Measuring the Economic Sentiments Using Ordinary Response Options

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Abstract

Two predominant consumer sentiment indexes in the U.S., the University of Michigan Index of Consumer Sentiment (ICS) and the Conference Board Consumer Confidence Index (CCI), are often compared for their predictive power on consumer spending and/or other macroeconomic impacts. However, relatively little attention has been made among the literature to their structural differences due to micro scoring schemes but mostly more to other distinctive details in survey questionnares and/or methodology. In this paper, we discuss some of their fundamental differences in statistical properties that should be awared of when applying these indexes to economic comparison studies.

Key Words: Index of Consumer Sentiment, Consumer Confidence Index, Micro Scoring, Neutral Response, imbalance

1. Introduction

Economic sentiment indexes are typically measured utilizing ordinary response options based on a set of questions. This is because such simple qualitative assessments enable swift evaluation of the current economic sentiments. For example, two popular consumer sentiment indexes in the U.S., the University of Michigan Index of Consumer Sentiment (ICS) and the Conference Board Consumer Index (CCI), are derived from five questions, each with three-level ordinary response options: positive (+), neutral (0), and negative (-). The responses to each question are first converted into a score and the set of the resulting scores are then aggregated into indexes. Their trends over time, predictive powers on consumer spendings and/or many other macro economic impacts are often compared focusing on the associated effects of distinctive choices of survey questions for measuring the consumer's attitude and sentiment toward the genearal economy and survey methodolodies including sample design, sample size and interview modes. For example, Bram and Ludvigson (1998) conducted an empirical study to see if there is any significant gain in forecasting household expenditure by adding any of the two consumer sentiment indexes to baseline linear regression models with other economic variables. See, also, Qiao et al. (2009) for use with nonlinear regression models.

However, relatively little attention has been made among the literature to their micro scoring schemes applied to the responses to individual questions. The ICS utilizes the imbalance between positive and negative responses, but the CCI concentrates on the relative size of the positive responses among the non-neutrals. The ICS approach or its variants are adopted by many other consumer surveys and the Business Tendency Surveys (BTS) by OECD countries. See, for example, OECD (2003) for some related discussions.

In this study, we investigate their fundamental differences in statistical properties and aspects under simplication, which should be awared of when applying these indexes to economic comparsion studies. In Section 2, we discuss two micro scoring schemes that the two indexes are based upon. In Section 3, we study their statistical properties such as ranges and precisions. In Section 4, we provide a real data example to illustrate how these indexes can be different in portraying the economic sentiments in statistical points of view.

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In Section 5, we discuss implications and some pitfalls when using the two indexes with additional issues related to the measurement.

2. ICS and CCI

2.1 Index of Consumer Sentiment (ICS)

The University of Michigan survey, initiated in 1946, is conducted by telephone interviews to a rotating monthly sample of about 500 respondents representing the adult population living in the continental U.S. The ICS is made up of five questions: the first two to assess present conditions and the other three to guage expectations. Each question is asked with three response options including positive (+), neutral (0) and negative (-) and their proportions are denoted by p_q^+, p_q^0 and p_q^-, respectively. The index is derived by first adding 100 to the imbalance (or difference) between positive and negative response percentages for each question as follows:

$$m_q = 100[1 + (p_q^+ - p_q^-)], \tag{1}$$

where $q = 1, \ldots, Q(= 5)$. Their sum is then linearly adjusted to make February 1966 as the base period (i.e., the value of 100), leading to the ICS as given below:

$$ICS = \frac{1}{\beta} \sum_{q=1}^{Q} m_q + \alpha, \tag{2}$$

where $\beta(= 6.7558)$ is the index value from the base period and $\alpha(= 2.0)$ is to adjust sample design changes implemented in the 1950s. See, for example, Curtin (1992) and Bram and Ludvigson (1998) for detailed discussions.

2.2 Consumer Confidence Index (CCI)

The Conference Board, meanwhile, conducts its survey since 1967 to about 3,500 respondents out of a total of 5,000 panel mailouts. The CCI is based on five questions similar to those of the ICS with the same three response options. A score for each question is computed as the relative size of the positive responses in percentage points among the non-neutrals:

$$c_q = 100 \left(\frac{p_q^+}{p_q^+ + p_q^-} \right), \tag{3}$$

where $q = 1, \ldots, Q(= 5)$. The above scores are then divided by the correspoding scores from the 1985 survey and are also adjusted for the seasonal variation, resulting in the CCI in the form of the arithmatic average as follows:

$$CCI = \frac{1}{Q} \sum_{q=1}^{Q} \gamma_q \left(100 \frac{c_q}{c_{q0}} \right), \tag{4}$$

where c_{q0} denote the scores at the base year of 1985 and γ_q the adjustment factors for the seasonal variation. See, for example, Linden (1982) and Bram and Ludvigson (1998) for more details.

3. Statistical Properties

3.1 Simplifications

The two indexes are different in many aspects as discussed previously. Among others, we restrict our attention to how they differ in signaling the sentiment for a given response

composition (from the same question). To make the two indexes comparable, we consider the following four assumptions:

(A1) The index is based on a single question (i.e., $Q = 1$).

(A2) The non-neutral responses are perfectly balanced at the base period (i.e., $m_{10} = 100, \beta = 1$ and $c_{01} = 50$).

(A3) There is no need for sample correction and seasonal adjustment (i.e., $\alpha = 0$ and $\gamma_1 = 1$).

(A4) A simple random sample s of size n is selected without replacement from the population U of size N (i.e., $f = n/N$).

The first three are required for simplifying the indexes. The last is to provide the probabilistic statements about the indexes.

Result 1. Assume that (A1)-(A3) hold. Then, the two indexes are simplified as

$$ICS = 100[1 + (p^+ - p^-)] := \hat{M} \tag{5}$$

$$CCI = 200\left(\frac{p^+}{p^+ + p^-}\right) := \hat{C}. \tag{6}$$

Result 1 indicates that, when the indexes are based only on a single question, we have

$$\hat{M} = m_1 \quad \text{and} \quad \hat{C} = 2c_1$$

where m_1 and c_1 are the two associated scores for the question.

3.2 Illustration with Fictional Data

Table 1 illustrates how the responses to a single question are aggregated into the ICS and the CCI for five fictional cases varying the breakdowns on the three response options. Cases 1 and 2 have the same size of both positive and negative responses but their neutral responses differ by 20%, resulting in the perfect balance (i.e., $B_n = 0\%$ and $R_n = 50\%$) and thus yielding the index values of 100. In cases 3 and 4, the imbalances between the two non-neutral response options are the same (i.e, $B_n = -28\%$) but the positive responses are slightly smaller in size for case 4 (i.e., $R_n = 22\%$) than for case 3 ($R_n = 30\%$) among the two non-neutral options. Meanwhile, case 5 has a different imbalance between the two non-neutral response options but its relative size is the same as that for case 3. Figure 1 shows these five cases listed in Table 1 in a two-dimensional plane with the positive and negative percentages in the x- and y-axes, respectively. As seen from Figure 1, any breakdown formed along the line connecting cases 1 and 2 would give the same magnitude for both p^+ and p^-, yielding the same values for both ICS and CCI. Any breakdown along the line connecting cases 3 and 4 would yield the same value only for the ICS, while any point along the line connecting cases 3 and 5 would produce the same value only for the CCI. Lines 1-2 and 3-4 are parellel but lines 1-2 and 3-5 are not, addressing the different formation of the ICS and the CCI. Although the indexes aim at evaluating *economic sentiment* per se, their different scoring schemes would give much different signals in their magnitude.

Table 1: Comparisons of Imbalance, Relative Sizes and Indexes from Five Fictional Raw Response Data Sets. $B_n = p^+ - p^-$ denotes the **balance statistics** and $R_n = p^+/(p^+ + p^-)$ denotes the relative size of the positive responses among both positive and negative responses

	Percentages			Index			
Case	Positive	Neutral	Negative	$B_n(\%)$	$R_n(\%)$	$\hat{M}$	$\hat{C}$
1	35	30	35	0	50	100	100
2	25	50	25	0	50	100	100
3	21	30	49	-28	30	72	60
4	11	50	39	-28	22	72	44
5	15	50	35	-20	30	80	60

3.3 Statistical Properties: Ranges and Precisions

Result 2. Assume that (A1)-(A3) hold. Then, we have $100p^0 \leq \hat{M} \leq 200 - 100p^0$ and $0 \leq \hat{C} \leq 200$.

Result 2 shows that the range of the ICS varies by a relative size of the neutral responses, while the CCI does not. Thus, the range of the ICS is shorter for a larger p^0. However, the CCI has the full span from 0 to 200 regardless of the size of the neutrals.

Result 3. Assume that (A1)-(A4) hold. Then, the variance $V(\hat{M})$ is unbiasedly estimated by

$$v(\hat{M}) = A_n \left[100^2(1 - p^0) + \left(\hat{M} - 100 \right)^2 \right]. \tag{7}$$

Also, the variance $V(\hat{C})$ is asymptotically unbiasedly estimated by

$$v(\hat{C}) = \frac{A_n}{(1 - p^0)} \hat{C}(200 - \hat{C}), \tag{8}$$

where the variances $V(\hat{M})$ and $V(\hat{C})$ are defined similarly as their estimators $v(\hat{M})$ and $v(\hat{C})$ in expressions (7) and (8), respectively, but with p^0, $\hat{M}$ and $\hat{C}$ replaced by their population analogues and $A_n = (1 - f)/(n - 1)$ by $(1 - f)/n$ and $f = n/N$ denotes the sampling fraction.

Result 3 indicates that $v(\hat{M})$ increases as $\hat{M}$ gets apart from 100 but its magnitude is shrinked for p_0 closer to one. In other words, the precision of the ICS is large when the consumer's attitude/expectation is clear in either direction (positively or negatively to a larger extent) but its level is reduced for a large portion of the neutral opinions. Similarly, $v(\hat{C})$ decreases as $\hat{C}$ deviates from 100 but its degree is severely inflated for a larger p_0. That is, the precision of the CCI is large when the consumer's attitude/expectation is distinct either positively or negatively but its level becomes huge as the neutral opinions becomes dominent. Thus, the size of the neutral answers has an impact on the precision of the two indexes in the opposite direction.

4. Numerical Example

We consider a real data example from Begium's Business Trend Survey on "Judgements on order books" during sixteen months from July 2000 to October 2001 (see OECD, 2003, p. 34). As in most sentiment surveys, respondents were given three response options. Figure 2 shows the corresponding levels of the three response options in percentage points for the 16 months. Three symbols $+, -$ and 0 represent the levels of the corresponding response

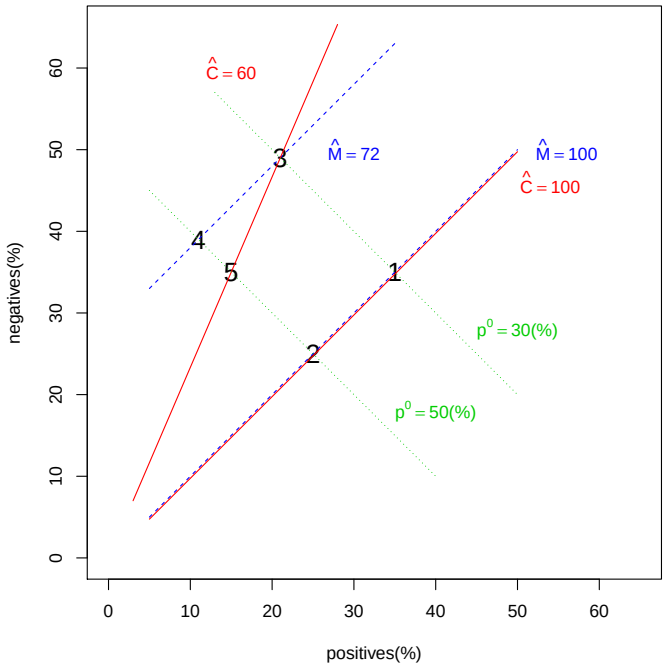

Figure 1: Contour Plot for Five Fictional Cases. $\hat{M}$ and $\hat{C}$ denote the ICS and the CCI, respectively, and p^0 represents the proportion of the neutrals. Solid lines connect the response compositions of the same level for the ICS, dashed lines for the CCI and dotted lines for the neutrals.

options, respectively. The dotted line connecting the blue squares shows the ICS values over the period, drifting downward a little bit as the negative imbalance becomes larger. The red solid line, on the other hand, shows the CCI values over the 16 points in time. As seen, their movement over time is much wider than that of the ICS as empirically seen by Bram and Ludvigson(1998). The 95% confidence bands show that, over the entire period, the instability of the CCI is much higher than that of the ICS. Let alone their index values, their confidence intervals do not even overlap each other for many months.

5. Discussion

The two predominent indexes of consumer sentiment are different in many aspects including questionnaire compositions, survey modes, sample designs and sizes. Above all, the two indexes treat the neutral responses differently in forming their indexes. The Michigan index reflects the neutrals, while the Conference Board index does not as seen in the corresponding expressions in (1) and (3) as easily seen below:

$$\hat{M} \propto \frac{(1)n^+ + (0)n^0 + (-1)n^-}{n^+ + n^0 + n^-} \quad \text{and} \quad \hat{C} \propto \frac{n^+}{n^+ + n^-}.$$

In other words, the ICS gives the zero weight for the neutrals in aggregation but the CCI do not take the neutrals into account by simply ignoring from the micro scoring. Different signals from these two indexes (even based on the same response compositions as demonstrated in Sections 3 and 4) are mainly attributable to their different treatments of the neutrals in forming the micro scores and thus the indexes. Because of that, the movement of the CCI should be much wider than that of the ICS for relatively small imbalance

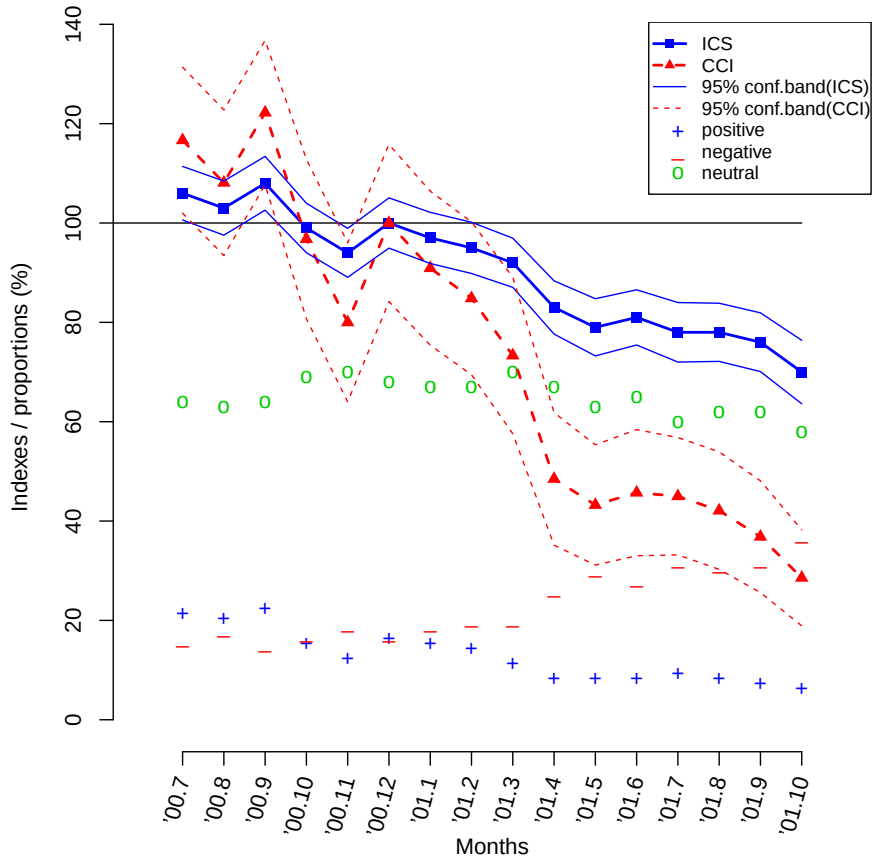

Figure 2: Comparisons of the ICS and CCI indexation Results on Belgium's Business Trend Survey on Judgements on Order Books from July 2000 to October 2001.

between the positives and the negatives when the neutrals are dominent. This is so even the Conference Board includes much larger number of respondents in its survey than that of the Michigan. The relative size of the neutrals is very informative for the index's relative standing and stability even for the ICS.

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