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RETAIL DEMAND FORECASTING IN 2023 AND BEYOND

Every generation of retailers has its forecasting challenges.

But this is the first with access to an AI toolset more than equal to the task.

Spreadsheets became the dominant retail demand forecasting platform in the early 1980s. (VisiCalc, anyone? Lotus 1-2-3?) Even as spreadsheets grew progressively more powerful—incorporating modeling capabilities such as autoregressive integrated moving average (ARIMA) and exponential smoothing methods—they still only considered historical data.

The art and science of retail demand forecasting is much more complex than ever before in part because businesses and external sources generate more data than ever before. But today's AI-driven technologies put the power of data-driven insights at your fingertips, putting you in greater control than ever before.

Here we explore some of the key trends shaping retail demand forecasting and the available tools—from the increasing role of artificial intelligence and machine learning algorithms to the integration of real-time data—enabling you to stay comfortably ahead of customer demand.

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Understanding Retail Forecasting Intersectionality

To grasp retail forecasting's complexity, it helps to assign the key issues to the following evergreen categories:
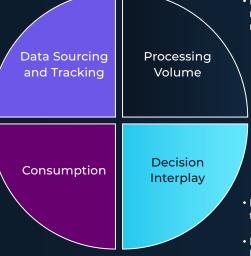
• Data sourcing and tracking

• Processing volume

• Decision interplay

• Consumption

Complexities in retail forecasting

• Internal factors like lost sales, offer types, marketing spends, etc. need special variable treatments for accuracy.

• Sourcing external data and automatically synthesizing them is tedious.

• Trying out multiple models and experiments becomes very challenging in large datasets.

• Most retail datasets run into trillions of rows, which require advanced machines to process.

Data Sourcing and Tracking

Processing Volume

Consumption

Decision Interplay

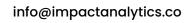• Predicting anomalous events and sudden shifts in customer behavior is difficult.

• Need to incorporate expert opinion either through inputs or by allowing users to easily override forecasts.

• Retail decisions are made by disparate teams at different points in time.

• Essential to understand the interplay between upstream and downstream decisions while creating forecasts for different use cases.

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Understanding Retail Forecasting Intersectionality

Data Sourcing and Tracking

This category comprises the myriad internal and external factors that make generating accurate forecasts so challenging. Accordingly, it's the category most retailers have been most aware of, and concerned with, in recent years.

- **Internal factors:** While readily available inside the organization for direct use, this data—including sales trends, pricing, promotions, logistics, and inventory—requires unique variable treatments and derivations for it to be made useful by forecast models.

- **External factors:** The main difficulty with accommodating external factors—such as macroeconomic trends, demographics, geopolitics, weather, and events—is sourcing and authenticating the data, then automatically synthesizing it for use in forecast models.

Modern forecasting systems must be able to process these data types plus be agile enough to handle unforeseen factors as they crop up.

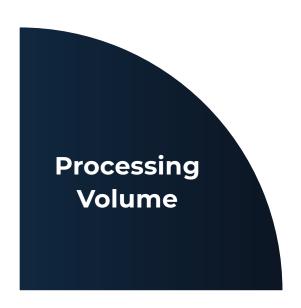# Understanding Retail Forecasting Intersectionality

Processing Volume

You simply can't process all this information, let alone experiment with multiple models, without using machine learning operations (MLOPs)-based solutions. The relevant datasets now run into trillions of lines of code thanks to, one, the immense variety of factors your forecasting system must consider and, two, your organization's need to generate the most granular forecasts possible.

MLOPs systems are also necessary for automating the entire forecasting process so you receive regular and timely results and updates.

The irony, of course, is in a way we're victims of our own success: Before AI/ML-driven algorithms got this powerful, no one would have dreamed of trying to analyze how these many intertwined, shifting issues might impact forecasting (or, at least, certainly not to the degree that's now possible).

Understanding Retail Forecasting Intersectionality

Decision Interplay

Forecasting systems must account for retail decision making's diffuse and nonlinear nature, especially when you're creating forecasts for various short- and long-term use cases. Disparate teams decide things at different times, all affecting one another and rolling up to even larger decisions.

For example, while working out allocation, you cannot plan promotions or markdowns without factoring in the product's price elasticity. Similarly, for short-term forecasting, your system must consider the buy volume across categories to determine pricing that will achieve your sell-through targets.

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Understanding Retail Forecasting Intersectionality
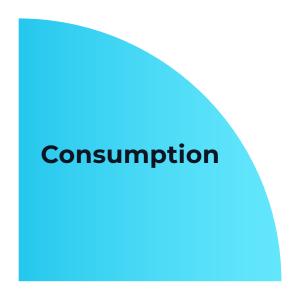
Consumption

Modern forecasting systems should enable users to easily "consume" data an recommendations, typically via visual interfaces, and provide exception mechanisms that allow human experts to discount or override forecasts as necessary. Despite its increasingly analytical underpinnings, retail forecasting remains an art as well as a science; no model can accurately predict every sudden shift in customer behavior or anomalous event. Ensuring there's a role for skilled oversight optimizes your odds of creating positive business outcomes.

Your system's forecasts should also be easily connected to downstream systems so your organization has a single source of truth for making across-the-board decisions.

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Macroeconomic Turbulence Typically Shakes Things Up

Macroeconomic factors often fundamentally shape and at times control the contours and extent of consumer spending, especially in the retail fashion and consumer packaged goods (CPG) markets.

As the world emerges from the COVID-19 pandemic (and, who knows, maybe teeters into the next one), the United States (US), the European Union (EU), and China face an unusually volatile macroeconomic environment. The mix includes a war in Europe, heightened international tensions, inflation (and the recession-producing tools employed to fight it and the banking troubles that that creates), other international dynamics affecting market functions and supply chains, and more.

2023 Macroeconomics Forecast:

Retail in the United States

In 2022, inflation spiked, interest rates rose, and recession fears spread. The US economy may take one of several possible paths ahead.
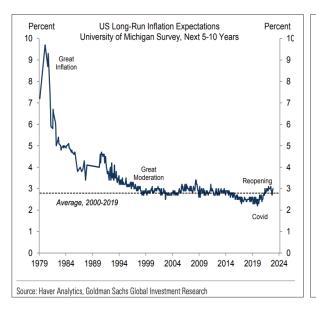
- **Mild Recession**
  - There are big economic headwinds from high interest rates, high inflation, the end of the COVID-19 fiscal stimulus, and weak export markets abroad.

- **Severe Recession**
  - Though considered unlikely given the robustness of the US economy, the right shocks—the continued failures of large banks, unforeseen supply chain traps, even larger geopolitical conflicts, etc.—or a devolving chain of events could prove disastrous.

- **Soft Landing**
  - This is what economists—and everyone else—is hoping for: The Federal Reserve raises interest rates just enough to slow the economy, thus bringing down inflation, without causing significant harm to the job market, the stock market, etc.
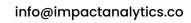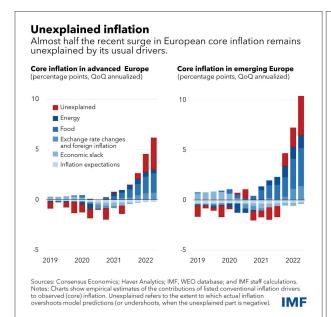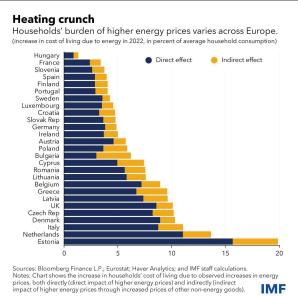

Source: Haver Analytics, Goldman Sachs Global Investment Research

Note: Dashed lines indicate GS forecasts.

Source: Haver Analytics, Goldman Sachs Global Investment Research

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2023 Macroeconomics Forecast:
Retail in the Europe Union

The EU is facing a contracting economy due to soaring energy and food prices plus tightening monetary policy. Even as people's cost of living increases and their purchasing power declines, the European Central Bank has increased interest rates to maintain price stability, dampen demand, and guard against inflation.

Unexplained inflation
Almost half the recent surge in European core inflation remains unexplained by its usual drivers.

Core inflation in advanced Europe
(percentage points, QoQ annualized)

Core inflation in emerging Europe
(percentage points, QoQ annualized)

- Unexplained
- Energy
- Food
- Exchange rate changes and foreign inflation
- Economic slack
- Inflation expectations

Sources: Consensus Economics; Haver Analytics; IMF, WEO database; and IMF staff calculations.
Notes: Charts show empirical estimates of the contributions of listed conventional inflation drivers to observed (core) inflation. Unexplained refers to the extent to which actual inflation overshoots model predictions (or undershoots, when the unexplained part is negative).

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Heating crunch
Households' burden of higher energy prices varies across Europe.
(increase in cost of living due to energy in 2022, in percent of average household consumption)

- Direct effect
- Indirect effect

Hungary, France, Slovenia, Spain, Finland, Portugal, Sweden, Luxembourg, Croatia, Slovak Rep, Germany, Ireland, Austria, Poland, Bulgaria, Cyprus, Romania, Lithuania, Belgium, Greece, Latvia, UK, Czech Rep, Denmark, Italy, Netherlands, Estonia

Sources: Bloomberg Finance L.P.; Eurostat; Haver Analytics; and IMF staff calculations.
Notes: Chart shows the increase in households' cost of living due to observed increases in energy prices, both directly (direct impact of higher energy prices) and indirectly (indirect impact of higher energy prices through increased prices of other non-energy goods).

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Macroeconomics Forecast:

Retail in China

Last year (2022) in the world's second-largest economy, China's zero COVID policy hampered consumption and production (China is the world's largest apparel exporter). The Chinese government ended this policy at the outset of 2023, a move that shows signs of boosting the economy. But surging infections could once again affect consumer demand and disrupt the supply chain.

China's retail sales contraction deepens

Retail sales fell 5.9% in November from a year earlier, the biggest contraction since May, hobbled by surging COVID-19 infections and widespread virus curbs.

Source: Refinitv Datastream | Reuters, Dec. 15, 2022 | By Pasit Kongkunakornkul

Macroeconomic Issues Affecting Apparel and Grocery in the US, EU, and China

Macroeconomic Issues Affecting Apparel: US
- Consumers are spending less on clothes due to high inflation, leading to more unsold inventory at stores.

Macroeconomic Issues Affecting Apparel: EU
- GlobalData[1] estimates Russia's war in Ukraine will wipe $18.8B off the Russian apparel market.
- Because polyester and nylon are derived from petroleum, a surge in crude oil prices will increase production costs and force brands to hike prices to maintain profitability.
- As shipping companies raise pricing due to the growing cost of gasoline, garment manufacturers are squeezed with logistical costs when importing and exporting textiles.

Macroeconomic Issues Affecting Apparel: China
- COVID outbreaks continue to threaten a nationwide labor shortage causing production delays and factory closures, imperiling the global textile and apparel supply chain. Fashion brands and retailers are likely to accelerate their "China exit" strategy, making it near impossible to foretell if China will be a fashion company business opportunity or liability in 2023.

Macroeconomic Issues Affecting Grocery: US
- USDA economists are overall optimistic, as falling commodity prices and subsiding inflation should lead to the cooling of food cost inflation in 2023.

Macroeconomic Issues Affecting Grocery: EU
- Grocery is one of the most energy-intensive sectors due to cooling costs and the cost of stock warehouses.
- Ukraine has been the breadbasket of Europe. Russia's invasion disrupted transport to and from Ukraine, causing a drastic decline in the availability of food commodities and higher prices for wheat, barley, soybeans, oils, and more.
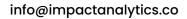
Macroeconomic Issues Affecting Grocery: China
- China's packaged food industry was a 2022 bright spot as it benefitted from COVID panic-induced stockpiling.
- The end of zero COVID policy will have a net positive impact on food sales. GlobalData says meat, dairy, soy, baked goods, and cereals are set to be the largest categories in 2023.

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The Failure of Traditional Forecasting Methods

Long gone are the days when retail sales followed "same as last year" patterns. In truth, disruptions from fluctuating macroeconomic indicators, weather, natural disasters, disease outbreaks, competitors' actions or announcements, and more have always rendered historic sales patterns a poor predictor.

But especially today—with a fast-changing global economy, social media propelling turn-on-a-dime customer sentiment, and other hard-to-predict effects of our modern world—traditional forecasting approaches simply cannot accurately forecast future demand. There's just too much relevant data to collect, evaluate, and synthesize.

Imagine you want to generate sales forecasts, at the SKU per store per day level, for a CPG client with approximately 100,000 products and 400 stores. Traditional methods and tools lack the parallel processing power and infrastructure framework to make it happen.

Here are five key reasons traditional methods fall short of AI/ML-based forecasting:

1. **Inability to analyze complex and volatile patterns:** Traditional forecasting methods fail to learn nonlinear patterns in data.

2. **Inability to analyze multidimensional data:** Traditional methods typically deal with univariate data, and are thus unable to take into account external factors.

3. **Poor long-term forecasting accuracy:** Traditional methods mostly rely on lag features and recent data, limiting their ability to project forward.

4. **Intermittent manual processes:** Traditional methods require manual intervention at multiple steps.

5. **Slow; just … slow:** Traditional methods can't match the GPU/TPU parallel processing power required for complex computing.

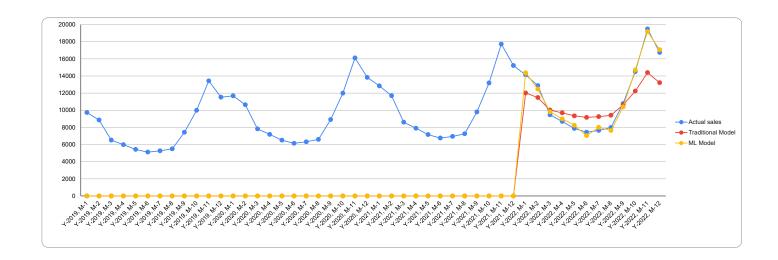▶ ▶ ▶ ▶ ▶   🌐 www.impactanalytics.co   ✉ info@impactanalytics.co   ◀ ◀ ◀ ◀ ◀

AI/ML Forecasting Vs. Traditional Methods: A Use Case Illustration

To illustrate the differences between traditional and ML forecasting methods, let's explore a business use case using the actual monthly sales of one division of a CPG retailer.

The figure below shows the actual vs. predicted sales using both methods. The model was trained for 12 months of 2021, then sales units were forecast for 2022, which we later compared with actual sales units. We calculated the mean absolute percentage error (MAPE) to evaluate model accuracy.

The traditional forecasting method had a MAPE of 15.6 percent.

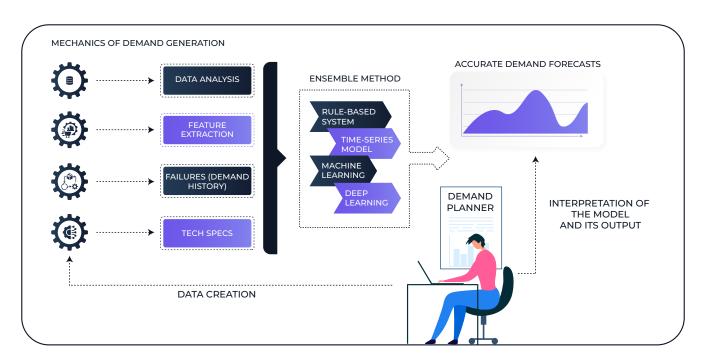The AI/ML model showcased a MAPE of 3.3 percent.

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AI-Powered Forecasting: The Best and Getting Better

We can't say this often enough: Better forecasting means better decisions and better results. Modern forecasting solutions for retail, CPG, and grocery verticals use a mix of sophisticated models—statistical, machine learning, time series, neural network (deep learning), and others—to produce remarkably accurate near- and long-term predictions. By comparison, traditional forecasting models, Excel-based or otherwise, are woefully inadequate.

"AI/ML-powered forecasting reduces errors up to 50 percent in supply chain networks, lost sales due to stockouts by as much as 65 percent, and warehousing costs up to 40 percent."

—McKinsey & Company[2]

It's Complicated

Today's innovative AI/ML-powered forecasting engines enable your organization to weigh a bewildering array of fluctuating and often-surprising demand-influencing variables and to find the relevance in patterns that are hidden from other statistical methods (such as ARIMA).

AI/ML-driven forecasting sees through the noise to find profitable data relationships, absorbing demand shocks and trends and, using the most recent data, automatically updating and generating refreshed forecasts.
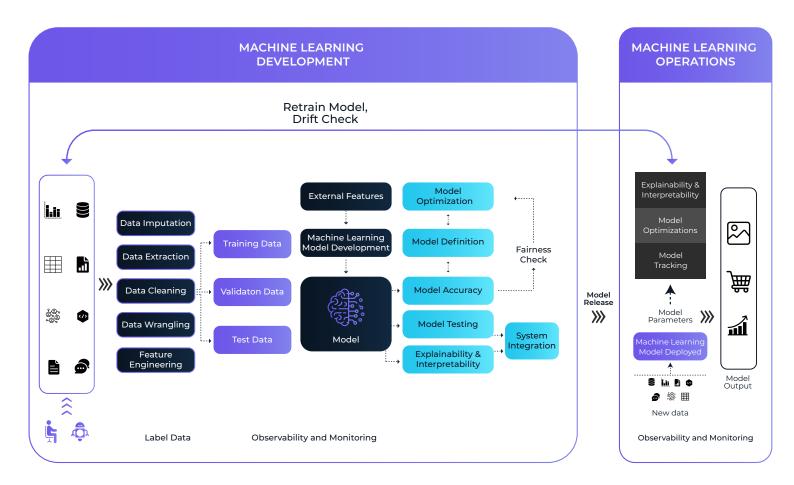
Despite performing this intricate balancing act with massive amounts of data, turnkey AI-based forecasting solutions are able to handle the entire pipeline—from data preprocessing to consuming the insights—with minimal user input.

All available data—prices and discounts, store information, product information, weather information, web traffic, local events, more—can be correlated with a SKU or location or date and blended into the modeling database. MLOps services plus container technologies ensure smooth model deployment, automation, and maintenance while the data pipeline ingests this information at blazing speed. Modern algorithms running on the latest chip architectures squeeze more calculations per second than ever before for light-speed results.

![Impact Analytics logo]

Specific, Verifiable Results:
Impact Analytics Clients

Impact Analytics clients use our AI-powered forecasting platform to improve key performance indicators such as sales forecasting accuracy (boosted as much as 20 percent), lost sales (cut as much as 20 percent), time spent creating and managing forecasts (cut as much as 90 percent), and time to respond to events (cut as much as 50 percent).
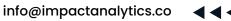
To learn more about our client success stories noted below, visit www.impactanalytics.co/case-studies/

- Kids apparel retailer—Reduced planning time 60 percent with Impact Analytics PriceSmart™

- BJ's Wholesale Club—Added $19M in revenue with PriceSmart

- Procter & Gamble—Improved process efficiencies 75 percent with Impact Analytics RackSmart™

- 390-store restaurant chain—Reliably tested strategy without risking the overall business with Impact Analytics TestSmart™

- Puma—Improved gross margin 4-6 percent with Impact Analytics AssortSmart™

- Pet Supplies Plus—Improved bottom line 5 percent, and margin 20 percent, with Impact Analytics PromoSmart™

- Pandora—Reduced on-hand supply 50 percent with Impact Analytics InventorySmart™

- Dick's Sporting Goods—Saves $20M annually with PromoSmart

- Joann—Achieved 90+ percent forecasting accuracy with InventorySmart

- Department store—Reduced operational costs 60 percent with Impact Analytics AttributeSmart™
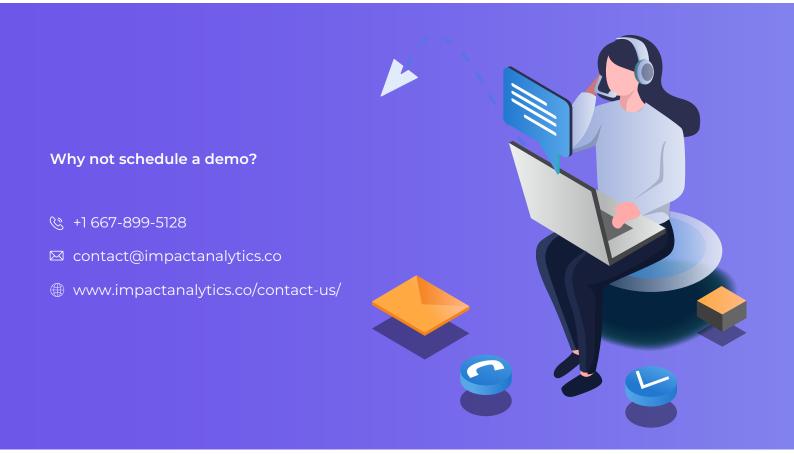
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Take the Next Step

Our clients use Impact Analytics AI/ML-driven products and services to automate the end-to-end retail forecasting process. No additional programming (or human intervention) needed.

Why not schedule a demo?

📞 +1 667-899-5128

✉ contact@impactanalytics.co

🌐 www.impactanalytics.co/contact-us/

1 Impact of the Russia-Ukraine Conflict on Apparel Industry – Thematic Research" © GlobalData Plc 2023

2 Smartening Up with Artificial Intelligence © McKinsey & Company

About Impact Analytics

Impact Analytics is a proven leader in enterprise AI SaaS solutions, that combine the art and science of merchandising and supply chain optimization. Our cloud native integrated platform's planning, pricing & promotion, inventory management, and intelligence suites, are built on the foundation of an innovative AI & ML guided forecasting engine with robust predictive algorithms. Impact Analytics is a trusted partner for top retailers, CPG and manufacturing companies across the globe, and is empowering them to make smart data-based decisions, unlock process efficiencies, transform their businesses, and achieve unparalleled business benefits. Our unique engagement model allows for implementations to be executed in a quick and cost-efficient manner.