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# Using Financial and Macroeconomic Indicators to Forecast Sales of Large Development and Construction Firms

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## Abstract

Sales forecasting is a pivotal component of a corporation's planning and control activities. Despite the panoply of approaches to sales forecasting, relatively few published studies in forecasting address firm-specific sales forecasting model development for the construction industry. While there is evidence that events in the macroeconomy significantly affect the construction market, most published studies on construction sales forecasts using S-curve models are unable to account for the economic climate. This study proposes an approach that employs financial and macroeconomic indicators to forecast sales of large development and construction corporations. First, by using data for 37 large development and construction firms listed on the construction sector of the Taiwan Stock Exchange

between 1997 and 2006, hypothesis tests uncover useful relationships between firm sales and financial and macroeconomic indicators. Second, based on these relationships, a two-stage mathematical modeling procedure is used to develop firm-specific sales forecasting models for three of the sample firms. Finally, out-of-sample forecasting accuracy is evaluated using Theil's  $U$ -statistic and mean absolute percentage error (MAPE).

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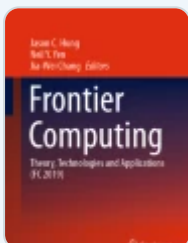
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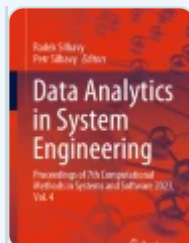
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# Notes

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1. For example, Smith et al. ([1994](#)) developed a two-stage forecasting methodology based on an integrated least squares procedure for estimating the sales of a retail chain response to promotional variables such as price, promotional sales, promotional frequency, and inventory ratio. Luxhoj et al. ([1996](#)) developed a hybrid econometric-neural network model for sales forecasting of an audio manufacturing company in response to the consumer price index, long term interest rates, retail volume, optimism indexes, bulk national product for each market, and lagged explanatory variables for certain sales markets. Moe and Fader ([2002](#)) developed a duration model to forecast new music album sales before the actual launch of the album, based on advance purchase orders. Chiu and Shyu ([2004](#)) used a vector autoregression (VAR) model and a Litterman Bayesian vector autoregression (LBVAR) model for sales forecasting of portable computers, based on national consumption expenditure, the exchange rate (to US dollars), and desktop computer sales. More recently, Pantelidaki and Bunn ([2005](#)) proposed a multifunctional sales model with the diagnostic aid of artificial neural networks (ANN) models for toothpaste product sales forecasting, based on sales price, advertising, promotion, and competitors' price variables. Other similar sales forecasting studies include, but are not limited to, Arora ([1979](#)), Dubin ([1998](#)), Fader et al. ([2004](#)), Foster et al. ([2004](#)), Gelfand et al. ([1998](#)), Lee et al. ([2003](#)), Moe and Fader ([2002](#)), Parsons and Abeele ([1981](#)), Putler and Lele ([2003](#)), Steffens ([2001](#)), and Wacker and Lummus ([2002](#)).
2. For example, a low profit margin and high asset turnover are indications that the firm adopts a low-price strategy to achieve high sales.
3. The mathematical expression of the change ratio and the test hypotheses are shown in the "Hypothesis Tests and Results" subsection.
4. We did not include privately owned development and construction companies because the financial statement data for the private companies is difficult to

obtain.

5. The TSEC was funded in 1961 and began operating as a stock exchange on the 9th of February 1962. The TSEC is regulated by the Financial Supervisory Commission, a commission of the Ministry of Finance, subordinate to the Executive Yuan of Taiwan.
6. Because the quarterly data were used for assessing the potential for employing financial and macroeconomic variables as predictors for firm sales in this study,  $c$  therefore equals 4.
7. Because adding more variables does not improve the values of  $R$ -square after Model 4, the optimal models developed at steps 6 to 11 are not presented in Table [5](#).
8. As reported in the bottom portion of Table [5](#), the chi-square value of the White test (Eq. 4) is 14.37 and the associated  $p$  value is larger than 0.1, suggesting the acceptance of the null hypothesis of no heteroskedasticity in the residuals at the 0.1 level for Model 4. Furthermore, as seen in Fig. [1](#), the plot of the residuals versus predicted values of Model 4 reveals that no pattern exists in the plots, suggesting that specification errors are not present in the model.
9. In this study,  $p$  was assessed for 1 through 4, and the threshold  $p$  value of 0.1 was used for judging the existence of autocorrelation.
10. Kaka and Lewis's ([2003](#)) S-curve computer model has an average MPE of 4.91%. This, however, is based on the assumption that the forecast number of projects that started in year 2001 is 100% accurate. Namely, Kaka and Lewis ([2003](#)) directly used 44 projects, the actual number of projects that started in year 2001, as the input for the model to forecast sales in year 2001. Consequently, the difficulty in applying the S-curve models for company-level sales forecasting in a project-based industry, the prerequisite

of forecasting future unknown individual projects, has been erased. In reality, the use of S-curve models requires forecasting the number of projects that start in each future period, which might be even more challenging than to directly predict firm sales.

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