

Professor Yves R. Sagaert

Demand Planning Excellence: The Case for Incorporating Macroeconomic Leading Indicators

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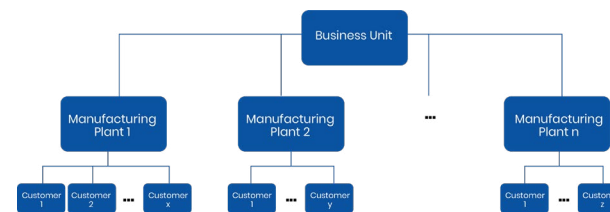




Today's demand planning landscape is increasingly defined by radical uncertainty. Professor Yves R. Sagaert from the research group Predictive AI and Digital Shift at VIVES University of Applied Sciences is one of many scholars who posits that to survive and thrive in this new normal, demand planners must consider incorporating leading macroeconomic indicators into their demand forecasts. This field of research is vital for better understanding how the early warning signals in leading macroeconomic indicators can be used to inform precision forecasting and minimise forecast-reality variance.

Demand Planning and Inventory Tactics

When operating on a global scale, firms are typically subject to larger shifts in supply and demand as a consequence of the substantially greater number of variables involved. Demand planning is a vital tool for ensuring that firms anticipate and respond effectively to these seismic shifts. Demand planning refers to the ability of an organisation to forecast how demand for their products and services is likely to evolve over time. The output of demand planning activities can provide both operational and tactical benefits for organisations. Operational benefits are those that are typically short-term focused (i.e., increased visibility of day-to-day inventory movement). Contrastingly, tactical benefits are more medium to long-term focused, and include extensive risk identification and qualification, demand profiling capacity, and stock-out contingencies. Demand planning is also important for informing key inventory tactics, like fill rate strategy, inventory as buffer solutions, and lag strategy.



Limitations of Existing Inventory Management Methods

The predominant inventory management methods used by contemporary firms are typically comprised of two overarching elements: calculating safety stock requirements based on future demand forecasts, and calculating variability and scope for forecast errors. Professor Yves R. Sagaert argues that these methods are fundamentally flawed because they are based exclusively on

accuracy metrics to determine the reliability of future forecasts. Accuracy metrics are somewhat limited in this context as they disregard higher data points and outliers in error distributions. Accuracy metrics also exhibit a fairly weak degree of correlation with real decision costs. This is perhaps indicative of the fact that decision quality is more important than decision accuracy as a foreshadower of real decision cost outcomes. Dr Sagaert further cautions that the applicability of demand planning forecasts made based on traditional two-factor models is wholly limited to short-term intervals.

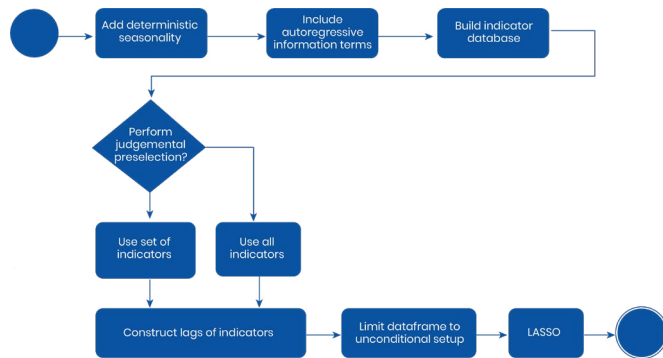
When planning for the longer term, more variables need to be taken into account. However, the existing demand planning models used by many of today's leading firms do not readily allow for the incorporation of more external variables. The forecasts produced by these models tend to present a fairly microclimatic picture of the firm's inventory network, and any decisions made based on such forecasts will likely overlook one or more critically important variables that were not statistically modelled. Larger-scale firms or firms looking to plan for tactical flexibility are particularly exposed to this issue caused by existing model typologies. Traditional demand planning models also rely disproportionately on historical data as a precursor to understanding and making sense of future market scenarios. Dr Sagaert observes that this is a flawed manner of thinking, because supply and demand data points are intrinsically non-linear, meaning that their degree of variance from historical averages can change radically and unpredictably.

What Are Leading Macroeconomic Indicators?

Prior to presenting the case for incorporating leading macroeconomic indicators into demand planning, it is first necessary to exactly define them. Leading macroeconomic indicators are economic time series which are almost always quantitative as opposed to qualitative, and tend to change in advance of broader shifts in economic conditions. For instance, the Gross Domestic Product (GDP), inflation, retail sales,



consumer price index, consumer confidence, and commodity prices. When a marked change is observed in any of these indicators, this could spotlight a wider shift in economic conditions; for example, increased inflation may increase the risk of economic recession. Therefore, the case for adding macroeconomic indicators to demand planning forecast models is simply to provide organisations with more awareness and knowledge of the economic factors that are driving changes in their supply and demand network. The organisation can then make more informed decisions regarding how much of their available inventory should be mobilised versus stockpiled.



The Case for Incorporating Leading Macroeconomic Indicators into Demand Planning

To present the case for integrating leading macroeconomic indicators, professor Sagaert compares two demand planning models within case company settings: a linear modelling approach called Least Absolute Shrinkage and Selection Operator (LASSO) and a non-linear method named Light Gradient-Boosting Machine (LightGBM). In both instances, incorporating leading macroeconomic indicators into

demand planning positively influences the assessment of inventory decision making quality. This is a measure of the degree to which inventory management decisions have generated clear performance gains for the organisation (i.e., improved flexibility). Referring to leading macroeconomic indicators such as unemployment, personal income, and consumer price indices also directly informs the selection of more relevant measures of demand planning quality, in particular service levels and realised inventory.

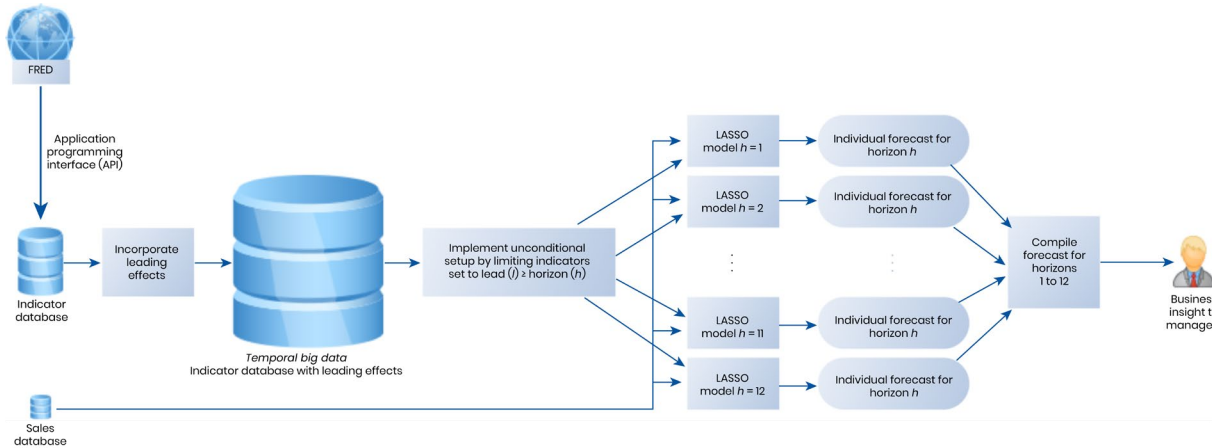
Dr Sagaert concludes that forecasts formulated with leading macroeconomic indicators have less uncertainty over longer time horizons. Modern-day firms that do this could benefit from insights that are not necessarily more accurate but more dependable – meaning that the actual inventory requirement never deviates too far from the forecast, and generates the greatest gains in tactical-level decisions, like fill rates, and stockout costs. Macroeconomic indicators also serve as a reliable early-warning system for broader changes in the supply and demand ecosystem.

For example, if unemployment rates increase, this could foreshadow reduced demand for luxury commodities as a consequence of consumers benefiting from reduced levels of disposable income. Here, some level of data interpretation is required, as the raw data output does not provide specific correlations between variables and economic events. There is also some evidence to suggest that, compared to traditional demand planning forecast methods, leading macroeconomic indicator methods tend to be more fluid, because their metrics can run parallel with variable economic conditions. For firms seeking to mobilise competitive advantage from tactical demand planning, this benefit is not insignificant. Indeed, the ability to measure trends as they continue to evolve in real time could extend such firms the possibility of more easily identifying the opportune time to stock-out or backorder top-sellers.



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Potential Drawbacks of Incorporating Leading Macroeconomic Indicators into Demand Planning

In spite of the many promising benefits, the use of macroeconomic indicators in demand planning forecast models remains a relatively nascent endeavour. More research is required in this field to further substantiate the claims made by Dr Sagaert and other leading exponents before fully embracing the incorporation of leading macroeconomic indicators into demand planning. Furthermore, as a direct consequence of the relative newness of the demand planning forecasting approach popularised by Dr Sagaert, the scope for perfecting methodological technique is still considerable. There is also the problem of context to consider, as it is unclear whether the case is equally strong on a short-term or strategic level, or indeed whether it remains so relative to firms of a different size or geographical location.

In addition, in certain forecasting scenarios where the planning benefits are indexed to the use of leading, macroeconomic indicators demand planning is more acute. The use of such variables potentially provides the greatest premium during times of extreme market volatility, but less so during extended periods of stability. This could

be viewed as a drawback when considering that it is often during periods of economic stability that large-scale firms benefit from the conditions under which to successfully finalise demand planning decisions for the future. The decision pertaining to which specific leading, macroeconomic variables to include in the demand planning forecast also remains an inexact science. The current approach to this process (i.e., allowing the organisation to choose) leaves fairly significant scope for confirmation bias. Hence, the new demand planning forecast method suggested by Sagaert also requires a considerable level of technical dexterity, serving as a substantial barrier to entry for some less experienced practitioners.

Future Research Agenda

In future, alternative weighting schema will likely be more extensively studied, with a specific focus on overall cost function. To-date, the Least Absolute Shrinkage and Selection Operator (LASSO) weighting scheme has been used pervasively. The LASSO weighting scheme method involves preventing overfitting via balancing the absolute values of the weights in the objective function of the regression.

Much of Dr Sagaert's research points towards a shift from incomplete existing simple, univariate forecasts to a merging of these with leading, macroeconomic indicators of choice. To this end, future studies will be geared towards further developing this narrative. In particular, future research will aim to critically explore how best to qualify indicators for model inclusion, as well as to investigate the effectiveness of different indicator combinations in concert with different study contexts (i.e., by organisation, industry sector and/or geographical region), and the exact level of aggregation at which the new variables should be introduced (organisation-wide or individual inventory functions).

Dr Sagaert makes a compelling case for the utility of incorporating macroeconomic indicators in demand planning forecast models. There is also some evidence to suggest that such models are readily applicable to real-world scenarios. In the auto manufacturing sector for example, macroeconomic indicators forecasts were reportedly 8.6% more accurate than traditional demand planning forecasts, when compared like-for-like. Similarly, in the tire production sector, macroeconomic indicator forecasts provided plant owners with enhanced tactical demand owing to more in-depth market knowledge and risk visibility. In multinational corporations more generally, the use of macroeconomic indicator forecasts has also generated discernible gains in forecast accuracy, hierarchical decision making, risk anticipation, and inventory management. The benefits provided by macroeconomic indicator forecasts are therefore practical as well as theoretical.





MEET THE RESEARCHER

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Professor Yves R. Sagaert obtained a Master of Science in Industrial Engineering and Operations Research from Ghent University in 2013. He then latterly received a PhD in that same area. Dr Sagaert has industry-relevant experience through positions as Sales & Operations Forecast Consultant in various industries and as manager at ArcelorMittal. Presently, professor Sagaert is the head of the Research Group Predictive AI and Digital Shift at VIVES University of Applied Sciences, specialising in topics relating to tactical supply chain management forecasting, human-and-AI, capacity planning and inventory management. His research is especially concerned with forecasting accuracy and modelling new forecasting tools which allow for precision capacity planning. In more recent times, his research has extended to 4th age industrial technologies such as artificial neural networks, deep learning and Artificial Intelligence (AI) with a particular focus on their data mining potential. Dr Sagaert has popularised the use of leading macroeconomic indicators in univariate capacity planning models to positively enhance organisations' supply and demand visibility and market anticipation. It is perhaps in this area that his corpus of research material is having the greatest degree of impact.



KEY COLLABORATORS

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FURTHER READING

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