

Supply-Neutral versus Unconstrained Demand

By Larry Lapide

EXECUTIVE SUMMARY | This column discusses what is commonly known as unconstrained demand, which represents customer demand devoid of any impacts due to supply limitations. It recommends extending the concept to focusing on “supply-neutral” demand that also reflects demand devoid of distortions due to supply surpluses and other supply-related factors. Over time, forecasting demand that is not supply-neutral can “condition” customers to demand product based on available supply rather than on true demand needs. Several examples of these distortions in real-world settings are discussed and forecast data cleansing methods are recommended to estimate true demand from the data.



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(This is an ongoing column in the Journal, which is intended to give a brief view on a potential topic of interest to practitioners of business forecasting. Suggestions on topics that you would like to see covered should be sent via e-mail to llapide@mit.edu.)

I recently attended an interesting IBF Boston chapter meeting hosted by forecast managers at a Stonyfield Farm Yogurt plant in New Hampshire. The meeting started with a plant tour and snacks, and was followed by a presentation by its forecasting team. The managers discussed how forecasting is done there, a lot of questions were asked, and discussions ensued to make it a learning experience for everyone.

After the meeting, I noted to the leader of the team that I was impressed by the fact that the managers had mentioned several

times that they had implemented forecast methods aimed specifically at generating “unconstrained” demand forecasts. Most forecasters recognize that a forecast organization is ultimately responsible for providing planners (such as in a Sales and Operations Planning [S&OP] team) with “unconstrained” forecasts rather than ones “constrained” in any way by limited supply. These are essentially projected business that would be generated if a company had an infinite and immediate supply to fill customer demand—when, where, how, and in what quantities demanded. Some

forecast organizations, however, don’t recognize or realize the need, nor do some take the effort to go far enough in this regard. Yet from a competitive perspective, they should, despite the fact that it is often easier said than done.

In my *Journal of Business Forecasting* (JBF) column, “Forecast Demand or Shipments?” (Spring 1998), I stated that “forecasters out there that are currently using a product’s historical shipment (or sales) data to forecast customer demand should take heed. Use of this data may be dangerous to your demand forecasts! The primary

reason for this is that a shipment-based forecast is often not a clear indicator of what your customer's demand for a product might be in the future." I also discussed several anecdotes in which companies were (unbeknownst to them) using constrained data for forecasting, because what appeared to be unconstrained demand was really constrained or influenced by other supply-related factors. I then covered various methods that might be used to better align historical shipment data to better reflect unconstrained demand. This column updates my view on the subject.

DEMAND CAN BE DISTORTED BY OTHER SUPPLY-RELATED FACTORS

I recall a comment made by the late Dick Clark during a discussion about the difference between constrained and unconstrained forecasts. Dick, the consummate industrial forecaster (who was P&G's forecasting guru for several decades before he passed away a few years ago) doubted that "true" unconstrained demand even existed. I never really understood what he meant by this until recently, largely because I was simply viewing unconstrained demand as just demand devoid of any impacts due to supply shortages—such as distortions caused by lost sales due to stock-outs or late shipments due to backorders.

There are times when other supply factors, such as a surplus of supply, can affect demand as well. Thus, the term unconstrained demand is a bit of a misnomer in this regard, and the proper term should be extended to supply-neutral demand. Therefore, forecasters should give the matter more attention

than they do today, because these other supply factors, that influence and distort true demand, may not be as transparent as those that relate to supply shortages.

I believe that this was what Dick was somewhat referring to with his comment. Many companies "condition" their customers' ordering behavior to align with time periods when product availability is plentiful. For example, there might be times of the year when product availability is scarce (at a reasonable price), and this might foster customers to avoid buying the product during these times, despite the fact that that is when they really need it. This type of conditioning caused by supply factors is often done unconsciously, is not planned for, and is not transparent. Certainly promotional activities that influence demand are consciously done and planned out in great detail, because the main job of sales and marketing organizations is to shape and create demand. Conceptually, supply-side managers should not be influencing demand to the extent that they are conditioning customer-buying behavior. Yet these factors, in conjunction with marketing and sales demand-shaping activities, lead me to believe that it is no wonder that Dick believed it is very difficult to get a good handle on true demand, devoid of both supply- and demand-shaping factors.

That said, forecasting demand devoid of any supply issues is still important from a competitive perspective. Conditioning customers to buy product when, where, how, and in what quantities it is most convenient for a supplier might well suffice in the short-run. However, it could foster a false sense of comfort in perceived customer loyalty. For example, in the short run a customer might be willing

to align its demand to suit its supplier's product availability, possibly because there aren't other suppliers that can meet the customer's needs. However, there is a risk that a competing supplier may come along and steal the business away in the long run. There is no such thing as long-term guaranteed business in a competitive free market!

SUPPLY-RELATED DEMAND DISTORTION EXAMPLES

While supply shortages due to backorders and stock-outs are not easy to gauge and correct for, at least they are relatively transparent and purposeful. Demand influenced by supply surpluses and other factors is often inconspicuous and not purposeful. The following six anecdotal illustrations I've encountered show how these supply factors can unknowingly influence demand.

1. During a workshop I conducted with the S&OP team of a global tire manufacturer, the topic of constrained versus unconstrained demand forecasts came up. The team leader went around the room and asked each region's process leader what type of forecast was submitted to the planning process. The first three leaders that represented North America, Latin America, and Europe stated that they submitted unconstrained demand forecasts. The last, the Asian-Pacific leader, to the surprise of all, said that they submit a constrained demand forecast. Flabbergasted, the S&OP team leader asked: Why? The leader glibly answered that "we never get the supply we ask for, so we submit a forecast reflective of what supply we think we may be able to get."

Thus this leader was essentially distorting true demand and likely hampering the growth of the region by submitting demand forecasts that were not supply-neutral.

2. A new store manager was responsible for ordering inventory for each week's promoted sale items. She did this by reviewing reports showing each item's sales performance during prior promotions. Her predecessor was conservative in nature, so he always under-ordered promoted items to insure none would be left after the promotion was over. His store frequently ran out of promoted items by Friday, despite the fact that promotions went through Saturday. Was the new store manager looking at true demand in reviewing the past performance of an item? Obviously not. If she uses this data, her store will tend to run out early, and leave little or no inventory for customers who come in for promoted items on Saturday. The reports she looks at represent supply-influenced demand or demand distorted from the loss of business from an untold number of Saturday shoppers—and due to the conservative nature of the prior store manager.
3. Every August a company shuts down its plants for summer vacation. Thus, historically shipments in August are extremely low, while shipments in July and September are extraordinarily high. This is due to customers ordering earlier than they wanted, ordering later than they might like, or just being backordered because the plants are shut down. While customers have potentially gotten used to this over the years, it is likely that this conditioning might not bode well for the company in the long run.
4. Corporate buyers for an apparel

retailer always send a mix of sizes to a store based on the store's prior sales, which are similar to the mix of the average store. The store, however, is in an ethnic Asian neighborhood where the population is somewhat smaller than that of the average store. Every season the store's manager has to drastically mark down the larger sizes because few people need them. When she finally marks them down to below cost, they eventually sell out. Since all sizes eventually sell, this indicates to the corporate buyers that the store's size mix forecast was accurate because every size sold out. The drastic markdowns are not visible to the corporate buyers, so they continue to send the store the same mix of sizes year after year; and the store manager continues to mark down the prices of larger sizes to clear up the surplus stocks. In this case, the corporate buyers are not using true demand to allocate sizes. They are using shipments and sales that are distorted by a surplus of the larger sizes that has to be drastically marked down every year. Obviously, while there are markdown sales of the larger sizes in this store, there really is little true supply-neutral demand for them.

5. A distribution center (DC) in Boston is frequently out of stock of a particular item because the manager thinks the item is too cumbersome, takes up too much space in his DC, and consumes too many labor hours to handle. Whenever a local customer orders it, the manager often gets the item shipped to the customer from a Hartford DC. Corporate distribution planners that use DC shipments to determine how much inventory to deploy, see little being shipped from Boston; thus they deploy very little inventory there. Meanwhile, they

deploy a lot in the Hartford DC. It is no wonder that Boston is always out of stock and Hartford always has a surplus. Since Boston customers typically have to wait longer for their deliveries coming from Hartford, they have been conditioned over time to accept later deliveries, or possibly gave up and starting ordering from a competitor. Thus, true demand has been distorted by the whims of the Boston DC manager.

6. The last situation involved a grocery store chain that did business in Puerto Rico (PR). Each week, the stores ordered goods from a warehouse in Florida where the goods were loaded in a container for shipment. Often, after all the ordered goods were loaded, there would be a lot of extra space left in the container. So to save transportation costs, workers filled in the extra space with paper-goods. When a store manager in PR got the extra paper goods and realized that there was a surplus, he would conduct a sale to get rid of them. Over time, the store managers were running weekly sales—that is, until it was discovered what the warehouse workers were doing. In effect, to reduce transportation costs, the warehouse workers invariably forced store managers to heavily discount paper goods and conditioned consumers to buy on promotion. This definitely distorted true demand, all by creating unnecessary supply surpluses.

In each illustration above, shipments and sales do not reflect supply-neutral demand for reasons other than just supply shortages. These include distortions resulting from supply-chain manager behaviors/whims, S&OP planner miscommunication, ad hoc distribution execution, and an overreliance on shipment/sale data to

forecast demand. In all the cases, the supply-related distortions were not transparent to demand forecasters. In addition, it took a lot of investigation and analysis to assess if true demand was being distorted by supply, as well as to identify the specific supply-related causes.

SUPPLY-NEUTRAL DEMAND DATA CLEANSING

A demand forecasting organization's primary role is to provide S&OP planners with a demand forecast that incorporates the impacts of all future demand-shaping activities planned by the sales and marketing organizations. It should not, however, include impacts due to supply-related factors. This is what is often termed the unconstrained demand forecast, though it should be better extended to a supply-neutral forecast, devoid of any distortions due to supply-related factors.

While that sounds reasonable, how should one develop these forecasts from historical sales, shipment, and booking data that include distortions to true demand caused by both demand and supply-related factors? Basically the historical data must first be cleansed of these distortions before using it to forecast true demand. Typically forecasters start with the "de-promotioning" or demand-cleansing of the data, which involves sifting out the effects of sales and marketing promotional activities aimed at demand-shaping. Methods for this are not discussed in this column.

Next the demand-cleansed data needs to be cleansed of supply-related distortions to true demand. While this is normally done today for supply-shortage distortions to true

demand, this also needs to include the cleansing-out of other supply-related distortions. Two general approaches to cleansing are described below.

The first approach is to try to capture data at the time of orders that better reflect supply-neutral demand. These include:

- Capture the date a customer really wanted the product instead of the negotiated due-date between the customer and the company's sales/customer service representative.
- Capture "lost sales" by keeping track of orders that were not placed due to a lack of product availability.
- Capture the date of the order, rather than the date of its shipment.
- Capture shipments based on customer ship-to locations instead of a company's ship-from locations. Ship-to locations would be used in historical shipments to get geographical demand profiles. (This method would have been useful for the Boston DC example described above.)

The second approach is to adjust history to more closely reflect true demand such as by adjusting shipment and sales data prior to using it to forecast. Some of these adjustment methods include:

- Capture out-of-stock information and adjust the shipment/sales data during out-of-stock periods. For example, estimate lost sales that occurred during out-of-stock periods and add them to shipments in these periods. (This method would be useful for the retail store example described above. That is, estimate what an item's promotional sales would have been on Saturday if the product were in stock. Then add the estimate to actual historical sales from Sunday through Friday. This would give an estimate of true demand for the promoted item for a

whole week.)

- Capture information on backorders, as well as order, manufacturing, and distribution processing delays. Use the information to adjust historical order shipment dates.
- Capture pricing information and use it to reduce sales data during periods where prices were marked down to "bargain basement prices" to "dump" unwanted merchandise. (This would be relevant for the apparel size mix example described above.)

In addition to these general approaches, there are also a variety of ad hoc corrections that will depend on the nature of the supply-related distortions. For example, in the case in which the Asian Pacific S&OP leader was submitting constrained demand forecasts, this was easily rectified at the meeting once he realized it should have been unconstrained demand forecasts. In the case of the DC workers stuffing extra paper goods on to unfilled trucks, this was solved by setting a policy to stop doing it. A detailed analysis would have to be conducted in the case of the August plant shutdowns to estimate how much business was lost, and how much product was bought earlier or later than when customers really wanted it. These estimates would be used to correct the supply-distorted shipment data.

In summary, forecasting managers should evaluate if there are any demand signals being used that are distorted by supply-related factors. Their job is to provide (for example) S&OP planners with a supply-neutral demand forecast rather than just an unconstrained one. Failure to do so might work in the short-term, but does leave open the risk that a customer might get tired of being conditioned by supply-related factors and move on to a competitor in the long run.

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