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An evaluation of business survey indices for short-term forecasting: Balance method versus Carlson–Parkin method

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ABSTRACT

When questions in business surveys about the direction of change have three reply options, "up", "down", and "unchanged", a common practice is to release the results as balance indices. These are linear combinations of the response shares, i.e., the percentage share of the respondents who answered "up" minus the percentage share of those who answered "down". Forecasters traditionally use these indices for short-term business cycle forecasting. Survey response shares can also be combined non-linearly into alternative indices, using the Carlson–Parkin method. Using IFO and ISM data, this paper tests the relative performance of Carlson–Parkin type indices versus balance indices for the short-term forecasting of industrial production growth. The main finding is that the two types of indices show no difference in forecasting performance during the Great Moderation. However, the Carlson–Parkin type indices outperform the balance indices during periods with higher output volatilities, such as before and after the Great Moderation.

1. Introduction

Balance indices are a popular way of condensing the information in business surveys. Usually, these surveys contain questions about the direction of change, typically with three response options: "up", "down", and "unchanged". For example, a common question is: "*Has output this month gone "up", "down", or remained "unchanged" compared to the previous month?*" A balance index summarizes the individual answers into a linear combination of the response shares: the percentage share of "up" answers (U) minus the percentage share of "down" answers (D). The rationale for constructing the index in this particular way is straightforward. Imagine that all businesses answering "up" grow at the same rate R, while all businesses answering "down" simultaneously grow at the rate $-R$. The average growth rate of all businesses will be $(U - D) \times R$. Under these assumptions, the balance index $U - D$ measures the mean growth rate of all businesses perfectly, up to a multiplicative constant.

However, since at least Theil (1952), it has been understood that combining the response share data in a balance index might not be the best way to capture the average growth rate in the economic variable of interest. Generally, growth rates are dispersed among businesses. If the distribution of growth rates were to be known, it would suggest a different combination of the response shares for constructing the average growth rate.

The idea of inferring the average growth of some economic variable from the response shares of business survey data goes back to Anderson (1952) and Theil (1952). Carlson and Parkin (1975) developed what has been referred to in the literature as the 'probability method' for quantifying qualitative survey data. This method infers a growth rate from response shares in three steps. First, the growth rate of the economic variable is assumed to follow some distribution $F(.)$ with unknown mean μ. Second, the "up" and "down" response shares are transformed

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using the quantile function F^{-1}. Third, the transformed response shares are combined using the following formula: $\delta\frac{F^{-1}(D)+F^{-1}(1-U)}{F^{-1}(D)-F^{-1}(1-U)}$, with δ being some given constant. Carlson and Parkin (1975) show that, under certain conditions, using this formula results in an unbiased estimate of the mean growth rate μ.

The Carlson–Parkin formula above presents an alternative way of summarizing the information in a business survey. Traditionally, survey results are released as balance indices. These have become very popular for short-term business cycle forecasting, as they are released before hard data. When added to simple autoregressive forecasting models of hard data, they often improve the forecasting performance. It is therefore important to known whether the current practice in constructing balance indices is optimal from the forecasters' point of view. Response shares can equally well be combined differently, using the Carlson–Parkin method.

The main purpose of this paper is to test whether the insights of Anderson (1952), Carlson and Parkin (1975) and Theil (1952) are important for short-term forecasting. As the main purpose of these indices is in fact short-term forecasting, it is important to know whether the traditional balance indices perform as well as the distribution-based Carlson–Parkin type constructed indices.

I use the response share data underlying the ISM production index (for the US) and the output question in the IFO survey (for Germany) for the manufacturing sector to investigate the relative performance of the balance index versus indices constructed using the Carlson–Parkin method. For both the ISM and IFO surveys, a representative sample of industrial firms in both economies is asked whether output (at the firm level) went up, went down or remained unchanged relative to the previous month. Thus, in principle, the ISM and IFO response shares should reveal information about the direction and strength of monthly industrial production growth.

To test whether a balance index is as informative as Carlson–Parkin type constructed indices, I do two things. First, the in-sample fits of the different indices are compared. The main finding here is that balance indices and Carlson–Parkin type indices have almost equal fits. Next, I perform an out-of-sample forecasting exercise. The main finding is that the balance indices perform as well as the Carlson–Parkin indices for forecasting during more stable times, but are not as good in periods of volatile industrial production growth. Then, and only then, the Carlson–Parkin estimates perform better. This can be explained by the fact that the Carlson–Parkin method takes large shifts in the distribution into account much better than a simple balance index. For small regular business cycle movements, balance indices perform equally well.

The rest of the paper proceeds as follows. Section 2 explains the Carlson–Parkin method. Section 3 describes some related literature. Section 4 contains the empirical analysis. Section 5 concludes.

2. The Carlson–Parkin method

This section briefly explains the Carlson–Parkin method, and shows how the method leads to a different way of combining response shares, compared to the balance index. Alternative explanations of the Carlson–Parkin method are provided by Carlson and Parkin (1975), Cunningham (1997), Dasgupta and Lahiri (1992), and Nardo (2003), among others.

Consider a business survey of a sample of N firms. Firm i's actual output growth g_{it} at time t is defined as the sum of the average output growth of all firms in the survey sample g_t^s and an idiosyncratic shock ϵ_{it},

$$g_{it} = g_t^s + \epsilon_{it}, \tag{1}$$

where ϵ_{it} has mean zero and variance σ_t. The cumulative distribution function of ϵ_{it} is denoted by $F_t(.)$.

Imagine that the manager of firm i observes g_{it} and is asked the following question: *"Did output go up, go down or remain unchanged relative to last month?"*[1] She answers that output in firm i went up when $g_{it} \geq \delta$. The indifference threshold δ accounts for the fact that people often don't perceive very small changes. In the literature, this is sometimes known as the threshold of perception, or 'just noticeable difference' (see e.g. Batchelor, 1986). Similarly, she answers that output went down when $g_{it} \leq -\delta$, and answers with "no change" when $-\delta < g_{it} < \delta$.

The share of 'up' answers in the survey sample is then $U_t = \sum_{i=1}^{N} \frac{I(g_{it} \geq \delta)}{N}$, with the indicator function $I(x)$ being 1 when x is true and 0 otherwise. Similarly, $D_t = \sum_{i=1}^{N} \frac{I(g_{it} \leq -\delta)}{N}$. So U_t and D_t are random variables, and have the following expectations:

$$E(U_t) = 1 - F_t(\delta - g_t^s), \tag{2}$$

$$E(D_t) = F_t(-\delta - g_t^s). \tag{3}$$

These can be solved for the unknown average output growth of firms in the sample, g_t^s, as

$$g_t^s = \delta \frac{F_t^{-1}(E(D_t)) + F_t^{-1}(1 - E(U_t))}{F_t^{-1}(E(D_t)) - F_t^{-1}(1 - E(U_t))}. \tag{4}$$

Now the actual time series of up and down response shares in the data, $\overline{U_t}$ and $\overline{D_t}$, with the bar indicating data, can be used as maximum likelihood estimates of the expected values.

The Carlson–Parkin index is then defined as

$$\overline{CP}_t \equiv \frac{F_t^{-1}(\overline{D_t}) + F_t^{-1}(1 - \overline{U_t})}{F_t^{-1}(\overline{D_t}) - F_t^{-1}(1 - \overline{U_t})}, \tag{5}$$

using a parametric assumption on $F_t(.)$.

So, using Eqs. (4) and (5), the average growth rate of firms in the survey is a linear function of the Carlson–Parkin index,

$$g_t^s = \delta \overline{CP}_t + \upsilon_t, \tag{6}$$

where the sampling error υ_t reflects the replacement of the expected values of the response shares by the realized shares.

Strictly speaking, the Carlson–Parkin index (multiplied by δ) only provides a good estimate of the average growth

[1] In practice, the manager might not know the actual output of the month at the time when the question is asked. In that case, imagine that the manager answers based on some private forecast of g_{it}.