

Market Size estimation of Domestic Apparel Retail in India using Predictive Analytics

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Abstract


The ensuing research aims at estimating the future market size of domestic Indian apparel industry. The study is based on secondary data and uses longitudinal study design. Univariate time series data is used in this study and annual retail sales data, collected from reliable secondary sources, for the period 2000 to 2019 forms the basis of generating predictive models. Owing to the available number of observations in the dataset, the researchers have considered Holt's exponential smoothing method for the purpose of model generation and making forecasts. The absence of seasonal component in the time series data suggests the use of double exponential smoothing technique which includes effects of trend only. The analysis begins with the forecast of nineteen years with various combination of the coefficients, namely, α and β values and then deviation computed from the actual data. The deviation or the error estimates, namely MSE, MAPE, and MAD have been used to identify the best model in the present research study. The paper concludes with the actual forecasts for the next three years, 2020 till 2022 using the best model, i.e. the model which has resulted in minimum error. To the best of the knowledge of the researchers, this present study makes a maiden attempt to use Holt's method at an individual level to predict the future market size of the second largest retail industry in India. Apart from the scholarly contribution, the researchers anticipate this study outcome likely to act as an aid to the apparel marketers for their future planning.


Keywords: Domestic apparel retail, forecasting, forecast errors, Holt's exponential smoothing, Indian retail

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Introduction

The Indian apparel industry has emerged as one of the most important sectors in the domestic business space and occupies the second position in value terms (IBEF, 2017; CARE Ratings, 2019). The domestic apparel market size in 2019 was estimated at US\$ 100 billion and the sector attracted huge Foreign Direct Investment (FDI) amounting to US\$ 3.09 billion in a span of nearly 1.5 years between December 2018 and April 2020 (IBEF, 2019). The undeniable importance of apparel sector is understood from the contributions it makes towards the total industrial output, GDP and exports. The Indian apparel segment contributes nearly 7% of the total industrial output, 2% of the country's GDP and contributes to 15% of export earnings (CARE Ratings, 2019). According to a recent estimate, the total apparel market size comprising of both domestic and export grew at a CAGR of 13% during the financial year 2010 to 2018 (CARE Rating, 2019) while the domestic apparel market exhibited a CAGR of 13.8% during the same period (CARE Ratings, 2019). In terms of export income the segment grew at a CAGR of 9.8% between the period 2010 and 2018 (CARE Ratings, 2019). The domestic apparel market growth is observed to be significantly higher than exports and this trend may be attributed to a host of demand drivers like robust economic growth, growing population, advent of digitalization, enhanced total house-hold final consumption, disposable

personal income and demographical changes in the country to name a few. From the perspective of supply side, substantial investments are noticed in this sector by both domestic and global retail players.

While forecasting of the Indian apparel sector have been conducted by some research firms, the exact methods are not disclosed and there appears to be some inconsistency between the predicted values reported by the past researches. As for instances, India Brand equity foundation (IBEF, 2016) reported that total Indian domestic apparel market size was estimated to reach US\$108.5 billion in 2015 from US\$ 78 billion in 2010 with CAGR of 8.7%. According to the report, the extrapolated market size of Indian domestic apparel would touch US\$ 226 billion in 2023 (IBEF, 2016). Another textile and apparel based research organization highlighted that actual Indian domestic apparel market size stood at US\$ 50 billion in 2010 and predicted to reach US\$ 85 billion in 2016 with CAGR of 11% between 2010 and 2016 (Wazir, 2017). By 2025, the Indian apparel market is expected to reach to US\$ 220 billion (Wazir, 2017). Both the research organizations however, did not disclose the forecasting techniques followed. Moreover, research by individuals on Indian retail apparel sales prediction have not been found for the chosen period which further inspires the researchers to explore objectively. The present research makes use of secondary data on Indian domestic apparel retail, collected from multiple reliable secondary sources. Annual time series data for twenty years from 2000 to 2019 forms the observation set and using Holt's exponential smoothing technique, the researchers endeavor to project future apparel retail sales till 2022. Before the final forecast is made, alternative models have been generated and the one with minimum error is used for predictive purpose.

The remaining part of this paper follows a structured approach. Section II elaborates on the review of literature made and the objectives framed for this study. Section III details the methodology used along with various sources from where data is captured. The findings and analysis are discussed in section IV while in section V conclusions have been drawn and the scope for further research are highlighted.

Literature Review

A systematic review on the domestic apparel industry was made by the researchers. Large number of studies have been conducted on this area, however, there appears to be a significant dearth of literature on prediction of market size of domestic Indian apparel retail, especially those making prediction till 2022. The areas that have primarily received research thrust in the Indian apparel context include those of consumer behaviour, supply chain, store choice and consumer perception while, lesser attention is noticed in the area of apparel forecasting. Some of the important works conducted on this domain include that of Venkatesh, Rathi and Patwa (2015) where they have made an analysis on supply chain risks in Indian apparel retail chains. A study on business disruptions in sustainable supply chain management in Indian apparel industries has been made by Nayak (2018). In the consumer behaviour and perception area, studies by Jindal (2013) on private label brand in apparel retail industry have been found. In another study, Rishi (2009) explores the buying behavior of the apparel customers in the organized retail formats. A similar study on analyzing consumer behaviour towards the organized retail sector have been conducted by Rajput and Khanna (2012). Anand and Kheterpal (2014) have studied the growth of apparel industry in India from a qualitative perspective. Mittal and Mittal (2008) has made an empirical analysis on the store choice in the emerging Indian apparel retail market. An interesting study focusing on the factors responsible for strengthening the competitive position of apparel retail, has been found (Singh & Samuel, 2018).

Several prior researches provide critical insight on selection of appropriate forecasting methods. Some scholarly literatures have been found to have used both the traditional methods like exponential smoothing, multiple regression, Auto-regressive Integrated Moving Average (ARIMA) and newly developed Artificial Neural Network (ANN), Artificial Intelligence (AI), fuzzy logic and Neural network and data mining depending upon the objective of the individual problem set by the forecasters (Ren, Choi, Hui, and Ng, 2013). Past researches also advocate machine learning (ML), especially neural networks (NN), as a prominent alternative to the statistical approaches of time series forecasting (Qi & Zhang, 2008). NN is based on the principles of non-linear algorithm of error minimization as opposed to the linear approach adopted in statistical methods (Makridakis, Spiliotis & Assimakopoulos, 2018).

An important class of forecasting procedure is that of univariate projection methods where forecasts of a given variable are based on the recent past and distant values of the variable. The Holt Winters forecasting procedure, also known as double exponential smoothing, use univariate data and can cope with trend and seasonal variation (Chatfield, 1978). Exponential smoothing techniques are found to be very popular for forecasting due to its impressive performance in empirical studies (Gardner, 2006) and the same has been used through years in many predictive situations (Taylor, 2010). Exponential smoothing is an intuitive forecasting method that weights the observed time series unequally and the popularity of this technique can be attributed to its simplicity, computational efficiency, the ease of adjusting its responsiveness to changes in the process being forecast, and its reasonable accuracy (Ostertagova, & Ostertag, 2012). From practical considerations of short-range forecasting, this method finds great appreciation (Gardner, 1985) as it is found to consistently provide better short-range forecast accuracy (Gardner & Dannenbring, 1980).

Many distinguished academicians have shed much light on forecasting techniques on apparel products all over the world (Liu et al., 2013; Thomassey, Happiette and Castelain, 2003; Thomassey, 2010). Some foreign researchers investigated on retail sales for individual company (Aras, Kocakoç, and Polat, 2017; Curtis, Lundholm and Mcvay, 2014). However, from the perspective of domestic Indian apparel retail business, forecasting based researches have not been found. Interestingly, various authentic retail publications generated by national, international business consulting firms, namely - KPMG, IBEF, PwC, Deloitte, E&Y, CARE Ratings etc. as well as Retail Association of India (RAI) do not demonstrate the forecasting techniques used, as mentioned earlier. In this study, the researchers have made a maiden attempt by objectively quantify the market size of Indian domestic apparel industry till 2022.

Research Methodology

This research involves longitudinal study design and univariate time series data is used as the input. For the purpose of this study, Indian apparel retail sales have been extracted for twenty years (2000 - 2019). It is worthwhile to mention that since retailing in India is an emergent sector availability of Indian apparel market size data are quite limited. The limited number of observations restrict the researchers from using Box-Jenkins approach, ARIMA technique to be precise.

Data Source

The various secondary sources from where the annual domestic apparel retail data have been collected include Indian Bureau of Equity Foundation apparel reports (IBEF 2006, 2016, 2017, 2019, 2020), CARE Ratings (2019), Federation of Indian Chamber of Commerce and Industry (FICCI, 2014), Indiastat report (2014), Ministry of Textiles, Government of India and Textiles and Apparel sector conference report (Texcon, 2014).

Forecasting Method

For short term forecast a class of forecasting method is applied where weights are given to recent past data. These weights decay in an exponential manner from the most recent data to most distant observations. Exponential smoothing techniques are frequently used when the forecasters attempt to forecast one period at a time or routine forecast with series of observations usually noticed in very short term forecast like monthly or weekly sales or inventory. The major advantages of using smoothing methods are the simplicity of models.

Double Exponential Smoothing - Additive Trend Exponential Smoothing Model: Holt (1957) derived the linear trend (additive trend) exponential smoothing to allow forecast with trends. In this method there are two smoothing coefficients, α and β with $0 < \alpha < 1$ and $0 < \beta < 1$. When upward trend is present in the time series, an estimate of current slope as well as current level is required for forecasting. One of the greatest advantages of Holt's technique is that it provides a great deal of flexibility in selecting the rates at which the level and trend is tracked. Double exponential smoothing method is applicable to the time series data where the trend is additive and is essentially free from the seasonal component. There are two smoothing equations, one for the level and one for trend. Three equations used in the Holt's model are:

$$X_t = \alpha Y_t + (1 - \alpha)(X_{t-1} + T_{t-1})$$

$$T_t = \beta(X_t - X_{t-1}) + (1 - \beta)T_{t-1}$$

$$F_{t+k} = X_t + kT_t$$

X_t = Exponentially smoothed series or current level estimate in the time period t

T_t = The trend estimate in the time period t

K = Periods to be forecast into the future

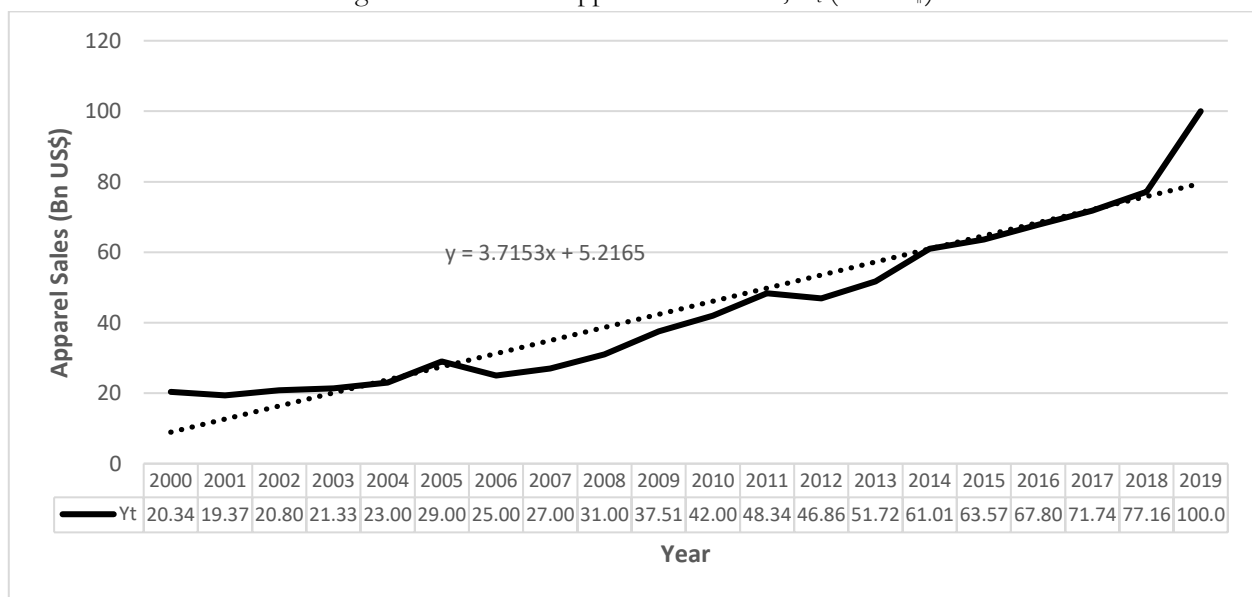
F_{t+k} = Forecast for k period into future after the time period t .

The initialization process in Holt's method requires two estimates X_t and T_t . One alternative is $X_t = Y_t$ and $T_t = Y_2 - Y_1$. Another alternative is to use least squares regression on first few values of the series for X_1 and T_1 . The values of α and β values are usually estimated by minimizing the mean square error (MSE) over a test set. The researchers have used R programming language for making forecast using Double Exponential Smoothing.

Findings & Analysis

In the present computation, Y_t is the demand at the period t which is set from the year 2000. Hence t will take the values 1, 2, 3, ..., 19, 20. To initialize the Hotel's linear smoothing process $X_1 = Y_1$ and $T_1 = Y_2 - Y_1$. The domestic apparel retail sales for the period 2000-20 is shown in Figure 1.

Figure 1: Domestic Apparel Retail Sales, Y_t (Bn US\$)



Source: Author's Computation

The data pattern of Indian apparel sales exhibit a growing trend and no seasonal fluctuations are noticed. To accommodate trend component, Holt-Winters' double exponential smoothing models have been employed to compute apparel sales revenues. Initially, the forecast for the time period 2001 – 2019 have been predicted with eleven different combinations of the smoothing constants (Table 1) and their errors estimated. For uptrend time series the smoothing coefficients α and β values are taken within the range of 0 and 1 Holt (1957).

Table 1: Apparel forecast for the period 2000-20 with 11 combinations of α and β .

Period (t)	Actual Y_t	F_t with $k=1,$ $\alpha=0.1,$ $\beta=0.2$	F_t with $k=1,$ $\alpha=0.2$ $\beta=0.2$	F_t with $k=1,$ $\alpha=0.2,$ $\beta=0.3$	F_t with $k=1,$ $\alpha=0.3,$ $\beta=0.2$	F_t with $k=1,$ $\alpha=0.3,$ $\beta=0.4$	F_t with $k=1,$ $\alpha=0.4,$ $\beta=0.3$	F_t with $k=1,$ $\alpha=0.4,$ $\beta=0.5$	F_t with $k=1,$ $\alpha=0.5,$ $\beta=0.4$	F_t with $k=1,$ $\alpha=0.5,$ $\beta=0.6$	F_t with $k=1,$ $\alpha=0.6,$ $\beta=0.5$	F_t with $k=1,$ $\alpha=0.6,$ $\beta=0.6$
2000	20.3											
2001	19.4	18.5	18.6	18.7	18.7	18.8	18.9	19.0	19.1	19.2	19.3	19.3
2002	20.8	17.7	17.9	17.9	18.1	18.2	18.3	18.4	18.5	18.7	18.7	18.7
2003	21.3	17.1	17.7	17.8	18.2	18.5	18.8	19.2	19.4	19.7	19.9	20.1
2004	23.0	16.7	17.8	18.0	18.6	19.2	19.6	20.2	20.5	21.0	21.2	21.4
2005	29.0	16.7	18.4	18.8	19.7	20.7	21.2	22.1	22.4	23.1	23.2	23.5
2006	25.0	17.5	20.5	21.3	22.8	24.5	25.5	27.0	27.6	28.9	29.4	29.9
2007	27.0	18.0	21.6	22.7	23.9	26.0	26.4	27.9	27.7	28.6	28.1	28.3
2008	31.0	18.8	23.1	24.4	25.4	27.8	27.8	29.1	28.7	29.0	28.5	28.4
2009	37.5	20.2	25.4	27.1	28.1	30.7	30.6	31.8	31.6	31.8	31.8	31.8
2010	42.0	22.4	29.0	31.1	32.4	35.4	35.8	37.2	37.5	38.2	38.7	39.1
2011	48.3	25.3	33.3	35.8	37.4	40.9	41.4	43.1	43.6	44.7	45.2	45.8
2012	46.9	28.9	38.6	41.7	43.4	47.5	48.1	50.3	50.8	52.3	52.5	53.2
2013	51.7	32.5	42.9	46.4	47.4	51.6	51.4	53.3	52.8	53.7	52.9	53.0
2014	61.0	36.5	47.7	51.4	51.9	56.0	55.4	56.8	56.1	56.2	55.6	55.4
2015	63.6	41.5	53.9	57.9	58.4	62.4	62.2	63.4	63.3	63.6	63.9	63.9
2016	67.8	46.8	59.7	63.9	64.0	67.8	67.4	68.4	68.3	68.5	68.6	68.8
2017	71.7	52.3	65.6	69.8	69.5	72.9	72.3	73.0	72.8	72.9	72.8	72.9
2018	77.2	58.1	71.3	75.4	74.6	77.5	76.7	77.1	76.8	76.7	76.5	76.5
2019	100.0	64.2	77.2	81.1	79.9	82.3	81.6	81.7	81.6	81.5	81.5	81.4
2020	77.2	72.7	87.4	91.4	91.8	94.6	95.9	97.3	99.1	100.8	102.7	103.8

Source: Author's Computation; F_t = Forecast***Selecting the best forecast model for Indian Apparel Retail:***

From the forecast of Indian apparel retail sales revenues (2001 to 2021) using Holt's exponential model 11 combination of level (α) and trend (β) coefficients, the errors have been computed in the next step. It is to be noted that the researchers have not used random smoothing coefficient because actual time series data does not exhibit major randomness or fluctuations.

An important issue is always raised with regard to goodness of forecasted results. Researchers in the past have used numerous error statistics for this purpose (Aras, Kocakoç and Polat, 2017). No single evaluating statistic can be regarded as the best method. For the purpose of estimating and forecasting the performance of the models generated, this study used the mean absolute error (MAE), the mean absolute percentage error (MAPE) and mean squared error (MSE). MAE or MAD, MAPE and MSE can be calculated as follows (Adhikari, 2013):

$$MAE = \frac{1}{n} \sum_{t=1}^n |e_t|$$

$$MAPE = \frac{1}{n} \sum_{t=1}^n \left| \frac{e_t}{y_t} \right| \times 100$$

$$MSE = \frac{1}{n} \sum_{t=1}^n e_t^2$$

Here, n is the size of the test set, e_t , the forecast error is defined as $e_t = (y_t - f_t)$, y_t being the actual value and f_t being the forecasted value. MAE, also termed as mean absolute deviation gives the magnitude of the overall error

in the forecasting process. For a good forecast the value of MAE should be as small as possible. MAPE indicates the percentage of average absolute error. Like MAE, the lower the value of MAPE, better is the forecast. Lewis (1982) showed the prediction capability levels of MAPE (Table 2).

Table 2: Prediction capability levels of MAPE

MAPE (%)	Prediction Capability
< 10	Highly accurate
10 - 20	Good
20 - 50	Reasonable
> 50	Inaccurate

Source: Lewis (1982)

In this study the researchers have estimated various forecast errors such as Mean absolute deviation (MAD) or MAE (Mean absolute error), Mean square error (MSE) and Mean absolute percentage error (MAPE) for every combination of α and β values. The individual forecast errors have been tabulated and compared in Table 3. The comparison shows that error statistic is lowest for all the parameters (MAD, MSE and MAPE) when $\alpha = 0.3$ and $\beta = 0.4$ (ERROR 5) and is thus regarded as the best combination of parameters for forecast.

Table 3: Measurement of forecast errors for Apparel retail sales

Errors	α, β	MAD	MAPE(%)	MSE
Error 1	0.1, 0.2	14.94	31.32	299.06
Error 2	0.2, 0.2	8.72	19.42	99.86
Error 3	0.2, 0.3	6.87	15.84	68.58
Error 4	0.3, 0.2	6.32	14.06	62.56
Error 5	0.3, 0.4	4.36	9.66	45.20
Error 6	0.4, 0.3	4.41	9.47	47.79
Error 7	0.4, 0.5	4.25	8.97	46.58
Error 8	0.5, 0.4	4.35	9.06	50.66
Error 9	0.5, 0.6	4.46	9.16	54.50
Error 10	0.6, 0.5	4.53	9.16	59.24
Error 11	0.6, 0.6	4.60	9.33	62.50

Source: Author's Computation.

Forecasting Domestic Apparel Retail Sales till 2022 using the best model:

From the previous step the best model to predict is found to be the double exponential smoothing model with $\alpha = 0.3$ and $\beta = 0.4$. Using it, the forecast of Indian domestic apparel sales revenues till 2022 i.e. for subsequent three years, have been computed (Table 4).

Table 4: Forecast of Indian Domestic Apparel Retail Sales (Bn US\$)

Period (t)	Actual Y_t	Level (α)	Trend (β)	Forecast with $\alpha = 0.3,$ $\beta = 0.4$ (USD\$Bn)
2000	20.34			
2001	19.37	19.66	-0.85	18.19
2002	20.80	18.98	-0.79	18.50
2003	21.33	18.97	-0.47	19.22
2004	23.00	19.35	-0.13	20.67
2005	29.00	20.35	0.32	24.49
2006	25.00	23.17	1.32	26.02
2007	27.00	24.64	1.38	27.82
2008	31.00	26.32	1.50	30.65
2009	37.51	28.77	1.88	35.41

Table 4 contd...

Period (t)	Actual Y_t	Level (α)	Trend (β)	Forecast with $\alpha = 0.3$, $\beta = 0.4$ (USD\$Bn)
2010	42.00	32.71	2.70	40.88
2011	48.34	37.39	3.49	47.51
2012	46.86	43.12	4.39	51.63
2013	51.72	47.31	4.31	55.98
2014	61.01	51.65	4.32	62.41
2015	63.57	57.49	4.93	67.83
2016	67.80	62.76	5.07	72.88
2017	71.74	67.82	5.06	77.46
2018	77.16	72.54	4.93	82.26
2019	100.00	77.37	4.89	94.60
2020				101.62
2021				108.64
2022				115.65

Source: Author's Computation.

The projected Indian apparel retail sales stands at US\$ 115.5 Bn for the year 2022. The computed level and trends values against actual apparel sales between the period 2000 and 2019 are also depicted in table 4. According to the forecast result, Indian apparel market is expected to increase with a CAGR of 6.85% during the period 2019-2022.

Conclusion and Recommendations

The domestic apparel market is highly competitive in India with huge number of brands vying for the wallet share of consumers. The market is characterized by a healthy balance of organized and unorganized retailers. However, market structure conditions, increase in disposable income, rapid urbanization rate and rapid change in life-styles have reduced the apparel product life cycles considerably. To meet the consumer expectations is a matter of big challenge, especially from the view point of how much to produce of a particular variety and in ensuring a realistic inventory. This challenge has been further aggravated by the disruption in normal life owing to the recent pandemic situation since 2020. Thus, accurate forecast is the need of the hour. Companies rely heavily on research outputs and especially those which gives not only a prediction but also shares the methodology involved in such estimations. The overall market size of domestic apparel industry is a critical component which every organization in this trade is anticipating as accurate predictions can provide an aid in minimizing the risk of investment.

The present study focuses on the trend of Indian domestic apparel retail sales and projects future sales i.e. market size till 2022. The lack of studies by individuals on this aspect of domestic apparel retail sales have motivated the researches to delve into this area and present an in-depth analysis using one of the most popular forecasting methods, double exponential smoothing. The study output reveals that the market size of domestic apparel retails sales in India is expected to touch 115.6 Bn US\$ with a growth of 15.6% from the pre-pandemic phase. Almost every research in forecasting can be said to be effective if it matches or it is close to the actual figure. The financial year closing figures of 2022 will remain an acid test for this research work, however, the researchers anticipate this study results to be robust not just because of the strong methodological approach but also on the detailing (iterations) performed to arrive at the best model for the purpose of prediction. To the best of the knowledge of the researchers, this is a maiden attempt by individual researchers to predict the market size of the domestic apparel retail sales in India. The researchers further admit that owing to the limited number of observations, further sophisticated techniques based on Box-Jenkins approach or machine learning based techniques could not be applied. Future researches may focus on the supply chain challenges or identify the drivers responsible for the low growth in apparel sales.

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