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INCREASED COMPANY PERFORMANCE THROUGH MACROECONOMICS SALES FORECASTING: A CASE STUDY

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ABSTRACT
Traditional planning in the business environment is used to allocate and coordinate resources mainly on basis of company-internal data. Thereby, a general weakness is that macroeconomic changes, due to business cycles, are not taken into consideration and the chance to take advantage of the associated effects on the revenues of an individual enterprise is missed. Including a macroeconomic trend analysis in business planning fosters the objectivity to create a solid basis for a corporate decision-making process. This paper deals with the Economic Trend Outlook Model which allows to consider macroeconomic influences on the company-specific capacity planning. In doing so, a company can turn into a proactive organization that makes use of advanced trend information and improves the individual forecasting accuracy. Thus this paper describes the method behind this strategy and introduces a stepwise approach using the examples of two company cases.

Keywords: forecasting, macroeconomics, strategic planning and management

INTRODUCTION
When the functions in a company's value chain relevant to its business model are planned, the result is an overall plan that is "cast in gold," i.e., the budget. Budgeting is a planning process and an essential element in company management (Malik, 2006) that forms the basis for other important processes such as variance analysis, reporting, and "fine-tuning" within a management/controlling system (Tschandl, 2012). When used properly, planning and budgeting leads to a clear definition of goals and a corporate mindset that operates in terms of relationships and alternatives, coordinating different areas of the company and creating clarity through documentation and information. This increases the company's adaptability, responsiveness, and innovative strength (Egger and Winterheller, 2007; Gleich et al., 2013).

Traditional planning and budgeting models, however, have come under increasing criticism in recent years (Horváth, 2003). Critics point out that they are expensive and time-consuming. They tend to focus inwardly and consequently lack strategic value (Tschandl et al., 2009). Accordingly, there is a lack of planning precision and accuracy, together with an overlapping failure to identify larger economic trends. Efficient business processes and efficient logistics processes in particular, require a high degree of planning precision and accuracy. At the same time, sales-related factors such as the rising complexity of service offerings or increased volatility in the markets make it difficult to achieve successful or even accurate planning and budgeting. This creates a planning paradox: As complexity increases, there is a growing need for (precise) planning, while at the same time it is even more difficult to do any planning at all within these complex, interconnected systems (Szyperski, 1973).

Emphasizing the impossibility of forecasting given an uncertain future, some academics and business people have for decades expressed doubts as to whether budgeting makes any sense: "Most corporate planning is like a rain dance; it has no effect on the weather that follows, but it makes those who engage in it feel that they have the control," (Ackhoff, 1981). Finally, economic crises have helped to raise doubts about traditional planning models. It was scarcely possible for companies to have anticipated the economic downturn of 2008 and 2009 through conventional planning methods. The same applies to 2001 and 2002 as well as previous economic crises and economic cycles (Horváth, 2009). The obvious weakness in traditional budgeting methods is that large future macroeconomic changes and their associated effects on the revenues of individual companies are not really taken into account (Weber et al., 2009; Weber et al., 2006). The negative effects of imprecise sales planning and an inaccurate budget are far-reaching. They lead to excess or underutilized production and human resources capacities. Other strategically important medium and long-term decisions are frequently based upon incorrect capacity and budget figures. Even when strategic considerations are incorporated into traditional budgeting processes (Rickards, 2007), these ultimately originate from subjective expectations and assessments by individuals both inside and outside the company who are involved in the budgeting process. This lack of an objective consideration of external market factors can be rectified by the planning that takes macroeconomic trends into account. A praxeological approach also captures, assesses, and constantly monitors, for planning and budgeting purposes, macroeconomic trends that have an empirically demonstrable and significant influence on company results. Macroeconomic trends are defined here as the total of all business and economic factors that influence the business environment, the market potential, and thus company revenues (Mankiw, 2003). By increasing objectivity, the incorporation of macroeconomic analyses into business planning helps improve information quality within a company's decision-making processes. Companies that have implemented a macroeconomic planning model in addition to traditional budgeting tend to achieve improved planning quality (Navarro 2006, 2009). This enables greater profitability. Based upon statements regarding the lack of forecasting in traditional planning concepts, the following chapter explains the Economic Trend Outlook Model (Macroeconomic Trend and Sales Forecasting Model), which makes it possible to document the macroeconomic influence of economic development on a company-specific basis. This concept has been proven in practical use with less than 5% annual plan-actual variance.

In this paper, we show some calculations which are done on real-world data. For this purpose we will focus on two case companies. The first one is active in the oil and gas industry, based in the US. For the sake of simplicity we further denote this company as "case company A." The second case company is active in the formwork industry, based in Austria. It is further named

"case company B." Whereas the case of company A is based on several years of experience, the case of company B is to be regarded as work in progress where the method, described in this paper, is applied step by step. A similar approach is presented in Sagaert et al. (2018). They forecast actual sales using LASSO regression with seasonal, autoregressive and leading indicator values as explanatory variables using mostly statistical techniques for selecting leading indicators. We forecast rates of changes and rely more heavily on managerial input to select leading indicators. Thus, our model is simpler, easier to implement and better understood by managers. On the other hand, the model of Sagaert et al. (2018) is capable of automatically combine different leading indicators. In order to formulate the research target as a research question we agreed on the following: "In which way, can macroeconomic trend information serve as an improvement for business forecast accuracy?"

TRADITIONAL BUDGETING METHODS: BUDGETING IN RELATIONSHIP TO MARKET VOLATILITY

Whereas traditional budgeting (in a narrower sense) is defined as a process of determining formal and budget goals, an expanded concept of budgeting also includes the monitoring of budget compliance (Tschandl et al., 2009). Budgeting then becomes the process of creating and monitoring operational plans or budgets (based upon formal goals) with the effective and efficient forecasting, coordination, control, and motivation as part of the business process of creating goods and services (Weber et al., 2006). Budget control, monitoring, and analysis enable systematic problem detection and create an early warning system, which in turn allows for the fine-tuning of business operations. The integrated planning process begins with long-term planning targets. Taking the previous year's results into account, these long-term targets are used to extrapolate the contribution necessary to achieve the target for the coming planning period. In this process, corresponding general conditions (such as structural changes in the markets due to bankruptcy of market participants or events such as wars, crises, or new statutory regulations) are taken into account using systematic information collection methods. An ideal typical sequence consists of sales and revenue planning (usually the predominant bottleneck in planning), inventory planning (what is already in the warehouse?), production planning (what still needs to be done?), procurement planning (what still needs to be purchased?), investment planning (what needs to be invested for this purpose?), activity planning (special projects, e.g. introduction of Enterprise Resource Planning), human resources planning (what personnel are required for all of this?), planning of overhead costs, and coordinating meetings until a decision is made (Tschandl et al., 2009). Planning is integrated vertically across the individual functions and horizontally between the performance budget, financial plan, and budgeted balance sheet, as well as chronologically between years and within the year (Egger and Winterheller, 2007).

In this process, different expectations from the participants regarding planned figures or budget goals will lead to planning gaps, i.e. differences between the figures envisaged by different groups (e.g. top management expects +10% revenue, while management at the division/department level expects +3%). Differences in the negotiating strength of the participating areas within the company, differing interests, and a lack of data on expected market potential may lead to contradictions and conflicts, which in turn cause increased time and financial expenditures for negotiations and planning and/or significant plan-actual variances due to a lack of commitment (Centage/IOMA, 2007). In practice, the following factors may have a primary influence on plan-actual variances:

- company-relevant macroeconomic data, economic indicators, and their trends are not considered or are not considered in a timely manner or as required. There is no consistent, structured process of identification, analysis and utilization.
- the systems for calculating the revenue- or cost-relevant effects of identified, relevant economic and macroeconomic developments are lacking or are not integrated into budget planning.
- the first budget year is linearly projected onto the second and third year. This frequently leads to gross estimates without an objective basis, usually based on the prior year's budget and increased by the "desired" or typical annual growth rates for the market.
- the “customer” is used as an information source, of course, but as the customer generally lacks substantial knowledge of the market, this communication channel does not function;
- Changes in the order situation are passed on, if at all, with insufficient notice or just before a crisis, thus leaving no reaction time.

Even if macroeconomic trends are available to the company, they are frequently ignored by management. The sources of budget variances are also often misinterpreted and are more often viewed as management errors rather than the results of an economic up- or downturn. Why do traditional budgeting models fail primarily in times of crisis and economic expansion? Conventional, usually linear, planning models function only to a limited extent and only in phases of linear growth, although not in times of severe expansion and recession (Navarro, 2009). In economics research, expansion and recession phases are considered as business cycles, i.e. recurring, wave-shaped changes in the level of economic activity within a market economy (Wildmann, 2007; Blanchard and Illing, 2006; Maußner, 1994; Schumpeter, 1961). The four main phases of a business cycle are expansion, boom, recession, and depression. Since the beginning of the 19th century, in the USA alone there have been 23 full economic cycles in which all four phases were fully experienced. There have been eleven cycles since 1945, with the last three crisis phases occurring from July 1990 to March 1991, March 2001 to November 2001, and December 2007 to June 2009. With an average length of just over one year, the recession phases in the USA were significantly shorter than those of expansion, which lasted approximately seven years (US National Bureau of Economic Research, 2010). Industries are linked to these economic cycles in different ways. Practically all industries and sectors interact with economic trends; very few industries remain unaffected by business cycles and have a relatively constant market potential (Berman and Pfleeger, 1997; Petersen, 1996; Braun and Larrain, 2005). Since business cycles (could) have a significant influence on company revenues and profits (Hewel and Neubäumer, 1998), strategic business cycle management (BCM) is important. The goal of BCM is to optimize the organizational performance and profitability of a company in every phase of the business cycle and thus to increase its competitiveness. This is achieved by identifying macroeconomic trends relevant to the company and instituting typical anti-cyclical behavior (Bromiley et al., 2008). Navarro (2009) proposes three steps for business cycle management:

- development of forecasting capabilities that lead to successful and early identification of economic and industry cycles as well as their specific effects on the company,
- development of well-coordinated strategies and operational tactics that cover all business functions and are integrated with sales and trend forecasting,
- creation of a structure and culture within the organization that supports and promotes this process.

The Trend and Sales Forecasting Model (Economic Trend Outlook Model) presented in the next section is an instrument for fulfilling the first step. It supplies the forecasts necessary for the other steps. For the second step, the literature provides standard recommendations for action in the individual phases. Ideally, these proposed behaviors are evaluated for each specific company and adapted as necessary. Important topics for proactive business cycle management include human resources management, financing and loan management, investment and disinvestment management, and Supply Chain Management, including production and inventory management (Navarro et al., 2010; Navarro, 2009). A study conducted by the Merage School of Business (University of California-Irvine) involving 70 publicly-traded companies from 35 industries represented in the US S&P 500 index and accounting for 75% of the investment volume in the US stock exchange tested the hypothesis that a statistically significant correlation exists between growth in share price and proactive business cycle management. The study examined the economic crisis of 2001. The period of observation was five years, from February 1999 until December 2003. This covered all the phases of an economic cycle. The results showed significantly higher performance among companies with active business cycle management as compared to that of the reactive companies. There was a clear and strong statistical correlation between organizational performance and strategic business cycle management. Proactive companies experienced an average annual stock price gain of 23.3%, whereas reactive companies suffered an average annual price loss of 6.6% (Navarro, 2009).

ECONOMIC TREND OUTLOOK MODEL: BUDGETING WITH MACROECONOMIC TREND AND SALES FORECASTING

The starting point for the development of a macroeconomic trend and sales forecasting model in 2009 was the vision of a budgeting concept that considers future macroeconomic prospects, which is company-specific and user-friendly, and can be integrated into an existing planning and budgeting architecture with minimum time and effort. The goals of the Economic Trend Outlook Model (ETOM) are as follows:

- to detect and record economic trends and developments,
- to describe their effect on company sales, and
- to integrate this into the traditional budgeting process in practical form as a supplemental, independent instrument ("add-on tool"),
- without a need to change the conventional budgeting process,
- thus solving the problem of missing macroeconomic budgeting models.

A tool that can be immediately integrated into an existing planning process minimizes the typical acceptance problems during the introduction. The theoretical foundations for macroeconomic trend analysis are the business cycle theory and the use of economic and industrial indicators. By comparing the respective annual rates of change across a time period of more than seven years, it is possible to identify correlations between company sales and economic indicators. The usage of such a model enables the traditional budgeting process to be enhanced and can evolve the realization of numerous benefits. This involves the consideration of macroeconomic information like trends by identifying suitable, leading macroeconomic and industry-specific business indicators. Examples would be the Purchasing Manager index, the Industrial Production Index, the Industrial Machinery Index or the Investment Index. The model offers a consistent and structured process for the identification, analysis and utilization of company-relevant macroeconomic indicators. By means of mathematical models, company-

specific sales impact of identified, correlating macroeconomic indicators are calculated. Thus, an accurate forecasting of future company sales based upon leading macroeconomic indicators is enabled. This results in an improvement of the medium-term budgeting objectivity. The goal is to obtain a sales forecast based upon real market benchmark data and the specific effect on the company's revenue. This should prevent a linear forecast based on management expectations and desired growth rates. ETOM comprises a five-step process.

In the **first step**, monthly sales are aggregated and displayed in a streamlined format as an annual rate of change. Annual rates of change are the basic data format for the cyclical analysis.

In **step two**, multiple economic and business indicators are analyzed towards their correlation with company sales. The selection of indicators for the correlation analysis is based on standard leading indicators as well as industry-specific leading indicators, which are selected on a company-by-company basis. Most indicators for correlation analysis also use annual rates of change. Through the use of annual rates of change for the company sales and indicators, short-term volatility can be eliminated and the underlying trend, respectively economic cycle, is displayed.

Step three includes the proper calculation of lead time (x-axis) and scale ratio (y-axis) for significantly correlating indicators. Important are those indicators that correlate with company sales and show a lead time. The lead time is the time delay between the economic indicator and the company sales. Step one to three can be called time series analysis. These three steps make it possible to draw initial conclusions about expected future company sales. In general, leading indicators have a lead time between 4 and 15 months, depending on the industry sector.

Additional future sales visibility can be gained by applying the optional **step four**: Establishing a rolling 36-month forecast for identified leading indicators.

The last step, **step five**, includes professional documentation, reporting and monitoring of the results.

Step 1: Mathematical analysis of monthly company sales

Monthly company sales for at least one business cycle are streamlined and aggregated using annual rate of change calculation. In the case company A sample, the average duration of an entire business cycle is seven years (US National Bureau of Economic Research, 2010). As is the case with a moving average, the annual rate of change targets to eliminate the short-term volatilities of monthly sales, in order to identify the underlying medium- and long-term sales trend and the company-specific business cycle (see Figure 1). The negative phases in Figure 1 during the years 2002/2003 and 2009/2010 reflect the economic downturn during these years. The years 2004 – 2008 and 2011 – 2012 show the economic expansion following the downturn.

Figure 1 - Case study case company A; Annual Rate of Change of Company Sales (2001-2014).

Method for calculating annual rate of change:
A rate of change is the ratio of one figure in a time series to a preceding figure in the same time series. When annual rates of change are calculated, the time interval between the two years being compared is fixed at 12 months (i.e. one year, thus "annual" rate of change). The annual rate of change can then be used to confirm whether the current activity (in this case: company revenue) is above or below the result of the previous year. The annual rate of change is calculated as follows:

1. The monthly revenue data are calculated for the last seven or more years. Significant non-recurring events that do not fall within regular business activities and influenced revenue by more than 15% (e.g. acquisitions, introduction of new, groundbreaking developments, the start of a new corporate division, etc.) are eliminated in order to prevent any distortion of the underlying company's core business trend.
2. Monthly moving totals are calculated. This intermediate step is required in order to calculate the annual rate of change. Monthly moving totals are the total of monthly values for a defined number of months. For example, the 12-month moving total for December 2018 is the total for the months of January 2017 to December 2018.
3. Finally, the annual rate of change for a specific month is calculated based upon the following formula:

$$Annual\ rate\ of\ change\ December\ 2018 = \left(\frac{\text{12-month moving total per December 2018}}{\text{12-month moving total per December 2017}}\right) \times 100 - 100$$

Example:
12-month moving total per December 2018: EUR 35 million
12-month moving total per December 2017: EUR 40 million
$Annual\ rate\ of\ change\ December\ 2018 = (35/40) \times 100 - 100 = -12.5\%$

4. To arrive at the curve in Figure 1, the annual rate of change for each month must be calculated and depicted graphically. An appropriate formula for the calculation can be created in e.g. Microsoft Excel.

Based upon these initial data and calculations, the goal is to find suitable economic indicators that show a similar correlating curve and have a lead time (therefore they are significant with reference to future revenue potential based upon relevant market benchmark data). Indicators with a lead time are described as leading indicators.

Step 2: Correlation analysis between company revenues and economic indicators
In this step, a correlation analysis is performed between the calculated annual rate of change of company revenues and selected economic time series. The annual rate of change of company revenue is subjected to a correlation analysis with annual rates of change or indexed values of selective economic, business, macroeconomic, and industry-specific market indicators. Empirical values from typical leading indicators for each industry can be used for this analysis in order to identify correlating, leading indicators. The related data and indicators are widely available. There are estimated one million or more different business indicators and time series available worldwide in a wide variety of databases, most of which are fee-based. One very famous example is the Federal Reserve Economic Data (FRED) (2019) which is a database

managed by the Federal Reserve Bank of St. Louis (USA). It offers more than 530,000 leading indicators from 87 sources in a structured and maintained manner. FRED offers both a graphical representation and a text form as optional output. For our use case, it is of particular importance that FRED offers a monthly bucket download feature, which allows an export in comma-separated values (CSV). This vast number of available indicators need to be reduced to a manageable set. Based upon the authors' experience with the case company A from the oil and gas industry, the number of leading indicators examined for correlation can be between 800 and 1,000 per company. To get to this reduced set of indicators, experts need to investigate on plausibility of the respective macroeconomic key indicators. The selection process for identifying relevant leading indicators occurs in two steps, using correlation and regression analyses:

a) Managerial expert judgment is inevitable as a lot of experience can be included in the selection process. This process starts with a selection of business sectors for which the macroeconomic key indicators are considered (Sagaert et al., 2018). In our case they are the construction and building industry for case company B as well as the oil and gas industry for case company A. Thereby the preselected, typical leading indicators are examined for their correlation strength (standard indicator set).
b) A company-specific set of potential leading indicators is created, taking into account the industry and geographical location, as well as the market and customer structure (company-specific indicator set) and its correlation to company revenues.

Both steps are mainly done for the purpose of excluding correlations based on coincidence. For our case company B, active in the formwork industry, it would add no value to know that based on the past, the rate of change for company B is similar to the rate of change for the volume of pineapple export in Thailand over the past years. Even if there seems to exist a correlation between those two rate of change curves, there is no evidence that the one indicator (pineapple export in Thailand) is leading the revenue evolution of company B. However, we have to be careful when excluding individual macroeconomic indicators or even whole business sector indicators as we might exclude reference values which indeed would make sense on the second glance. Let us think about case company B, doing business in the formwork industry; that is, they have a close relation to the building and construction industry. If we, by default, would exclude the whole bunch of macroeconomic indicators, related to the transportation sector, we would cut off thousands of possible correlations. It is on the dice that the transportation industry, including road transportation, air and sea freight, could somehow correlate with the construction industry as material needs to be shipped to the construction site. The other connection could be that the construction and building sector enhances transportation as roads for trucks as well as rails for the railway are built. Therefore, the transportation sector makes sense to be part of the correlation test in our example. The indicators are mostly index series, ratios, or reference figures with their rates of change, which are subdivided chronologically and by markets and sectors (e.g. indicators for goods markets, production markets, money markets, industry activity, investment activity, consumption activity) (Oppenländer, 1996). Examples of typical leading indicators:

- new order levels,
- production indices and capacity utilizations, e.g. total industrial production or production indexes for selected industries,

- sales figures and revenues, e.g. retail or wholesale revenues,
- business climate indices, e.g. German Business Climate Index, CEO Confidence Index, ISM Purchasing Managers' Index,
- consumer climate indices, e.g. US consumer confidence, consumer climate index for Germany,
- Investment indices/share indices, e.g. DAX, S&P 500.

The degree of linear relation between two features (time series) can be calculated using the Pearson correlation coefficient. The closer the correlation coefficient is to +1 or -1, the more positive or negative the relation. A correlation coefficient of |0.8| or more signifies a (very) high correlation. The check for statistical significance of the presumed relation between the variables (and the check for normal distribution) is performed using the t-test as well as the Kolmogorov-Smirnov test. The coefficient of determination R^2, i.e. the square of the correlation coefficient r, indirectly indicates the robustness or strength of the relation: To what percentage can the variances between the two-time series (indices) be explained by the assumed relation? In our case study of case company A, a total of 41 business indicators were identified with a coefficient of determination $R^2 > 0.8$. Thus, there is a high correlation between the indices, i.e. a strong correlation with a coefficient of determination greater than 80%. Approximately one-third of the 41 indicators were leading indicators with a maximum lead time of 15 months. The final established overall indicator system at case company A consists of four main leading indicators and eight confirming leading indicators. The main leading indicators include the indicators with the strongest correlations. The confirming leading indicators still correlate well and typically show a wide distribution across different branches. They are further characterized by a long lead time and a cyclical correlation to significant company business cycle changes (i.e. cycle phase changes). Figure 2 shows the annual rate of change for case company A (solid line) with an identified main leading indicator, the "Total Industrial Production USA" (dashed line). Another economic indicator with a statistically high correlation to the sample company is the Purchasing Manager Index (PMI). As evident in Figure 3, the lead time for this indicator is significantly longer than "Total Industrial Production USA." Determination of the optimal time delay for an indicator, known as "lead time," is shown in the next step of the Economic Trend Outlook Model.

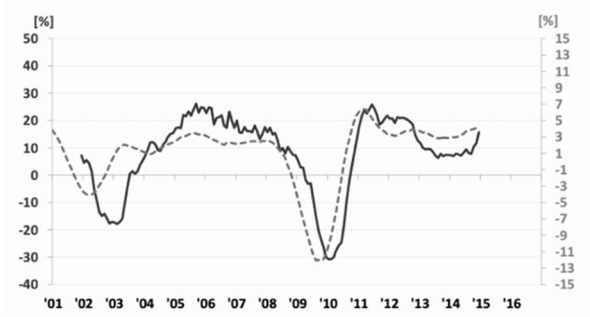

Figure 2 - Case study case company A; Company Sales (solid line) vs. correlating Leading Indicator Total Industrial Production USA (dashed line).

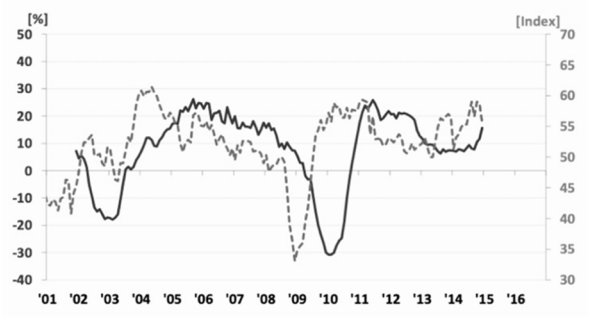

Figure 3 - Case study case company A; Company Sales (solid line) vs. correlating Leading Indicator Purchasing Manager Index (dashed line).

Step 3: Lead time and scale ratio analysis of leading economic indicators
In terms of timing relationship, the previously identified indicators can be classified as follows (Hewel and Neubäumer, 1998):

- leading business indicators,
- parallel business indicators,
- lagging business indicators

For purposes of planning and budgeting, the indicators that precede the company trend, i.e. the leading indicators, are relevant.

In a further step, the indicator variable is scaled and shifted horizontally and vertically until a maximum coefficient of determination R^2 between the company revenues and the transformed indicator variable is reached. The optimal lead time l is determined by shifting the indicator variable to the right and left on the x-axis. An optimal offset o is determined by shifting the indicator variable up and down on the x-axis, and the original indicator variable is multiplied by a scale factor f, which shows which percentage of growth or stagnation of the indicator corresponds to which percentage of growth or stagnation of company revenue (e.g.: 1% increase in industrial production corresponds to 5% increase growth in revenue). Formally, a transformation is defined as

$$K_t = K_i + l * f + o$$

where K_t represents the transformed key performance indicator, while K_i states the original KPI. The variable l stands for lag, f for the scale factor and o for the offset. Figure 4 shows the leading indicator "Total Industrial Production USA" as a dashed line, shifted by the identified lead time of five months on the time axis (to the right on the x-axis). For case company A, shown as solid line, this means that the indicator, Total Industrial Production USA, indicates the market potential (the expected company revenues) with five months' lead time.

Figure 4 - Case study case company A; Company Sales (solid line) vs. correlating Leading Indicator Total Industrial Production USA (dashed line). Leading indicator moved on x-axis by identified lead time of 5 months.

Figure 5 - Case study case company A; Company Sales (solid line) vs. correlating Leading Indicator Purchasing Manager Index (dashed line). Leading indicator moved on x-axis by identified lead time of 14 months.

Figure 5 shows the Purchasing Manager Index moved by the identified lead time of 14 months, thus indicating upcoming corresponding revenue changes for case company A. Having

a look on case company B, a major player in the formwork industry, gives us some interesting matches in terms of macroeconomic indicators as well. To begin with, we create the 12/12 rate of change curve with the revenue data of the North American market of case company B with a time span between January 2004 and April 2019, returning the first 12/12 rate of change value in December 2005. For a start we match this company rate of change curve with more than 70,000 macroeconomic indicators from the FRED database. This gives us a ranking of matches, shown in Figure 6, where the best match, based on the R^2 value, is on the top left corner followed by the second-best match and so on along the line. The black solid lines represent different macroeconomic indicators whereas the shaded line shows case company B's rate of change curve. Like in previous representations, the x-axis reflects the timeline and the y-axis stands for the respective rate of change value. The header of each graph in Figure 6 shows the ranking of the indicator match as the first number. The second number references the indicator (e.g. the first graph illustrates the macroeconomic indicator number 47). In addition, the individual p-value as well as the correlation coefficient mccr and R^2 are given. Already on the first glimpse one can see that the case company B values correlate with the individual macroeconomic indicators.

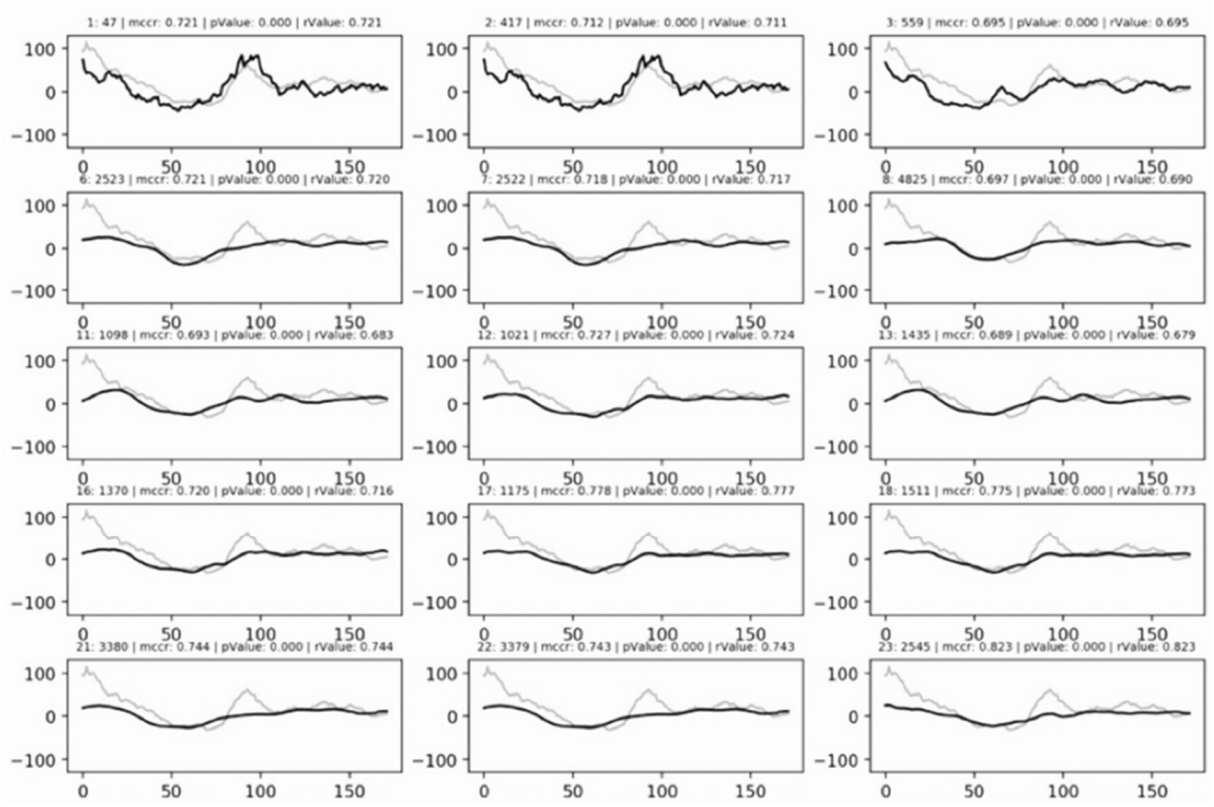

Figure 6 - Case study case company B; Company Sales vs. several leading indicators ranked by R^2 value.

After this first test, we reduce the set of 70,000 indicators to a smaller set of indicators which, based on our experience, have some correlation as all of them are part of the construction and building sector. If we now match case company B's rate of change values against this set of 80 construction and building indicators, we get a result of best fit, shown in Figure 7 and Figure 8.

Case company B's rate of change is represented in the shaded line, whereas the reference indicators are shown in solid line.

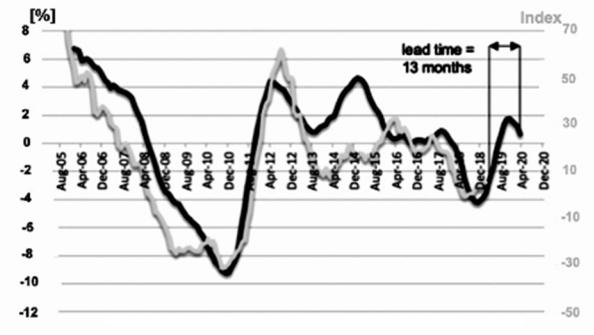

Figure 7 - Case study case company B; Company rate of change sales vs. correlating Leading Indicator Building Material and Garden Equipment and Supplies Dealers in Washington-Arlington-Alexandria. Leading indicator moved on x-axis by identified lead time of 13 months.

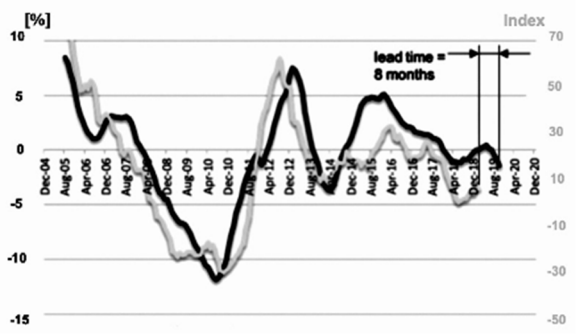

Figure 8 - Case study case company B; Company rate of change sales vs. correlating Leading Indicator Construction in Vermont. Leading indicator moved on x-axis by identified lead time of 8 months.

The dramatic rate of downturn change downturn, case company B as well as both reference indicators, in the years between 2008 and 2010 is due to the economic crisis in the respective time span. Yet, case company B experienced a significant growth in the subsequent years, followed by several up- and downturns in terms of growth. The first reference indicator, shown in Figure 7, is called "Building Material and Garden Equipment and Supplies Dealers in Washington-Arlington-Alexandria" and gives us a lead time of 13 months and an R^2-value of 0.79. Therefore, case company A is able to base the forecast procedure on this macroeconomic indicator as the high R^2-value also shows a strong correlation. The lead time of 13 months could be long enough to execute necessary tactical decisions. The same holds true for the reference indicator 2 shown in Figure 8. The macroeconomic indicator is called "Construction in Vermont" and represents the number of construction sites in Vermont (USA). Our calculation gives us a lead time of 8 months with a respective R^2-value of 0.74. In contrast to the reference indicator 1, these 8 months represent a shorter time in which the management can take the decision to react accordingly. The method behind the calculation of R^2 and way to get to a ranking of which macroeconomic indicator fits best is shown in a subsequent paper as it would be beyond the scope to go into detail. The top-ranked macroeconomic indicator for case company B is "Advance Retail Sales: Building Materials, Garden Equipment and Supplies Dealers."

Step 4: Revenue forecast based upon leading indicators' lead time and their forecast
Up to the preceding step, the scope of the forecast depends upon the indicator's lead time. Rolling forecasts (e.g. 36 months) of leading indicators can be created to obtain an even more long-range outlook (see Figure. 9). As a result, the planning horizon is increased from the actual lead time of the indicator, which is typically between four and 15 months, or up to for example three years. These 3-year forecasts for economic and business indicators can be purchased from external institutions and are available in very large quantities. Data is available for numerous indicators. Therefore, it is unlikely that the lead time is not long enough to perform a sales

forecast. In the unlikely event of missing indicators, a reduction of the required lead time needs to be done.

A 36-month company sales forecast is created based upon the 36-month forecasts of the selected company-specific leading indicators (see Figure 10). The forecast quality is increased through a rolling forecast, updated every 6 months, taking the most recent economic trends into account. Technically, new available data will be added to the existing database, rather than replaced. Annual, quarterly, and monthly company revenues are calculated based on forecasted annual rates of change for the company and can therefore be incorporated into the budgeting process.

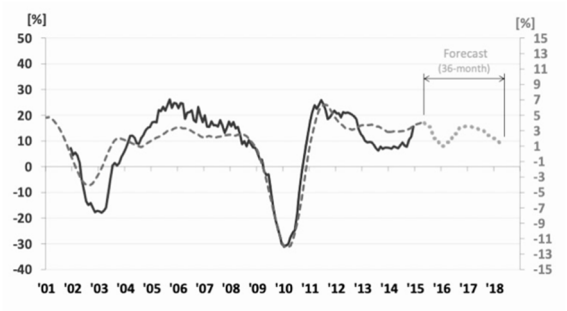

Figure 9 - Case study-case company A (solid line); 36-month forecast (dotted line) of the annual rate of change of correlating Leading Indicator Total Industrial Production USA (dashed line).

Figure 10 - 36-month forecast (dotted line) of the annual rate of change based upon leading indicators at case company A (solid line).

Step 5: Monthly update and variance analysis reports

The last step of the Macroeconomic Trend and Sales Forecasting Model contributes significantly to the model's functionality and acceptance. This consists of professional documentation and monitoring of forecast precision, and the information collected in the preceding steps. Because incorporating macroeconomic data into company revenue planning is still a relatively new, innovative, and not very widely spread approach, a strong focus on model monitoring, regular reporting, and measurement of results is essential. In addition, traditional forecasts on a tactical level are typically based on univariate methods. Thereby, it is not possible to implement various changing market conditions. Hence, expert adjustments are needed for organizations albeit this comprise biases and might be unstructured in a way (Fildes et al., 2009). The method described in this paper intends not to replace traditional planning entirely; rather the method has the aim to serve as an additional planning tool to support managers in strategic and tactical planning. It is not the aim to deny any of the c-level executives their responsibility or the like. Instead, described method should enhance the overall business success in the medium run. With respect to functionality, changes that could necessitate an adjustment of the model may be overlooked unless there is monthly monitoring of trends and developments. Is there still a strong correlation between a leading indicator and company revenues? If not, what has changed, and why does an indicator no longer correlate? In addition, significant deviations between the forecast and actual revenue call for systematic research into their causes. Does the macroeconomic model need to be adapted, or can the decisive factors for these variances be traced back to purely internal, temporary causes? In an ideal case as well as the normal case

(based upon experience), leading indicators change only rarely, and plan-actual variances are of a more short-term nature (monthly to at most quarterly). These variances are for example due to differing numbers of monthly working days, vacation periods, and large individual orders and deliveries. Such disturbance variables, however, are not taken into account in a macroeconomic forecast that is aimed at identifying higher-level systemic and company-specific trends. It is possible for a company to exceed or fail to reach its forecasts consistently. If such a trend continues over the long-term, this must be reflected in the model as a structural change. The scale ratio can be adjusted if necessary.

In addition to improving the model, the monthly, quarterly, and annual measurement of figures towards forecast quality also help increase the acceptance of such an innovative system. Without correspondingly detailed documentation, the probability of broad acceptance will decline, primarily among middle and top management. Specifically, forecast quality can be determined and presented in a comprehensible manner by providing good documentation and plan-actual variance analyses. This will significantly increase acceptance of the system. In addition, the preparation of a monthly multi-page report with graphics and tables to present the results helps ensure that all decision-makers are adequately informed, and that the macroeconomic revenue planning is established as a permanent process.

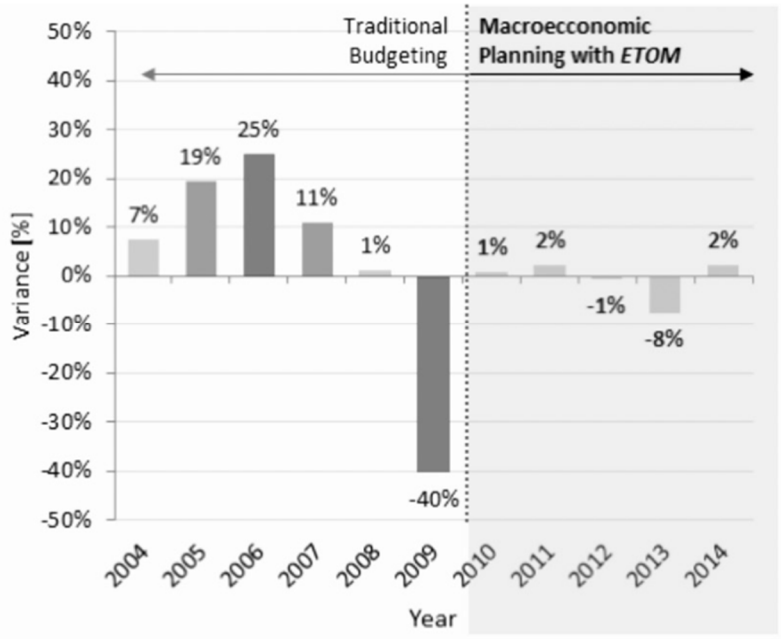

Figure 11 - Budget variance in %, company revenue forecast vs. actual, case study case company A. Years 2004 - 2009 budgeting with traditional methods; Years 2010 – 2014 forecast figures based upon the Macroeconomic Trend and Sales Forecasting Model.

At case company A, a midsize firm with global operations, the Macroeconomic Trend and Sales Forecasting Model has been in use since 2010 and has provided extraordinary forecasting precision of company revenues. Figure 11 shows the improvement in annual forecast quality since introduction of the macroeconomic model following the financial crisis of 2009. Prior to the model implementation, variances of +25% and -40%, applying the mean percentage error, occurred between revenue forecasts and actual revenues, and the average forecasting error was 17%. Since implementation of the macroeconomic forecasting model these differences subsequently decreased to +2% and -8% with an average forecasting error of 3%. This is a

significant improvement. Midrange and long-range company decisions are therefore made on the basis of model predictions, and the model has been rolled out to sister companies.

LIMITS

It is important to know that the macroeconomic trend and sales forecasting model has its natural limits in case the related company executed some special activities in the past. Examples would be acquisitions of new business areas, conducting major sales campaigns or launching of new products or services. The same holds true for withdrawals of certain business areas and major internal changes in the organizational structure. The reason why such special activities or events lead to a distortion of the forecasting model is that those circumstances affect the rate of change curve in a way that it does not reflect the real market potential anymore. They are independent of external market and economic conditions and are just as difficult to capture with a macroeconomic model as the fundamental changes within the market (e.g. the introduction of a new technology) that invalidate current market rules. It goes without saying that new business organizations like start-up companies also have difficulties to apply the stated forecasting model as they lack historical data that includes at least one business cycle.

In general, such special activities or events can have two consequences. The first is that they lead to individual peaks that look like outliers in a graphical representation of the rate of change curve. After the time period in which such an event occurs, the curve settles down again around the level prior to the event. The second possibility is that the occurrence of a certain activity or event can lead to a general offset of the rate of change curve so that the basis is shifted up or down. Both consequences, a single peak and a general offset, might lead to wrong matches of leading indicators. There might exist some macroeconomic indicators which show, by coincidence, the same structure like the company rate of change curve even with the triggered peaks or offsets. Without further investigation we would be exposed to the risk of taking wrong decisions on the basis thereof. The question is how to handle such peaks or offsets to prevent misleading indicator matches. First and foremost, a company needs to have a close look on their past business activities, even before creating the rate of change to ensure a solid basis for further analysis. After creating the rate of change curve we need to conduct a plausibility check. Is the level of granularity (e.g. the correct revenue data of a certain country or region) correct? Does the rate of change curve depict the real business evolution over the past? If the investigation leads to the conclusion that the revenue figures are correct and the right level of granularity is applied, we need to have a close look on the structure of the rate of change curve. If the curve shows some significant peaks, outliers or other unusual behavior, we need to take a close look on the company's business history. In case we spot a significant, huge peak that can be traced back to a sales campaign in the past that led to higher sales and thereby higher revenue we have the option to omit this peak entirely or smooth the outlier to a certain extent. We need to be particularly careful when doing this as we run the risk to omit or smooth not only the revenue distortions as a result of sales campaigns but also the regular business evolution. Therefore, a close collaboration with the sales and marketing department is inevitable to sharpen the power of the economic trend forecasting tool. In case we are facing a past special event that led to a constant increased or decreased level of the rate of change curve, we can either apply further smoothing techniques or simply take the increase or decrease as granted and include the change in our indicator matching process.

CONCLUSION

The weaknesses of traditional budgeting have led to the development of the concept of modern budgeting. One of these new dimensions of budgeting is the objectified and quantifiable incorporation of the economic environment by means of macroeconomic indicators that can capture evidence of the company's market and revenue potential. Incorporating macroeconomic trend analyses into business budgeting helps improve the quality and objectivity of information in a company's decision-making processes. Macroeconomic trends are defined here as the total of all external factors that influence the business environment, the market potential, and thus company revenues (Mankiw, 2003).

The theoretical foundations for this approach are the business cycle theory and the use of economic and industry indicators whose correlation and "lead time" relative to company revenues (and/or the annual rates of change of these revenues) are determined using statistical methods. Once the economic indicators relevant and leading to the company have been identified, timely macroeconomic changes and trends can be detected, and expected company revenues can be extrapolated / calculated. Users can expect a significant increase in budgeting accuracy. The benefits are many and varied, particularly the ability to avoid excess capacity or under capacity in production and manpower. An optimal design of the supply chain and logistics processes based upon correct revenue figures prevents the need for resource and time-intensive adjustments during the year, and the resulting identification and dissemination of information on demand helps reduce the so-called "bullwhip effect." The latter term describes a phenomenon in which even small changes in consumer demand can radiate upstream in the supply chain, causing increasingly greater fluctuations in ordered quantities.

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