Predicting Price, Turnover and Employment at Market Balance *

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Abstract

A comprehensive approach to predicting the growth and employment in various niches of the economy is presented, based on a precise formulation of the market supply and demand with several function variables and software development suitable for event-based and judgmental forecasting. The function variables include propensity to consume, consumer's budget, interest rate - inflation quotient, propensity to sell, value added tax, profit, price volatility, market share and 'market diversity-technical level'. Forecasting with the end-user software spans one year in monthly increments.

Keywords: Event-based forecasting, judgmental forecasting, market balance, economic growth, employment

1 Theory

Forecasting the economy can be trend-based, event-based and judgmental. In event-based and judgmental forecasting, the topic of this brief paper, one problem besides intuitively predicting the events and making the right judgements, is to instantaneously get an overview of the prices and turnovers of many different items in several market scenarios and how the respective labor markets are timely affected. This paper will present a solution comprising theory, computer algorithms and end-user software.

The psychometric propensities to consume and sell are taken as starting point for the theory. These are interpreted as decision probabilities with exponential decays [1] conforming to a general theory of cognitive processes [2], [3]. The propensity to consume, C, is written (index 'd' for demand)

$$C = \frac{1}{N_a - N_d} \int_0^{\tau_d} exp(-\frac{In^\alpha}{It^\beta} A_d \tau) d\tau \tag{1}$$

where τ is regarded as a period of turnover of value contained in the item, which is longer the more value it represents and hence proportional to price. N_a is the number of items afforded (equivalent

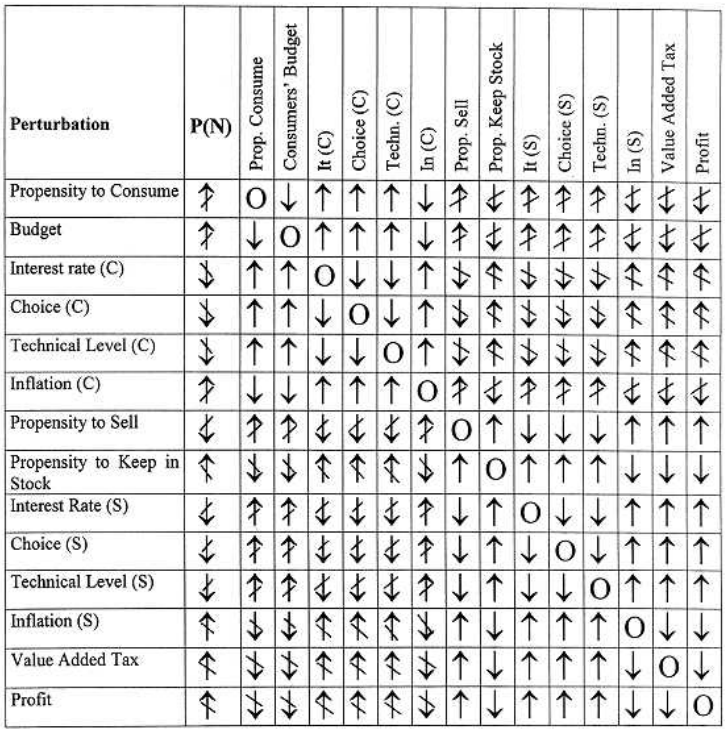

Figure 1: The effects of an increase of the numerical values of a variable in the left column on the prices ($P(N)$) at market balance and the direction of change of the numerical values of the other variables (abbreviated in column headings in the upper row) necessary to restore the original price. Upward arrow indicates price increase and downward arrow price decrease (second column) or increase respective decrease of the other variables of eq. 3 and eq. 4 (column 3 - 16). From left to right tilted line crossing the arrow indicates direction of accompanying change of turnover at balance defined by $N_d = N_s$.

of consumer budget in terms of a standard item), N_d is the number of items demanded (the x-axis of the demand curve). In is the inflation, which is balanced by It, the bank interest rate, adjustable through coefficients α and β. The factor A_d in eq. 1 links the demand of the particular item to the economic context like in the general formulation of cognitive processes [2], [3]. Its inverse, $1/A_d$, is positively correlated with the market differentiation, the technical level, and the market diversity in the sense that for high numerical values of $1/A_d$ a) the probability of the acquisition of the particular item is kept high irrespective of the presence of competing items and b) for any fixed probability of an acquisition more item value (proportional to τ_d) is accommodated such that c) a high numerical value of the factor indicates more auxiliary economic activity sustaining each acquisition.

The propensity to sell, S (index 's' for supply), is written

$$1 - S = \frac{1}{N_s} \int_0^{\tau_s} exp(-\frac{In^\gamma}{It^\eta} A_s \tau) d\tau. \tag{2}$$

The function variables here are with the exception of $(1 - S)$, similar to those of eq. 1. $1/N_s$ is the item sold divided by the number of items supplied (yielding the x-coordinates in the plots) while the interest rate on the supplier's side is interpreted as returns from investment. It has different effects on the market balance compared to the consumption interest rate of eq. 1. These probabilities are

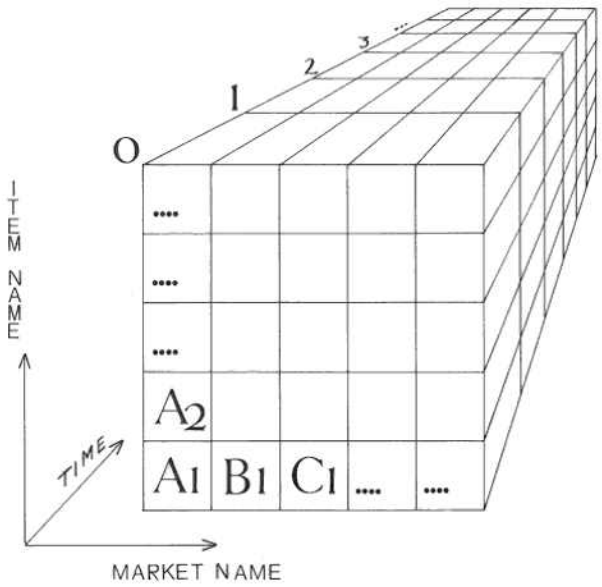

Figure 2: Schematic illustration of the strategy of the present forecasting approach whereby the market balance condition obtained from eq. 3 and eq. 4 with characteristic variable values for each item and each market scenario apply in each of the segments of time.

integrated to unity to reflect that the market transaction takes place sooner or later (P = price, F = proportionality factor or function of τ, K = integration constant) yielding

$$P_d = -F_d \frac{ln(1-(N_a-N_d)CA_d\frac{In^\alpha}{It^\beta})}{A_d\frac{In^\alpha}{It^\beta}} + K_d \tag{3}$$

and

$$P_s = -F_s \frac{ln(1-N_s(1-S)A_s\frac{In^\gamma}{It^\eta})}{A_s\frac{In^\gamma}{It^\eta}} + K_s \tag{4}$$

The market demand and supply curves are then obtained from respectively eq. 3 and eq. 4. The curves may be represented graphically with the number of items on the x-axis and price on the y-axis to yield the typical classical curves that cross each other at the market balance point [1, 4]. (A similar procedure can be used for the labor market balance [5]). The market balance as a function of the variables has the properties illustrated in Fig. 1 [4, 5] whereby the price volatility (not shown) is added as a linear factor on the price function value of both curves and VAT-profit is a linear amplification of the supply curve prices only. Also the market share can be forecasted (not shown in Fig. 1). The results apply provided there is no economic policy (like financial restraint or regulations) limiting the natural turnover at balance.

The computer program [6] is based on reading the prices and turnovers at the balance point, redefining the balance with forecasted variable settings in consecutive months like in Fig. 2 [5], and linking it to the labor market (the employment level) through work input per item comprising a time-shift which is user-defined in units of month. The function variables may be linked to selected items or, macro-economically, to all items.

2 Computations

A comprehensive description of the computer program in which this theory has been implemented can be found in the online tutorial [7]. Briefly, any verbal statement about the market (a market event) is user-processed by a) judging the onset of its effect and its applicability to the various items and markets (alternatively, market scenarios), b) determining how the function variables are affected by the event, up or down relative to predefined standard conditions, again by selecting one, several, or all items, and c) calibrating price and turnover in the current interval of time. While the function variables are set their effects on the price and turnover can be monitored. The program then on command sums all market effects in each item-market-time box as illustrated in Fig. 2. The prices, item turnover, and total value turnover of up to 9 items on three markets can be obtained in each month one year ahead, for the purpose of comparison and optimization. Three different such data sets of 9 x 3 x 12 can be defined. Instantaneous estimations of relative prices and turnover of any particular item within each data set can be obtained even without calibration. The total value turnover (price times item turnover) is related to economic growth in the item-specific niche. The program on command orders the items sequentially according to decreasing total value turnover (for the purpose of estimating niche-specific productivity or fraction of GDP) and according to increasing price in each month of the year ahead, it then orders the months according to decreasing total value turnover and according to decreasing price (for the purpose of guiding time of trading). Finally, the program compares the total value turnover the year ahead on three markets (or macroeconomic scenarios) and calculates the employment linked to the turnover on each market based on the user-defined correlation between item turnover and work input. A separate program module calculates the amount and timing of work input, linked to different items, that is required for delivering on time (order processing). The program can be integrated with other software through text-files or direct transfer of numerical results.

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