THE JOURNAL OF BUSINESS FORECASTING

Volume 26, Issue 2 Summer 2007

SEPTEMBER 9-11 2007

SAVE THE DATE!

Green Valley Ranch
Henderson (Las Vegas Area), Nevada

EXECUTIVE BUSINESS FORECASTING & PLANNING FORUM

2007

MENTION THIS AD TO RECEIVE A $100 DISCOUNT ON 2 REGISTRATIONS!

KEYNOTE ADDRESS

"Forecasting Emotions – The Opportunity in Direct Selling"

Kanwar S. Bhutani, *PRESIDENT U.S. & CANADA*
TUPPERWARE BRANDS CORPORATION

DISCUSSIONS WILL INCLUDE:

- Executive S&OP: Top Management's Handle on the Business
- Optimally Matching Supply and Demand Over Time
- New Product Forecasting & Planning

CONTRIBUTORS INCLUDE:

Tom Wallace
PRESIDENT
TF WALLACE & COMPANY

Larry Lapide, Ph.D.
DIRECTOR, DEMAND MANAGEMENT
MIT CENTER FOR TRANSPORTATION & LOGISTICS

Kenneth Kahn, Ph.D.
PROFESSOR
UNIVERSITY OF TENNESSEE

Martin Joseph
HEAD OF FORECASTING & INFORMATION MANAGEMENT
ASTRAZENECA

Steve Vielmetti
VP OF DEMAND PLANNING
CONAGRA FOODS

Dean Smetana
VICE PRESIDENT
SANFORD/NEWELL RUBBERMAID COMPANY

Rick Hall
VICE PRESIDENT
THE HOMAC COMPANIES

Kevin Smith
DIRECTOR, GLOBAL DEMAND MANAGEMENT
KRAFT FOODS

Ravi Vancheeswaran, Ph.D.
DIRECTOR OF STRATEGY AND CONTINUOUS IMPROVEMENT FOR THE GLOBAL CHAIN
ON SEMICONDUCTOR

Richard Herrin
GLOBAL SALES, OPERATIONS, AND INVENTORY PLANNING MANAGER
TREDEGAR

Jason M. Blanchette
MANAGER OF MARKETING PLANNING AND ADMINISTRATION
JOHN DEERE INTELLIGENT VEHICLE SYSTEMS

Institute of Business Forecasting
Increasing Organizational Performance Through Forecasting Education

TEL: 516 504 7576 | FAX: 516 498 2029 | EMAIL: info@ibf.org | WEB: www.ibf.org/0709jbf.cfm

Smart SOFTWARE | see what's next

info@smartcorp.com
800-762-7899

Forecast and Plan with Confidence

Now you can accurately forecast demand, safety stock and inventory requirements at any customer service level and lead time. With SmartForecasts® you get results you can rely on!

Balance Inventories

Optimize your inventories to have the right products on the shelf at the right place and right time.

Reduce Costs

Balanced inventories reduce capital and carrying costs, freeing financial assets for other uses

Improve Customer Service

With the right inventory you reduce stockouts and lost sales, thereby improving cash flow and profits.

Leverage Your IT Investment

SmartForecasts easily integrates with all major ERP and SCM systems, as well as host databases such as Oracle, SQL Server, and IBM DB2.

Benefit from Proven Solutions for:

- ☑ *Sales and Demand Planning*
- ☑ *Automatic Multilevel Forecasting*
- ☑ *New and Aging Products*
- ☑ *Intermittent (Slow-moving) Demand*
- ☑ *Inventory Optimization*
- ☑ *Promotion Management*
- ☑ *Web-based Collaboration*

SmartForecasts' revolutionary patented technology—proven the most accurate solution for companies with hard-to-forecast products!

Please contact us for a live web demo of SmartForecasts
1-800-762-7899

THE JOURNAL OF BUSINESS FORECASTING

Chaman L. Jain, Editor in Chief

Evangelos O. Simos, Editor
International Economic Affairs

U. Rani
Business Manager

Constance Korol
Advertising Manager

Tita Young
Graphic Designer

MANUSCRIPTS INVITED

Submit manuscript to: Dr. Chaman L. Jain, Tobin College of Business
St. John's University, Jamaica, N.Y. 11439
Jainc@stjohns.edu

Contributors must obtain a copy of the Journal's "Editorial Policy Statement" from the Editor before attempting to prepare a paper for submission. Acceptance and publication of papers does not constitute endorsement by the editors of the Journal of Business Forecasting or of the views and conclusion expressed by the authors.

SUBSCRIPTION INFORMATION

The Journal of Business Forecasting is published quarterly by Graceway Publishing Company, Inc. Subscriptions rates, hard copy, domestic, $95 a year; foreign including Canada, $120 a year; PDF file $55 a year (both domestic and foreign); and student rage $60 a year.

Changes of address, requests for subscription information, and other correspondence should be addressed to:

Journal of Business Forecasting
P.O. Box 670159, Flushing, N.Y. 11367-0159
516.504.7576 • Fax No. 516.498.2029
Email: info@ibf.org • **Website:** http://www.ibf.org
Our ID No.: 11-263-2688

 ISSN 1930-126X

EDITORIAL REVIEW BOARD

VOLUME 26, NUMBER 2 ***Summer 2007***

CONTENTS

SECTION 1

SECTION 2

BUSINESS AND ECONOMIC OUTLOOK

ANSWERS TO YOUR FORECASTING QUESTIONS

Q. I ran MPE, MAPE, WMAPE, and Standard Deviation for one of our product lines and got different error numbers. I ran them at the aggregate level as well as at the SKU level. I was wondering if you could tell me what should be the next step based on my error measurements and how I should proceed. I am a business analyst and my background is engineering in design and application. I would like to provide a meaningful report based on my error measurements, and make a recommendation as to the next step based on my historical data and error measurement. Also, I want to ask the right questions to sales, marketing, and operations.

Shirin Bakhshi
AMCC

A. In your presentation, stick with one error metric, otherwise you will be confusing them. The error metric that I would choose is the WMAPE. Keep in mind, since each error metric highlights different aspects of an error, their error won't be the same. For example, MPE will always be smaller than MAPE because in the former, over-estimated errors are cancelled by the under-estimated errors. The standard deviation of errors gives the range of error you can expect. Next step, of course, is to find out where the error is coming from. The error can come from any or all of three sources: (1) The data was faulty. (2) The assumptions you made were wrong. Assumptions deal with what price you will charge and how much you will spend on promotions, competitive pricing, etc. Maybe you wanted to spend X amount on advertisements, but you spent only Y amount. You wanted to promote a given product in January, but for one reason or another, you ended up doing it in February. (3) It may be that the model you selected was not appropriate. Try to find out where it went wrong. Further, it may be that someone in the upper echelon of your company is biasing the forecasts by overlaying his or her judgment over statistical forecasts. Once you know the cause, you will know what to do about it. The other suggestion I have is for you to break your SKUs into two categories: the first would be the SKUs that are most important to your business in terms of generating revenue and the others that don't. Then find out which, among the high-level revenue generating SKUs, are easy to forecast and which are difficult to forecast. Concentrate on the ones that are important to business but are difficult to forecast. Once you get a handle on those, concentrate on other SKUs. In presenting forecasts, you could suggest what you would like to do and why. A number of companies have found that a large portion of their revenue/profit come from a few SKUs. Maybe your company is creating unnecessary volatility in the data through promotions and other means, which makes it difficult to forecast. In that case, it may be in the best interest of your company to stabilize the data by cutting out these activities altogether or at least reducing them somewhat.

Q. You mentioned an article that explains how to forecast the unforecastables. Could you tell me where I can find it? Also, I want to measure overall forecast accuracy on a monthly basis. Let's assume that a company sells four SKUs. How can we compute it based on the data given in the table below?

January 2007			
SKU	Actual	Forecast	MAPE
A	100	80	25%
B	110	120	8%
C	250	300	17%
D	800	600	33%
Total	**1,260**		

Hikmet Erkan
Eczacıbaşı-Baxter, Turkey

A. That article was published in the Winter 06-07 issue of the *Journal*, and was written by David Montgomery. About the error, you should compute the weighted average % error (WMAPE). You should give a weight to each error by the actual sales. In other words, you should multiply 25 by 100 plus 8 by 110, plus 17 by 250, and plus 33 by 800, and then add them up. Divide this total by 1,260, which is the sum total of actual sales. The end result will be WMAPE.

Q. I recently came across the article titled "Forecasting Errors in the Consumer Goods Products Industry," published in *The Journal of Business Forecasting* in 2003. Is this survey conducted regularly? If so, when would the next set of results be released? Further, have you benchmarked forecast errors in retail and other non-CPG industries?

Sanjay Saigal
ILOG, Inc.

A. We publish the results of the survey regularly. The last one came out in the Winter 06-07 issue, which gave the information on the errors in the CPG and food and beverages industries, along with overall averages. We gather data of the retail industry too, but we don't publish those results regularly because of the limited number of observations. We published the information on retail industry in the book, *Benchmarking Forecasting Practices*, which came out in 2004. The book was authored by Jack Malehorn and me.

Q. I just read with great interest your article "Benchmarking Forecast Errors" and wondered if I could pose a couple of questions to you. The company I work for uses MAPE as an error measure. We calculate an overall weekly MAPE for

all SKUs, for the entire country, which is around 18% to 20%. We are a food company that not only produces products with a short shelf life (< 25 days in the main), but also receives no information/ data whatsoever from the trade we sell to. The 18% to 20% includes huge swings due to promotional activities, making it very difficult to come up with good forecasts. In your view, is this a decent result? Is there a way to manage forecasts of products that are highly promoted, have a short-shelf life, and are perishable?

John Mee
Glanbia Consumer Foods

A. You should be proud of what you have accomplished. To me your forecasting error is not only decent but also excellent. Your numbers appear to be above the norm. For highly promoted, short cycle, and perishable products, you should try to develop some relationship with your customers. POS data plus the knowledge about the promotional activities of customers will give you a much better handle on forecasts. You may also have to educate your customers about the mutual benefits of collaboration. If they place an order and you don't have it in stock, they also will be the losers. You may also like to read the article "Don't Just Measure Forecast Errors," by Larry Lapide, which appears in this issue. It highlights how to manage demand risk by leveraging the forecast errors.

Q. I have the opportunity to modernize and incorporate some the best practices in the demand-planning department that I now manage. I would like to implement MAPE and WAPE. Before I do that, I want to sort out some questions; I hope you will help me with answers. My first question is about MAPE. Our product is structured as brand, category, and SKU. Each brand has several categories and each category has several SKUs. In order to calculate MAPE for a particular category in a single period, should I add up the absolute percentage errors of the member SKUs and then divide by the number of member SKUs to get the category MAPE? Or do I divide the combined absolute error of the member SKUs by the combined actual of the member SKUs? How should I calculate the MAPE for the brand, given there are several member categories? How should I calculate the MAPE for a particular category or brand for the past 12 months? Do I need to make rules for when there was a forecast but no actual, and when there was actual but no forecast? Should error be constrained in any of the calculations? About WAPE, I don't have an example that can show me how to apply a volume weight. Would you have any example readily available that could help me understand how to do it for monthly data as well as over time?

Mark Reinhardt
Emerson Process Management

A. The first thing is to decide whether you want to compute MAPE of a brand, category, or SKU. If you want to compute MAPE of a brand, add up the forecasts of all the categories or SKUs that fall within that brand for each period. Do the same with the actuals. The error will be the difference between the total actual of the brand minus total forecast of that brand. Then compute its percent error. Do the same for each period, which may be a month in your case. Then compute MAPE of all the % errors, which is the sum total of all the absolute % errors divided by the number of % errors. Here, if, in any given period, a SKU has a forecast but no actual, just include that forecast in the sum total of forecasts of that brand. If you have an actual number but no forecast, include the actual in the combined total of the brand.

Again, if you want to compute MAPE of a category, add up the forecasts of all the SKUs within that category, and then in the same way add up the actuals of all the SKUs that fall within that category. The error will be the sum total of actuals of the category minus the sum total of forecasts of that category. Then, compute the % error. From that compute the average % error, which would be the MAPE of that category. Here too you should treat a SKU with a forecast but no actual or a SKU with an actual but no forecast the same way as I mentioned earlier.

However, if you want to compute the MAPE of a SKU, you have to exclude the period in which SKU has a forecast but no actual, or has an actual but no forecast. Probably, there will be a very small number of periods in which a given SKU has such a problem. (This may very well be a product with intermittent demand.) If you compute the % error of a SKU of a period in which it has a forecast but no actual, or has an actual but no forecast, the answer you get will be absurd.

About WAPE, I believe that you are referring to WMAPE, which is Weighted Average Percent Error. The computation of WMAPE is shown in my book, *Practical Guide to Business Forecasting*, page 406, Table 1, 2005.

Q. Do you know of any benchmarking study that shows how to determine the number of people required for demand planning for a company that imports products totaling U.S. $65 million a year, has eight product families, purchases products from 300 suppliers, has 8,000 to 10,000 SKUs, produces products that are highly seasonal, and has one distribution center and 121 stores?

Raimundo Veloso
KOM International
Valenzuela

A. In our benchmarking study, the average number of people working in the demand planning area is 4.2. The survey is based on the people who attend the Institute of Business Forecasting conferences. The people who attend such conferences normally come from mid- and large-size companies. Based on the information you gave me, your company looks like a mid-size company.

Readers

If you have any questions or comments, send your email to:

Chaman L. Jain, Editor
St. John's University
Jainc@Stjohns.edu

In-House Business Forecasting
Training Seminar

Build a foundation in forecasting and improve your forecasting performance!

- Obtain training in forecasting and planning when and where you want it
- Cut costs, improve efficiency, increase bottom-line performance even during a challenging economy
- Reduce your company's cash investment in inventory
- Improve your company's forecasting accuracy as well as the value and effectiveness of your forecasting and planning team
- Earn Credit Towards IBF Re-certification

You will learn (partial list) :

- The Key Ingredients of a Forecasting Process and System
- The Keys to a Successful Forecasting Function
- How to Build Forecasting Models and When to Use them
- New Product Forecasting Methods
- Collaborative Planning, Forecasting, and Replenishment (CPFR)
- Benchmarks of Forecasting Practices in Corporate America
- And Much More

Fee : $9,995 plus expenses for two days (up to 20 people)

Companies that have participated (partial list) :

AOL
BOMBARDIER
BROWN & WILLIAMSON
CECO DOORS
EASTMAN KODAK
EVINRUDE & JOHNSON
GAP
HEWLETT PACKARD
SWEETHEART CUPS
TYCO HEALTHCARE
VAN CITY
WACHOVIA
WELLPOINT
WYETH

Testimonials (partial list) :

"Enjoyed the perspectives on wide applications of forecasting models for various industries, and benefited from wide business experiences."
J. Wong, Product Manager, VAN CITY CREDIT UNION

"This [seminar] really helped us validate our strategic forecasting initiatives, and helped create additional buy-in by including other areas of our organization."
J. Minerva, Sr. Budget Analyst, BOMBARDIER RECREATIONAL PRODUCTS

"Very thorough and detailed."
G. McNett, Forecasting/Planning Mgr., EVINRUDE & JOHNSON

IBF Institute of Business Forecasting

516.504.7576 or 800.440.0499
Fax. 516.498.2029
Email. info@ibf.org
Web. www.ibf.org/ihjbf.cfm

LIFE AND WORK LESSONS OF FORECASTING IN CHINA

By Mark Covas

The forecasting model used in demand planning is the same across all P&G forecasting groups, but the way Demand Planners in China apply it within their Markets is different ... an increase in purchasing power has enabled Chinese consumers to purchase premium brands they could not afford before or may not have even been available to them ... where no single retailer accounts for more than 3% of total China sales volume and about 65% of consumer products are sold in China through distributors who then re-sell directly to grocers as well as to second-level distributors, making it difficult to have a timely visibility of inventory held by each trade channel.

The adventure of living and working in China began for me about a year ago when Procter & Gamble (P&G) invited me to focus on operational forecasting needs in China as well as on overall demand planning capability in Greater China (China, Hong Kong, and Taiwan). I joined P&G following the acquisition of The Gillette Company where I had been the Global Demand Planning Process owner. In this role, I traveled extensively to Gillette's 26 different key regional offices within Europe, Latin America, Eastern Europe/Middle East, and all of the Asian countries. Having this global exposure and multi-faceted demand planning background should have made the transition to living and forecasting demand for consumer products in China a breeze. But it was far from it. In fact, nothing can really prepare you for everyday life in China. The following is my perspective of living and working in China.

MARK COVAS

Mr. Covas works for the Procter & Gamble Company. Currently based in Guangzhou, China, he is building demand planning capability in the region. Before that, he worked at the Gillette Company as the Director of Global Demand Planning. In that role, he provided strategic leadership and direction to the demand planning groups across the company's five geographic regions. Before Gillette, Mr. Covas worked in the areas of forecasting, demand planning, and marketing at a number of organizations including Starbucks Coffee Company, Johnson & Johnson, Colgate-Palmolive, and Levi-Straus & Co. He holds an MBA in International Marketing from Westminster College in Utah.

In any new assignment there are many different aspects you face, e.g., adjusting to a new role, a new work team or manager, a new geographic location, sometimes learning a new language, and possibly interfacing a very different life/work culture. There is an ancient saying in China, "When in China, do as the Chinese do." O.K., my Chinese is not very good, but this is how I translate it. Later on, the Romans adopted this phrase just as the Italians adopted spaghetti. Today, the world has been "touched" by all things made in China. In my travels around the world, I used to look for exciting gifts for my family and friends in my home country. Today, my family and friends have greater access to products made in China than I do; in fact, I write home to have things sent to me. The tremendous new wealth that all of these exports has brought to China has greatly changed its landscape. You also see a change in the landscape as well as in the lives of young people as they begin their careers with global companies that give them access to a world their parents had never dreamed of. In such an environment of social and economic change, it is quite challenging for large companies such as P&G to build a forecasting capability that effectively anticipates the demands of customers and consumers. To meet that challenge we have established a global work process that is followed by every Demand Planner within the world of the Procter & Gamble Company. Within our Demand Planning teams, we ask ourselves the following three questions.

1) What is driving consumer behavior?

2) Is our forecast in line with our market share trends?

3) What is going on with trade inventories?

To be successful, we also have in place advanced technical forecasting tools, a robust demand plan creation work process, well-trained Demand Planners with qualification guidelines who attend regularly scheduled S&OP meetings, and a comprehensive process of tracking and reviewing key metrics along with root-cause analysis. You could say that this forecasting model is not unique as it is present in most demand planning organizations around the world. What is unique at P&G is that the global integrity of this model is secured by conducting annual assessments using internal and external benchmarks. Also distinctive to P&G is how it detects problems in each country/market through this assessment process and how it responds to them.

WHAT DRIVES CHINA'S CONSUMER BEHAVIOR?

Today, China has around 1.3 billion consumers. To understand what drives demand, you have to understand the Chinese consumer. The global investment community identifies the "BRIC" countries—Brazil, Russia, India, and China—as "emerging markets." While that term reflects their growing importance on the world's economic stage, it is worth remembering that China is 20 times older than the United States, and Guangzhou (originally called Canton), where I am based, was a major artery of trade across Asia centuries before America was even discovered. China's economy grew over 10% last year, whereas the U.S. economy grew by about 3%. China's consumer base continues to expand even with the single-child-per-family policy. But here is where China, the United States, and many other countries have an important commonality. The average young Chinese adult has two major priorities. The first is saving and spending money on his/her child's education. The second is saving and spending for the care of their aging parents.

The young Chinese adults, whether single or married, work as the main income producers while the parents or grandparents live in the same home, care for the child, and do the household tasks of cleaning, shopping, and preparing the meals. Since their basket size (the amount of goods purchased per visit) is fairly small, they tend to visit the market quite frequently. The smaller basket size is driven by the desire to cook with the freshest meats and produce, limited cooking and storage space, and the desire to make the most from often-limited financial resources. Where most value conscious consumers might seek out products with large-volume packaging and lower unit costs, value pricing in a "just in time shopping" market environment may be replaced by off-shelf displays, temporary price reductions, and in-store product demonstrations. In fact, we now look at the "quality of display" supporting product promotions as well as "store impact," i.e., whether the focus of a promotion is on the top "A" volume stores or across all store types.

Even so, you still have to ask the question: what is driving the double-digit growth rates? Quite simply, the answer is that over the past several years the Chinese people have been given more choices as consumers of packaged goods. They are exposed to new products with new features that are supported by ever-growing promotional and media support. As major cities like Shanghai, Guangzhou, and Shenzen continue to create new jobs, more and more people will be enjoying a new purchasing power that will enable them to purchase premium brands that they could not buy before. Believe it or not, P&G sells more Crest toothpaste in China than anywhere else in the world! Starbucks also is doing extremely well in China with their longstanding selling principle that a $3 Frappuchino is an "affordable luxury." And Häagen-Dazs has been able to keep a premium pricing strategy, selling a small scoop of ice cream for over $3USD. As Demand Planners, our job is to work with marketing and market research to determine if this growth will be sustainable as competitive pressures increase, which leads to our second key question.

IS THE FORECAST IN LINE WITH MARKET SHARE TRENDS?

Whether or not a forecast is in line with our market share trends is one of the most critical issues of our forecasting process. In the process of creating our demand plan, the key elements are what we call the "Building Blocks." What are the key marketing plans to grow our market share? Our forecast time horizon is 24 months out, so we are looking monthly at what is happening to the brand base, the timing and impact of new product introductions, changes in pricing strategies, and key promotional activities. Based on our knowledge of the brand category size and marketing's share assumption, we can see if our volume forecast is aligned with their projections. There is obviously a disconnect in timing across months, given pipeline builds and promotion sell-in, but over time the two should align. To support this effort, there is an established process through which all new initiatives must pass. At each gate, a review of the key assumptions is made as well as a look at where necessary adjustments must be made to align Marketing's share forecast with Demand Planning's volume forecast. We look at share trends at all brand levels and across all geographic/market types to understand where growth is coming from. We compare this with our shipment trends to see how shipments are flowing to ensure we are not building inventory with the trade. This crosscheck comes by way of monitoring the trade's inventory levels, which also can be a challenge.

WHAT IS GOING ON WITH TRADE INVENTORIES?

For China, this is a very critical question. About 65% of consumer products are

Statistical Forecasting:

A Hands-On Workshop

Meeting Your Numbers Can Be Sweet Music To Your Ears

Brussels, Belgium
October 22 & 23, 2007

Chicago, Illinois
December 6 & 7, 2007

Day One

Section 1: Introduction to Business Forecasting

- Requisites for an effective forecasting process
- Types of forecasting methods
  - i. Extrapolative (time series) methods
  - ii. Explanatory (cause-and-effect) methods
  - iii. Judgmental methods
- Data Considerations (e.g., missing data, outliers, etc.)

Section 2: Introduction to the Naïve Model, Moving Averages and Exponential Smoothing

Exponential smoothing is today the most widely practiced method of extrapolative forecasting.

- Naïve Model
- Moving Averages
- Why smoothing is widely applied
- The family of smoothing models
- Exponential weighting of data
- Modes of implementation: manual, standard and automatic
- Choosing a particular smoothing model
- Simple, Holt and Winters' smoothing models
- Understanding & explaining exponential smoothing forecasts
- Damped and exponential trends
- Automatic model selection
- Dealing with intermittent series - Croston's approach
- Strengths & weaknesses of exponential smoothing

Section 3: Time Series Decomposition

This method also works well in actual practice and illustrates the basic terms of time series forecasting: time plots, trends, seasonality, cyclical factors, special events and noise.

- The principle of decomposition
- Assessing trends
- Seasonal indexes and seasonal adjustment
- Leading indicators of the business cycle
- Tracking special events
- Recognizing noise in the data

Section 4: Forecasting Accuracy

The measurement of forecast accuracy is essential in any forecasting process.

- Goodness of fit vs. forecast accuracy
- Within-sample vs. out-of-sample tests
- Rolling out of sample evaluations
- Three important statistical measures of forecast accuracy: MAD, MAPE, and RMSE
- Designing an out-of-sample test

Day Two

Section 5: Regression Models for Forecasting

Regression is the basic tool for measuring the relationship between variables. It is often used where some understanding of the underlying reasons for the forecasted values is needed.

- Classical regression model
- Simple regression
- Multiple regression
- Interpreting results
- Regression coefficients
- The R-squared statistic
- "t" ratios and statistical significance
- Multicollinearity
- Serial correlation
- Nonlinear regression
- Dummy variables
- Seasonality
- Dynamic (lagged) term

Section 6: Overview of Box-Jenkins Models (ARIMA)

Box-Jenkins models try to improve upon the method of exponential smoothing by considering a new information source called autocorrelation.

- What does ARIMA stand for?
- How does ARIMA differ from Exponential Smoothing?
- Creating lagged variables
- Autocorrelations: the key to understanding ARIMA
- Types of ARIMA models:
  - i. Autoregressive Models
  - ii. Moving Average Models
  - iii. Mixed Models
- Three step approach to model building:
  - i. Identification
  - ii. Estimation
  - iii. Validation
- Explaining the forecasts
  - i. Series 1, ARIMA at its best. Smoothing at its worst
  - ii. Series 2, ARIMA and Smoothing: Too close to call
  - iii. Series 3, ARIMA breaks down for short time series.
- Strengths and weaknesses of ARIMA

Section 7: Practicum and Extra Resources

An opportunity for "hands-on" use of some of the techniques covered, as well as information on forecasting resources & software.

- Forecasting publications
- Forecasting conferences
- Forecasting software

Institute of Business Forecasting

516.504.7576 or 800.440.0499
Fax. 516.498.2029

Email. info@ibf.org
Web. www.ibf.org

sold through distributors who then re-sell directly to grocers or to other secondary distributors who continue the re-selling process. Having accurate, timely visibility of how much inventory a trade channel is holding can have a significant impact on forecasting demand. We track and monitor the change in days' supply the distributors are carrying to understand if excess inventory is being built, which could lead to an inventory correction. On the contrary, if it is too low, it could mean that retail shelves are out of stocks. A fundamental principle of P&G marketing is the "First Moment of Truth": a product has to be on the shelf, be in good shape, and priced in a way that provides meaningful value to consumers when they walk down the store aisle. Demand planning's responsibility is directly linked to ensure that product is on the retailer's shelf to meet consumer demand.

The other 35% of our customers are called "Modern Trade," which are global, regional, and countrywide retail chain stores. These stores have very sophisticated sales reporting and data storage systems that allow us to see more clearly how monthly product shipments are flowing through the channel. This information is used very effectively to create a better daily forecast, giving our warehouses visibility to peaks and valleys in order flows that help us manage picking and trucking requirements.

Each of these components provides insight into the business, which enables the creation of a robust forecast. But it is the S&OP process that ensures the integrity of that forecast and cross-functional alignment/joint ownership of the results. Again, P&G follows a global standard cycle of weekly/monthly meetings with very clear expectations of how the output of one meeting will drive the success of the next step in the process. Collaboration across functions is essential. Input from sales, marketing, supply, finance, and market research through a series of timely, well-linked meetings ensures all points of view are captured and new information incorporated into the next rolling 24-month forecast.

To conclude, forecasting demand in China is no different from forecasting demand in any other country/market in the world; and just like every country/market in the world, no two are alike. I believe that China's Demand Planners are positioned to become global thought leaders in demand planning best practices. In fact, P&G China has the best WMAPE (Weighted Mean Absolute % Error) results within the P&G world—about 32% at the SKU level on a weekly basis! With 1.3 million consumers making purchasing decisions every day, there is a requirement to continuously monitor and improve our forecasting systems and processes. This drives the need for a strong, capable demand planning organization to give the company a bottom-up view of true demand for our products. In this way, we add value to the organization by playing a key role in leading how we manage and optimize the supply chain with the ultimate goal of ensuring our consumers have full access to our products.

There is another expression that I have learned in China: "Live a happy life." Most days I go to the gym in the afternoon and return to eat a McDonald's spicy chicken sandwich and drink a Coca-Cola at my desk. This is my attempt at work/life balance. Some in my team come in later and go home later. Others come in early so that they can enjoy dinner at home with their children. The most important lesson to learn from forecasting in China is to make sure you are living a Happy Life and have a good work/life balance. Knowing how to say "not too spicy please" will also surely help you live a Happy Life in China! ■

(covas.ma@pg.com)

UPCOMING EVENTS

Business Forecasting: A Tutorial Forecasting Training @3 Levels
August 23 & 24, 2007
Boston, Massachusetts USA

Executive Business Forecasting & Planning Forum
September 9-11, 2007
Henderson (Las Vegas), Nevada USA

HOW TO SELECT A DEDICATED FORECASTING SOFTWARE

By David P. Reilly

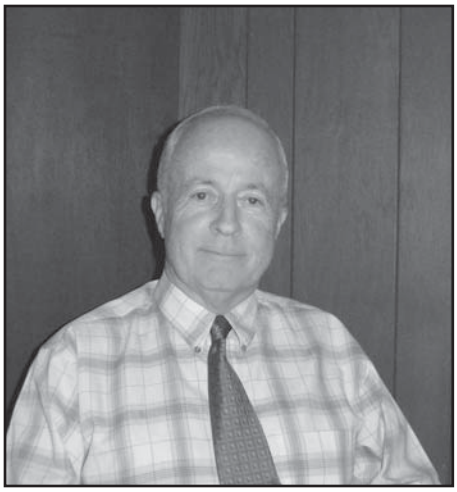
Before you start searching for the right software, determine your forecasting needs … forecasting software should accommodate your forecasting process and not the other way around … forecaster must have a working knowledge of forecasting models, diagnostic tools, and error metrics.

While many forecasters use spreadsheet applications, many have found the benefits of using dedicated forecasting software (DFS). The search for such forecasting software should result in a solution that best suits a particular company's needs, circumstances, and expectations about the future. Simple forecasting problems lend themselves to less formal approaches and to simpler methods. Complex forecasting problems require more organized forecasting processes and statistical methods. Furthermore, they necessitate the use of more sophisticated tools and more complex solutions. DFS is an essential tool for a forecaster. The basic question is how one should search for and evaluate such a forecast software solution?

FORECASTING NEEDS

A dedicated forecasting software solution can support a company's need for data collection, analysis, model development and evaluation, and forecasting. It is important that whatever the software you select, it should be consistent with the specific needs of the company. In other words, the company's needs should not be driven by the software's needs. Therefore, it is important for a company to determine what its business needs are before looking for a software.

What does a company need to know before embarking on a search for a DFS solution? It is often helpful, but not mandatory, for a company to develop its forecasting process. The process should reflect the company's business processes, business decisions, and management information needs. A complete understanding of the nature of the variables to be projected, time horizons for forecasting, historical patterns experienced, and drivers of the actual outcomes is important. The levels of detail required in the forecast along with the data and forecast segmentations must be known before searching for a software solution. The types of management reports and forecasting presentations are also important to know in advance of software evaluation and selection. One can ask relevant questions about the DFS package that is under consideration only if it is known what one is trying to accomplish, the nature of the present and expected forecasting problems to be addressed, and the goals of the forecasting efforts.



DAVID P. REILLY

Mr. Reilly is Senior Vice President of Automatic Forecasting Systems, Inc. He has distinguished career as an innovator and a developer of creative time-series applications. He is a former GE executive and Senior Manager at the American Stock Exchange. He is also on the Drexel Graduate Faculty. He has been a senior consultant to companies including Pepsi-Cola, General Mills and Anheuser-Busch.

There are many forecasting software solutions available, each with different features, different statistical models, and different levels of vendor's support. There is a wide range of performance features of forecasting packages but DFS offers substantially more advanced characteristics when compared to spreadsheet applications and spreadsheet add-ins. Therefore, a systematic inquiry and search is important to find the best DFS solution for your needs—both for the present and for the future. Different companies will make a different selection based on their needs, but the budget allotted for DFS will also play a role in the selection.

FORECASTING SOFTWARE CONSIDERATIONS

There are two broad levels of consideration when evaluating a software package: (a) what does the package do and (b) how does it do it. The "what" provides insight into the potential of the package to solve the forecasting problems that are central to the business and to its management. The "how" provides insight into the effectiveness

of the software in implementing features the company is concerned about. The "how" is just as important as (sometimes more important than) the "what" when it comes to forecasting packages. Hence, in developing questions for a software search, each "what" question should also have an accompanying "how" question to ensure that the software fits well into the company's needs.

So, what are the key features a company should be concerned about when considering a forecasting package? The general concerns typically include:

- Expert System and Algorithms
- Data Preparation and Analysis
- Method Selection
- Model Diagnostics
- Aggregation and Segmentation
- Reporting Capability

EXPERT SYSTEM AND ALGORITHMS

The expert system within DFS is essential for data analysis, as well as for forecasters' ability to produce quality forecasts. Most forecasters are not statisticians, nor do they need to be. Most forecasters deal with problems that require a huge staff of trained statisticians. But with a proper expert system, which is built into a forecasting package, the forecaster can achieve efficiency and quality of forecasts with minimal manpower. Hence, a clear understanding of the level of support that the software provides to a forecaster is essential. While the forecaster should be able to interpret and evaluate the information provided by the expert system, it should not be necessary for the forecaster to undertake and complete all of the functions of a statistician. Much has been systematized through the algorithms built into the dedicated software forecasting packages. The expert system capability is often described as the automatic forecasting system that automatically selects the best model for a data set to prepare forecasts. Discussing the expert system's capability with the software vendor and understanding its functionalities is an important part of the inquiry process.

DATA PREPARATION AND ANALYSIS

Data preparation and analysis are a central consideration in the ability of a system to satisfy the forecaster's needs. A feature which is typically important is data cleaning along with stability testing. This calls for the use of a variety of statistical measures of central tendency and dispersion. Evaluation of the data for trend, seasonal patterns, outliers, shifts, and event-driven conditions is also an important feature of a software package. The presence of data transformation functions that can be applied to the data is important to the analysis capability of the package. Certainly, for analysis and presentation purposes, the ability of the DFS solution to plot data is fundamental to the forecasters' mission. Visual graphic presentation along with thorough data analysis is fundamental to a satisfactory software solution for forecasting.

METHOD SELECTION

Statistical method selection is a most critical consideration in evaluating a forecasting package. The ability of DFS to use the data preparation and analysis and to match the statistical method to the data is extremely important. Since the issue is one of matching the statistical method to the forecasting problem and to the data pattern, the range of forecasting methods resident within a forecasting package is a prime factor in deciding on a software package. The ability of the package to build models that reflect the data history and the business factors are very important. So, in many cases, one may be looking for combinations of model types to produce the best forecast for management. A range of univariate methods (time series), multivariate methods (cause and effect), and ARIMA/Transfer Function methods is generally a desirable feature in a forecasting package. With that, the forecaster can use both "single-threaded" solutions as well as "multi-threaded" solutions for business forecasting.

The DFS solution should allow different orders of SARIMA (p,d,q) (P,D,Q) models with different lags and leads of exogenous variables either specified by the user or internally developed. The DFS solution should serve as a good proxy for a skilled statistician. Tests for changes in historical patterns should be done to ensure that it reflects only those historical patterns in the forecasts that have been shown to have a consistent presence.

Many developers of DFS, unable to duplicate the correct statistical analytical process of decomposing the observed set to signal and noise, limit their selection to pre-programmed alternatives (much akin to being forced to buy a suit off the rack without the benefit of tailoring). In an ideal DFS, historical data is partitioned into "training data" and "validation data" (or out-of-sample data), and alternative models are estimated using the training data and evaluated using the validation data, normally from a single origin. In many DFS, no tests of significance are ever performed, no tests of the Gaussian Assumptions are made, and no residual diagnostic checking is performed in the "fitting process." To make things worse, if you change the number of "out-of-sample" values, the best model changes, which suggests the tail is wagging the dog.

MODEL DIAGNOSTICS

The approach of the software to model development (specification, estimation, validation, and forecasting) is a major area of concern in evaluating software packages. From a statistical perspective, it is best if the software can build a model that provides the highest degree of reliability and accounts for shifts, pulses, and causal factors. Level shifts in the data reflect the impact of such things as changes in the law and competitors going out of business. The ideal DFS solution should be able to identify automatically such level shifts and incorporate their effect

into the model. Also, changes in trend need to be identified and incorporated. Unusual values also need to be identified and accommodated with pulse variables. Finally, seasonal pulses (the impact of Christmas, for example) should also be accounted for.

If the DFS solution does not perform these tasks, then it is left to the forecaster to do them, shifting a great deal of the "virtual statistician's" work to the forecaster. It is important that the software package facilitates the consideration of alternative model specifications and their estimates. The presence of effective expert system algorithms is important to the ability of software to evaluate data and alternative model specifications and estimates for recommendation to a forecaster. (Of course, the ability to override these recommendations is also important to the forecaster.) Also, it is important that the software package gives a range of error criteria that the forecaster can use to select the optimal model for forecasting. Typically, one will select the model that produces the lowest expected error and/or lowest range errors. However, the final model selected must be scrutinized both for statistical significance of the estimated parameters (necessity) and for sufficiency of the model (i.e., the errors from a selected model are random.)

To determine the appropriate model for forecasting, the forecaster has to test a model with all the diagnostics tools at his or her command. So it is important that the software package has adequate test statistics, including R-square, t-test, F-test, Durbin-Watson statistic, and so on. The forecaster needs to have a working knowledge of the test statistics that he or she uses, and ensure that these are available within the software. The ability of the DFS solution to graph the actual data, forecasts and forecast errors is important for evaluating and presenting forecasts. Presenting a forecast range both numerically and graphically is equally important. Capturing assumptions and tracking their validity is also important to the forecast process and forecast analysis. The ability of the software to support tracking, analyzing, and remediating error is a key consideration in selecting the best forecasting package.

AGGREGATION AND SEGMENTATION

Different users of forecasts have different needs for aggregation and segmentation of forecasts and actual data. Typically the forecaster wants that the software package has the capability to slice and dice the data—both historical and forecast. So being able to look at the data and forecasts by hierarchy structure is important. These hierarchies may include product hierarchies, distribution hierarchies, geographic hierarchies, management structure hierarchies, customer configurations, and business unit hierarchies. With that feature, one can look at the data from different perspectives.

The forecaster is looking for a software support tool that has the necessary characteristics to produce adaptable, accurate, and meaningful projections for management. The ability of the software to minimize the amount of unnecessary data handling and manual data manipulation as well as unnecessary export of information for use by management is essential to the goals of a forecaster. Ultimately, the forecaster is a business analyst providing forward-looking information to management. He or she needs a tool that optimizes the use of time and professional energy and facilitates the analytical and communication capabilities.

REPORTING CAPABILITY

Another important feature is the reporting capability of a package. Since each end-user has a different need of forecasts, they have to be reported differently. Some want the report in units and others in dollars. Some want them by category/brand, while others at a SKU level. Also, forecasts may have to be broken down by customer, channel of distribution, region, and country. The software should be able to do all of these.

QUESTIONS TO BE CONSIDERED

The search for a DFS solution is a systematic inquiry into the needs of the company, as well as into the capabilities of the software. In order to get the best results, it is best to have an agreed upon set of questions to ask vendors that offer a software solution. The questions are intended to ensure that the company gets a complete solution to its business and forecasting needs. Below are questions that can be used as the starting point of inquiry when searching for a software solution. These can be of great help not only to those participating in the forecasting process but also to the IT personnel who are assisting in the search process.

DATA PREPARATION AND ANALYSIS QUESTIONS

The heart of a dedicated forecasting package is the data preparation and analysis. All other forecasting-related activities are contingent upon the data, data pattern, and business variables being forecasted. So, which questions should be asked by the forecaster? Below are some of the most critical questions.

1. Which means of data collection and data loading are available?
2. How are data accessed and how easy or difficult to access?
3. How does the software segment (slice and dice) the data?
4. Does the software decompose data into separate elements—trend, seasonality, and cyclicality?
5. What type of data plotting capability does the software has? How flexible and user friendly is this capability?
6. What types of data transformations are possible (e.g., logarithms, inverse transformation, power functions, etc.)?
7. How does the software identify and handle seasonality and cyclicality structure in the data?
8. How does the software identify and

deal with missing values?

9. How does the software identify and deal with shifts in the data?
10. How does the software identify and deal with outliers in the data?
11. How does the software identify and deal with distinct time trends in the data?
12. How does the software handle lead and lag structures?
13. Which metrics (such as cross-correlations, tests for constancy of variance, and constancy of the parameters) are produced by the software in undertaking the data analysis?
14. How does the software "verbalize" the model and its coefficients so that different members of the forecasting team are comfortable with and can readily understand and buy into the forecasts?

Note: Be sure to add a "how" question to each "what" question posed to the vendor.

METHOD SELECTION QUESTIONS

Data analysis is fundamental to the selection of the right model. The model is designed to reflect the data pattern (i.e., the "memory" within the history) as well as the business factors that may be driving the forecast. Time series and ARIMA models deal with the "memory" element, while regression models, transfer functions, and econometric models deal with the cause-and-effect elements. (A transfer function is simply an optimal combination of ARIMA models supplemented with cause-and-effect elements.) Hence, it is important that the software is capable of supporting both time-series and cause-and-effect models, as well as capable of using them in combination. So, which questions should be asked by the forecaster? Below are some of the most critical questions on this subject.

1. Which models and statistical methods are resident within the DFS solution? How are these models evaluated and implemented by the expert systems? Does the DFS test the adequacy of a model? How does it "grow the model?" Does it incorporate either leads or lags of the variables or augmentation via an error structure?
2. Can the package produce a model that has never been produced before, i.e., can it tailor the model to the data instead of forcing the data into a pre-programmed set of models?
3. Which criteria are available for model selection purposes? Can multiple criteria be used for this purpose?
4. How does the package fit alternative models to the data set?
5. What level of expert system capability exists to qualify and select models for consideration?
6. What level of user override is available in the creation and selection of models for consideration?
7. Which test statistics are available for use in validating and evaluating alternative models and model specifications, e.g., statistical significance, autocorrelation, multicollinearity, and heteroscedacity?
8. How does the software deal with uncertainty, e.g., range forecasting and simulation?
9. How does the package recognize patterns within time series modeling?
10. How does the package deal with regression for developing and validating a model?
11. How does the package deal with seasonal factors, cyclical factors, event factors, leads and lags, data transformations, and other such considerations affecting model development?
12. Which metrics are included in the software to support model diagnostics?
13. Which metrics are included in the software to support error measurement and analysis?
14. How does the software handle "in-sample" forecasts?
15. How does the software handle "out-of-sample" forecasts?
16. What types of graphics are available for model development and model evaluation?

Note: Again, be sure to add a "how" question to each "what" question posed to the vendor.

FORECAST IMPLEMENTATION QUESTIONS

There is a variety of concerns related to forecast implementation. Some of the questions that forecaster should ask are given below.

1. How are the updated actual data collected and loaded on to the forecasting package?
2. How is the forecast and resulting error updated, tracked, and analyzed within the forecasting package?
3. Is large-scale batch forecasting available within the software?
4. What levels of aggregation of forecasts can the package handle?
5. Can the forecast reports be compiled by segmentation type, e.g., by function, product and product category, and geographic territory?
6. How does the software handle "top-down" forecasting?
7. How does the software handle "bottom-up" forecasting?
8. Which management reports are available from the software?
9. Does the software report on the model used?
10. Which measures of error are available for analysis?
11. What are the "drill down" and query capabilities within the forecast and the actual data?

12. Can the software evaluate the data and create analytical statements, such as "…the following list of SKUs experienced a significant level shift starting such and such periods ago?"
13. How are assumptions identified, quantified, and stored?
14. How are the forecasts and forecast assumptions and reports shared with other users?
15. How are the forecasts and forecast assumptions and reports shared with management?
16. What types of graphics are available for the forecast?

Note: Again, be sure to add a "how" question to each "what" question posed to the vendor.

SOFTWARE SUPPORT AND OTHER REQUIREMENTS QUESTIONS

Assuming that the software has the desired combination of features and capabilities, the last set of considerations relate to the "mechanics" of the software. Typical questions to be asked should include:

1. What are the query capabilities of the software?
2. What are the report writing capabilities of the software?
3. What is the presentation capability and format of the software?
4. What level of graphics and graphics presentation exists within the system?
5. Does the software have batch forecasting capabilities in addition to real-time forecasting capability?
6. What data bases and software interfaces are supported by the software?
7. What are the hardware requirements for the software?
8. Does the package interface with the company's existing hardware and software platforms?
9. Can the software be readily linked to other data bases and software (internal and external)?
10. Can the software be readily interfaced with other dedicated forecasting packages?
11. Can the software be readily interfaced with specialized packages, e.g., neural networks and econometrics?
12. What is the frequency of updated software releases? How are these distributed? Are they cumulative in nature or are they independent releases?
13. What level of training is available for the software users? What is the quality of the manual and reference material for users?
14. What type of vendor support is provided on an ongoing basis?
15. What level of vendor support is provided during the installation and set-up of the software?
16. What level of consulting support is available and/or required in the installation and set-up phase of the software implementation?
17. Which other companies are using this software? What has been their experience? What is their degree of satisfaction?
18. Will the vendor provide a list of references of users of its software to determine their level of satisfaction with the software?
19. What are its limits in terms of data base size, number of variables, data length, forecast time horizon, and data export and data import?

Note: Again, be sure to add a "how" question to each "what" question posed to the vendor.

SUMMARY AND CONCLUSIONS

The set of considerations and questions presented in this article is not exhaustive, but it gives a good starting point. Supplementing the above with other questions pertinent to the specific situation and concerns facing the forecaster, the company, and its management will have a broad basis of inquiry to ensure a better software selection decision. The objective is to find the solution that best fits your company's needs and circumstances.

Ultimately, one is entering into a partnership with the vendor and its employees. Be sure to meet with the vendor's management, development staff, and support staff. Talk with them in order to develop a sense of their commitment and capability to deliver the services they promise. Make sure that the vendor is financially sound. This will minimize the risk of unexpected disruptions of service or withdrawal of vendor support.

The bases for selecting dedicated forecasting software are grounded in the specific needs of the company, its forecasting process, the business decisions to be made, and the application of appropriate data and statistical methods for forecasting. These requirements should be fully defined and explored before undertaking a software search. An independent consultant can sometimes be of great assistance in giving you an unbiased perspective in these regards. It is important to consider both current and future needs. Make sure that the selected DFS package has the flexibility and expandability that will be required for both its current and future needs.

Certainly a forecaster's education is important. Before embarking on this venture, make sure that the forecaster has a working knowledge of various metrics, analytical tools, and methods and models that can be applied to a forecasting problem. This way you will be sure that you are getting exactly what the company needs (not just what a particular software solution may offer). While it is not necessary to be a statistician to effectively use the available software with the embedded expert system, the forecaster must have a reasonable level of knowledge of when and how to use different methodologies in order to make informed judgments about

the best approach and the trade-offs that are inevitable in such an undertaking. So a forecaster with a good working knowledge of forecasting methods as well as of the business and its operations is in an excellent position to take the forecasts to a higher level of performance by selecting the best dedicated forecasting software solution for his or her company.

Properly structured, the search process can result in a software package that will significantly improve the ability to forecast as well as the management's decision process. It can also improve the productivity of all who are involved in the forecasting process of the company. The search is an exploration where asking the right questions and getting clear feedback from vendors are essential. Structure your inquiries, ask follow-up questions, check vendor references, and be sure to become familiar with all of the key personnel of the vendor. It is ultimately a business partnership, and your forecasting success depends on it.

Here is a last suggestion that can assist a great deal in selecting the best software solution. Create a test data set or sets that best characterize your company's forecasting problems. Share these with the potential vendors (holding out a sample to which their forecast results can be compared). Ask the potential vendors to develop the optimal model(s) and produce a forecast of the hold-out period, and do so within some designated time period. With that one can determine the effectiveness of the software. Since the vendor is most knowledgeable about the forecasting software it is offering, this exercise will provide "live" insight into the speed and ability of the software package in dealing with your forecasting problem. It also affords an opportunity to see how the software presents the forecast, does the data analysis, and verbalizes the model, key assumptions, and other forecast issues. These can then be compared across vendors to determine the best software solution for your company. Here, you may like to find an independent consultant or someone else you trust to help you in evaluating different software results.

A very powerful way of assessing different Dedicated Forecasting Solutions is to attend a forecasting conference like the ones conducted by the IBF. Bring your data with you in an MSExcel file or a basic text file and walk around the booth area and ask several vendors for a live demonstration on your data. Some vendors only want to exhibit their software on their data, which oftentimes is trivial. Find out what their software will do with your data!

The key to finding the best software solution is to know your company's needs, know the forecasting models and metrics of most importance to your company's forecasting problems, and ask the right questions. Surprises after the fact usually do not come from the inquiries that were made, but rather from the questions that were not asked. So ask the right questions. ■

BOOK REVIEW

Dougherty, John and Christopher Gray, ***Sales & Operations Planning—Best Practices,*** Trafford Publishing, 6E-2333 Government St., Victoria, BC V8T 4P4, Canada, pp. 321, $56USD.

This book is about a communication and decision-making process that the authors call Sales and Operations Planning (S&OP). It is based on their experience with the processes and best practices of 13 companies. It deals with issues that impact logistics, supply chain management, sales and operations planning, and planning of resources. It is not, however, about forecasting principles, processes, and practices; in fact, sales forecasting is treated in just two pages.

The authors deal primarily with the operational aspect of the business decision-making process. Almost half of the discussion revolves around companies covered, their S&OP processes, and best practices. They share success stories dealing with decreased inventories and costs, and increased efficiencies resulting from the application of S&OP best practices in different companies.

There are many useful ideas dispersed throughout the book, the most noteworthy among them are monthly S&OP process charts, distinction between volume and mix, and balancing demand and supply and their interrelationship. Other issues covered include how fulfillment strategies work when dealing with seasonal demand, how to focus on resource planning and scheduling, how to use TQM and Six Sigma concepts in sales and operations planning, and how to collaborate with customers in the demand-planning phase.

The companies selected for exposition include a wide spectrum of industries of differing sizes and operating environments. The authors emphasize that for an effective S&OP process, we need accurate data, and not necessarily precise data. The discussion of various demand/supply planning meetings and their processes is of great value, as are the described best practices. Although principles discussed in this book are straightforward and easy to apply, some issues are not discussed in depth. Also, coverage is limited to the treatment of S&OP as it relates to Production and Financial Planning, and does not discuss much about issues dealing with strategic planning, environmental assessments, pricing leverage, and advertising impacts on S&OP. New forecasters and demand planners will benefit by the exposure to the S&OP process along with the realities and complexities of it. The book's ideas will expand the forecasters' understanding beyond the demand planning function and give a better appreciation of other stakeholders' perspectives. If forecasters fully grasp the issues their end users face, they would become better providers of forecasting services.

John Triantis, Principal
Long Range Planning Associates
(johntriantis@comcast.net)

DON'T JUST MEASURE FORECAST ERRORS

By Larry Lapide

(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 email to llapide@mit.edu.)

"If only we could do a better job of forecasting demand." If I had a dollar for every time I heard this, I would be partying on a big yacht in the Mediterranean rather than working for a living. This statement is usually made by managers asking my advice on how to improve their forecasting process because they feel their forecast errors are much too high. Recently, for example, someone asked me what is a benchmark of forecast error for a consumer products company. I stated that the best is 25% error, but typically it is 50% at the stock-keeping-unit (SKU) and location (such as a warehouse) level. He was shocked to hear this since he was experiencing 50% or greater errors; he thought his results were much worse than others.

This manager then asked what he should do about this. I glibly told him to do the best job he could to improve forecast accuracy, but recognize there is a limit. Since he would never get it down to a level that everyone in his company would be satisfied with, he should eventually stop fixating on substantially reducing forecasting errors and learn to live with them regardless of the level achieved.

WHY MEASURE FORECAST ERRORS?

Every forecaster knows that he/she should measure forecast errors. Most do it, however, for only one reason. They use it largely as a report card because they want to know how well they are doing. Measuring error just to move down a path to perfect (zero error) forecasting is pure folly. It's like searching for the Holy Grail; it's elusive and you'll never get there.

One should measure forecasting errors for two primary reasons: to learn from them and to manage demand risk. Regarding learning from them, forecasts errors should be analyzed to assess where errors are too high or have gotten too large so that more focus can be placed in those areas for improvement. Regarding managing for demand risk, users of the forecast need to know how accurate they are in order to leverage risk management strategies designed to mitigate the risk. I will elaborate on each of these reasons below.

LARRY LAPIDE

Dr. Lapide is Director, Demand Management, at MIT's Center for Transportation & Logistics where he is responsible for managing its initiatives in Demand Management and Supply Chain Strategy Alignment. He has extensive business experience in industry, consulting, and research, and has a broad range of forecasting experiences. He was a forecaster in industry for many years, has led forecasting-related consulting projects for clients across a variety of industries, and has taught forecasting in a college setting. In addition, for seven years he was a leading market analyst in the research of forecasting and supply chain software.

LEARN FROM FORECAST ERRORS

Learning from your mistakes is probably the most important reason to measure forecast errors. The forecasting process, like any other process, needs metrics that indicate how well it is performing. However, metrics won't add any value if you don't learn anything from them and don't take any action to improve the forecasting process.

An important input to this learning involves the analysis of which portions of the demand forecast are most accurate and which are the least accurate. This will help to assess which forecast methods are working well and which are not, as well as to help identify areas where alternate methods might improve accuracy.

Many forecasting software applications, for example, have a module called something like "best fit." In that module a variety of different methods are tried out on historical data to see which of them would yield the best forecast. The software then assumes that method will be best for forecasting the future. It makes sense to do this. That analysis addresses the basic question: which forecast methods would

have been the best historically?

Learning from one's mistakes addresses the question: which forecast methods historically worked best and which worked the worst? The answer to this question can be gleaned by doing deep-dive analyses of both aggregated and disaggregated forecast errors. Below are some of the error analyses that can be performed to measure the performance of the forecasting process in attempt to improve it.

- ***Final Forecast versus Intermediate Forecasts:*** In these analyses, the error from the final forecast is compared to the error that would have occurred if the revised forecast were used instead as a final forecast. For example, most forecasting processes start out with an intermediate forecast called the "baseline" forecast. It is revised based on market intelligence, which was not accounted for in the baseline forecast—such as promotions, competitive actions and price changes. Often the market intelligence is largely subjective, while the baseline forecast is objective. Identifying the portions of demand for which the baseline forecast would have performed better can help in assessing where the market intelligence made the forecast better, and where it made it worse. This information can also help decide when the baseline forecast should not be revised or to develop new approaches to incorporating market intelligence to improve it. You can also compare intermediate forecast errors or final forecast errors to the errors of forecasts received from marketing and sales organizations and/or customers.

- ***Final Forecast versus a Naïve Forecast***: In this analysis, the error from the final forecast is compared to the error that would have occurred if a simple naïve method were used instead. (This is a variation that I recently heard about in response to what I had proposed in a column I wrote in the Winter 1998/1999 issue of *The Journal of Business Forecasting*. In that column, I advocated comparing the Mean Absolute Percent Error [MAPE] of the final forecast to the Mean Absolute Percent Variation [MAPV] of historical demand. As long as MAPE was lower than MAPV the forecasting process was adding value. However, if MAPE was larger than MAPV, then the forecasting process was making matters worse). In this error analysis, a naïve forecast, such as a simple or weighted moving average, would be compared against the accuracy of the final forecast. In cases where the naïve forecast is more accurate, this simpler forecasting method might work better than the more elaborate process currently being used to develop the final forecast.

- ***Detail Breakdown of the Forecast Errors***: In this analysis, the errors from the final forecast are disaggregated into different components to determine portions of demand where forecast errors are abnormally higher or lower than others. Also to evaluate where some methods are working better than others. This analysis helps address what portions of demand need forecast improvement as well as foster learning from the portions where forecasts are most accurate. For example, a comparison of forecast errors by sales channels, product groupings, customer/product sales (e.g., an A/B/C categorization based on sales), customer types, and geography can help pinpoint areas that need improvement in forecasting. In addition, a comparison of the forecast errors among various statistical methods and/or among various forecasting approaches, such as top-down and bottom-up, can also help to determine what methods or approaches work best for certain portions of demand.

USE ERRORS TO MANAGE RISK

A majority of forecasting organizations are whetted to producing point forecasts. The point forecasts (if developed well) are unbiased in that they should represent the average demand that might be experienced in the future. So while they are somewhat useful, they have limited use for planners who are responsible for putting supply in place to meet future demand.

Planning based on an average has its limitations as it calls for putting in supply to meet average demand, which means that you would have enough supply to satisfy demand 50% of the time. For example, to manage for demand risk and leverage any upside potential in demand, supply planners place inventory buffers in their supply chains. These risk management strategies, however, need to consider the level of demand risk, namely the forecast errors that reflect that risk. Thus forecasters should provide an estimate of the forecast error for each forecast they publish to fully support supply planning. Yet most don't. Why not?

I think that most forecasters don't like to bring up the topic of forecast errors because they are afraid they will be held against them—especially when the errors are big, which they often are. I'd encourage them, however, to do so because there are risk management strategies that need these estimates of forecast error to mitigate demand risk, such as:

- ***Hedging Supply:*** Such risk management strategies lock-in supply in advance for scarce materials and components. They guarantee that goods are available when needed in the future and follow the practice of locking-in and phasing-in supply to cover more certain demand before uncertain demand. For manufacturing, the strategy manifests into "first make products that have less risk" because one is more certain of being able to sell all of them. These supply hedging strategies leverage range forecasts rather than point forecasts. These are forecasts where both an average and a forecast range are developed based on forecast errors. They can be used

to develop optimal hedging methods that can be imbedded into flexible contracts and procurement strategies for critical parts and scarce materials. HP, for example, uses range forecasts to develop contracts with their suppliers to guarantee they will have critical parts available at a reasonable price, as well as to secure them in advance so that they are available when needed for production. The range demand forecasts help HP determine what percentage of average supply is best to lock-in, enabling a purchasing strategy of "securing first what you are more certain of needing."

- ***Delaying Decisions:*** These risk mitigation strategies work on the premise that short-term forecasts are more accurate than long-term forecasts. Therefore, demand forecast errors will decrease as one moves closer to demand generating events. Thus, one is better off delaying a decision when possible in order to base supply needs on a more accurate assessment of demand. Recognizing this principle, you can note that in the production hedging example mentioned above the delaying of production of less-certain products has an additional benefit. That benefit comes from improved demand forecasts by the time a decision needs to be made on how much less-certain products have to be produced.

- ***Risk Pooling:*** These risk management strategies work on the premise of compensating errors and the law of large numbers. Under these strategies, aggregated rather than detailed forecasts are used to make higher level or aggregated product decisions. Postponement is one example of these strategies. Under a manufacturing postponement strategy, final production and assembly steps are delayed until closer to when orders arrive. In this way, inventories can be held at a Work-in-Process (WIP) or component level. Since the inventory levels are held to support aggregated final product demand, having lower forecast errors, less total inventory is required than if final products are inventoried. For example, in Dell's build-to-order business model, components are inventoried rather than the final system configurations of which they will be part of. Such a strategy aggregates demand and leverages inventories more efficiently.

- ***Supply Buffers:*** These risk management strategies increase the flexibility of a supply network to meet demand. Holding safety stock inventory of finished goods, for example, is a very common inventory management strategy for mitigating against demand risk. In a production system, WIP inventory is often held between manufacturing stages to help mitigate demand (as well as supply) risk. In addition, another manufacturing buffer strategy involves planning to operate plants at less than full capacity in order to have excess capacity available to capitalize on any upside sales potential that occurs when demand exceeds planned supply.

Key inputs needed to optimally implement these risk management strategies are demand uncertainties in the form of forecast errors. To apply them to specific portions of a business, many of them need the same breakdown analyses of errors previously mentioned that are useful for learning. For example, a breakdown of forecast errors by sales channels, product groupings, sales levels, customer types, and geography are needed to develop postponement and supply buffer strategies specific to each of these aspects of a business.

SUMMARY

Summarizing, forecasters need to do more than just measure errors. They need to get a better understanding of them as well as communicate them more widely across their companies. Deeper analysis of errors can help improve forecast accuracy over time, while openly divulging forecast errors will help supply planners cope with the uncertainties of demand.

Of course, most forecasters will be wary of exposing to a wide audience their levels of forecast errors, because they don't want to look bad. However, it is better for all concerned if everyone in your company recognizes that forecasting is not just about trying to get to 100% accuracy, it's about getting the best accuracy possible. In addition, supply planners need forecast errors to develop rational and fact-based risk management strategies that mitigate demand risk. ■

REFERENCE

Sheffi, Yossi. "Creating Demand-Responsive Supply Chains." **Supply Chain Strategy Newsletter.** Harvard Business Review and MIT Center for Transportation & Logistics. Vol. 1, No. 2, April 2005.

INTEGRATING DEMAND FORECASTING WITH REPLENISHMENT IN A HIGH-TECH RETAIL CHAIN

By Cleopatra Bardaki, Katerina Pramatari, and Panagiotis Miliotis

Since many of the customers of the high-tech industry are willing to wait when retailers are out-of-stock, stores should keep inventory at a low level ... often shortages occur because of the poor replenishment procedure at the central warehouse ... the more volatile the sale of a product, the more difficult it is to forecast.

Demand forecasting and efficient replenishment policy are two important elements in managing inventory, a difficult challenge in the high-tech industry. High-tech products are characterized by short life cycles, too many SKUs, volatile demand, and quick obsolescence. As such, demand forecasts are unlikely to be accurate, resulting in product shortages and lost sales. To counter such issues, high-tech companies carry extra inventory, which is very costly.

In this article, we propose an experimental approach to address demand forecasting and efficient replenishment in a high-tech retail chain. The approach consists of three steps: (1) selection and evaluation of the demand-forecasting model, (2) integration of the demand-forecasting model with the chain's replenishment policy, and (3) application of these two models to a pilot program. The experimental approach has been applied to the Greek Telecommunications

CLEOPATRA BARDAKI

Ms. Bardaki is a Ph.D. candidate at the Athens University of Economics and Business (AUEB) and a research officer in the SCORE group of the ELTRUN Research Center at AUEB. She is a recipient of Bodossaki Foundation scholarship for her Ph.D. studies, a PriceWaterhouseCoopers scholarship for her MSc studies, and the Ericsson Award of Excellence in Telecommunicationj for her BSc thesis.

KATERINA PRAMATARI

Dr. Pramatari is Lecturer at the Department of Management Science and Technology of the Athens University of Economics and Business (AUEB) and scientific coordinator of the ELTRUN-SCORE research group at the ELTRUN Research Center at AUEB. Prior to that, she worked for Procter & Gamble European Headquarters on the development of global Category Management applications.

PANAGIOTIS MILIOTIS

Dr. Miliotis is Professor of Operational Research at the Management Science and Technology of the Athens University of Economics and Business. Before holding that position, he worked as the Vice Rector of the Athens University of Economics and Business. His articles have appeared in journals such as *Applied Mathematics*, *Operational Research*, and the *European Journal of Operational Research*.

Organization, which operates a wide retail chain of stores that sell high-tech telecommunication and mobile telephony products.

THE REPLENISHMENT PROCESS

The high-tech retail chain comprises a number of stores across the country and one central warehouse. The stores sell high-tech telecommunication products, such as telephones, phone cards, and ISDN equipment. The replenishment process of the chain is periodic (see Figure 1); on a given day of every week, store managers place their orders to the Central Office (COF). The COF checks the orders and forwards them to the Central Warehouse (CWH). Once a week, the CWH sends batch orders to the suppliers, e.g., Nokia and Ericsson. The CWH delivers the products to stores based on their orders and availability. The ordering process does not utilize any forecasting technique.

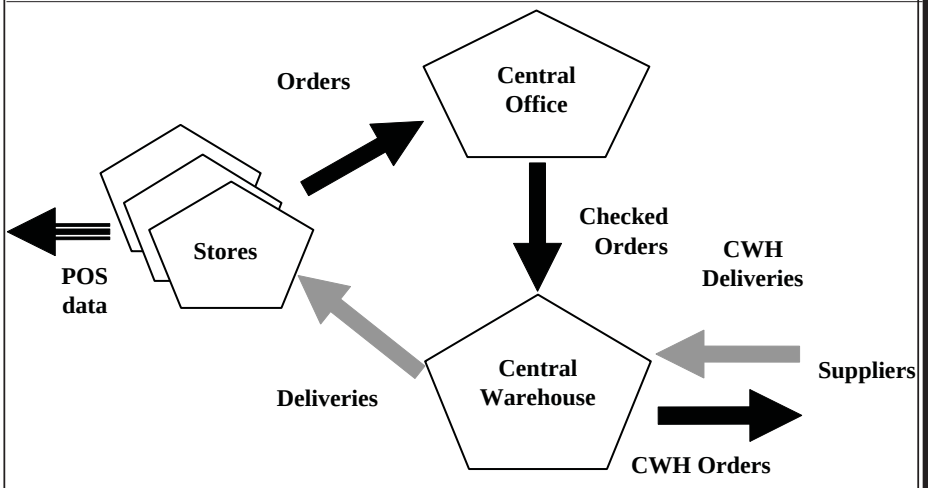
The retail chain faces two main problems: low product availability (Out-of-Stock), which leads to lost sales and decreasing customer loyalty; and increased safety stock, which is accompanied by high holding costs and increased risk to sale stock at depreciated values.

THE EXPERIMENTAL APPROACH

We have developed a five-phase experimental approach for integrating the demand-forecasting model with the high-tech chain's replenishment policy. The objective of this approach is to support the ordering process and improve the product availability while keeping minimum inventory levels. We will describe the application of these phases to a high-tech retail chain, which is a part of our case study.

Phase 1: Data Manipulation and Selection of a Products Sample. The data came from 10 stores that were selected according to their sales volume, location, and lead time. The data refer to the daily sales of 1,532 single products. Each product's daily sale is identified by Store, Date, Product Key, and Category. The Microsoft SQL Server 2000 database management system was utilized to store, process, and transform the data. The products were classified into four groups based on weekly demand uncertainty as measured by the mean (μ) weekly sales and the coefficient of variation (cv), where cv is the ratio of the standard deviation to the mean and measures variability relative to average demand. From these four groups of products, a sample of 46 products, which belong to five representative categories (fixed-line phones, mobile phones, ISDN equipment, phone cards, and mobile phone accessories), was taken to test our experimental approach.

FIGURE 1
THE REPLENISHMENT PROCESS OF THE HIGH-TECH RETAIL CHAIN



Phase 2: Selection and Evaluation of the Demand-Forecasting Model. The length of the forecast period was selected to be one week. Trend-Corrected Exponential Smoothing (Holt's model) was chosen as the most appropriate forecasting technique for our retail chain; the Moving Average and Simple Exponential Smoothing forecasting methods were tested also, but they gave higher forecast errors. The statistical package (SPSS v12.0) was employed to execute the Holt's model experiments with 24 weeks of sales history to produce the forecast parameters for the sample of products and categories. Each forecasting model was evaluated based on the forecast error, which was MAPE (Means Absolute Percent Error).

Phase 3: Integration of the Demand-Forecasting Model with the Replenishment Policy. According to the periodic replenishment policy of the high-tech chain, the order quantity must not exceed Order Up to Level (OUL), which is expressed as

$$OUL = F_{T+L} + ss \quad (1)$$

where F_{T+L} is the forecast of the demand that arises in the time period of the review interval T plus the lead time for replenishment L and ss is the required safety inventory to handle demand volatility. The proposed order quantity was estimated as

$$Order = OUL - Available\ Inventory \quad (2)$$

Holt's demand forecasting model was integrated with the periodic review policy, since it was used to produce the demand forecast F_{T+L}.

Phase 4: Application of the Demand-Forecasting and Replenishment Models to a Pilot Program. Holt's forecasting

model and the periodic replenishment model were put in practice for a four-week pilot program in eight stores of the retail chain. The models were implemented using Microsoft Excel spreadsheets to provide the order forms for each store. Each week of the pilot program, the order forms automatically calculated the demand forecast and proposed to the user-store manager an order quantity based on the formula given in equation (2); then the manager decided about the final order. The store managers and the central warehouse manager were also completing inventory and shortage forms with the daily inventory by product and the daily product shortages, combined with customers' reactions to the shortages in order to gather useful information for the evaluation of the pilot program.

Phase 5: Evaluation of the Pilot Program. The four-week pilot program results were analyzed quantitatively and qualitatively, based on the order, inventory, and shortage forms that were collected during the pilot program. The analysis included: (a) a comparison of the demand forecast with the real demand during the pilot program, (b) a comparison of the replenishment system's order with the store manager's final order, (c) a monitoring of the daily level of product shortages and inventory, (d) an estimation of the weekly inventory duration (that is, for how many days a week the store can satisfy the customers' demand) measured as the inventory level at the beginning of the week divided by the average daily demand, (e) an investigation of the cause of Out-of-Stock cases in stores by determining whether or not the product shortages were due to inventory shortages in the central warehouse or due to something else, and (f) a monitoring of the customers' reactions (that is, if the customers waited, bought a substitute product, or left the store without buying anything) to Out-of-Stock products.

RESULTS

The study's objective was to evaluate the demand-forecasting and replenishment models, analyze the Out-of-Stock cases, and determine the customers' reactions to low product availability. These are the findings.

FIGURE 2
CAUSE OF OUT-OF-STOCK CASES

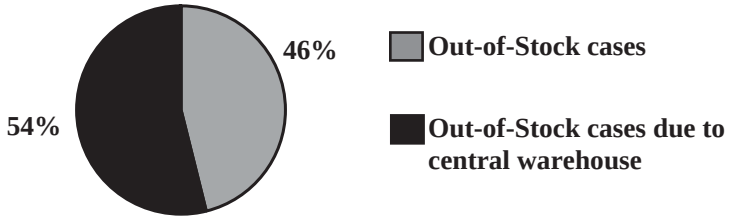
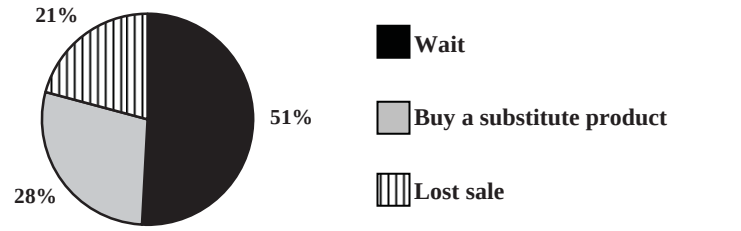


FIGURE 3
CUSTOMERS' REACTIONS TO LOW PRODUCT AVAILABILITY



Evaluation of the Demand-Forecasting Model. Since high-tech telecommunication products are characterized by volatile demand and quick obsolescence, it was important to study the effect of product demand uncertainty—measured by coefficient of variation (cv)—on forecast accuracy. The data show that we get better forecasts of product categories with low cv. In addition, the bigger the mean (μ) weekly sales, the smaller the ratio of forecast error to μ. Moreover, during our pilot program the forecast error was less than two product items in more than 65% of the cases where we compared the demand forecast with the real demand.

Evaluation of the Replenishment Model. The replenishment model was evaluated based on three criteria: the daily level of product shortages, the daily level of inventory, and the weekly duration of inventory. In our pilot program, daily product shortages declined as we moved towards the last week of the program. Similarly, there was a decreasing trend in the daily inventory level during the pilot program. However, inventory duration per week remained almost stable. All these show that the ordering process functioned efficiently for the representative sample of products during the pilot program, resulting in a decrease in inventory levels along with a decrease or stabilization in product shortages.

Analysis of Out-of-Stock Cases. The pilot program results show that the percentage of product shortage cases in stores depends on the product category. Fixed-line phones and mobile phones were two product categories with maximum Out-of-Stock cases. The analysis of product inventory levels in stores and in the central warehouse revealed that almost half of the Out-of-Stock cases (54%) in the stores were due to inventory shortages in the central warehouse (see Figure 2). The other half can be attributed to the problems related to the replenishment procedure. This means that in order to improve the supply chain, the company has to improve the replenishment procedure as well as the inventory management at the central warehouse.

Customers' Reactions to Low Product Availability. Figure 3 illustrates that, based

on this pilot program, when a product shortage occurs, the customers have three options: they can wait for the product to be replenished, they can buy a substitute product, or they can leave the shop, which represents a lost sale. Monitoring the customers' reactions during the pilot program showed that the customer chose to wait in 51% of the low-product-availability cases. It also was noted that the customers' behavior varies, depending on the product category; in almost one-third (28%) of the mobile phones, Out-of-Stock cases resulted in a lost sale.

CONCLUSIONS

The results of our pilot program are:

- The demand forecast was reliable and the replenishment process functioned efficiently in most of the ordering cases.
- The customers are tolerant towards low product availability. Therefore, the high-tech chain stores should focus on keeping stores inventory level down instead of trying to be more responsive to customers' expectations.
- Most Out-of-Stock cases in stores were due to inventory shortages in the central warehouse. Thus, to improve the supply chain, the company has to improve the replenishment procedure as well as the inventory management at the central warehouse. ■

(cleobar@aueb.gr, k.pramatari@aueb.gr, miliotis@aueb.gr)

BOOKS

1. **Practical Guide to Business Forecasting**, edited by Chaman L. Jain & Jack Malehorn. Flushing, New York: Graceway Publishing Company, 2005, pp. 510. $59.95
2. **Regression Analysis, Modeling and Forecasting,** by George C. Wang & Chaman L. Jain. Flushing, New York: Graceway Publishing Company, 2003, pp. 299. $58.95.
3. **Benchmarking Forecasting Practices,** by Chaman L. Jain & Jack Malehorn. Flushing, New York: Graceway Publishing Company, 2006, pp. 116. $68.95.

THE FORECAST-CENTRIC ENTERPRISE

By Illie Csorba

Forecasts affect all functions, which in turn affect forecasts ... if all the forecasts are tied to the budget, all the departments will be in sync at the budget level, but not necessarily at the product level ... most of the problems stem from poor communication among various departments.

At some time, all professional business forecasters have experienced the following "typical" Monday morning—beginning with a call from the Fulfillment Manager.

"What's up with this order for 10,000 A15s for ABC Distributing? That's more than our monthly average demand. From what I see, there is no history to support this demand. You can't even forecast rain when you're standing in a thunderstorm! What am I supposed to do now? Should I miss a shipment to this new customer or not ship to the rest of our customers for a month?"

What a way to start a Monday. Let me have a cup of coffee and figure out what is the root cause of this problem. Who could be responsible for this "unforecasted" demand? I will call the Sales Manager.

"Hi Larry, I just found out we have a new order for 10,000 A15s from a new customer, ABC Distributing."

"Yeah, what about it?" replied Larry. "That's what we sell!"

Slightly taken aback by his response, I countered with, "How can you sell an entire month's supply of a product without including it in your monthly S&OP adjustments?"

Larry replied, "Hey, it's in the budget for our quota for this quarter, why didn't you add in it?"

"There is no mention of this SKU for this month," I responded.

Larry: "Marketing threw some business development funds my way to close the deal, so we did."

Since it was in the budget and marketing had some funds, we closed the sale. I guess I will have to maintain better communication with our Marketing department and their business development budget. It was the time to speak with Marketing Director to make sure no other surprises are waiting for me.

"Hey Mike, just heard from Larry that you guys worked together to close a deal with our new customer ABC Distributing on the A15. Congratulations! Is it because you had budgeted some business development funds? Do you have any money budgeted for other customers and SKUs?"

"A15s? I thought I told Larry that the funds were earmarked for the new product line."

"Product Development has laid out a new strategy for that product line; you should talk to them."

A few minutes later (after another cup of coffee), I rang up Dieter, the head of Product Development.

"Hi Dieter, I just found out from Mike that you've got a new product line to replace the A15 line."

"Yes, we determined last year that our technology was inferior … so to stay competitive, we decided to introduce the new line. In fact, we recently acquired a small competitor who will provide this technology."

In that case, we need to ship a month's supply of a soon-to-be-obsolete product to a new customer at a discount that was supposed to be used to promote the new product line that has a superior technology.

ILLIE CSORBA

Mr. Csorba is a senior principal consultant at Oracle. He has over 20 years of experience in Forecasting, Demand Planning and Supply Chain Management. He has created systems solutions for various organizations including Ford Motor Company, Wal-Mart, Chevron, and Toyota. He is the recipient of R. L. Polk's Inventory Efficiency award. He holds a B.S. degree from Radford University.

Business Forecasting: A Tutorial at 3 Levels

August 23 & 24, 2007 • Seaport Hotel • Boston, Massachusetts

Beginners

Day One • August 23, 2007

8:30–9:00am **WELCOME & OPENING REMARKS**
9:00–11:30am **FUNDAMENTALS OF FORECASTING**

1. Role of Forecasting in an Organization
- Value of forecasting to business
- Develop effective forecasting processes
- Forecasting best practices

2. Forecasting Process
- Organization stakeholders and their roles
- Organization design & culture issues
- Importance of consensus meetings

3. Software Forecasting System Frameworks
- Management information needs & goals
- Analytical needs & expectations
- Report writing & presentation

4. Software Evaluation and Selection
- Appropriate statistical models
- Ease of data selection and manipulation
- Interface with several systems

5. Introduction to Forecasting Methods
- Time series models
- Cause and effect models
- Qualitative models

Mark Lawless
Senior Consultant
INSTITUTE OF BUSINESS FORECASTING

2:00–4:30pm **HOW TO DESIGN A BUSINESS FORECASTING PROCESS**

1. Introduction to Forecasting Processes and Methods

- Why forecast?
- Forecasts organization
- "Single number" forecasting
- Sales and Operations Planning (S&OP) process
- Measuring forecast performances
- Forecast methods

2. Case Study

- Case activity on forecast process design
- Group activity on a case study
- Discussion of group solutions

Larry Lapide, Ph.D.
Director, Demand Management
MIT CENTER FOR TRANSPORTATION & LOGISTICS

Day Two • August 24, 2007

9:00–11:30am **HOW TO PREPARE FORECASTS WITH TIME SERIES MODELS**

1. Background: Time-Series Concepts You Already Know
- Rolling the dice and the random walk
- You're only as good as your last deal, product, etc.

2. What is Time-Series Forecasting and When to Use it?
- Learning from the past
- Time-series vs. other methods

3. Identifying Patterns and Decomposing Series
- Level, trend, seasonality, cyclicality, & intervention
- Seasonal indexes and seasonal adjustment

4. Time-Series Methods
- Simple averages (level, percent change, & weighted percent change)
- Moving averages (level and percent, single and double)

5. Pulling It All Together (Case Study with MS Excel)
- Constructing the forecast
- Evaluating the forecast (RMSE, MAD, MAPE)

6. Successful Presentation: Understanding & Explaining Forecasts

Sara Brumbaugh
Principal Statistician
AFFINOVA

2:00–4:30pm **HOW TO PRESENT FORECASTS TO UPPER MANAGEMENT**

1. Forecast Priorities of Upper Management vs. Other Functions
- Full plate / limited time
- Different constituencies
- Educational and functional background

2. Presentation Content
- Consistent agenda
- Maintenance vs. new vs. discontinued products
- Accuracy of past forecast
- Future forecast vs. plan, year-to-date, and year-to-go
- Key Measures—sales, inventory, customer service levels, etc.

3. Forecast Delivery—Speak the Right Language
- Relevant vocabulary
- "Our" forecast, not mine
- The big picture

4. Conflict Resolution—Minimize Politics
- Demand vs. supply
- Risk analysis
- Use other "influencers"

5. Exercise

Robin Simon
Senior Consultant
INSTITUTE OF BUSINESS FORECASTING

Business Forecasting: A Tutorial at 3 Levels

August 23 & 24, 2007 • Seaport Hotel • Boston, Massachusetts

Intermediate

Day One • August 23, 2007

8:30–9:00am **WELCOME & OPENING REMARKS**

9:00–11:30am **SUPPLY CHAIN METRICS AND VALUE CHAIN PERFORMANCE**

1. Value Chain Balance—Overview
- Understanding the importance of a balanced value chain
- Metrics and goal alignment

2. Review of Customer Service Metrics
- Measuring customer service
- First time fill rate
- Order complete
- Decomposing service failure

3. Inventory and Production Metrics
- Inventory turns and inventory coverage
- Do we need inventory coverage?

4. Forecast Performance Metrics
- Measuring forecast error
- Forecast bias and attainment

5. Introduction to Exception Management
- What do we learn from forecast error?
- Decompose forecast error to understand its major drivers
- Define process & systems to understand exception management
- Illustrations of sample exception reports

Mark Chockalingam, Ph.D.
Management Principal
DEMANDPLANNING.NET

2:00–4:30pm **CONSUMER BASED FORECASTING, PREPARING FORECASTS WITH POS & SYNDICATED DATA**

1. What Are POS & Syndicated Data?
- Definitions
- Sources (EDI, IRI, Nielsen, SPINS, etc.)
- Importance to CPFR

2. How Do POS & Syndicated Data Relate to Other Data Sources and When Should They Be Used?
- Different dimensions: product, geography, period, measure
- Strategic vs. tactical forecasts
- Exercise

3. Real-Life Example (Fast-Growing Grocery Product) Using POS Data to Forecast Consumer Demand
- Basic concept of regression
- Identifying possible model inputs
- Producing a forecast
- Simulating different future scenarios

4. Case Study

5. Summary

Robin Simon
Senior Consultant
INSTITUTE OF BUSINESS FORECASTING

Day Two • August 24, 2007

9:00–11:30am **HOW TO DESIGN A FORECASTING SYSTEM**

1. Introduction to a Forecasting System
- Introduction to system architecture
- The criticality of building the system around the process
- Resource requirements
- Data integrity
- Importance of a data warehouse
- Product and geographic hierarchies—how you slice and dice your business
- System design, set-up, and configuration
- Reporting requirements and options
- Practical examples

Jonathan Bortz
Senior Demand Planning Solution Specialist
PLAN4DEMAND

2:00–4:30pm **COLLABORATIVE PLANNING WITH CUSTOMER DATA AND AN INTRODUCTION TO DEMAND DRIVEN SUPPLY NETWORKS**

1. Collaborative Partnerships Overview
- Leveraging information exchange to maximize value
- Continuous replenishment programs
- VMI, CRP, and CMI

2. The What and Why of CPFR
- Holistic linking of the partner value chains
- Forecast accuracy as the driver for both supply chains
- Leveraging accurate forecasts to drive the manufacturing process

3. Customer Collaboration in Practice
- POS forecasting and collaboration
- Shared single forecast

4. Demand Driven Supply Networks
- Integration of retail intelligence into supply chain process
- Creation of order forecast using customer POS and inventory

5. Collaboration Case Study
- Is there value in the order stream for a collaborative forecast?
- How to choose among the programs
- How leveraging supply chain processes improves customer service

Mark Chockalingam, Ph.D.
Managing Principal
DEMANDPLANNING.NET

Business Forecasting: A Tutorial at 3 Levels

August 23 & 24, 2007 • Seaport Hotel • Boston, Massachusetts

Advanced

Day One • August 23, 2007

8:30–9:00am **WELCOME & OPENING REMARKS**

9:00–11:30am **HOW TO DESIGN A SALES & OPERATIONS PLANNING (S&OP) PROCESS**

1. Introduction to S&OP Processes and Technologies

- Importance of S&OP
- How is S&OP done with examples
- Success factors and improving the S&OP process
- Diagnosing a company's process

2. Case Study

- Case activity on S&OP process design
- Group activity on a case study
- Discussion of group solutions

Larry Lapide, Ph.D.
Director, Demand Management
MIT CENTER FOR TRANSPORTATION AND LOGISTICS

2:00–4:30pm **HOW TO PREPARE FORECASTS WITH REGRESSION MODELS**

1. Regression Background
- X-Y scatter plots and rise over run
- From two dimensions to three and more

2. Business Applications of Regression Forecasting
- "What if" scenario analysis
- Business strategy and measuring impacts

3. The Building Blocks of Regression Analysis
- Dependent & independent variables
- Theory meets practice: the statistician's assumptions
- What can go wrong

4. Validation of Regression Models
- R-squared: a measure of explanatory power
- F-statistics, overall performance of a model
- T-statistics, significance of a variable

5. Evaluating the Model and Forecast
- Measures of accuracy for model building
- How to take your model for a test drive
- Finalizing the model

Sara Brumbaugh *Principal Statistician*
AFFINOVA

Day Two • August 24, 2007

9:00–11:30am **NEW PRODUCT FORECASTING**

1. New Product Development Process

2. Sizing the Opportunity
- Qualitative / judgment
- Delphi method
- Bottoms-up from sales
- Penetration / buy rate
- Concept test

3. Shape / Timing of Demand
- Product life cycle
- Diffusion / Logistic / Gompertz / Logit / Bass
- Test market / Trial & repeat
- Analog / Looks like

4. Summary

5. Group Exercises

Robin Simon
Senior Consultant
INSTITUTE OF BUSINESS FORECASTING

2:00–4:30pm **FORECASTING WITH UNIVARIATE BOX-JENKINS**

1. The Box-Jenkins Method: Where Does It Fit in Your Toolkit?
- What are the advantages / disadvantages of using it?
- What are the underlying assumptions?
- Techniques for identifying determinism within your data

2. Modeling with Univariate Box-Jenkins (ARIMA)
- Tentative identification: weak stationarity
- Model estimation: using the ACF and PACF
- Diagnosis of model adequacy

3. Forecasting Case Studies
- The pure AR & MA forms
- A seasonal model: air carrier freight
- Mixed models

4. Putting It All Together: Regression with Box-Jenkins

5. Modeling with Multivariate Box-Jenkins

Steven S. Shwiff, Ph.D.
Professor
TEXAS A&M UNIVERSITY—COMMERCE

Business Forecasting: A Tutorial at 3 Levels

August 23 & 24, 2007 • Seaport Hotel • Boston, Massachusetts

Who Should Attend

Brand/Product Manager
Business Development Mgr.
Call Volume Forecaster
Chief Procurement Officer
Demand Manager/Planner
Distribution Director/Manager
Financial Officer
Forecast Analyst
Forecast Manager
Forecasting & Planning Dir./Mgr.
Information Systems Dir./Mgr.
Inventory Systems Dir./Mgr.
Logistics Manager
Logistics Professional
M&A Director/Manager
Marketing Director/Manager
Material Management Manager
New Product Director/Manager
Operations Manager
Production Director/Manager
Purchasing Director/Manager
Regulatory Analyst
Research Director/Manager
Sales Director/Manager
Scheduling Director/Manager
Sourcing Director/Manager
Strategic/Tactical Purch. Mgr.
Supply Chain Director/Manager
Systems Analyst
VP of Forecasting
VP of Marketing
VP of Supply Chain

Why You Should Attend

It is no secret to deliver optimal customer service and minimize costs, companies need to prepare accurate forecasts. This tutorial on business forecasting is both for those who have been in the forecasting profession for some time and those who are new to the field. Here, you will meet experienced instructors who will show, step-by-step in a classroom setting, how to recognize, prepare, improve, and present forecasts.

Whether you are fresh to the field, or have been in the forecasting function for some time, you stand to benefit from this tutorial. Each level will have its own concurrent track, and there are no restrictions on any of the sessions you attend. You have complete freedom (at any time) to move from one session and/or level to another, according to your various interests. This flexibility will allow you to customize your schedule to meet your needs.

Another benefit of this program is that it can give you the necessary training to assist you in achieving IBF Certification. As an added incentive, you can receive professional credit towards Continuing Education (CE), as well as IBF re-certification credit by attending this tutorial. Plus, if you are in search of a forecasting software package or demand planning/forecasting system, there's no need to go any further! Our exhibitors are the premier forecasting vendors in the field. They will help you learn more about how technology is making forecasting more efficient and cost effective than ever.

Do you want to strengthen your company's competitive advantage? Are you looking to increase your company's margin? If you've answered affirmatively, then the IBF's "Business Forecasting: A Tutorial" is for you. You will not find another tutorial as complete as that of the IBF, because it will give you a solid foundation in business forecasting.

Hotel Information:

Seaport Hotel

One Seaport Lane, Boston, MA 02210

RESERVATIONS: **617.385.4514**

FAX: **617.385.4001**

SPECIAL IBF RATE: **$229/Night***

**Reserve by July 20, 2007*

WEBSITE: **http://www.seaportboston.com**

Registration Information:

How to Register:
You may register by phone, fax, mail, or our web-site. When registering, please state Key Code listed above your name on the address label.

Payment:
Payment in full is required 15 days prior to scheduled date of tutorial. Unless payment is received by that day, your registration will be cancelled.

Cancellation:
Registrant may cancel without penalty up to 15 days prior to the date of scheduled tutorial and receive a full refund. All cancellations must be submitted in writing. Cancellations received less than 15 days prior to scheduled tutorial are subject to a $195 (USD) service charge. No refunds will be given for cancellations made on the date and thereafter of the scheduled tutorial.

Accommodations:
We have set up a special discounted rate of $229/night at the Seaport Hotel, Boston, Massachusetts. To be eligible for the discounted rate, please mention the Institute of Business Forecasting when reserving your room by July 20, 2007. Rooms are limited, so act fast! Hotel reservations: 617.385.4514.

TUTORIAL FEE

Non-Members:
O Tutorial Fee: $1495 (USD)

IBF Members
O Tutorial Fee: $1395 (USD)

Special rates for academics. Please call for details.

CERTIFICATION FEE (OPTIONAL)

Non-Members:
O $350 (USD) per module
O $275 (USD) Group rate per module*

IBF Members
O $300 (USD) per module
O $250 (USD) Group rate per module*

**5 or more employees must be enrolled to qualify for group rate.*

PLEASE CIRCLE WHICH EXAM MODULE(S) YOU ARE INTERESTED IN TAKING

1 2 3 4 5

Exam Date: August 25, 2007, Boston, Massachusetts

PLEASE REGISTER THE FOLLOWING: (Photocopy if more than 1 registrant)

KEY CODE: **JBF**

First Name _____ Last Name/Surname _____

Title _____ Company _____

Address _____ MS/Suite _____

City _____ State/Province/County _____ Zip _____ Country _____

Telephone _____ Fax _____

Email _____

Industry _____

O Check O Payment Enclosed O Bill Company O Credit Card

Visa/Mastercard/American Express/Discovery _____

Signature _____ Exp. Date _____

After a stop at the first aid cabinet to get something to relieve my headache, I put in a call to the Operations Manager.

"Tom, did Mike from fulfillment call you about the A15s for our new customer ABC Distributing?"

"Sure, he did. He said you guys in forecasting and planning don't know anything! Where do you think I can come up with a month's supply of this product? I have neither the materials nor the manpower to manufacture any more than is already scheduled … in fact, Finance told me to shut down Plant 2 this month!"

Now I am thinking about lunch. You know the kind with three martinis like we used to have way back when. So, I called the CFO.

"Bud, how are you? I just heard from Tom that you asked him to idle Plant 2. I've got a huge order from a new customer and with that plant shut down there is no way to fill it."

"Hey, your forecast didn't show this extra demand … we needed the cash from working capital to make an important acquisition for Product Development."

Now it is lunchtime. I popped into the CEO's office to share the news and get some advice. I mentioned all the conversations I had this morning.

"Unbelievable! Don't we pay you for that? Do you people ever talk?"

What a disturbing conversation. And, you know what? The CEO is right!

FORECASTING—THE ENTERPRISE'S CIA

So, what do we have here? With Marketing's funds, Sales is promoting an obsolete product that is being replaced by a new product, which was acquired with the savings generated by closing a plant that manufactures the old product. I have seen it before … I am sure you have too!

The comments from the CEO are not atypical. Upper management expects forecasters and planners to operate as the organization's Central Intelligence Agency (CIA). The personnel responsible for a company's forecasting/planning function must be involved in all facets of the organization; they must understand how to gather the necessary data and information; and they must evaluate how different pieces fit together, and how each affects the other. The difficulty is bringing all the facets together to generate a unified forecast.

BUILDING A UNIFIED FORECAST

How does a unified forecast come about? Traditionally, forecasting in an organization is directed from the top management; so is forecasting within each department of an organization. The most important metric of all is budget. It is the budget that serves as a common language for all departments when communicating. In the aforementioned scenario, the department players seemed to be in sync with the company's budget, but grossly out of sync at the product level. Frequently, these situations can be resolved by implementing On-Line Analytic Processing (OLAP). This technology makes it possible to synchronize all forecasts (and budgets) to the organization's present plan. Ideally, a company's plan serves as a summary of what goods and/or services it intends to deliver to customers within a planning horizon and beyond, as well as which ones are expected to be over or short of the budgeted plan. Such a plan should also show why discrepancies would occur. Would it be because of errors in the Product, Market, Region, or Supply? This would become a reality if all the enterprise-forecasting activities start with the lowest common denominator—the SKU level forecast. The forecast will get even better if the forecaster knows which old product is being replaced with which new product, when, and with what marketing support. The forecaster should also know what plant capacity is being built, where, and with what working capital. In the earlier scenario, it is likely it was not done that way because no one had time to do it that way. All the SKUs do not have to be involved in such a forecast—maybe just the ones that are being replaced.

At this time, I would expect you to ask, "Didn't this whole problem start with a new customer?" Yes, it did! So what caused things to go into a tail spin? The Sales function was not aware of product changes, used market development funds to promote the wrong product, and generated orders that could not be fulfilled.

THE FORECAST-DRIVEN ENTERPRISE MODEL

Strategically, the organization creates a vision of what it would like to see in the future. Sales and Operations are assumed to make the vision a reality. How can we bring it all together? It can happen if all the functions share the same forecast.

FORECAST-DRIVEN PLANNING FOR THE ENTERPRISE

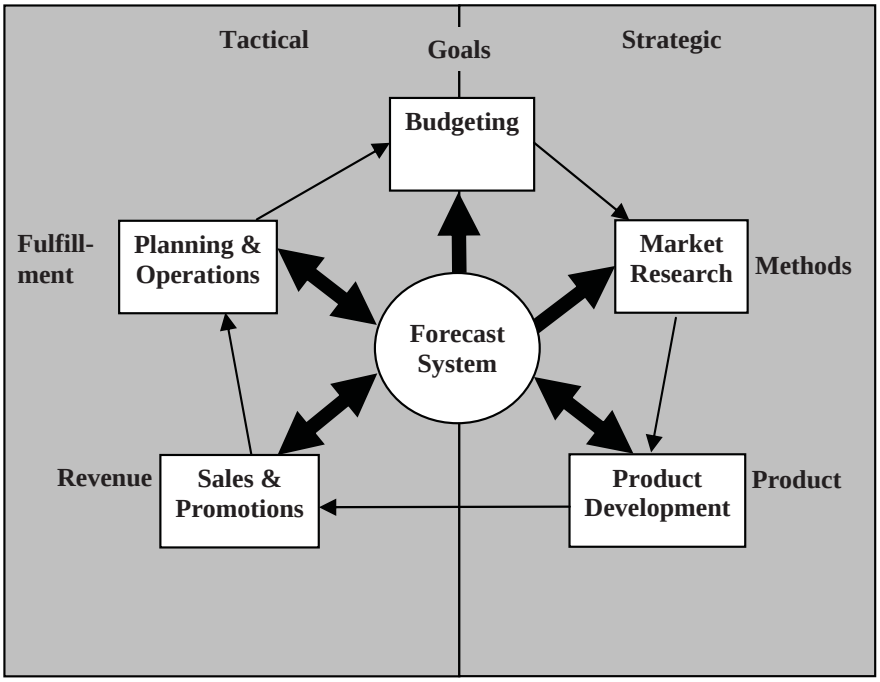
Figure 1 illustrates how different functions (Budgeting, Market Research, Product Development, Sales and Promotions, and Planning and Operations) within an organization are related. Forecasts affect all the functions, which in turn affect forecasts.

GOAL SETTING AND BUDGETING

Whether done through consensus or leadership, if they intend to stay in business, all organizations must set goals and budgets together. Where do all the activities start—from a forecast? Where is the forecast frequently born? This often stems from a top-level financial

prediction based on past performance and knowledge of investor requirements. If the organization has tactical forecasts, driven by Sales and Operations, then the budget number for the year can be derived by aggregating all the tactical forecasts. Strategic goals, on the other hand, can be derived from what is happening in the market place (new technologies and consumer trends) and planned product developments (product life cycle and new product introductions). For instance, revenue trends may have risen due to a closeout of old technology, which will not be replaced in the current fiscal year. The revenue trend increases because demand is artificially induced by a lower price to clear inventories. In that case, you have to modify the tactical revenue forecast. Let us have a look how these two functional areas impact the goal setting and budgeting forecast.

FIGURE 1
THE FORECAST DRIVEN ENTERPRISE MODEL



MARKET RESEARCH AND ANALYTICS

What can a forecasting system tell us about the market and trends? With the proper understanding of the attributes of the goods and services of an organization, one can determine the direction of the market, as well as what changes need to be made to future product categories. These may provide opportunities to introduce a new technology and alert us about the technology that seems to be dying. For instance, the attribute of "clock speed" (the processor speed of a computer) may show that future demand of the PC will drastically increase with the advent of very inexpensive physical storage. While the gross numbers might still indicate a positive increase in physical storage capability, a trend increase in the 50% range for clock speed probably serves as a good indicator that clock speed will outweigh physical storage over the next goal setting and budgeting period.

PRODUCT DEVELOPMENT

Now that marketing has identified a trend, what will Product Development do with it? Since Marketing is now forecasting a 50% increase in demand for clock speed, Product Development must determine if new products can be introduced within the budgetary time frame and at what cost. A major factor is whether the technology for the new market trend is available. If the technology is abundantly available, the product development team is free to chase the market trend within the constraints of distribution channel and ERP availability. If not, look for alternate technology and its suitability to the consumer needs.

SALES AND PROMOTION

Let us assume that our organization is very good at chasing an emerging product trend. Do we have the sales and distribution channels well developed to take advantage of it? We might have done a good job in selling products of the old technology, but channels where we can sell products of the new technology may be blocked or our salespeople are not ready for that. Our Sales team may need to use all kinds of promotions to enter into these channels of distribution. This may require special sales training to penetrate into such markets. In any case, the tactical sales forecast must reflect the reality of the market.

ERP AND SUPPLY CHAIN

Forecasting and goal setting are meaningless if we have neither the resources nor the strategy to support it. Productive capacity and material supply constraints may require a resetting of budgets and goals. If new products cannot be outsourced or if there is no productive capability, whatever goals and budgets you may have would not be met. In that case, to maintain the integrity of budgetary forecasts and goals, you have to modify them. All the functions should work together in the modification process.

LOGICAL FLOW OVERVIEW

In the end, we have a common operation-

al revenue forecast to drive all the forecasting and budgeting activities for the enterprise, which should follow this sequence:

1. Budgeting activities are driven by the forecast.
2. Marketing drives new product opportunities from forecast trends.
3. Product development identifies a new product mix based on the product trend developed by Marketing. It also determines the new product's life cycle.
4. Sales drive its forecasts from identified trends, new product mix, and channel penetration needs. As products develop, the Sales function must determine the allocation of goals within its function.
5. Operations determines its ability to procure and produce to sales forecasts.
6. Top management approves or modifies the budget forecast based on changing constraints and/or stretched goals. It is the top management that is the ultimate judge of whether or not goods or services forecasted will meet the operational and financial goals of the organization. If the forecast does not produce enough revenue/profit, then goals (and the forecast) will have to be modified.

ENTERPRISE PERFORMANCE MANAGEMENT

Now we have a plan based on a forecast to drive our enterprise. The natural extension of this is to compare the performance with the plan after the facts are in. There is software on the market that can do that. The key to managing the plan is to compare it at some meaningful level of aggregation. Budget shortages/overages can be identified through exception reporting by using OLAP technology. The only problem with this is that it is after the fact. However, with our ability to forecast, we can learn about these potential gaps before they happen and then take necessary action.

If we can drive our budgeting activities from our enterprise forecast, we can manage our performance with the forecast too. The trend of the actual performance is forecastable with a fair amount of accuracy at a high level of aggregation. So if we know that our forecast at a product-family level is usually 93% accurate, but our forecast is expected to be off by 20%, it means that there is a problem with the product family. We have to do something about it. A bad quarter is impossible to correct if it is already over. However, if trends become visible during the first month, we can take an action to correct it.

A "BRAVE NEW WORLD"

As forecasting process and technology progress, our ability to realize the vision of the forecast-centric enterprise will become more achievable. Granted, there is no perfect forecast; however, comparing high-level forecasts against a plan provides a good indication of where we are going. The primary hurdle in achieving success is having a reasonably accurate forecast at the product level. As forecasting systems and processes improve, so would forecast accuracy. If we can achieve forecast accuracy at a product level below 20%, we can drive fairly successfully the budgetary plan. At that point, the forecast function becomes the central repository of all of the enterprise's intelligence. Top management can craft plans from forecasted trends and determine from the forecast where the enterprise is heading.

This, of course, means that the forecast function will become more important to the enterprise. It will support not only the supply chain activities but also help set the enterprises's financial goals and plans. Forecasts will drive the strategic plans. The detail of goods and services making up the enterprise's revenue stream will be tied to both the strategic and tactical business plans. The result is a truly "forecast-centric" enterprise where core business activities are driven by a unified forecast that accurately predicts the direction of the enterprise's activities. ■

(*icsorba@adelphia.net*)

PHARMACEUTICAL FORECASTING MODEL SIMULATION GUIDELINES

By John E. Triantis and Hu Song

Describes in simple terms how the statistical technique known as "simulations" can identify and determine the sources of risk in a new product introduction in the pharmaceutical industry ... simulation brings different parties together ... gives a list of simulation software available in the market and their capability.

Simulation is a statistical technique for understanding the range and certainty of outcomes of a variable due to variations in the components of the process that generates the outcome. Simulations ordinarily involve assessing the impact of changes in model parameters, but sometimes values of variables that drive another variable also need to be simulated. For demand forecasting applications (short-term—six to 18 months; long-term strategic forecasting or licensing—two years to 25 years), simulations involve changes in the parameters of events affecting the forecasted number of patients and sales.

The purpose of performing simulations is to get a sense of where risk originates and how much risk is involved in the forecast. In other words, simulations increase the understanding of, say, how much the actual sales may be different from the forecast when the assumed value of a variable or a model parameter is different from what actually happens, i.e., when the nature of the relationship turns out to be different from what was hypothesized in the model. (A variable is a driving factor and a parameter is the value of a relationship estimated by the model. For instance, price may be a variable in a sales forecasting model, but the price elasticity, i.e., the sales response due to price changes estimated in a regression model, is a parameter).

SCENARIO VERSUS SIMULATION

Besides short-term forecasting, simulations are used when the value of parameters around events changes. Below are several examples of parameter changes.

- New drug (own or competitive) launch date changes, say, from August 15 to December 1, 2007
- Prices of your own and competitor products change
- Maximum share of treated patients changes, say, from 5% to 6%

JOHN E. TRIANTIS

Dr. John Triantis is Managing Partner of Long Range Planning Associates. He has over 30 years of forecasting experience and extensive experience in model simulations for performing model sanity checks, evaluating outcomes, and identifying sources of forecast risks. He has established, trained, and managed several forecasting groups and has successfully integrated forecasting, simulation analysis, and scenario development in new product development, strategic and business planning, licensing, and strategic alliance projects.

HU SONG

Dr. Hu Song is Director of Business Information Worldwide at ETHICON, Inc., a Johnson & Johnson Company, where he is responsible for primary market research, secondary market research and competitive intelligence, and forecasting. He has over 20 years of business experience in the industries of healthcare, pharmaceuticals, and medical devices. He holds an M.D. degree from Xian Medical University and has practiced medicine for several years. He also holds a Ph.D. in epidemiology from the University of Iowa.

- New drug uptake rate changes from slow to medium, or from medium to fast
- Time from launch to maximum market share changes, say, from 5 years to 3 years
- Sales force size changes from one sales team to one-and-a-half sales teams
- Detailing effectiveness changes from an average of three doctor office visits to generate one new prescription to generating two new prescriptions
- Overall treatment changes due to increasing market noise, say, from 45% to 50% in five years

Scenario assessment entails describing a sequence of events and the probability of those events occurring, as well as evaluating the overall impact on the variable in question (in technical terms, the loss function). When you are assessing the impact of varying events (not variables or model parameters) on the number of patients and sales, you are trying to understand the market dynamics at a more basic level than when you are changing the value of the variables or parameters. Examples of market dynamics include the following.

- Go or no-go decisions for own or competitive new drug launch
- New FDA regulations affecting drug labeling
- Disease diagnosis and treatment pattern change by new or different treatment guidelines
- New diagnostic criteria in effect
- Implementation of new HMO regulations
- Go or no-go decisions concerning new co-promotion strategy
- Go or no-go decision based on a new indication (use of currently marketed drugs) approval
- Whether or not to include annual drug price inflation
- Generic drugs launched

In some cases, a hybrid of scenario assessment and simulations may be more appropriate than using each one separately to evaluate the overall uncertainty of a particular outcome. The reason for this is that often we know neither the probability of events to occur nor the strength of relationships as measured by the event parameters.

USE OF SIMULATIONS

There are several ways to use simulations. We have described four of the most common and useful ways this statistical technique can add value to your operation.

1. The purpose of simulations is not to come up with the "right value" of parameters but rather, to find out, for example, how the forecast will differ if we did not specify correctly the nature of the relationship between a component of an event, such as price, and the resulting variable, sales.

2. The use of forecast simulations is to determine the likelihood of certain levels of sales to be materialized or, to put it differently, to identify sales projections associated with different levels of probability of occurrence. When models are specified correctly and simulations are done properly, forecast simulations give strong indications of the amount of risk involved in the forecast.

3. They are used for testing the reasonableness of "explicit assumptions" in the absence of major "implicit assumptions." Explicit assumptions are those that are stated up front; whereas, implicit assumptions are those that are not stated anywhere, but they underlie a model. An example of an explicit assumption may be that a competitor will decrease price by 10%. An example of an implicit assumption is a common, yet never stated, assumption that the industry structure stays constant in the forecast period. Another example of an implicit assumption is taking for granted that a company will promote a new drug at appropriate levels to obtain an adequate share of the market. This kind of application requires a great deal of experience and care in interpreting results and is only recommended for demand forecasting purposes by seasoned practitioners.

4. Simulations bring different forecasting stakeholders together. This is particularly important in the pharmaceutical industry in the case of a co-marketed drug. Each party brings to the table different expertise and expectations. It is unrealistic to expect one party to agree fully with the other. However, quite often the difference is the reasonableness of a given forecast range. With proper simulations, one can demonstrate that the gap between two different forecasts is not that significant. The two projections might be within the 20% and 80% probability ranges.

In our experience, the importance of simulations is to establish within what range both the baseline and adjusted forecast would fall. This is very significant especially for those adjustments that are not fact-based, and shows the risk that one takes in choosing a forecast that has a probability of occurrence outside the 20% and 80% probability range, established by changing variables or model parameters.

SIMULATION FREQUENCY

Best simulation practices dictate that forecast simulations should be used in cases where a "wrong" forecast has a large impact on the market share, the company's financial health, or brand equity. Such forecasts include strategic plan forecasts, major brand forecasts, and forecasts for significant products whose market dynamics have changed significantly since the last forecast update.

The best simulation process suggests

how often forecasts should be simulated. Since much depends on the particulars of a product and its market dynamics, judgment must prevail. A good rule of thumb is that unless major events have occurred that changed the industry structure drastically, forecasts should be simulated on an annual basis. More frequent simulations often are exercises for manipulating the forecasts. Keep in mind that the idea is to prevent from happening what statisticians fear most: If you torture the data enough, they will confess to anything.

PARAMETERS TO SIMULATE

Forecast model variables such as the percent of compliance, persistence, average daily dosage, and mono-therapy must be fixed before simulating the impact of changes in event parameters. (Compliance is adherence to a drug regimen as in taking medications correctly and on time; persistence is the accumulation of time from initiation to discontinuation of therapy; and mono-therapy is taking a single drug or therapy versus a combination therapy, where multiple drugs are taken.) The first set of variables to simulate should be the ones that are known to have a major impact on the maximum share of selected patients.

Another set of variables are those that are based on tenuous premises, such as the rate of uptake for a new product when there are no market research data readily available to support it. A third set of variables you may like to simulate may be, for example, for a better understanding of the effect of a sustained promotional campaign.

Forecast simulations are far more useful when the nature of the variables and parameters is varying, rather than deterministic. For instance, there is a great deal more value in understanding the boundaries/impact of changes in average daily dosage than changes in the launch date of a product.

To maximize effectiveness, the variables to simulate should be kept to no more than five or six. It is a good idea to select from the following set of variables.

- Overall treatment
- Compliance, persistence
- Source of business, such as competitive switch, add-on to the existing therapy, or price increase of therapy
- Market expansion
- Maximum market share of selected segment(s)
- Years of maximum market share
- Rate of uptake
- Maximum overall market growth
- Years of maximum overall market growth
- Rate of overall market growth uptake
- Your own and competitor's new product prices

There is a common tendency to over simulate demand and sales forecasts. The logic of doing so is to let the computer identify the most important variables driving the business, which often leads to a "garbage in-garbage out" situation. The main selection criterion and focus should be on what matters in the market and what one can control in that market.

REASONABLE RANGES AND POINTS TO SIMULATE

The reasonableness of ranges depends on a number of conditions and circumstances used, such as the following.

1. Uniqueness of the market
   - Country
   - Health care system
   - Culture / traditions (for example, medication compliance rate can typically reach 90-95% in Japan, but no more than 50-60% for U.S. patients)
   - Reimbursement policy (for instance, there is almost 100% medication coverage in Japan)
   - Mature market versus emerging market, or lifestyle market
   - Level of unmet market needs
   - Pricing policy (United Kingdom and Germany are often considered as high-price countries, whereas France, Italy, and Spain are considered low-price countries)
   - Any foreseen government interventions
2. Similarities of the comparative products
   - What we know about the existing market
   - What market share each of the comparing products have
   - Who are the major players—major pharmas or newcomers
3. Uniqueness of the ready-to-launch product
   - Efficacy relative to existing drugs
   - Unique market strategies
   - Safety profile of the drug relative to life-threatening disease versus lifestyle conditions

For example, the simulation range for the maximum share of selected patients for a newly launched product may vary between + or – 20% from the starting value. On the other hand, for a mature product with a 45% maximum share of selected patients, the simulation range may be in the neighborhood of + or – 5%.

Because simulations are costly and time consuming, and sometimes their results are difficult to interpret, one must also be selective in choosing the number of points to simulate within a reasonable range of the variable. For example, we recommend against using more than two or three points in the + or – direction. Also, variable simulations should not be mixed with event scenarios unless there is a clear understanding of the risk and uncertainty one would like to measure. Plainly stated, mixing simulations and scenarios leads to

erroneous conclusions when the purpose is to see what happens with changes in the driving variables.

SYMMETRY OF SELECTED POINTS

There are specific instances when non-symmetric values of a variable may be selected by using different distributions. However, the value of forecast simulations is usually maximized when the number and the distance of points selected from the starting value in the reasonable range is symmetric (that is, of the same magnitude in either the + or – direction from the starting point). In some computer simulation packages, this condition is satisfied with a pseudo-random number generation of variable or parameter values to be simulated. In others, this may not be the case and the forecaster must ensure that there are as many values below the starting point as there are above it. In addition, the deviations from the starting point should be equal; that is, + or – 2%, + or – 5%, not + 4% and – 5%. Table 1 gives suggested simulations that can be used in the selection of ranges and points within those ranges, and Appendix I gives list of software in the field.

SIMULATION RESULTS AND CAVEATS

The end result of parameter simulations in demand forecasting models should be sales forecasts with 20%, 50%, and 80% probability of occurrence. These sales forecasts reflect the level of uncertainty as the model is simulated with values of a variable farther away from its starting value of the parameters. Moreover, notice that the forecast associated with an 80% probability of occurrence is based on a more conservative set of variable values than the one with a 20% probability.

A major caveat in simulations is that they are good but the impact of their resulting insights is far greater if the forecaster has the necessary experience in the area. Also, since they are not exhaustive, they portray only a part of the possible outcomes, and numbers outside the 20% and 80% probability range are possible. One should do simulations carefully and keep the variables or parameters to a reasonable number. Above all, keep in mind that the value of simulations goes down considerably when the market environment changes rapidly. ■

(hsong4@ethus.jnj.com, johntriantis@comcast.net)

TABLE 1
SUGGESTED SIMULATIONS AND RANGES

Parameter	Range
Compliance	±10% of starting level
Persistence	±10% of starting level
Mono-therapy use	±10% of starting level
Maximum Share of Patients	
1. Starting with share up to 1%	± 100%
2. Starting with 1.1-5% share	± 100% to 80%
4. Starting with 5.1-10% share	± 80% to 50%
5. Starting with 10.1-25% share	± 50% to 35%
6. Starting with 25.1-50% share	± 35% to 20%
7. Starting with >50% share	± 20% to 10%
Years of Maximum Market Share (Years)	
1. Life-threatening disease (i.e., cancer)	1-2 years
2. Chronic disease (i.e., hypertension)	5-7 years
3. Medical devices	7-9 years
Time of Maximum Generic Erosion (95% of branded drug market share)	3-6 months
Prices for New Products	
1. Your own price	±10%
2. Competitor's price	±10%

APPENDIX I
SELECTED SIMULATION SOFTWARE: THEIR INPUT AND OUTPUT

	Model Building		
Software	**Input Distribution Fitting**	**Output Analysis Support**	**Batch Run or Experimental Design**
@RISK	BestFit distribution fitting module.	Statistic and graphs, sensitivity and scenario, and analysis.	
AgenaRisk	Uniform, triangular, normal, lognormal, gamma, exponential, beta, Bernoulli, binomial, Poisson, Weibull plus hybrid, hierarchical, loglinear, and mixture parameter estimation.	Bar graphs, line graphs, scatter plots, and histograms. Multiple data sets are shown simultaneously. Displays statistics on graphs.	Interactive and batch mode. Many data sets can be simultaneously analyzed in a batch.
Analytica	Library for fitting a variety of single and joint distributions.	Sensitivity and uncertainty analysis.	

APPENDIX I (Continued)
SELECTED SIMULATION SOFTWARE: THEIR INPUT AND OUTPUT

AnyLogic 6.0	Stat::Fit	Basic statistical analysis built-in, export to text, Excel, and DB.	Simple, parameter variation, risk assessment and optimization experiments.
Arena	Arena Input Analyzer at no charge.	Arena Output Analyzer at no charge.	Arena Process Analyzer at no charge.
AutoMod		AutoStat - statistical analysis, confidence intervals, graphs, DOE, and optimization.	Using AutoStat.
AutoSched AP		AutoStat	AutoStat
Crystal Ball Professional	Three fitting methods: Chi-Square, Kolmogorov-Smirnov, Anderson-Darling for continuous distribution.	Analyzes statistics and displays results in output charts. Extracts raw data and creates reports.	Developer Kit contains macros and functions that can be programmed to automate all simulation.
Crystal Ball Standard	Three fitting methods (Chi-Square, Kolmogorov-Smirnov, Anderson-Darling) for continuous distributions.	Analyzes statistics and displays results in output charts. Can extract raw data and create reports.	
CSIM 19		Confidence intervals and run-length control.	
DecisionPro	Uniform, discrete, triangular, normal, lognormal, gamma, exponential, beta, Bernoulli, and custom.	Simulation statistics, sensitivity analysis, graphical presentation, all available as OLE objects.	Batch and interactive run.
DecisionScript		Simulation statistics, sensitivity analysis, graphical presentation, all available as Web pages.	Batch and interactive run.
eM-Plant	Datafit library	Bottleneck analyzer and neural network.	Experiment manager.
Enterprise Dynamics Simulation Software	All statistical distributions.		Both batch run and experimental design.
Enterprise Dynamics Studio	Autofit	Experiment Wizard and Scenario Manager.	Scenario manager.
ExpertFit	ExpertFit	Can be used to perform output analyses, including confidence intervals.	A large number of data sets can be analyzed using a few key strokes.
Extend Industry	Stat::Fit is included in the Extend Suite package.	Confidence intervals are calculated at the click of a button.	Automated execution of different scenarios is supported.
Extend OR	Stat::Fit is included in the Extend Suite package.	Confidence intervals are calculated at the click of a button.	Automated execution of different scenarios is supported.
Extend Suite	Stat::Fit is included in the Extend Suite.	Confidence intervals are calculated at the click of a button.	Automated execution of different scenarios is supported.
Flexsim	ExpertFit	Tabular, Gantt charts, spreadsheets, pie charts, histograms, bar charts, ODBC, and user-defined.	Design of experiments module by Flexsim.
GAUSS matrix programming language			
GoldSim		Uncertainty and sensitivity analysis.	
Lean MAST		Reports developed for engineer review and understanding.	

APPENDIX I (Continued)
SELECTED SIMULATION SOFTWARE: THEIR INPUT AND OUTPUT

Lean-Modeler			
MAST		Output designed for manufacturing engineer use.	
Micro Saint Sharp Version 2.1		Limited (max, mean, standard deviation, graphing).	Batch — not built-in experimental design.
Mystrategy			
Portfolio Simulator	User-defined distributions. 15 predefined distributions, plus distribution fitting using Stat::Fit software (additional).	Output analysis reports and charts included. Also outputs to MS Project for analysis.	Unlimited scenarios can be predefined to experiment on parameters.
Process Simulator	15 predefined distributions, plus distribution fitting using Stat::Fit software (additional).	Output analysis reports and charts included. Also outputs to Excel and Access for analysis.	Unlimited scenarios can be predefined to experiment on parameters.
Process Model Version 5.1	Via StatFit (included with tool).	Customizable visual and data representative reporting.	Via batching command in action logic property box.
Project Simulator	User-defined distributions, 15 predefined distributions, plus distribution fitting using Stat:Fit software (additional).	Output analysis reports and charts included. Also outputs to MS Project for analysis.	Unlimited scenarios can be predefined to experiment different parameters.
ProModel Optimization Suite	User-defined distributions, 15 predefined distributions, plus distribution fitting using Stat:Fit software included.	Output analysis reports and charts included. Also outputs to Excel and Access for analysis.	Unlimited scenarios can be predefined to experiment with parameters.
PSM++ Simulation System (new version of PASION)		Additional variance and confidence intervals in function of time.	For some continuous models.
Quantitative Methods Software (QMS)	Constant, uniform, normal, Poisson, negative expression and discrete.	Maximums and minimums identified with graphical representation.	
SAIL			
SAS Software	Extensive statistical capabilities available in SAS.	Built-in analytic functions supplemented by other SAS statistical capabilities.	
SCIMOD, Techno Therm, Techno Therm plus, Technical Audit, Techno Maint, Techno Corr, Techno Pas, Process Models, Profimax, etc.			User-specified variables may be tested.
ServiceModel Optimization Suite	User-defined distributions, 15 predefined distributions, plus distribution fitting using Stat::Fit software (included).	Output analysis reports and charts included. Also outputs to Excel and Access for analysis.	Unlimited scenarios can be predefined to experiment with different parameters.
ShowFlow 2	Built-in curve fitting.	Wait time hist., queue hist, util. pie; user-defined graphs/reports; DDE with Excel.	Built-in experiment mode.

APPENDIX I (Continued)
SELECTED SIMULATION SOFTWARE: THEIR INPUT AND OUTPUT

SIGMA	Supports most useful input distributions.	Graphical and statistical. Generates Excel spreadsheet data.	Extensive experimentation in spreadsheet or Web input formats.
Simcad Pro	Distribution fitting and inputs from actual historical data.	Graph with time analysis; custom and pre-defined reports.	Monte Carlo simulations or dynamic scenario analysis.
SIMPROCESS	ExpertFit - Can be used to perform output analyses including confidence intervals. Tabular, gantt charts, spreadsheets, pie charts, histograms, bar charts, ODBC, and user-defined.	A large number of data sets can be analyzed using a few key strokes.	Allows both batch run and experimental design.
SIMSCRIPT II.5	10 – Predefined Distributions. SIMSCRIPT II.5 provides random number generators for several distributions including uniform, normal, Poisson and exponential. Furthermore, SIMSCRIPT II.5 provides the user the ability to define their own distribution, from which random samples can be generated.	Dynamic – Bar Graphs, Line Graphs, Histograms, etc. Dynamic Display of statistics on graphs.	Both Batch Run and Experimental Design.
SIMUL8 Professional	SIMUL8 Professional includes Stat::Fit for SIMUL8.	Customizable statistical reports with 95% to 99% confidence intervals and graphs.	A series of scenarios/experiments can be run and analyzed.
SIMUL8 Standard	Stat::Fit for SIMUL8 can be purchased as Plug-in for $245.	Customizable statistical reports with 95% to 99% confidence intervals and graphs; export to Excel, Minitab.	A series of designed scenarios/experiments can be run and analyzed.
SLIM	Configurable	Configurable.	Configurable.
Stat::Fit	Stat::Fit includes 32 distributions.		
Supply Chain Builder			Built in.
Systemflow 3D Animator			
TreeAge Pro Suite		Statistics, bar/line graphs and charts, histograms, scatter plots, tornado diagrams, two- and three-dimensional density plots, sensitivity, uncertainty, and scenario analysis. Has ability to export raw data and create reports.	Y
Visual Simulation Environment (VSE)			
WebGPSS (micro-GPSS)		Confidence intervals	
WITNESS 2006		Inbuilt analysis options.	WITNESS Scenario Manager.
XLSim	Re-sampling, single and multivariate.		Parameterized simulation.

Source: Simulation Software Survey. OR/MS Today. December 2005, p. 3. Also available at http://www.lionhrtpub.com/orms/surveys/Simulation/Simulation3.html.

INTERNATIONAL ECONOMIC OUTLOOK

By Evangelos Otto Simos

EXPORT-LED GLOBAL GROWTH FROM RECYCLING OF OIL REVENUES

I. Global Assessment and Outlook

Annual statistics on national accounts for last year have been finalized around the globe. They show that the world economy expanded by an impressive annual growth rate of 5.4% in 2006, the fastest pace since 1973. We forecast this remarkable global growth performance to continue in 2007 and 2008, led by continued strong economic growth in the emerging economies of China and India.

In the last three years, the combined contribution of China and India to worldwide economic growth averaged 42%, twice their contribution recorded in 1990. Their combined market size, measured in Purchasing Power Parity (PPP) dollars, hit 14.5 trillion in 2006, compared with 2.8 trillion in 1990. Our global forecast calls for continuation of this record-breaking economic growth in both China and India (see Figure 1).

Despite a temporary U.S. slowdown driven by a correction in the housing market, recent evidence from quarterly national accounts and forward-looking economic data suggests that economic growth continues to be strong in the other industrial countries and via international trade in the developing world.

In the first quarter of 2007, the combined output of the member countries of the Organization for Economic Cooperation and Development (OECD)—the 30 richest economies in the world—was estimated to have grown at an annual rate of 2.7% from the first quarter of 2006, compared with 3.3% in the last quarter of 2006.

Although real output in the United States expanded at a year-over-year growth rate of 1.9% in the first quarter of 2007, the 27-country combined real output of the European Union (EU) advanced by an annual rate of 3.2% in the first quarter from 3.5% in the fourth quarter of 2006. The two major European economies of the United Kingdom and Germany posted solid gains of 2.9% and 3.6%, respectively.

Recent economic activity indicators from emerging Asia, an important driver of the current global upswing, have continued to be strong, particularly from the fast growing populous countries of China and India. In the first quarter of 2007, Chinese real output expanded by 11.1%, compared to the same quarter a year ago. In India, real Gross Domestic Product (GDP) jumped by 9.1% in the first quarter of 2007—compared to a year ago—driven by the manufacturing, trade, transport, and communications sectors where growth registered 12.4%.

Re-spending of oil revenues has contributed to export-led growth in industrial countries, especially in Europe, and the emerging industrial powerhouses of China and India. According to the latest Ifo survey, experts in the Arabian OPEC group—Algeria, Iran, Kuwait, Saudi Arabia, Qatar, and United Arab Emirates—expect their volume of imports to grow faster than their volume of exports, mainly oil.

The volume of world trade in goods and services is forecast to go along with global demand patterns over the forecast horizon. The recycling of oil revenues from the oil exporting countries will maintain world trade growth above the 25-year trend of 5.8%. Following acceleration to a growth rate of 9.2% in 2006 from 7.4% in 2005, growth in the volume of world trade is forecast to slow down to 7.9% in 2007 and bounce back to 8.5% in 2008. Global real GDP is forecast to grow at an annual rate of 4.9% during 2007-08, from 5.4% in 2006.

On the inflation front, growth in worldwide consumer prices rose by 3.4% in 2006, as in 2005. China and India have kept a lid on inflation by providing global competitive pricing for firms in industrial countries. The U.S. advancements in productivity have kept unit labor costs in check despite rising wages. Also, worldwide anti-inflation monetary polices have helped to end the acceleration in inflation rates despite higher oil prices. Over the forecast horizon, 2007-08, the worldwide inflation rate will slightly decelerate to 3.3% in 2007 and 3.2% in 2008.

Dr. Simos is Director of Forecasting at e-forecasting.com, a division of Infometrica's Data Center, 65 Newmarket Road, Durham, NH 03824, U.S.A. Web Site: www.infometrica.com, e-mail: eosimos@e-forecasting.com. This report does not purport to be a complete description of global economic conditions and financial markets. Neither the Journal nor Infometrica, Inc. guarantee the accuracy of the projections, nor do they warrant in any way that the use of information or data appearing herein will enhance operational or investment performance of individuals or companies who use it. The views presented here are those of the author, and in no way represent the views, analysis, or models of Infometrica, Inc. and any organization that the author may be associated with.

II. Short-Term Indicators and Forecasts

The baseline forecast incorporates major findings of the World Economic Survey conducted by the German Ifo Institute and the Paris-based International Chamber of Commerce in the second quarter of 2007. About 1,000 executives from 91 countries have indicated that the world's economic climate was flat in the second quarter of 2007 and remained above its long-term trend. The recent overall reading of the worldwide survey is consistent with a growing global economy at the same pace as in the first quarter of 2007. The major findings of the second quarter survey follow:

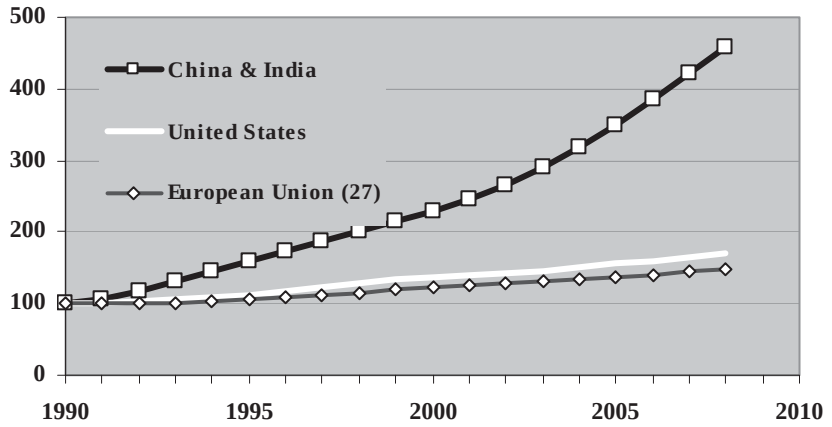
- Worldwide, executives evaluated the current situation, second quarter of 2007, favorably with overall economic conditions above satisfactory levels. They found economic activity in their countries to be better than in the second quarter of 2006. Regarding the future, executives expect economic conditions in the next two quarters to be as good as current economic conditions prevailing in the second quarter of 2007.

- On a regional basis, North American executives assessed the current economic situation to be above satisfactory levels but not as good as a year ago. Looking forward, business experts from the United States and Canada expect economic conditions to be worse in the next six months compared to the second quarter of 2007. Asian executives appraised the current economic situation as above satisfactory and better than a year ago; they were equally confident about the future, expecting economic activity in the next six months to be better than in the second quarter of 2007. Western European executives' appraisals of current conditions were substantially above satisfactory levels and considerably better than in the second quarter of 2006; expectations of European business executives on future economic conditions signaled an improvement in economic growth in the second half of 2007.

- With respect to prices, survey participants expect average worldwide inflation over the next two quarters to remain slightly above current levels.

- Looking at world trade, the business executives' combined assessment calls for the volume of exports and imports in the next two quarters to be higher than at present, the second quarter of 2007.

FIGURE 1
REGIONAL GROWTH IN REAL GDP
INDEX: 2002 = 100



Source: e-forecasting.com

Using the "soft data" findings of the World Economic Survey, a 91-country composite global business activity index is constructed by *e-forecasting* to evaluate and forecast the short-term worldwide business cycle. A reading of 50, the flatline, is used as a reference in evaluating the wave of alternating booms and busts that mark the global economy. In the second quarter of 2007, our global business activity index registered 73, slightly below its seven-year high mark of 74 in the first quarter of 2007, indicating a continuation of growth at a pace nearly the same as in the previous quarter. It was the 14th consecutive quarter that the index registered a reading above 50 suggesting that the world economy remains firmly in the growth phase of the global business cycle.

e-forecasting's global activity index tracks quarterly and in a timely way economic conditions around the world. Its historical behavior is consistent with the index of industrial production for a group of 22 leading industrial countries, constructed by "hard data" and maintained by the International Monetary Fund (IMF). However, IMF's index lags our diffusion index in terms of timeliness by two to three quarters. The *e-forecasting* global activity index is a "real time" indicator providing readings at the end of the last month of the reference quarter.

Historically, changes in our global activity index mirror the growth rate of worldwide industrial production (see Figure 2). Based on the real time behavior of our indicator, growth in industrial activity in the world's leading economies is estimated to have hit a growth peak in the third quarter of 2006.

By modeling business executives' two-quarter-ahead expectations into a dynamic high frequency forecast, we predict growth in the global business activity index to weaken in the second half of 2007. Global industrial production is forecast to experience a soft landing in the second half of this year.

Our composite index of global economic activity also serves as an indicator of worldwide demand and, consequently, its change from a year ago mirrors the year-to-year growth rate in the demand for inter-

TABLE 1
GLOBAL ECONOMIC GROWTH AND INFLATION

REGIONAL GROUPS Countries	Market Size 2005 GDP $PPP Billion	Economic Growth % Change in Real GDP				Inflation % Change in Consumer Prices			
		2005	2006	2007	2008	2005	2006	2007	2008
WORLD	**57,275**	**4.8**	**5.2**	**4.7**	**4.6**	**3.4**	**3.4**	**2.9**	**2.9**
EUROPEAN UNION (27)	**12,689**	**1.9**	**3.1**	**2.7**	**2.7**	**2.3**	**2.4**	**2.2**	**2.1**
Euro Area (13)	**9,071**	**1.5**	**2.8**	**2.4**	**2.4**	**2.2**	**2.2**	**2.1**	**1.9**
Austria	275	2.6	3.3	2.4	2.7	2.1	1.7	1.9	2.2
Belgium	325	1.5	3.1	2.4	2.5	2.5	2.4	1.9	2.0
Finland	163	3.0	5.8	4.2	3.6	0.8	1.3	1.5	1.8
France	1,830	1.2	2.1	1.9	2.1	1.9	2.0	1.7	1.8
Germany	2,522	1.1	2.7	1.8	2.2	1.9	1.7	2.0	1.1
Greece	249	3.7	4.1	3.8	4.0	3.5	3.6	3.3	2.7
Ireland	168	5.5	5.2	4.7	5.0	2.2	2.8	2.9	2.7
Italy	1,668	0.1	1.9	2.0	1.7	2.3	2.4	2.0	2.1
Luxembourg	32	4.0	6.2	4.3	4.7	3.8	3.3	2.0	2.2
Netherlands	503	1.5	2.9	2.8	2.9	1.5	1.5	1.6	2.1
Portugal	203	0.4	1.5	1.6	1.4	2.1	3.1	2.1	2.0
Slovenia	44	3.9	5.1	3.8	4.4	2.5	2.5	2.6	2.7
Spain	1,089	3.5	3.8	3.7	3.4	3.4	3.5	2.8	3.1
Non-Euro Area (14)	**3,619**	**3.0**	**4.1**	**3.6**	**3.5**	**2.5**	**2.7**	**2.7**	**2.4**
Bulgaria	71	5.5	5.7	6.0	6.2	5.0	7.2	3.3	3.6
Cyprus	17	3.7	4.0	3.6	3.9	2.6	2.6	2.4	2.6
Czech Republic	188	6.1	6.2	4.8	4.5	1.9	2.8	3.4	3.0
Denmark	188	3.0	3.1	2.2	2.0	1.8	2.0	2.2	2.5
Estonia	22	9.8	11.2	8.8	9.2	4.1	4.6	4.1	4.4
Hungary	170	4.2	3.9	2.2	2.8	3.6	3.9	6.8	4.0
Latvia	29	10.2	11.0	8.8	9.5	6.8	6.6	6.0	5.4
Lithuania	48	7.5	8.5	7.4	7.6	2.7	3.8	4.4	3.5
Malta	8	2.5	2.4	2.0	2.3	2.5	2.9	2.7	2.4
Poland	496	3.5	5.8	6.0	5.8	2.2	1.4	1.9	2.3
Romania	191	4.1	6.5	5.1	5.6	9.0	7.8	5.3	4.6
Slovak Republic	87	6.0	6.4	5.9	6.1	2.7	4.5	2.9	2.1
Sweden	271	2.7	4.3	3.7	3.1	0.5	1.4	2.1	2.3
United Kingdom	1,833	1.9	2.7	2.5	2.2	2.0	2.2	2.1	1.9
OTHER EUROPE	**2,915**	**5.5**	**5.8**	**5.3**	**5.2**	**9.3**	**8.1**	**7.8**	**6.5**
Norway	195	2.3	2.7	2.6	2.5	1.5	2.2	1.9	2.4
Russia	1,576	6.4	6.5	6.2	5.9	10.9	9.0	8.5	7.5
Switzerland	237	1.9	2.7	2.3	1.7	1.2	1.0	1.1	1.4
Turkey	569	7.4	6.1	5.2	5.1	8.2	9.6	7.6	5.8
Ukraine	338	2.6	6.0	4.5	5.6	13.5	9.3	12.1	8.6
NORTH AMERICA	**14,455**	**3.2**	**3.3**	**2.8**	**3.2**	**3.4**	**3.2**	**2.1**	**2.5**
Canada	1,105	2.9	2.7	2.3	2.9	2.2	2.1	1.7	2.1
Mexico	1,073	3.0	4.5	3.6	4.1	4.0	3.6	3.1	3.3
United States	12,278	3.2	3.3	2.8	3.1	3.4	3.3	2.1	2.5
SOUTH AMERICA	**2,972**	**4.7**	**5.0**	**5.0**	**5.0**	**6.5**	**5.4**	**5.5**	**4.5**
Argentina	534	9.2	8.5	7.2	6.5	9.6	12.3	9.8	7.8
Brazil	1,577	2.3	2.8	3.6	4.1	5.7	3.0	3.9	3.5
Chile	193	6.3	4.3	5.4	5.9	3.1	3.5	3.1	2.8
Colombia	337	5.1	6.7	5.8	5.7	5.0	4.7	4.2	4.0
Peru	167	6.4	6.6	5.5	5.0	1.6	2.4	2.5	2.1
Venezuela	164	9.3	10.2	7.9	6.8	15.9	12.1	15.4	9.8
ASIA & PACIFIC INDUSTRIAL	**5,637**	**2.9**	**2.9**	**2.6**	**2.7**	**0.4**	**1.1**	**1.4**	**1.9**
Australia	630	2.9	2.4	2.6	3.8	2.7	3.4	2.6	2.5
Japan	3,911	2.7	2.4	2.1	1.9	-0.6	0.3	0.7	1.4
Korea	994	4.0	5.1	4.4	4.9	2.8	2.5	2.9	3.2
New Zealand	102	2.1	1.5	1.6	2.4	3.2	3.3	3.2	1.8
EMERGING ASIA	**16,666**	**8.8**	**9.0**	**8.2**	**7.6**	**3.3**	**3.5**	**2.8**	**2.9**
China	9,412	10.2	10.5	9.4	8.4	1.8	1.4	1.2	1.5
Hong Kong	233	7.3	6.8	5.2	4.7	0.9	2.3	2.5	2.8
India	3,633	8.5	8.7	7.8	7.2	4.4	6.1	5.9	5.6
Indonesia	977	5.6	5.3	6.0	6.5	10.5	13.0	5.9	4.8
Malaysia	291	5.2	6.0	5.6	5.4	3.0	3.8	2.7	2.9
Pakistan	405	8.0	6.6	7.1	6.5	9.3	7.9	7.3	6.5
Philippines	415	5.0	5.5	5.2	5.9	7.6	6.7	5.0	4.9
Singapore	123	6.4	7.7	4.6	5.1	0.5	1.8	1.7	2.2
Taiwan	631	4.1	4.6	3.3	4.3	2.3	1.7	1.5	2.1
Thailand	545	4.5	4.5	4.6	5.1	4.5	4.9	2.6	2.8
MIDDLE EAST & AFRICA	**1,941**	**5.4**	**5.3**	**4.9**	**5.0**	**6.5**	**6.4**	**7.3**	**6.1**
Egypt	305	4.9	5.8	5.5	5.7	11.4	4.1	6.1	5.6
Iran	555	5.4	5.8	4.9	4.6	12.1	14.0	15.0	12.0
Israel	158	5.2	4.1	4.4	5.6	1.3	2.8	2.2	2.0
Saudi Arabia	352	6.6	5.8	6.5	5.6	0.7	1.0	1.0	1.2
South Africa	570	4.9	4.6	3.8	4.4	3.4	4.6	5.7	4.7

The 60 countries in this table account for 94% of world's estimated GDP expressed in PPPs in 2005

source: www.e-forecasting.com

nationally traded goods and services. Derived from the opinions of 1,000 business experts from 91 countries, *e-forecasting*'s composite global activity index has shown a strong performance record tracking the volume of international trade, measured by global exports adjusted for price changes (Figure 3). Following solid gains in 2006 at a nearly 10% rate, growth in the volume of international trade is estimated to have slowed down in the first half of 2006 to slightly below 10%. Looking forward, the predictive power of our global activity index suggests that growth in the volume of world trade has continued to weaken in the second half of 2006 and its moderation will prolong in 2007.

III. Regional Contributions to Global Growth

In our baseline annual forecast, global output—a worldwide composite of 60 countries that account for 94% of the world's GDP using as weights each country's relative GDP converted to international dollars at purchasing-power-parity (PPP)—is estimated to have grown by 5.4% in 2006 from 4.8% in 2005. Global real output growth is forecast to decelerate to 4.9% in both 2007 and 2008.

Given the relative economic size and expected output growth in each of the major regional blocs, the contribution of each region to overall global economic growth is computed and presented in Table 2. This unique regional contributions-to-growth analysis helps identify the distribution of worldwide growth and, consequently, the allocation of global demand among geographic areas along with its changing pattern over the forecast horizon.

The baseline forecast calls for the countries in the North American (NAFTA) region to grow by 2.3% in 2007 and 3.3% in 2008, following a 3.4% growth in 2006. Thus, economic growth in NAFTA is estimated to have contributed 16% to global economic growth in 2006. The contribution of NAFTA to the growth of global demand will decrease to 12% in 2007 and jump to 16% in 2008.

FIGURE 2
PREDICTING GLOBAL INDUSTRIAL ACTIVITY

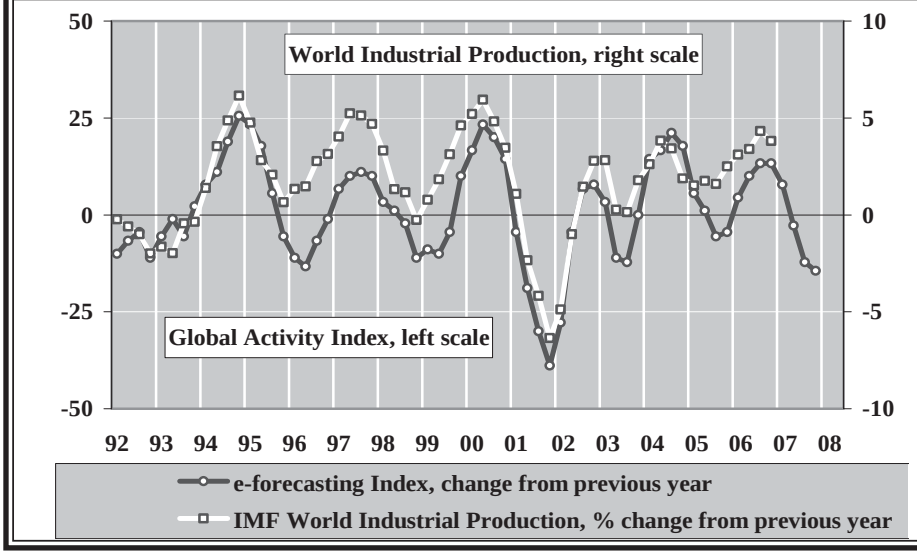
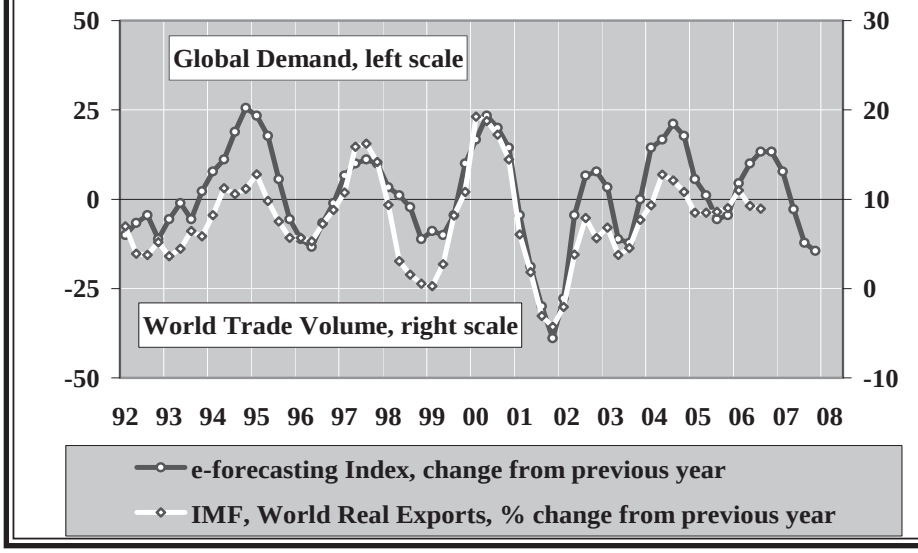


FIGURE 3
PREDICTING WORLD TRADE



In the Euro Area, growth in the combined output of the 13 members of the European Union (EU) that use the euro as common currency, accelerated to 2.8% in 2006 from a growth rate of 1.5% in 2005. Euro Area growth is forecast to grow again by 2.8% in 2007 and moderate to 2.6% growth rate in 2008; as a result, Euro Area's contribution to global economic growth is forecast to stabilize at 8% during 2007-2008. In the non-Euro countries of the European Union, output is forecast to increase by 4% in 2007 and 3.6% in 2008, from 4.3% in 2006, contributing 5% to global economic growth. The rest of the European countries, including Norway, Switzerland, Russia, Ukraine, and Turkey, are forecast to grow by 5.7% in 2007 and 5.6% in 2008, twice as fast as the output growth in the European Union; its contribution to the growth of global GDP is forecast to average 6%.

In the Emerging Asia region—which includes the two most populous and fastest

growing countries, China and India—output is forecast to decelerate to 8.5% in 2007 and 8.2% in 2008 from 9.2% in 2006. The region's economies not only grow faster than any other economic bloc does, but they also drive one-half of the projected growth in global demand. The combined output of the advanced economies in the Asia and Pacific Rim region—the group that includes Japan (the world's third largest economy), Australia, New Zealand, and Korea—is forecast to grow by 2.9% in 2007 and 2.8% in 2008, thus contributing 6% to the growth of the world's real GDP.

Real output in the major countries of South America is forecast to enjoy solid gains over the forecast horizon growing at an annual rate of 5.3% in 2007 and 4.5% in 2008. Given the relative market size of the region in the world economy, South America is forecast to average a contribution of about 6% to the growth of global output during 2007-2008.

TABLE 2
CONTRIBUTION OF REGIONS TO GLOBAL GROWTH

REGION	Percentage Points Contribution				Relative Contribution,%			
	2005	2006	2007	2008	2005	2006	2007	2008
European Union (Eu27)	**0.44**	**0.69**	**0.59**	**0.58**	**9.2**	**13.2**	**12.4**	**12.5**
Euro Area (Euro13)	0.24	0.44	0.36	0.37	5.1	8.3	7.7	7.9
Non-Euro Members (14)	0.20	0.26	0.23	0.21	4.1	4.9	4.8	4.6
Other Europe	**0.28**	**0.30**	**0.27**	**0.26**	**5.8**	**5.6**	**5.7**	**5.7**
North America	**0.81**	**0.84**	**0.70**	**0.78**	**16.8**	**16.1**	**14.8**	**16.8**
United States	0.69	0.71	0.59	0.65	14.5	13.5	12.5	14.0
South America	**0.25**	**0.26**	**0.26**	**0.26**	**5.1**	**4.9**	**5.4**	**5.5**
Asia & Pacific Industrial	**0.30**	**0.28**	**0.25**	**0.25**	**6.2**	**5.4**	**5.2**	**5.5**
Emerging Asia	**2.47**	**2.63**	**2.46**	**2.34**	**51.6**	**50.2**	**51.9**	**50.4**
China & India	2.12	2.28	2.12	1.98	44.3	43.5	44.7	42.6
Middle East & Africa	**0.18**	**0.18**	**0.17**	**0.17**	**3.8**	**3.4**	**3.5**	**3.6**
WORLD GROWTH[1]	**4.8**	**5.2**	**4.7**	**4.6**	**100.0**	**100.0**	**100.0**	**100.0**

[1]Sum of Regional Contributions

Source: e-forecasting.com

IV. Financial Markets

Despite an economic weakening in the United States and rising interest rates in most financial centers, strong labor markets coupled with solid gains in international trade and a bouncing back in oil prices have generated a climate of rising inflationary expectations. Long-term rates have begun to move upwards and monetary policy may shift to further tightening from neutrality. The current phase of de-synchronization of monetary policy now favors dollar depreciation. As growth bounces back in the United States and European monetary policy shifts to neutral from tightening, the dollar is expected to appreciate. The key features of the financial forecast for major markets and currencies are presented in Table 3.

According to the latest Ifo survey, executives from around the world do not anticipate the pace of interest rate hikes to slow down in the coming six months for short-term rates. Specifically, interest rates in North America are expected to increase in the second half 2007. In the Euro Area, executives strongly anticipate both short-term and long-term interest rates to rise in the second half of this year. Regarding exchange rate movements over the next two quarters, the experts surveyed assessed the U.S. dollar and the Japanese yen as undervalued, while the euro and British pound are judged as overvalued. ■

TABLE 3
INTEREST RATE AND EXCHANGE RATE FORECASTS FOR MAJOR MARKETS

Major Market	Short-Term Interest Rates 3-months				Long-Term Interest Rates 10-years				Exchange Rate (Local Currency/$US)*			
	Actual	Forecast			Actual	Forecast			Actual	Forecast		
	May 07	07:Q4	08:Q1	08:Q2	May 07	07:Q4	08:Q1	08:Q2	May 07	07:Q4	08:Q1	08:Q2
United States	5.32	5.50	5.50	5.50	4.95	5.25	5.65	5.75				
Euro Area(12)	4.10	4.50	4.60	4.75	4.40	4.70	5.00	5.25	1.34	1.24	1.20	1.18
Japan	0.67	1.00	1.25	1.50	1.72	2.25	2.35	2.55	122	114	120	124
United Kingdom	5.78	5.75	5.35	5.05	5.29	5.35	5.30	5.30	1.98	1.88	1.80	1.72
Switzerland	2.44	2.75	3.00	3.25	3.02	3.25	3.50	3.40	1.23	1.24	1.26	1.30
Canada	4.34	4.75	4.75	5.00	4.51	4.65	4.75	4.95	1.06	1.15	1.18	1.22
Australia	6.36	6.80	6.90	7.00	6.01	6.15	6.30	6.45	0.83	0.80	0.77	0.74

*For euro, British pound, and Australia dollar: $US/Local Currency

Source: www.e-forecasting.com

THE NATION'S ECONOMIC OUTLOOK

By Jack Malehorn

THE U.S. ECONOMY ... POSITIVE, BUT SUBDUED

Slower but sustained growth best describes the Consensus Outlook; however, it does portray a divergence of opinion in forecasts. The Consensus calls for a slow but continued growth through next year—a roughly 2% growth in real Gross Domestic Product (GDP). GDP is the most-often cited economic statistic deemed to provide the general sense of direction for the economy as a whole. Dr. Rajeev Dhawan, Director of Georgia State University's Economic Forecasting Center, believes that the economy will continue growing during the forecast period because of the likelihood that the Fed will cut back interest rates to relieve weakness in the housing sector and ease liquidity concerns across the consumer sector. With that scenario, Dr. Dhawan projects a more favorable outlook for 2008 and beyond.

THE CONSUMER SECTOR

Representing approximately two-thirds of all economic activity, consumer activity has two key indicators: Disposable Personal Income and Personal Consumption Expenditures. Disposable Personal Income is expected to increase at a 4.2% rate over the forecast period, followed by a bit less buoyant growth rate of 3.2% for Personal Consumption Expenditures. Clearly, these growth rates do not translate into a consumer-driven economy nor do they portend a complete collapse in consumer confidence. The Consensus calls for a slight increase in the nation's unemployment rate, edging up to 4.9% in the beginning of the New Year, but then begin a gradual decline at this same time next year.

The Consensus calls for automobile sales to have a modest growth, in the range of 16 million units. It calls for housing starts to be at the 1.5 million units during the forecast period.

THE BUSINESS SECTOR

The general outlook in the business sector is not as precarious. Bolstered by euphoric stock markets, businesses are riding a tad high. Still, the overall forecasts are somewhat subdued reflecting the pervasive risks in the business sector due to global instability, a waffling housing sector, currency risks, threats of terrorism, and the like. Nonresidential fixed investment is expected to rise by a modest 3.7% over the next four quarters. In the manufacturing sector, capacity utilization is projected to remain steady at roughly 80%.

INFLATION

The one bright spot in the overall forecast is the general agreement of containment of inflation over the next year. Both inflation indices are expected to remain below 2%, which keeps the Fed at bay and mitigates the risks of restrictive monetary tightening and subsequent rises in interest rates.

THE MONETARY SECTOR

Given the inherent risks evident in the economy, it is natural to expect some divergence of opinion concerning the direction of interest rates. The Federal Funds rate is projected to remain unchanged at 5.2%, falling slightly at this time next year. Still, a closer examination of the forecasts shows a rather wide divergence among them. For example, Dr. Dhawan sees the Fed Funds rate falling to 4.75% and continuing downward until it hits 4.5%. ■

Jack Malehorn is a consultant, specializing in forecasting and planning and is based in Nashville, Georgia. He is on the Editorial Review Board to the *Journal of Business Forecasting*. He has worked as President and CEO of The Black Hill Manufacturing Co., and COO of NorCom Advanced Technologies. He has also worked as Chief Economist for United Telephone Company of Pennsylvania and New Jersey, which is an operating company of Sprint. He has taught as an Adjunct Professor at Johns-Hopkins University, Graduate School of Business.

For any comments and suggestions, contact him at e-mail, Jmalehorn@yahoo.com.

2006

116 PAGES

BENCHMARKING FORECASTING PRACTICES:

A GUIDE TO IMPROVING FORECASTING PERFORMANCE

Edited by Chaman L. Jain, St. John's University & Jack Malehorn, Valdosta State University

$68.95

(Add $10 domestic & $50 foreign, for shipping & handling)

Graceway Publishing Company, Inc.

P.O. Box 670159 | Flushing, N.Y. 11367-0159 U.S.A | Tel: 516.504.7576 or 800.440.0499 | Fax: 516.498.2029

Email. info@ibf.org | Web. www.ibf.org

2005
510
PAGES

Practical Guide to Business Forecasting

Edited by Chaman L. Jain, St. John's University & Jack Malehorn, Valdosta State University

$59.95
(Add $10 domestic & $50 foreign, for shipping & handling)

Graceway Publishing Company, Inc.
P.O. Box 670159 | Flushing, N.Y. 11367-0159 U.S.A | Tel: 516.504.7576 or 800.440.0499 | Fax: 516.498.2029
Email. info@ibf.org | Web. www.ibf.org

MACROECONOMIC FORECASTS – TABLE I

PARTICIPANTS		GROSS DOMESTIC PRODUCT (GDP) Bil. of Chained (2000) Dollars, Level				PERSONAL DISPOSABLE INCOME (Based on GDP Concept) Curr. Bil. of $, Level (SAAR)				PERSONAL CONSUMPTION EXPENDITURE (Based on GDP Concept) Curr. Bil. of $, Level (SAAR)			
Quarter		007-3	007-4	008-1	008-2	007-3	007-4	008-1	008-2	007-3	007-4	008-1	008-2
Conf. Board	Ken Goldstein	11701.8	11810.1	11913.3	12002.3					9836.7	9946.7	10086.9	10218.9
Fannie Mae	David Berson	11693.5	11779.3	11867.2	11955.2	10139.6	10274.6	10433.6	10572.1	9880.1	10004.2	10121.0	10242.6
Global Insight	Andrew Hodge	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GSU-EFC	Rajeev Dhawan	11658.4	11731.8	11815.6	11905.6	10087.6	10198.7	10317.7	10474.4	9770.0	9861.7	9976.3	10091.8
Kellner Eco	Irwin Kellner	11656.2	11717.4	11781.8	11855.4	9940.8	10005.4	10070.5	10123.4	NA	NA	NA	NA
Moody'sEconomy	Mark Zandi	11694.4	11780.8	11871.2	11956.6	10109.1	10269.3	10446.5	10597.4	9829.9	9932.3	10031.2	10120.7
Morgan Stanley	Richard Berner	11716.5	11795.4	11883.3	11975.2	10199.1	10368.6	10553.0	10726.5	9874.6	9968.3	10071.2	10179.5
Mortgage	David Duncan	11682.9	11763.1	11845.4	11929.3	11629.7	11779.6	11957.2	12110.4	9886.0	10003.9	10118.8	10232.3
NAM	David Huether	11726.3	11817.7	11917.1	12009.2	10092.14	10265.1	10408.05	10537.97	9801.0	9906.2	10011.0	10108.2
Northern Tr	Paul Kasriel	11647.0	11695.8	11754.2	11819.3	NA	NA	NA	NA	NA	NA	NA	NA
Perryman Gp	Ray Perryman	11810.0	11873.3	11914.9	12065.9	10072.2	10232.2	10423.8	10546.5	9766.5	9919.7	10103.5	10220.5
S & P	David Wyss	11701.0	11789.0	11883.0	11982.0	10128.0	10256.0	10396.0	10552.0	9824.0	9899.0	10030.0	10156.0
UBS	Maury Harris	11662.1	11712.0	11798.1	11885.2	10172.2	10308.6	10460.4	10615.7	9835.6	9882.4	9994.7	10119.3
US Chamber	Martin Regalia	11697.6	11789.0	11882.0	11883.1	NA	NA	NA	NA	8409.4	8475.9	8540.8	8536.7
U.S. Trust	Robert T. McGee	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wachovia	John Silvia	11712.3	11800.2	11897.4	11996.6	NA	NA	NA	NA	NA	NA	NA	NA
Consensus		**11697.1**	**11775.3**	**11858.9**	**11944.4**	**10257.0**	**10395.8**	**10546.7**	**10685.6**	**9701.2**	**9800.0**	**9916.9**	**10020.6**

MACROECONOMIC FORECASTS – TABLE II

PARTICIPANTS		UNEMPLOYMENT (CIVILIAN --%) (SAAR)				TOTAL LIGHT VEHICLE SALES (FOR. & DOM.) Mil. of Units (SAAR)				CHAINED (2000) PRICE INDEX (Level)			
Quarter		007-3	007-4	008-1	008-2	007-3	007-4	008-1	008-2	007-3	007-4	008-1	008-2
Conf. Board	Ken Goldstein	4.6	4.6	4.6	4.6	16.4	16.5	16.8	16.8	119.2	119.8	120.5	121.2
Fannie Mae	David Berson	4.6	4.7	4.8	4.8	NA	NA	NA	NA	119.7	120.5	121.2	121.9
Global Insight	Andrew Hodge	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GSU-EFC	Rajeev Dhawan	4.9	5.0	5.1	4.9	15.5	15.3	15.5	15.6	119.2	119.7	120.2	120.8
Kellner Eco	Irwin Kellner	4.7	4.9	5.1	5.0	NA	NA	NA	NA	NA	NA	NA	NA
Moody'sEconomy	Mark Zandi	4.7	4.8	4.8	4.8	16.2	16.1	16.0	16.0	119.5	120.3	121.0	121.6
Morgan Stanley	Richard Berner	4.7	4.8	5.1	5.0	16.2	16.2	16.1	16.1	119.5	120.0	120.7	121.3
Mortgage	David Duncan	4.7	4.8	4.9	4.9	NA	NA	NA	NA	119.7	120.4	121.2	121.9
NAM	David Heuther	4.8	4.9	4.8	4.8	16.3	16.3	16.2	16.1	119.1	119.9	120.7	121.3
Northern Tr	Paul Kasriel	4.7	5.0	5.1	5.1	16.2	16.2	16.0	16.0	119.9	120.3	120.9	121.5
Perryman Gp	Ray Perryman	4.6	4.5	4.5	4.4	19.3	19.7	18.9	19.1	119.9	120.1	121.2	122.2
S & P	David Wyss	4.7	4.8	4.9	4.8	16.4	16.4	16.6	16.7	119.2	119.6	120.4	121.0
UBS	Maury Harris	4.7	4.8	4.8	4.8	NA	NA	NA	NA	119.2	119.8	120.3	120.8
US Chamber	Martin Regalia	5.0	5.1	5.1	5.0	NA	NA	NA	NA	119.4	120.1	120.7	120.8
U.S. Trust	Robert T. McGee	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wachovia	John Silvia	4.5	4.4	4.4	4.3	16.4	16.5	16.6	16.6	119.7	120.3	121.1	121.8
Consensus		**4.7**	**4.8**	**4.9**	**4.8**	**16.5**	**16.6**	**16.5**	**16.6**	**119.5**	**120.1**	**120.8**	**121.4**

MACROECONOMIC FORECASTS – TABLE III

PARTICIPANTS		CONSUMER PRICE INDEX (1996=100), LEVEL				INDUSTRIAL CAPACITY UTILIZATION (SAAR)				NON-RESIDENTIAL FIXED INVESTMENT (Bil. of Chained 1996 Dollars)			
Quarter		007-3	007-4	008-1	008-2	007-3	007-4	008-1	008-2	007-3	007-4	008-1	008-2
Conf. Board	Ken Goldstein	208.2	209.8	211.5	213.2	NA	NA	NA	NA	1364.2	1391.2	1415.7	1433.8
Fannie Mae	David Berson	208.4	209.8	210.9	212.1	80.3	80.7	80.7	80.7	1370.0	1391.5	1412.8	1434.5
Global Insight	Andrew Hodge	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GSU-EFC	Rajeev Dhawan	205.9	206.8	207.8	208.9	79.4	79.4	79.4	79.5	1347.1	1358.8	1373.7	1391.0
Kellner Eco	Irwin Kellner	205.6	206.7	207.8	209.1	NA	NA	NA	NA	NA	NA	NA	NA
Moody'sEconomy	Mark Zandi	207.8	208.9	209.8	210.9	78.7	78.5	78.3	78.2	1386.8	1408.2	1427.5	1442.8
Morgan Stanley	Richard Berner	208.4	208.8	209.9	211.0	80.7	81.0	81.2	81.5	1388.8	1412.3	1433.4	1454.6
Mortgage	David Duncan	208.4	209.6	210.9	212.1	81.4	81.7	81.8	81.7	1369.7	1384.5	1399.8	1413.9
NAM	David Heuther	206.0	207.1	208.1	209.2	79.7	79.8	79.9	80.1	1375.3	1396.4	1415.6	1431.7
Northern Tr	Paul Kasriel	207.8	208.6	209.8	211.0	81.1	80.6	80.4	80.2	1366.3	1369.7	1387.2	1397.5
Perryman Gp	Ray Perryman	NA	NA	NA	NA	81.6	81.5	81.8	81.8	1394.8	1407.7	1424.5	1455.2
S & P	David Wyss	207.4	207.3	208.3	209.3	80.4	80.9	81.1	81.3	1373.8	1391.2	1405.1	1417.0
UBS	Maury Harris	208.0	207.2	208.6	210.4	82.0	81.8	81.8	81.8	1366.8	1383.2	1408.3	1433.9
US Chamber	Martin Regalia	207.6	209.4	211.2	211.1	NA	NA	NA	NA	1360.0	1375.4	1393.6	1399.9
U.S. Trust	Robert T. McGee	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wachovia	John Silvia	207.4	208.2	209.4	210.8	NA	NA	NA	NA	1866.8	1872.0	1888.7	1902.9
Consensus		**207.4**	**208.3**	**209.5**	**210.7**	**80.5**	**80.6**	**80.6**	**80.7**	**1410.0**	**1426.3**	**1445.1**	**1462.2**

MACROECONOMIC FORECASTS – TABLE IV

PARTICIPANTS		FEDERAL FUNDS RATE %				AAA CORPORATE BOND RATE %				MONEY SUPPLY M2, BIL. OF $ (Level, SAAR)				PRIVATE HOUSING START TOTAL (Mil. Units) (SAAR)			
Quarter		007-3	007-4	008-1	008-2	007-3	007-4	008-1	008-2	007-3	007-4	008-1	008-2	007-3	007-4	008-1	008-2
Conf. Board	Ken Goldstein	5.5	5.9	5.9	5.9	5.5	5.7	6.0	5.7	7288.4	7365.5	7441..6	7508.4	1.50	1.50	1.50	1.51
Fannie Mae	David Berson	5.3	5.3	5.3	5.0	5.7	5.8	5.9	5.9	NA	NA	NA	NA	1.46	1.47	1.48	1.49
Global Insight	Andrew Hodge	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GSU-EFC	Rajeev Dhawan	4.8	4.5	4.5	4.5	5.4	5.4	5.4	5.6	7209.0	7258.4	7316.6	7378.6	1.47	1.49	1.51	1.54
Kellner Eco	Irwin Kellner	5.5	5.5	5.5	5.3	6.3	6.5	6.7	6.9	NA	NA	NA	NA	1.38	1.45	1.40	1.38
Moody'sEconomy	Mark Zandi	5.3	5.3	5.3	5.3	6.6	6.7	6.9	7.0	7261.4	7308.5	7370.0	7428.6	1.42	1.38	1.40	1.46
Morgan Stanley	Richard Berner	5.3	5.3	5.3	5.0	5.8	6.0	6.3	6.4	7208.4	7351.9	7512.1	7676.8	1.20	1.22	1.22	1.25
Mortgage	David Duncan	5.3	5.3	5.3	5.3	5.8	5.9	5.9	6.0	7305.5	7448.1	7600.3	7742.7	1.38	1.39	1.42	1.42
NAM	David Heuther	5.3	5.3	5.3	5.3	6.5	6.6	6.8	6.9	7152.3	7202.4	7267.8	7330.5	1.48	1.50	1.55	1.63
Northern Tr	Paul Kasriel	5.3	5.1	4.6	4.3	5.7	5.4	5.1	5.0	NA	NA	NA	NA	1.40	1.39	1.40	1.42
Perryman Gp	Ray Perryman	5.2	5.1	4.9	5.0	5.5	5.4	5.5	5.6	7218.2	7386.1	7486.0	7551.5	1.49	1.54	1.58	1.60
S & P	David Wyss	5.3	5.3	5.3	5.0	5.8	5.9	6.0	5.9	7281.9	7342.9	7420.6	7500.3	1.37	1.41	1.43	1.47
UBS	Maury Harris	5.3	5.0	4.8	4.8	NA	NA	NA	NA	NA	NA	NA	NA	1.40	1.45	1.50	1.55
US Chamber	Martin Regalia	5.3	5.3	5.0	5.0	NA	NA	NA	NA	NA	NA	NA	NA	1.60	1.65	1.70	1.80
U.S. Trust	Robert T. McGee	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wachovia	John Silvia	5.3	5.3	5.3	5.5	5.50	5.60	5.70	5.90	7200.0	7250.0	7300.0	7350.0	1.45	1.44	1.46	1.49
Consensus		**5.2**	**5.2**	**5.1**	**5.1**	**5.8**	**5.9**	**6.0**	**6.1**	**7236.1**	**7323.8**	**7409.2**	**7496.4**	**1.43**	**1.45**	**1.47**	**1.50**

Conf Board = Conference Board, New York, New York; Fannie Ma = Fannie Mae, Washington, DC; Global Insight = Global Insight, Eddystone, PA; GSU - EFC = Georgia State University, Economic Forecasting Center, Atlanta, GA; Kellner Eco = Kellner Economic Advisory, Port Washington, New York; Moody's Eco. = Moody's Economy.com, Westchester, PA; Morgan Stanley = Morgan Stanley Dean Witter & Co, N.Y.; Mortgage = Mortgage Bankers Association, Washington, DC; NAM = National Association of Manufacturers, Washington, D.C.; Northern Tr = Northern Trust Company; Chicago, IL; Perryman Gp = The Perryman Group, Waco, TX; S&P = Standard & Poors, New York, New York; UBS Investment Bank, New York, New York; US Chamber = U.S. Chamber of Commerce, Washington, D.C.; U. S. Trust = U. S. Trust, New York, New York; Wachovia = Wachovia Bank, Charlotte, NC.

Companies that have a Certified Professional Forecaster (CPF®):
(partial list)

Microsoft
GAP
Heineken
Hewlett Packard
Merrill Lynch
Rubbermaid
Wrigley
Cisco Systems
Chevron Texaco
Gillette
The Home Depot
Fruit of the Loom
Honeywell
Walt Disney World
Carhartt
Pepsico Beverage Products
Nestle USA
Fuji Photo Film USA
Nordstrom
The Boeing Company
Rand McNally
Delta Faucet
Georgia-Pacific
Panasonic
Revlon Inc
Circuit City Stores, Inc
Andersen Windows
Victoria's Secret Stores
Discover Financial
Best Buy Co., Inc
Delta Air Lines
Cisco Systems, Inc
General Mills, Inc
Land O' Lakes Purina Feed LLC
FedEx
Caterpillar, Inc.
Pepsi Bottling Ventures

BECOME A CPF®

CERTIFIED PROFESSIONAL FORECASTER

Advantages of IBF Certification:

- Validate your experience, knowledge, and skill sets
- Enhance your credentials, and advance your career
- Pre-qualify for new positions in your field
- Become more recognized at your company as well as in the field
- Set an example for others in your department

For Employers:

- Certified individuals are pre-qualified, allowing you to identify the right person for a forecasting/demand planning job with ease.
- Gain assurance that an IBF Certified individual has the background to help improve forecasting performance at your company.
- Increase the value of your forecasting and demand planning staff, department, and company.
- Save time and resources in training.

The IBF offers 2 Levels of Certification: CPF® & ACPF

Certified Professional Forecaster (CPF®)

Pass 3 exams for 3 different courses to achieve this designation:

Module 1: What You Need to Know About Business Forecasting.
Module 2: Data Sources, Data Analysis & Treatment, and Time Series Models
Module 3: Forecast Reporting and Presentation

Advanced Certified Professional Forecaster (ACPF)

Passing 2 additional courses and 2 exams will allow you to achieve this designation:

Module 4: Advanced Forecast Modeling
Module 5: Forecast Systems/Package

Schedule of Exams (Exams are administered following IBF events):

- Boston, MA | August 25, 2007 | Business Forecasting: A Tutorial at 3 Levels
- Orlando, FL | October 31, 2007 | Supply Chain Planning & Forecasting: Best Practices Conferences
- Atlanta, GA | December 1, 2007 | Executive Sales & Operations Planning (S&OP) Workshop
- Chicago, IL | December 8, 2007 | Statistical Forecasting: A Hands-On Workshop

For more information on IBF Certification, or to register for an exam please contact us:

Institute of Business Forecasting
Increasing Organizational Performance Through Forecasting Education

Tel: 516.504.7576 E-mail: info@ibf.org www.ibf.org/certjbf.cfm


Albatross sometimes sleep while they're flying.
They don't see what's ahead of them.
But you can. With proven forecasting software from SAS.
www.sas.com/albatross
sas
THE POWER TO KNOW

THE JOURNAL OF BUSINESS FORECASTING
P.O. Box 670159
Flushing, New York 11367-0159

POSTMASTER:
PLEASE RUSH!
CONTAINS DATED MATERIAL

PRSRTSTD
U.S. Postage
PAID
Birmingham, AL
Permit No. 394