How to get really good forecasts using APO Demand Planning

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About SCMO2

• SAP® Supply Chain Management experts
• Helping clients Get Better Results from SAP® SCM solutions for 12 years
• Experienced Platinum level consultants with strong supply chain backgrounds
• Inc 5000 Fastest Growing Companies list - 2011
• 50+ consultants experienced on over 100 SAP SCM projects
Presentation Bullet Points

- Review best practices in working with APO Demand Planning
- Automating forecasting in APO Demand Planning
- Roadmap to Forecast Accuracy
Return on Investment

- Managing inventory depends on improving forecast accuracy.
  - The theoretical safety stock required to run your supply chain for a given customer service level depends on the accuracy of the forecast.
Typical issues with APO

- Insufficient history for seasonal determination
- Planning seasonal products in weekly buckets using shipment history
- Planning using fiscal periods of uneven length
- Vastly too many data combinations
- Lack of understanding of disaggregation
- Undue reliance on auto-model techniques
- Difficulty in making changes to configuration
Best Practices - Why history is important

- Initialization is the process of generating the first model parameters of Basic Value, Seasonal Index, Trend Value, plus MAD (Mean Absolute Deviation).
- These values, where applicable (needed) are used to start the process of historical calculation of each parameter.
- Depending on the Statistical Strategy (Trend, Constant, Seasonal etcetera.) a different number of periods is needed to start.

<table>
<thead>
<tr>
<th>Model</th>
<th>Fixed number of historical values used for initialization</th>
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</thead>
<tbody>
<tr>
<td>Constant</td>
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<tr>
<td>Trend</td>
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<tr>
<td>Seasonal</td>
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</tr>
<tr>
<td>Seasonal trend</td>
<td>3 + 1 season</td>
</tr>
<tr>
<td>Automatic model selection with seasonal test</td>
<td>2 seasons</td>
</tr>
<tr>
<td>Automatic model selection with seasonal + trend tests</td>
<td>3 + 2 seasons</td>
</tr>
<tr>
<td>2nd-order exponential smoothing</td>
<td>3</td>
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</tbody>
</table>
Best Practices - Why weekly forecasting is hard

- View of weekly shipment history shows challenge of calculating a seasonal index
Best Practices - Why weekly forecasting is hard

- Same product with POS history superimposed shows the effect of the distribution process on the data - the peaks are not significant but they get picked up in the error calculation.
Best Practices - plan with periods of even length

- Many customers like the periods in their demand planning system to match their financial reporting system
  - When the fiscal periods are uneven length, as in 4-4-5 this makes forecast patterns difficult to identify both for planners and for the system
- Working day correction is available
  - Divides the longer period down for forecasting
- Enabling data storage in months works well
  - For markets with roughly equal numbers of selling days per month
  - If not enabled this requires a reload of data
Best Practices - Limit characteristics

- The data structure of Demand Planning allows for flexible data selection and slicing and dicing BUT
- Characteristic count and difficulties with realignment and disaggregation go together
- Planners are often very confused by unexpected disaggregation and struggle to control it
- High characteristics counts make the system clumsy and slow for many users
- Many customers reduce the characteristic count at the first redesign
Best Practices - understand planner frustrations

- Typical IT things planners struggle with
  - Inability to tune alerts
  - Inability to create data meaningful data selections
  - Inability to modify forecast profiles
  - Inability to get small changes to books or macros

- Often reflect a lack of knowhow in support organization
- Results tends to be a large degree of offline planning and a lack of success with Demand Planning
Presentation Bullet Points

- Review best practices in working with APO Demand Planning
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- Roadmap to Forecast Accuracy
Automodel- how it works and why it doesn’t

- Runs a series of Tests and adjusts the Statistical Forecast Parameters to determine the best fit model by attempting to minimize Statistical Error.
- Each Automodel follows this approach with some tests being assumed or skipped.
- Clients often have difficulty in setting up forecast models in DP
  - “Our consultants turned on automodel and left”
  - “We get a lot of straight lines”
Automatic Models in DP

- There are two types of automatic models in DP:
  - Automatic Model 1 (50, 51, 52, 53, 54, 55)
    - 50 – Automatic model selection 1 (same as 53)
    - 51 – Test for trend
    - 52 – Test for season
    - 53 – Test for season and trend
    - 54 – Assumes seasonal model, does trend test
    - 55 – Assumes trend model, does seasonal test
  - Automatic Model 2 (56)
- We will cover Automatic Model 2
  - The other automatic models each have a part of the functionality that is in Automatic Model 2
How It Is Set Up in SAP

- **Menu path**
  - Advanced Planning and Optimization ➔ Demand Planning ➔ Environment ➔ Maintain Forecast Profiles

  ![SAP Interface](image)

  - Number of periods for seasonality
Automatic Model — Tests Applied

1. Check for intermittent history (Croston)
2. Check for randomness (white noise)
3. Conduct a seasonal test
4. Conduct a trend test

These tests are done in sequence. Important to realize this if Auto Model is often returning a straight line (constant) forecast.
Check Intermittent History

- Automatic Model 2 looks to see if greater than 2/3rds of the historical entries have zero demand ("0")
  - If 66% (or more) of the entries are "0," then it chooses the Croston Model
  - If less than 66% of the entries are greater than "0," then it checks for randomness, white noise.

  - The 66% parameter can be adjusted by BAdI /SAPAPO/SCM_FCSTPARA
Check for Randomness – White Noise

- White noise means random data through time and no pattern can be found.
- An ‘autocorrelation’ test is conducted: *Box-Ljung Portmanteu*
If White Noise Is Detected, Constant Model Is Chosen

- As no pattern is identified, a CONSTANT Model is chosen by default

**Forecast in Interactive Planning; Change Mode**

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**Forecast Messages**
- Trend test called
- Trend: 32.2 859, Coefficient of determination: 0.367, Limit: 2.834
- Trend test is negative
- History consists of 10.67% zero values, limit: 60.67%
- White noise detected
- Ex post forecast carried out
Check for Seasonality

- Need 2 seasons of history to calculate seasonality
  - Typically 2 years of history
- Autocorrelation greater than 0.3 will identify seasonality
  - 0.3 is the predefined value, but it can be changed by creating a BAdI
  - Trend influences are removed
    - If you set a season length in the profile, it must be correct or the season test will fail!
- Can set a Season Determination
Example: 12 Periods per Season

Number of periods: 12, Autocorrelation: 0.620, Limit: 0.30
Season test is positive

Trend test called
Trend: 548.818, Coefficient of determination: 4.031, Limit: 2.034
Example: Can set a seasonal variance test to find seasonality length

- Seasonality can be identified in nonstandard cases
Check for Trend Significance

- If the coefficient of determination is greater than 2.034, then the test is positive

Forecast Messages
Trend: 552940.358, Coefficient of determination: 2.736, Limit: 2.034
Trend test is positive
Automatic model selection has chosen the trend model
Ex-post forecast carried out
Forecast values will be negative
Automatic Model — Logic Applied

- Check for intermittent history → Croston model
- Check for randomness → Constant model
- Conduct a seasonal test → Seasonal Model
- Conduct a trend test → Linear regression

Season Trend or SLR
Automatic Model 2 — Considerations

- Cannot turn on Auto Model 2 and “forget” (blindly follow results)
- The logic does not always predict the best results
  - Constant is often chosen, especially if history data is not carefully managed and cleaned
- Period-over-period data changes can cause different models to be chosen
  - Almost guaranteed to choose different model settings each forecast cycle
    - Because the forecast model is recalculated based on the data set and each forecast cycle has a different date range
    - This can be frustrating for the planner
      - Has to explain why forecast has changed
      - Quickly lose confidence in system
Presentation Bullet Points

- Review best practices in working with APO Demand Planning
- Automating forecasting in APO Demand Planning
- Roadmap to Forecast Accuracy
Roadmap to Forecast Accuracy

- Allows you to set up your own Automatic Model Selection with models that work for your business
- Uses the power of automation in APO
- Let’s look at how to set this up…
Step 1 Stratify products

- Try to stratify your products
  - Use knowledge and judgment to identify products that should have similar sales patterns
  - Product groups or families may be arranged by sales segmentation today, not by sales pattern
    - Example- printer and printer paper may be in the same ‘product group’ for sales management, but will have different sales patterns
Step 2 Choose hero products

- Identify hero products to analyze
  - Pick representative products with clean or corrected history
  - High selling products are good for many reasons:
    - Data fluctuations less significant if volumes are higher
    - Supply chain probably works best for high selling products
    - Purchase pattern by customers more closely matches their sales pattern
- Inspect sales history for aberrations
  - Confirm that sales history to be used in analysis looks valid and representative, and covers entire history horizon
    - Choose different products if there is a problem or special case
Step 3 Find best fit profiles

- Identify best fit profiles for hero products
  - Run Automodel and record results
    - Use high level of aggregation
      - Product – all customers
      - Product – all markets
      - Possibly combine multiple products-markets

- Repeat for different historical ranges
  - Confirm that similar results are obtained
  - Can use logs from previous runs

- Compare best fit profiles between different products
  - If similar profiles are being selected for products with similar sales patterns, you are getting close to the best fit profile
Step 3: Results from automatic model

- Review your previous logs from auto model or adaptive forecast runs
  - Check the Constant Model as well

Automatic linear model selection has chosen linear regression

$\text{ALPHA}: 0.50 \, \text{BETA}: 0.00 \, \text{GAMMA}: 0.00$

Automatic model selection has chosen the trend model

$\text{ALPHA}: 0.30 \, \text{BETA}: 0.50 \, \text{GAMMA}: 0.00$

Automatic model selection has chosen the seasonal trend model

$\text{ALPHA}: 0.10 \, \text{BETA}: 0.40 \, \text{GAMMA}: 0.10$
Step 3 Find best fit profiles - cont.

- Handful of profiles is sufficient to start
  - For most businesses, around 5 profiles will cover a large number of products
  - Ideally have profiles that are distinctly different

- Verify if profiles make sense
  - Seasonal profiles have correct season patterns
  - Trend profiles reflect long term trends
    - Trend dampening may be useful (not selected by automodel)
Step 3 Find best fit profiles - cont.

- Use Point of Sale data if available
  - For consumer products companies, the POS data will show the ultimate demand pattern
    - Consider developing a POS forecast
  - Still need to offset to allow for customer inventory fluctuation and lag through supply chain
    - The further you are up the supply chain the harder it becomes to relate POS information to your demand
Step 4 Set up composite forecasting - cont.

- Assign profiles to the composite forecast profile
- Select the mode to determine the lowest error
  - The mode identifies the method to choose the model
Step 5  Run forecasts

- Run forecast for selected products and verify results
  - The system runs each of your chosen profiles and picks the one with the lowest error in the category you defined

Several models run, Sorted by error, Best one picked
Step 5  Results….

- Utilize the Forecast Alerts to address concerns with your data, ex. High error

- Alerts can be used to identify that it may be time to use a new forecast model.
Step 6 Analyze and Fine Tune

- Analyze results for a few cycles
  - Most products should be assigned to the same profile each cycle
    - This confirms you have found the correct profiles
  - Some products may frequently move between profiles, or return the constant profile
    - Often the result of data or supply chain issues, not a fundamental shift in demand
- Use alerts to identify products with higher error
- Assign products to best fit profiles where possible
  - This ensures stability of forecast results
    - Build selections manually or automatically
Advantages of the Roadmap Approach

- System will only select from models that you specify
  - You determine up-front that they are suitable for your products
  - Stability in forecast results

- Unlikely to change model selection unless there is a significant change in data
  - Your forecast models are usually distinct
  - Poor fit is often a result of data issues
What you should expect from Roadmap approach

- Optimum forecast profiles for your business with time
  - May need to ’tweak’ profiles at start
  - May identify additional profiles after some time
    - Example: More sensitive profiles for new products
- Stable forecast for products that fit profiles
  - These should remain in same profile between cycles
- Some products will never fit
  - Erratic sales behavior
  - Erratic data
    - Planner can focus on these
Forecast Behavior During Product Lifecycle

- Finding the points where the forecast behavior changes

![Graph showing stages of product lifecycle with indicators for sales volume and unit costs.](image)
Forecast Behavior During Product Lifecycle

- Different profiles are required for the various phases of life cycle
  - Responsive models during early life- growth phase
  - Trend models during steady growth
  - Responsive models to identify change to stable sales
  - Trend models during decline

- If your product portfolio contains products in all phases, you will need to run composite forecasting periodically for all products to identify when the changes occur
  - Increasing forecast errors may be an indication that life cycle change has occurred
  - Decreasing forecast accuracy should trigger investigation
## Wrap Up

<table>
<thead>
<tr>
<th>AUTOMATIC METHODS</th>
<th>ROADMAP METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assume forecast behavior changes every cycle</td>
<td>Assume sales behavior constant over long periods</td>
</tr>
<tr>
<td>Attempt to find best fit</td>
<td>Variations caused by supply chain fluctuations or data issues or life cycle changes</td>
</tr>
<tr>
<td>- Often fails due to data or supply chain fluctuations</td>
<td>- Finds best fit profiles by analysis</td>
</tr>
<tr>
<td>- Recalculate profile every period</td>
<td>- Sorts products into selected profiles</td>
</tr>
<tr>
<td>- Can stabilize with Adaptive Forecasting</td>
<td>- Stable forecast</td>
</tr>
<tr>
<td>- Guaranteed fluctuation in forecast</td>
<td></td>
</tr>
</tbody>
</table>
THANK YOU FOR PARTICIPATING.

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