Fast Moving Consumer Product Demand Forecasting Model with Multi Linear Regression

Abstract

One of the characteristics of growth in emerging economy like India is the sharp growth in FMCG consumption resulting from factors like

- Increased population of working women
- Increased disposable income and growing per capita expenditure
- Increased purchasing power of the customers
- Increased awareness of online shopping
- Higher brand recognition and consciousness
- Constant change in consumer preference
- Banking policies and government's regulations
- Growing interest for foreign investors

The last decade's healthy growth of the Indian economy has led to steep rises in the consumption of FMCG. In the last 10 years, the revenue in FMCG industry in India has been growing at the rate of 21.4%.There was a drastic change in revenues in FMCG sector growing from US$ 31.6 billion to US$ 52.8 from 2011 to 2017-2018 respectively. FMCG industry in India was expected to grow at the rate of 27.9% CAGR (Compounded Annual Growth Rate) to sum to US$103.7 billion by 2020. Additionally, the rural FMCG market is projected to grow at a CAGR of 14.6% to reach US$100 billion by 2020 and US$220 billion by 2025. The rural sector accounts for 45% revenue share while the urban sector dominates with 55% revenue share of the total revenue of the FMCG industry. More than 65% of people in India stay in rural places and those people spend around 50% of their total expenditure on FMCG products. The number of people buying consumer goods online in India is projected to reach 850 million by 2025. This paper is an attempt to econometrically analyse the sector wise growth in market demand for FMCG in India using aggregate demand patterns. It seeks to project demand-supply gaps up to 2017 – 2018. The results would be of interest to academics and for businesses

Key words: Fast Moving Consumer Goods, Annual growth Rate, aggregate demand, demand – supply gaps

Demand Planning and Forecasting

Demand forecasting is an integral exercise in the planning efforts of an enterprise. The choice of forecasting model is conventionally preceded by a formulation of the problem/objective and an initial assessment of the available data. Along with these, factors such as complexity of the relationship to be determined, and the desired level of forecasting accuracy sought from the modelling exercise help to decide on the nature and application of the forecasting model.

Forecasting literature is replete with several models for adoption. The commonly used forecasting methods of demand estimation may be broadly categorised as:

i. Judgemental Methods
ii. Econometric Methods
iii. Other Methods

Judge mental Forecasts

This method makes predictions on the basis of intuition and opinions and is highly subjective in nature. This category consists of a number of techniques including the simple survey method, Delphi method (an interactive forecasting method which relies on a panel of experts), analogy method (utilises analogies between the phenomenon to be forecast and some historical event, or popular physical or biological process) and scenario-building methods (a process of analysing possible future events by considering alternative possible outcomes).

Econometric Forecasts

Econometric methods of forecasting primarily include two types: time series forecasting and causal/structural forecasting. Time series methods are often considered as being a theoretical in nature as future predictions are made entirely on the basis of historical knowledge/data. The contrary causal/structural forecasting methods enforce a priori assumptions or restrictions on the theoretical linkages between the variables.

Other Methods

Other methods include artificial neural networks (essentially simple mathematical models associated with a particular learning algorithm or learning rule), simulation, probabilistic forecasting (a technique conventionally used for weather forecasting which relies on different methods to establish probability of an event occurrence/ magnitude), reference class forecasting (predicts the outcome of a planned action based on actual outcomes in a reference class of similar actions to that being forecast) and SVM (support vector machines, a set of related supervised learning methods that analyse data and recognise patterns)

Among these categories, econometric forecasting methods are conventionally applied to predict shifts in demand and supply patterns. These include a number of methods such as moving average, linear extrapolation or trend estimation, exponential smoothening, autoregressive integrated moving average (ARIMA) models, ARIMAX (ARIMA including explanatory variables) and vector autoregressive (VAR) methods. The relevance and 3 accuracy of these models to estimate demand varies with the nature of the variable that one is forecasting

In this paper, an attempt has been made to evolve a methodology to predict the supply of and demand for steel in India.

Introduction

Fast-moving consumer goods (FMCG) sector is India's fourth largest sector with household and personal care accounting for 50% of FMCG sales in India. Growing awareness, easier access and changing lifestyles have been the key growth drivers for the sector. The urban segment (accounts for a revenue share of around 55%) is the largest contributor to the overall revenue generated by the FMCG sector in India. However, in the last few years, the FMCG market has grown at a faster pace in rural India compared to urban India. Semi-urban and rural segments are growing at a rapid pace and FMCG products account for 50% of the total rural spending.

Market Size

The FMCG sector in India reached a revenue of Rs. 3.4 lakh crore (US$ 52.75 billion) in FY18 . According to Nielsen, the Indian FMCG industry grew 9.4% in the January-March quarter of 2021, supported by consumption-led growth and value expansion from higher product prices, particularly for staples. The rural market registered an increase of 14.6% in the same quarter and metro markets recorded positive growth after two quarters.

Rise in rural consumption will drive the FMCG market. It contributes around 36% to the overall FMCG spending. In the third quarter of FY20 in rural India, FMCG witnessed a double-digit growth recovery of 10.6% due to various government initiatives (such as packaged staples and hygiene categories); high agricultural produce, reverse migration and a lower unemployment rate. The Indian processed food market is projected to expand to US$ 470 billion by 2025, up from US$ 263 billion in 2019-20.

Investments/ Developments

The Government has allowed 100% Foreign Direct Investment (FDI) in food processing and single-brand retail and 51% in multi-brand retail. This would bolster employment, supply chain and high visibility for FMCG brands across organised retail markets thereby bolstering consumer spending and encouraging more product launches. The sector witnessed healthy FDI inflows of US$ 18.03 billion from April 2000 to December 2020.

Some of the recent developments in the FMCG sector are as follows:

- In May 2021, Nepal-based CG Corp Global, known for its popular noodles brand Wai Wai, announced its plan to invest Rs. 200 crore (27.42 million) to set up two new manufacturing plants in West Bengal and Uttar Pradesh.
- In April 2021, Rasna launched affordable immunity boosting syrup concentrates, comprising Vitamin E, B12, B6, Selenium and Zinc.
- In March 2021, ITC Ltd. launched milkshakes and cakes to expand in categories such as chocolates and staples.
- In March 2021, Sanjay Ghodawat Group launched RIDER, an energy drink. It is available across all modern retail formats such as supermarkets, general stores and e-commerce platforms.
- In February 2021, Nestle India announced plans to reach ~1.2 lakh villages (with each having population of over 5,000) over the next 2-3 years.
- In February 2021, Food and snack company, Haldiram's partnered with Africa's Futurelife to bring its nutritional food product range to India. The two companies launched a range of four products—Smart Foods, Smart Oats and Ancient Grains, Crunchy Granola and High Protein.
- In January 2021, Tata Consumer Products announced that it is looking for ways to add more of its beverages' portfolio onto a direct-to-consumer platform to capture the urban online market.
- In January 2021, Tata Consumer Products introduced two new products, TATA Tea Tulsi Green and TATA Tea Gold Care, and reformulated its existing Tetley Green Tea, with added Vitamin CIn January 2021, Dabur India decided to foray into the 'cow ghee' category. These product will be prepared from milk sourced from indigenous cows bred in Rajasthan.
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- In January 2021, Del Monte has launched a special 1 litre pouch pack in India, priced at Rs. 250 (US$ 3.42), thereby making olive oil affordable to consumers.
- In January 2021, FMCG businesses in India are planning to expand their oral care portfolio by entering new and niche categories such as mouth sprays, ayurvedic mouth cleansers and mouthwashes to meet the rising consumer demand for hygiene products.
- For example, Pulling oil, an ayurvedic concoction used as a morning oral cleansing ritual based on centuries-old Ayurvedic regimen, was launched by companies such as Colgate Palmolive (India) Ltd. and Dabur India.

Government Initiatives

Some of the major initiatives taken by the Government to promote the FMCG sector in India are as follows:

1. On November 11, 2020, Union Cabinet approved the production-linked incentive (PLI) scheme in 10 key sectors (including electronics and white goods) to boost India's manufacturing capabilities, exports and promote the 'Atmanirbhar Bharat' initiative.
2. Developments in the packaged food sector will contribute to increased prices for farmer and reduce the high levels of waste. In order to provide support through the PLI scheme, unique product lines—

with high-growth potential and capabilities to generate medium- to large-scale jobs—have been established.
3. The Government of India has approved 100% FDI in the cash and carry segment and in single-brand retail along with 51% FDI in multi-brand retail.
4. The Government has drafted a new Consumer Protection Bill with special emphasis on setting up an extensive mechanism to ensure simple, speedy, accessible, affordable and timely delivery of justice to consume
5. The Goods and Services Tax (GST) is beneficial for the FMCG industry as many of the FMCG products such as soap, toothpaste and hair oil now come under the 18% tax bracket against the previous rate of 23-24%. Also, GST on food products and hygiene products have been reduced to 0-5% and 12-18% respectively.
6. GST is expected to transform logistics in the FMCG sector into a modern and efficient model as all major corporations are remodelling their operations into larger logistics and warehousing.

The relevance of demand forecasting & planning for the FMCG industry

The success of any supply chain operation of an FMCG industry depends on accurate demand forecasting, which leads to accurate procurement, production, and supply planning. An accurate demand forecasting helps in proper planning to meet the customers' changing demands & expectations. Managers across departments of FMCG industry have to constantly cope with seasonality, a sudden change in demand levels, uncontrolled inventory levels, rough-cut capacity planning, price-cutting manoeuvres of the competition, sudden strikes, and large swings of the economy. Demand forecasting & planning helps them deal with these issues by driving visibility across different departments & processes within and outside the business (supplier, distribution).

Importance of demand forecasting & planning for the FMCG industry

Demand forecasting & planning in the FMCG industry is carried out by using data and insights to predict how much of a specific product the customers will likely purchase during a specific time period. This method of predictive analytics helps FMCG products distributors/retailers understand how much stock to hold on hand at a given time period.

Since the FMCG industry products have a short shelf life, a surplus in stock or shortage at the sales counter due to incorrect forecast & planning can derail the entire supply chain operation and adversely affect the profits.

Role of demand forecasting & planning in FMCG industry?

Accurate demand forecasting & planning helps FMCG stakeholders to achieve the following while meeting the customers' demand for a product:

Improved Inventory

For FMCG industries, accurate demand forecasting capabilities presents with clarity of supply planning. This, in turn, allows them to accurately evaluate the level of their customer demand and thereby ascertain the volume of component parts necessary to successfully manufacture and accordingly plan to supply orders.

Also, having an accurate forecast helps decrease the amount of warehousing or container space and plan supply operations by eliminating loss and significantly reducing the amount of time unused inventory lying in a warehouse.

Reduced Cost

Accurate forecasting & planning reduces any cost associated with materials/components lying unused in the warehouse. It helps reduce cost by providing manufacturers the foresight about any surplus/shortage in stock, necessary to fulfill customer demand.

In addition, it helps reduce the cost associated with several resources & critical production tasks pertaining to — job allocation & management, sourcing raw materials, logistics, and even some front-office/customer-facing duties. Since forecasting & planning impacts the product life-cycle — from start to finish, having a more efficient & cost-effective production leads to profitable FMCG company.

Optimized logistics

Forecasting & planning accuracy provides FMCG manufacturers to take a step further in the right direction and systematically examine their transportation strategy. It helps them identify areas where efficiencies can be increased, and redundancies eliminated. Effective logistics offers a quick & efficient way to move products within/outside the FMCG plant. Accurate forecasting & planning allows the manufacturer to see when, where, how, and why the most strategic logistics decisions can be planned & executed to have the desired result.

Increased customer satisfaction

A customer's satisfaction defines the global market. The successful FMCG industry is about ascertaining the customer has the right product in their hands at the right time, place and delivery means to meet the customer's expectations. Forecasting & planning is a holistic method of refining, streamlining, and enhancing an FMCG company's operational, logistics, and production cycle platforms. It promotes customer satisfaction, and company's growth & expansion in the short, mid, and long-term.

Effective production scheduling

Accurate forecasting & planning gives companies an ability to investigate the future and avoid holding hypothetical product stocks. It helps them to –

- have effective production scheduling
- meet customer demands & market forces, and
- align production with the availability of raw materials and component parts.

As forecasting assists FMCG companies with these elements of planning and production life-cycles, it facilitates them to operate with more agility, transparency, and flexibility. It helps them to adapt to changing production environments or customer demands.

Forecasting

Five important things for an organization to forecast effectively:

1. Understand the purpose of forecasting.
2. Integrate demand planning and estimates throughout the supply chain.
3. Identify the main factors that influence demand estimates.
4. Forecast at the appropriate aggregation level.
5. Set performance measures and errors for the estimate.

Forecasting Error

To develop forecasting model, validation is an important thing to determine the performance of the forecasting method, where the test is to determine the error of forecasting result.

Mean Absolute Percentage Error (MAPE)

MAPE is calculated using absolute errors in each period divided by the actual observation values for that period.

$$MAPE = \sum \frac{\frac{|Actual - Forecast|}{Actual} \; x\ 100\%}{n}$$

Where: Actual is actual data, Forecast is predicted value, and n is forecasting period

The first step in this stage is to determine the variables that affect the number of requests. In determining this factor refers to several theories and journals. A study of the factors mentioned in more than 2 journals was carried out.

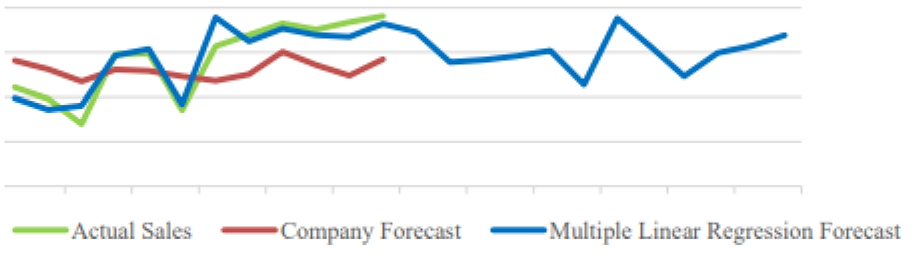
Based on this, there are 8 factors that greatly influence demand of products, namely:
1. Number of Consumers
2. Price
3. Cannibalization
4. Income
5. Price of Competitors / Other Items
6. Holiday
7. Weather
8. Number of Store

Multi Linear Regression

Simple linear regression is the existence of a causal relationship between one independent variable and the dependent variable. Where as if it consists of several independent variables, it is called multiple linear regression. Data consist of n set observation {X1, X2, X3,...., Xp, y}, that representing random samples from a larger population. It is assumed that this observation fulfills a linear relationship

$$Y = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + ... + \alpha_p X_p + \varepsilon$$

It has been seen in many situations that the forecasts obtained from the Multilinear Regression have always been more accurate than the company forecasts. Results comparisons are shown below:



Road Ahead

Rural consumption has increased, led by a combination of increasing income and higher aspiration levels. There is an increased demand for branded products in rural India. The rural FMCG market in India is expected to grow to US$ 220 billion by 2025 from US$ 23.6 billion in FY18.

On the other hand, with the share of unorganised market in the FMCG sector falling, the organised sector growth is expected to rise with increased level of brand consciousness, augmented by the growth in modern retail.

Another major factor propelling the demand for food services in India is the growing youth population, primarily in urban regions. India has a large base of young consumers who form majority of the workforce, and due to time constraints, barely get time for cooking.

Online portals are expected to play a key role for companies trying to enter the hinterlands. Internet has contributed in a big way, facilitating a cheaper and more convenient mode to increase a company's reach. The number of internet users in India is likely to reach 1 billion by 2025. It is estimated that 40% of all FMCG consumption in India will be made online by 2020. The online FMCG market is forecast to reach US$ 45 billion in 2020 from US$ 20 billion in 2017.

It is estimated that India will gain US$ 15 billion a year by implementing GST. GST and demonetisation are expected to drive demand, both in the rural and urban areas, and economic growth in a structured manner in the long term and improved performance of companies within the sector.

Note: *Conversion rate used for May 2021 is Rs. 1 = US$ 0.01365*

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