and clothing, the study focused on fibre content of clothing. According to Travers and Payne (1997), the popularity of cotton in respondents' clothes increased eight percent over five years while the popularity of wool dropped. They proposed that the change might be due to the reduced purchase of Winter coats and the increased supply of jackets and suits in non-wool fabrics sold at a cheaper cost. This consumer change is reflected in changes in the seasonal assortment allocation of the clothing and could be a reflection of temperature changes. Travers and Payne (1997) suggest that clothing retailers have purchased an increasing number of clothing items for Summer and Winter because temperature-wise the Spring and Fall seasons are getting shorter. An alternative explanation is that the effects of extreme outdoor temperatures may be reduced due to heating and air conditioning (Institute for International Trade, 2006). Regardless of indoor temperatures, retailers still need to ensure that the right seasonal merchandise is available at the most appropriate time in order to meet the customers' wants and needs and ultimately to make profitable sales for retailers. For improved assortment planning to increase profitability of retailers and satisfaction of consumers, further study is needed to analyse the relationship between temperature and clothing sales.

### Methods

This study used the case study method to analyse the sales of specific clothing items and variation in temperature. A retailer of branded women's business wear in South Korea provided the sales data of their 50 bestselling styles, presented in their 52 stores in the Seoul and Kyunggi areas from 1 February of 2007 through 29 February of 2008. The bestselling styles were selected because it was known that they were well accepted by consumers and had no defects in product quality, which sometime affects sales patterns as an extraneous variable. Target consumers of this brand are business women aged 30 to 40, who purchase clothing mostly by their career needs. Among the 50 individual styles, the assortment contained 12 styles for Spring, 13 styles for Summer, 11 styles for Fall, and 14 styles for Winter. The new fashionable styles were not selected because the sales of such fashionable items are more likely to be influenced by other factors (e.g. fashion trends, colour choice), which may mitigate the temperature effect on sales.



Instead of fashionable items, basic and carryover styles were selected. The sales data included daily selling counts of each style by the stores in the Seoul and Kyunggi areas. In addition to the sales data, specification sheets for each style with fabric swatches and photos of each style and store addresses were collected. In addition to this data set, the researchers conducted seven interviews with a merchandiser of the brand who knew the history of production, sales, special promotions, and markdowns of the products introduced during the 13 months period of study.

As a result of the interviews, the researchers found:

- no special promotion was conducted during the period;
- all products were marked down in all stores on the same date during the selling period; and
- selected styles did not have any defect in fabrics, overall sewing quality or design.

In addition, the merchandiser asserted that each markdown did not significantly affect sales of these bestselling styles because the brand is in the better price zone. For this pricing zone, the store has a standard markdown policy that begins with a 30 percent markdown on all styles and a 50 percent markdown at the end of each season. This pricing strategy is the consistent policy of this brand and its competitors. Although markdowns were not expected to be an influence, the relationship between sales and markdowns were tested in the data analysis. Day-of-the week was not considered for this study because only weekly sales data were employed instead of daily sales data. In an additional interview, conducted during the end analysis of sales data, the researchers found that holidays do not significantly affect the customers' purchasing behavior of the selected items because stores close on big holidays, such as on Thanksgiving Day or New Years Eve, in South Korea. Moreover, the interviewer commented that sales have not increased on holidays because women's business wear is rarely considered as a gift on holidays. Thus, the sales of selected bestselling seasonal items were not regarded as being associated with day-of-the week or with holidays. For validity of the study, correlations with sales and markdown were also investigated.

The temperature data sets used for this research were provided by the Korea Meteorological Administration, the most reliable weather service organization in South Korea. Celsius employed by South Korea was used as the scale of temperatures for the study while the Fahrenheit scale is still used in some countries (e.g. the US). The period covered by the temperature data is correspondent to the period of the sales data. The temperature data set contained the daily average temperature record from the Seoul Station. Each weekly average temperature was obtained by the researchers' calculating mean of daily average temperatures of a week (from Monday through Sunday). Some data included weekly average lowest temperatures in the case of Fall and Winter products because people are more likely to feel coldness by the lowest temperature of the day in the Fall and Winter. In contrast, other data included weekly average highest temperatures in the case of Spring and Summer products because people are more likely to feel warmth by the highest temperature of the day in the Spring and Summer. Each weekly average lowest (highest) temperature was procured by calculating the mean of daily lowest (highest) temperatures of a week (from Monday through Sunday). Rainfall, snow, sunshine, and humidity were not controlled because



the period covered did not show any abnormal climate fluctuations related to those weather variables as compared to the past.

The sample size of each analysis varied depending on selling pieces and selling periods of each garment style. Descriptive statistics, graphical evaluations, correlation analysis, and paired samples *t*-test were used to analyze the data. For descriptive statistics and graphical evaluations, Excel 2007 was used, and for correlation analysis and paired samples *t*-test, SPSS 16.0 was employed.

Results

*Correlation between sales and markdown*

Markdown is known as one of the strongest drivers of consumer purchases. According to a consumer survey, 57 percent of households reported that a markdown would attract consumers to buy end-of the season Winter clothing, even without an immediate need, if the price was right for the consumers (Souvenirs, Gifts, & Novelties, 2005). For validity of the current study, potential extraneous variables (e.g. markdown or discounting) known to affect sales patterns of seasonal garments were taken into consideration and controlled. To examine if a significant correlation existed between sales of seasonal garments and markdown, the two variables were examined in a Pearson Correlation, and the findings were confirmed by the interviews.

The correlations among the sales of bestselling seasonal products and markdowns are summarized in Table I. The sample sizes of the data across seasons vary because each season has a unique period of time and day-offs for the stores. For example, Spring season was examined from February 1 to May 31, excluding three days of day-offs, so the sample size is 117 (*n* = 117). The lack of correlation between sales of seasonal garments (i.e. Spring, Summer and Fall products) and markdowns suggest that the markdown is largely unrelated to customers' purchasing decisions of bestselling seasonal career clothing (see Table I). This finding is confirmed by the comments from the merchandiser as follows:

Most of our customers are aware that our brand always marks down by 30 percent every new seasonal product. They don't care if it's 30 percent or 50 percent markdown if they want the product.

The merchandiser also noted that:

I know if there is no significant effect of 50 percent markdowns on selling products, we don't have to do that. However, our competitors and leading brands of our market have done it for long, so we have actually no choice on that. We simply do as other companies do.

**Table I.**  
Correlations among sales  
of seasonal products and  
markdowns

Season	Correlations with markdowns	<i>N</i> (Period of season, days)	Sig. (two-tailed)
Sales of Spring products	0.018	117	0.847
Sales of Summer products	0.069	150	0.401
Sales of Fall products	− 0.036	113	0.707
Sales of Winter products	0.196 *	138	0.021

**Note:** Correlation is significant at the 0.05 level (two-tailed)

In contrast to the non-significant findings between the Spring, Summer and Fall sales and markdowns, a relationship between sales of Winter products and markdown was found (Correlation = 0.196,  $p < 0.05$ ). As a result of the interviews with the merchandiser and analysis of company documents, the researchers agreed that this correlation was not the discounting effect on sales but more of the effect of the timing of the markdown in the Winter in variance with the timing during the three other seasons. In the Spring, Summer and Fall seasons, products were marked down by 50 percent one month before each season ended, but Winter products were marked down by 50 percent three months before the season ended. With three months before the end of the season, consumers are still willing to buy seasonal products because enough time remains so that at the time they can wear the seasonal garments they purchase, regardless of the level of markdown. Three months are considered, by the merchandiser, as a long enough period of time for consumers to purchase and wear new seasonal garments.

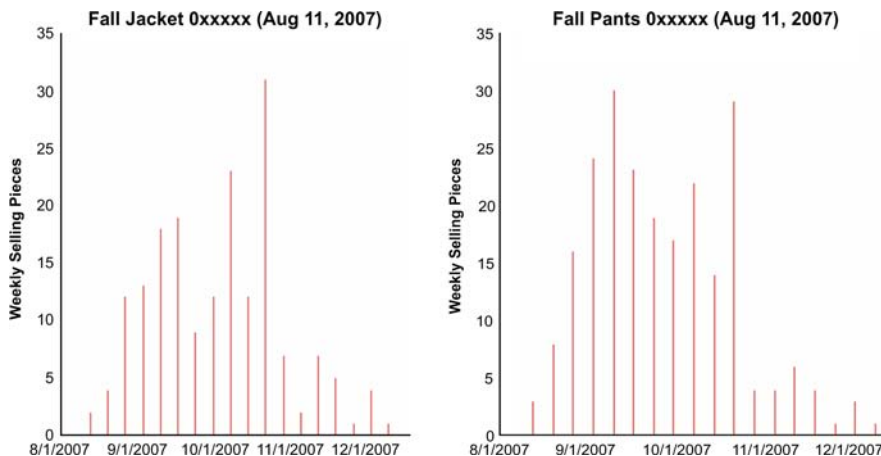
As a result of analysis of correlation and confirmative interviews, the researchers concluded that markdowns had no meaningful correlations with sales of the bestselling seasonal garments. In the subsequent analysis, markdowns were not controlled as an extraneous variable in this research.

*The relationship between sales of all seasonal garments and changes in temperature*

Overall, the weekly sales of the 50 bestselling seasonal garments, selected by the merchandiser, showed quadratic shapes that are similar to the product life cycle and normal distribution of clothing products (see Figure 1). Most seasonal garments have a 12 weeks selling period (i.e. Spring and Fall items) while 20 weeks of selling periods are more common for Summer and Winter items (see Figure 1). Two types of weekly sales patterns were discovered:

- (1) uni-modal (one mid-peak point); and
- (2) bi-modal (two mid-peak points).

These graphs also show that these two styles had approximately 15 weeks of selling period. Of the 50 selected seasonal garments, 41 styles had one mid-peak point and nine



**Figure 1.**  
Two types of graphs of  
weekly sales of seasonal  
garments; unimodal and  
bimodal. The two styles  
were presented in stores  
on August 11, 2007

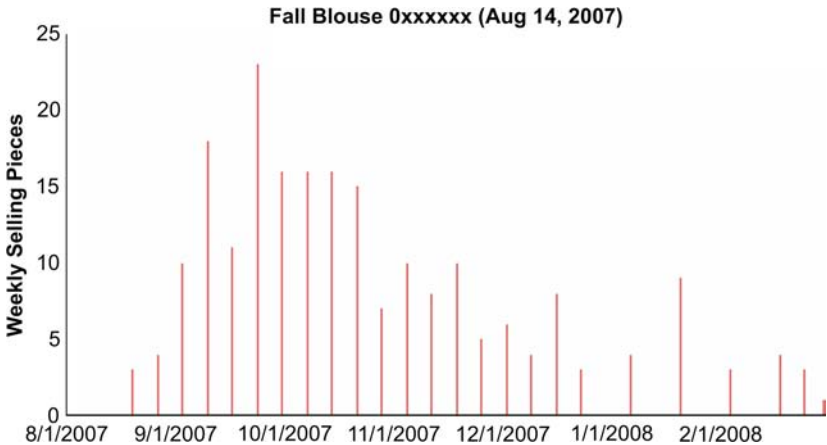
styles had two mid-peak points. In general, bottoms (e.g. trousers, skirts) had two mid-peak points and longer selling periods, while tops (e.g. jackets, coats) had one mid-peak point and shorter selling periods compared to bottoms.

The degree of seasonality of a garment was also seen as a factor in the sales to temperature relationship. A garment with a stronger seasonality had a sharper drop in sales after the mid-peak point than garments with less seasonality. Stronger seasonality was related to weight of the fabric and the lightness or darkness of the colour. For example, a silk blouse, which was categorized as a Fall seasonal item because of its colour and fabric thickness but was also wearable during the Winter season, had a more flat shape in the weekly sales graph and a longer selling period (4-12 weeks longer) than other items, which had stronger seasonality, such as wool jackets (see Figure 2). In addition, the sales of the low seasonality Fall blouse did not drop sharply after its mid-peak point. Figure 2 shows the 24 weeks of the selling period and does not include any weeks of no sales.

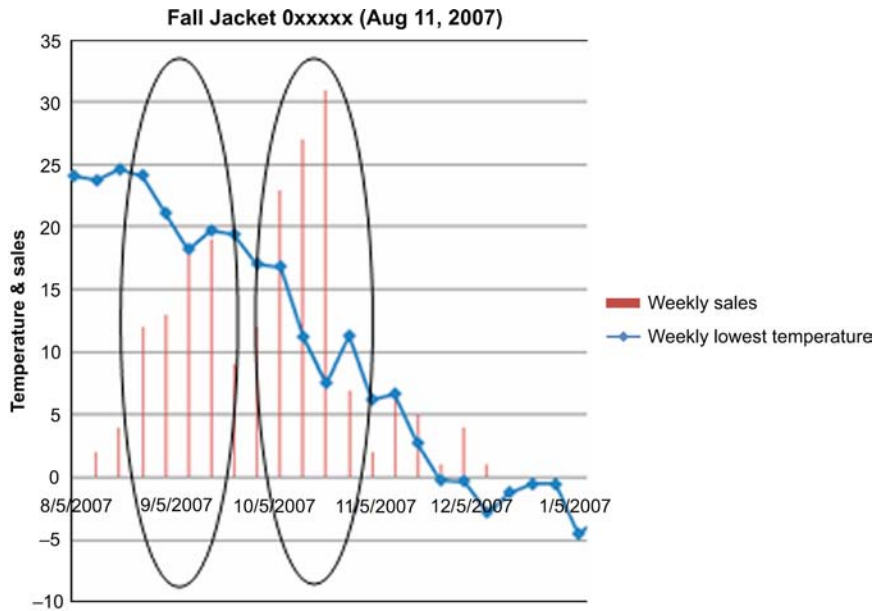
The results of the analysis show that when the temperature changed drastically, more seasonal garments were sold. In particular, when the temperature dropped quickly in the Fall and Winter seasons, the sales of seasonal garments soared. In the case of a bestselling Fall jacket made of 100 percent wool with a weight of 9.5 oz (i.e. a strongly seasonal item), the sales sharply increased when the temperature drastically dropped for two consecutive weeks (see Figure 3). Another example shows that the sales of a bestselling Winter coat made with 100 percent wool with a weight of 16 oz (i.e. heavy weight that would be considered highly seasonal for Winter), sharply increased when the temperature dropped drastically and went below 0° Celsius, a temperature at which people typically feel Winter coldness (see Figure 4). However, the temperature changes from day-to-day or week-to-week did not affect the number of garments sold for the whole season when compared to the sales of the previous year.

*The relationship between sales patterns of each seasonal garment made of same fabrics with style variations and weekly average temperature*

Among the seasonal garments that were expected to sell within the same season, the selling periods of each varied depending on the type of design for each product. For



**Figure 2.**  
Weekly sales of a Fall blouse, which was presented in stores on August 14, 2007



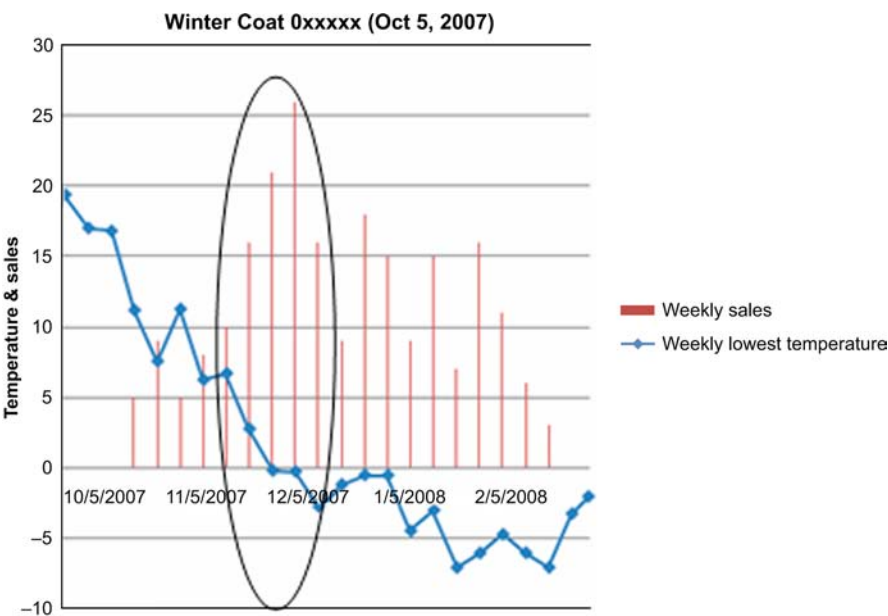
**Notes:** The bars show weekly selling pieces of this item, and the line is the weekly average lowest temperatures. The two ovals show that sales drastically increase as temperature drops

**Figure 3.**  
Weekly sales of a  
bestselling Fall jacket by  
weekly average lowest  
temperature

example, two Fall jackets that were made with the same fabric, 100 percent polyester with a 7.5 oz weight, but with a different style length, had different selling periods. The long style jacket (length: 38.5 inches) sold four weeks longer (from the third week of November through the second week of December) than the time period of sales for the short jacket (30 inches) (see Figure 5). This result implies that long jackets could be sold in a wider range of temperatures than shorter jackets. Perhaps, consumers expect that garments with a long length can give them more warmth over a longer period than the short length garments. If purchased in the Fall, a jacket, if considered appropriate by the consumer, can be worn for a longer period or across multiple seasons; therefore, explaining the longer selling period for the long jacket.

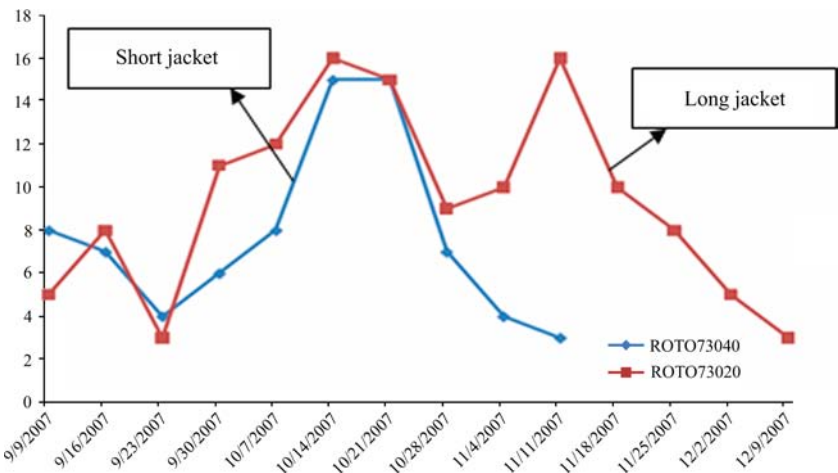
*The difference between the selling periods related to temperatures found from this research study and the selling periods generally established by clothing retailers*

In the case of some seasonal garments, one-week or two-week differences were found between the selling periods based on temperature ranges and the selling periods merchandisers expected. The differences included changes in the timing of the start date and mid-peaks of the selling periods. Figure 6 shows weekly selling pieces of a bestselling Spring jacket, which was presented in stores on February 18; however, the first purchases by customers (i.e. retail sales) occurred on March 4. Through the interview, the researchers found that the merchandisers expected this item to be sold as soon as it was displayed (i.e. mid-February). Selling periods of similar products from the previous year were used in merchandise planning for each item in the subsequent year. Although this style ultimately became one of the bestselling jackets in the Spring



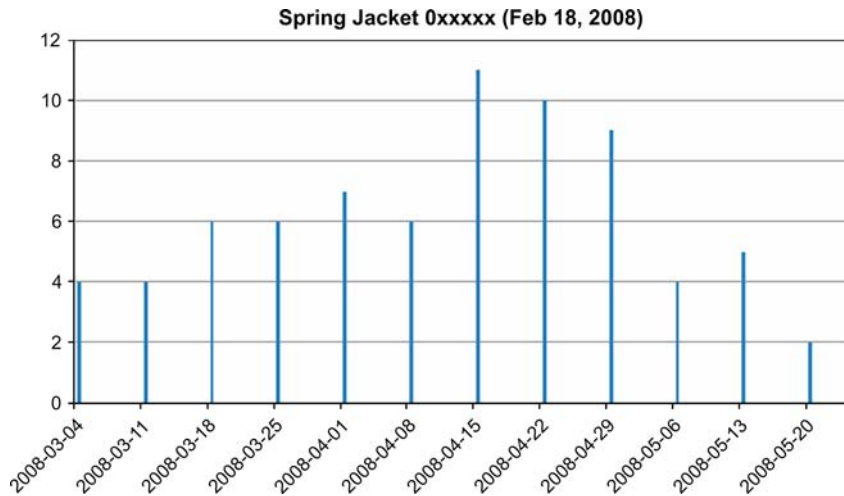
**Figure 4.**  
Weekly sales of a  
bestselling Winter coat  
and weekly average  
lowest temperature

**Notes:** The bars show weekly selling pieces of the coat, and the line is the weekly average lowest temperatures. The oval shows that sales drastically increase as the temperature drops below 0°C

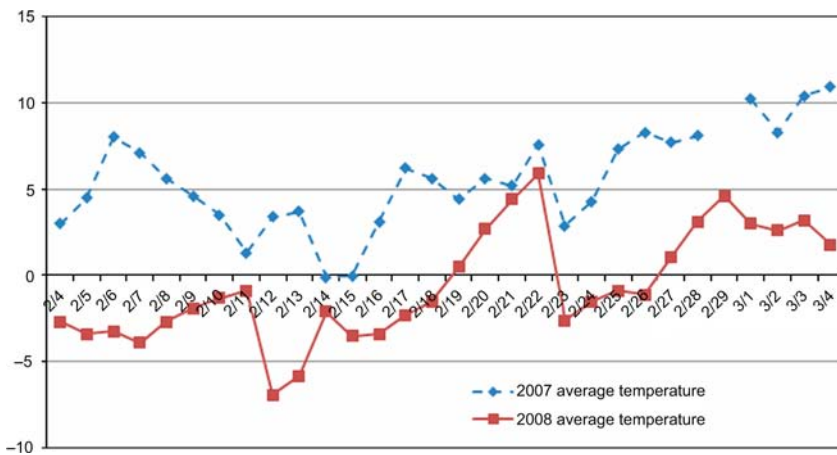


**Figure 5.**  
Comparison of weekly  
sales of two styles made  
with the same fabric. The  
two styles were presented  
in stores on September 5,  
2007

season, the two weeks delay in the onset of sales was statistically related to the temperature differences between the two years. Between the beginning of February and March in the study year, the overall average temperatures were 6.3 degrees lower than those of the previous year (see Figure 7). In addition, the overall average highest temperatures were 6.6 degrees lower than those of the previous year (see Figure 8).



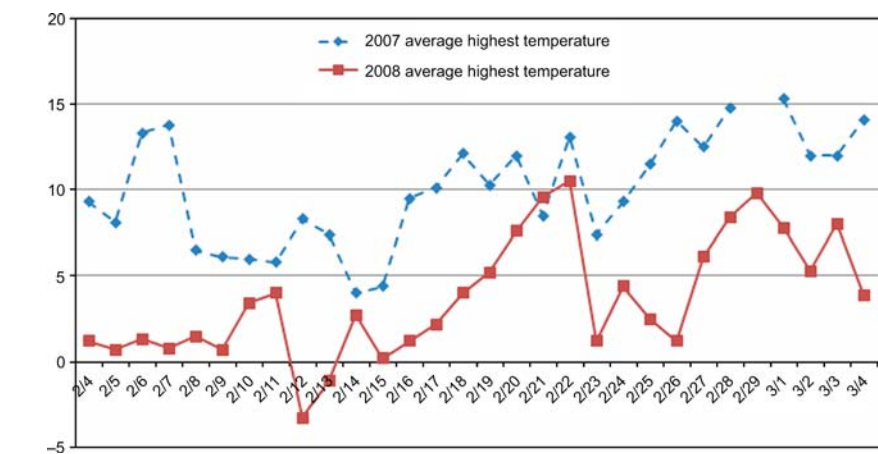
**Figure 6.**  
Weekly sales of a  
bestselling Spring jacket,  
which was presented in  
stores on February 18,  
2008



**Figure 7.**  
Daily average  
temperatures from  
February 4 to March 4,  
2007 and corresponding  
period of 2008

From this temperature comparison, the researchers proposed, and findings were confirmed by the merchandiser, that the prolonged cold weather in February of the year of study prevented consumers from feeling the need for new Spring clothing and delayed their actual buying behavior until the temperatures rose to more normal degrees in the beginning of March. In the clothing industry, February is known generally to be a month for transition of seasonal garments from Winter to Spring. During this season, sales of seasonal garments may be influenced more by temperatures than during any other season. Among the seven bestselling styles, introduced during February in the year of study, the actual retail sales did not occur until one to two weeks later. Figure 7 shows daily average temperatures from February 4 to March 4 for the previous year, and for the corresponding period in the year of study. Figure 8 shows daily highest temperatures from February 4 to March 4 for the previous year and for the corresponding period in the year of study. The difference

**Figure 8.**  
Daily highest  
temperatures from  
February 4 to March 4,  
2007 and corresponding  
period of 2008



between temperatures of February in the two years was estimated with paired-samples *t*-test (see Table II). As a result of the analysis, a significant mean difference (6.34° Celsius) between the average temperatures in the two years was noted ( $t = 12.06$ ,  $p < 0.001$ ). Table III also shows a significant mean differences (6.56° Celsius) between the highest temperatures in the two years ( $t = 10.21$ ,  $p < 0.001$ ).

**Discussion and conclusion**

The present study analysed the relationships between temperature and sales of seasonal clothing. Specific styles of garments and fabrics were included in the study. No previous study was found that investigated the significance of temperature on sales of each seasonal garment by comparing styles in specific fabrics and designs; however, previous research, not related to clothing products, revealed that some weather variables provided guidance for consumer shopping decisions (e.g. Parsons, 2001), and that weather could affect consumers' spending (e.g. Murray *et al.*, 2008).

Within a complex retail context and increased volatility in consumers' spending patterns, this research study contributes to the literature of how weather affects sales

**Table II.**  
Paired-samples *t*-test.  
Comparison of daily  
average temperatures  
from February 4 to March  
4, 2007 and corresponding  
period of 2008

	Mean	Std. deviation	<i>t</i>	Sig. (two-tailed)
Temperature 2007	5.54	2.89	12.06	0.000 *
Temperature 2008	−0.80	3.10		
<b>Note:</b> * <i>p</i> < 0.001				

**Table III.**  
Paired-samples *t*-test.  
Comparison of daily  
highest temperatures  
from February 4 to March  
4, 2007 and corresponding  
period of 2008

	Mean	Std. deviation	t	Sig. (two=tailed)
Temperature 2007	10.05	3.25	10.21	0.000 *
Temperature 2008	3.49	3.35		
<b>Note:</b> * <i>p</i> < 0.001				



by examining the relationship between temperatures and sales of seasonal garments. Several researchers have examined the relationship between emotion or mood and weather variables, such as temperature, humidity, sunshine hours and precipitation (e.g. Goldstein, 1972; Pawlik and Buse, 1994; Sanders and Brizzolara, 1982). Swinyard (1993) and Bagozzi *et al.* (1999) found that mood or emotional states have an impact on consumers' propensity to purchase. Based on the linkage of these three variables (i.e. weather, emotion, consumer behavior), Parsons (2001) found a significant association between daily weather (i.e. temperature and precipitation) and daily shopping patterns for a variety of products.

In addition to the evidence of overall relationships between weather and consumer shopping behavior, retailers are in dire need of more accurate information about weather's effect on clothing sales and systematic strategies for effective seasonal planning by utilizing weather forecast information. The findings from this study allow more retailers to realize that temperature has an effect on clothing sales. Knowledge about this relationship can be used in decision making as part of important assortment decision factors (e.g. sales history, budget) in retailers' buying or merchandise planning processes.

Although many retailers are aware that a significant temperature impact exists on sales of clothing, these retailers still have difficulty in making a precise sales data analysis in combination with temperature information because of the amount of variance in seasonality, styles, colours and fabrics of clothing. This complexity causes retailers not to utilize temperature forecast information in assortment planning for upcoming seasons in spite of the fact that weather forecast data have recently been more accurate and precise. In particular, short-term weather forecasts are more reasonably accurate than long-term forecasts, which can be useful because short-term weather forecasts relate to the fast-fashion trend that many retailers purchase new products in a shorter period (e.g. two-four weeks) than used in traditional planning periods (e.g. several months).

The weather's effect on clothing sales may vary depending on the geographical location of a store (e.g. northern area, southern area), type of products (e.g. women's wear, men's wear) and/or type of store (e.g. department store, independent specialty store). Therefore, each retailer's unique sales data need to be analysed regarding weather (i.e. temperature). The outcomes could be similar or different from the sales data for the particular seasonal basic products analysed in this study. Based on the accumulated sales history compared with temperature data, retailers may be able to use weather forecasts by comparing the past weather with future weather forecasts and ultimately to predict future sales.

Although temperature, one aspect of weather is subject to fluctuations, it could become a more important factor to determine success or failure of clothing sales. By knowing that they could adjust seasonal plans to temperature changes and more efficiently control inventory, clothing retailers could ultimately minimize actual losses. In order for retailers to obtain and/or develop systematic strategies for seasonal planning, understanding the impact of accurate temperature predictions on each seasonal garment style must be fulfilled, and application of the accumulated data to new seasonal lines is then suggested.

The results of this study showed several significant and detailed relationships between temperature and sales of seasonal clothing. First, the plotting of weekly sales

of seasonal garments basically draws quadratic shaped graphs that are similar to both the product life cycle and normal distribution patterns of clothing purchases. Some garments have one mid-peak point, and others have two mid-peak points in their selling periods. Second, seasonal tops (e.g. long sleeve silk blouses) have more flat shaped data in a weekly sales graph and exhibit a longer selling period (4-12 weeks longer) than seasonal outerwear (e.g. wool jackets) for Fall. Third, when temperatures drastically change to a more extreme of the normal, sales of seasonal garments are boosted. For example, if temperatures continually drop in the Fall and Winter, the sales of highly seasonal garments soared. Fourth, long jackets could be sold during periods of wider temperature ranges and could have a longer selling period than short jackets in Fall and Winter seasons. Finally, temperature changes can cause a delay in the onset of sales for seasonal garments particularly in the beginning of new seasons.

The findings of the present study lead to some implications for clothing retailers. As shown in the results, temperatures have an impact on sales of most seasonal clothing for this retailer; therefore, retailers may need to analyze selling periods that include starting, mid-peak, and ending points of each seasonal garment in specific fabrics and designs by linking them to temperature ranges for the sales periods. The researchers suggest that clothing retailers employ an analysis of their historic sales data in assortment planning for upcoming seasons, and utilize temperature reports and forecast information offered by weather forecast services to moderate the assortment plans.

Some limitations are noted for the present study. Because the 13-month sales data were collected by one retailer of branded women's business wear and the stores were located only in the Seoul and Kyunggi areas in South Korea, the findings of the study are limited when generalizing the results to other clothing lines (e.g. men's or children's wear) and areas (e.g. various countries or cities). Therefore, future studies extending the analysis to other clothing lines and using longitudinal analysis of two-year or three year sales data from several areas are suggested. In addition, studies such as the measurement of the outputs from testing the temperature analysis in their seasonal merchandise planning could be done by using Data Envelopment Analysis (DEA). As this present study analysed the relationship between temperature and completed sales of seasonal clothing, a future study should examine the following question that would be beneficial for clothing retailers: how can retailers utilize weather forecast in assortment planning for predicted sales? Lacking previous research on this topic, such work could begin through interviews with retailers and their merchandise planners.

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