Volume 40, Issue 2

A New Measurement for Japanese Consumer Confidence Index

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Abstract

The Consumer confidence index (CCI) has long centered on the psychological aspect of consumers. This paper proposes using Jiji Press poll data for Japan's newly defined CCI instead of the conventional Cabinet Office (CaO) survey. This allows for an additional 40 years of monthly data. Examining the similarity of conventional indices by time series cluster analysis with the derivative dynamic time warping method, this paper demonstrates that the monthly CCI has been consistent with the conventional CaO index since 1963.

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Abstract

The Consumer confidence index (CCI) has long centered on the psychological aspect of consumers. This paper proposes using Jiji Press poll data for Japan's newly defined CCI instead of the conventional Cabinet Office (CaO) survey. This allows for an additional 40 years of monthly data. Examining the similarity of conventional indices by time series cluster analysis with the derivative dynamic time warping method, this paper demonstrates that the monthly CCI has been consistent with the conventional CaO index since 1963.

1   Introduction

In both micro-/macroeconomics field, analysis has focused on the psychological aspects of the consumer confidence index (CCI) (Akerlof and Shiller, 2009), by considering the relationship between CCI and household consumption (e.g. Ludvigson, 2004), the connection between CCI and stock investments (e.g. Lahiri et al., 2016), and predictors of macroeconomic indicators such as gross domestic products (GDP) (Utaka, 2003, 2014), gross national politics (GNP) (Matsusaka and Sbordone, 1995), and industrial products or inventories (Kilic and Cankaya, 2016). Further, factors that affect CCI have been examined, such as government spending (Bachmann and

Sims, 2012), media coverage (Barsky and Sims, 2012), and political aspects (Duch and Kellstedt, 2011).[1]

Regarding CCI's applicability in Japan, the Cabinet Office (CaO; Former Prime Minister's Office) first used the "Consumer Demand Forecasting Survey (*Shouhi Juyou Yosoku Chousa*)" in 1957; that and the current "Consumption Trends Survey (*Shouhi Doukou Chousa*)" have been used to measure CCI. The index is based on five to ten questions that correspond to consumer perceptions of economic status.

Despite CCI's availability, however, the number of time points (observations) for CCI in Japan seems limited. Regarding CCI by CaO (CaO-CCI), quarterly data has been available since March 1982 and monthly data since April 2004. These timeframes show that Japanese cases were often excluded from OECD analysis of comparative panel studies (e.g. Schmeling, 2009).

This paper proposes to expand and increase Japan's usage of CCI data by using an alternative index. By redefining CCI, this study utilizes questions on economic conditions and forecasts in the Jiji Press monthly poll data; this data has relatively received less focus, having only been examined in the seminal work by Utaka (2003). To discern the cross-referenced validity of newly defined and conventional indices, this paper adopts time-series cluster analysis (TSCA) with dynamic time-warping (DTW) distance.

2   Measurements of the newly defined CCI

2.1   Considering the number and contents of questions

While many economic studies in Japan have used the CCI indicator collected by the CaO, Utaka (2003) focused on Jiji Press's monthly poll on Cabinet approval ratings. Utaka (2003) considered "business-conditions evaluation (*keiki*)" out of the four types of economic evaluations (business conditions, livelihood, price, and prospect), and applied them to the analysis by subtracting the

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[1]For an example of the detailed reviews of studies using CCI, see Ludvigson (2004), Manski (2018).

total "worse off" answers from the total "better off" answers.

Given this work and other literature, we propose the possibility of new indicators from two perspectives: (1) improvement of the CaO's conventional indicator and (2) improvement of Utaka (2003)'s indicator. For these improvements, Table 1 comparatively summarizes the question contents of CaO (CaO-CSI), Jiji Press (Jiji-CSI), and Surveys of Consumers by Survey Research Center in University Michigan (SRC-CSI), and this is used as the survey questionnaire benchmark.

Table 1: comparison of questions in three surveys

CaO	SRC	Jiji
living	living (past)	living
prospect for asset increase	economy as a whole (future)	prospect for future
durables	durables	
	business conditions	business conditions
income growth		
prospect for employment		
	living (future)	
		price

Note: The detailed questions are reported in Online Appendix.

Comparing questions by the CaO and SRC shows that assessments for income and asset growth are unique to CaO. While not reported in Table 1, the number of questions asked by the CaO has significantly changed over time. Ten questions were asked between 1982 and 1990, seven between 1991 and 2003, six between 2004 and 2012, and five from 2003 to the writing of this paper. Reviewing Jiji and SRC, these questions have more in common with CAO than SRC. The drawback of Jiji data is that the question regarding durables, considered a core element in consumer sentiment, is not included; however, the question about price has been asked since the survey's initiation and might substitute for the living prospect of SRC.

While differences do exist between Jiji and SRC, this is advantageous due to the availability a longer data period with stable wording and number of questions. There can be significantly

more observations with CCI measurements compared to CaO.

2.2 New indexing calculation

Next, let us consider the measurement and cross-referenced validity of the newly defined index. In Utaka (2003), which is the most simply defined among the related CCI indices, "%positive answer–%negative answer" was simply adopted as the CCI (Diffusion index). Utaka's measurement shares the same process with SRC's indexing, which is computed in relation to the base year's value.

$$ICS = \frac{(X_1 + X_2 + X_3 + X_4 + X_5)}{6.7558} + 2.0, \tag{1}$$

where X_i is called *the relative score*, calculated as "%(positive answer − %negative answer) + 100" in each question item, 6.7558 refers to the base year (reference/bench mark) value. This is the relative score of 1966, and 2.0 means a constant to correct for sample design changes from the 1950s (cf. ICS Indexing Calculation page). Each relative score corresponds to finance, living, business conditions, prospects and durables respectively.

Further, Cao's calculation process should consider Japanese circumstances. CaO's calculation process is set as following:

$$\text{CCI}_{\text{CaO}} = \frac{X_{living} + X_{income} + X_{employment} + X_{durables}}{4}, \tag{2}$$

where X_i (like relative value) is calculated from:

$$X_i = p_1 \times 1 + p_2 \times 0.75 + p_3 \times 0.5 + p_4 \times 0.25 + p_5 \times 0, \tag{3}$$

where p_1 denotes the %answer "better off" ("get larger" or "increased), p_2 "better off somehow", p_3 "neither", p_4 "worse off somehow," and p_5 "worse off," respectively. The computation process of CaO-CCI reflects the large number of responses to "*neither*" in the Consumption Trend Survey; thus, including $p_3 \times 0.5$ becomes a key feature in CaO index. When the percentage of respondents who answered "good" is subtracted from the percentage who answered "bad," as in SRC, the relative score of Eq(1) becomes a large negative value. It also causes the difficulty of deriving a reasonable base score as the denominator in Eq(1). This treatment affects how many Japanese surveys show high levels of middle responses (i.e. a higher proportion of intermediate categories) while proportions of good/bad answers are lower than the middle category (Harzing, 2006; Masuda et al., 2017). In the CaO-CCI surveys based on the consumption confidence, hence, the calculation method that incorporates the middle category proportion into the index is sought due to the tendency in Japanese respondents. Based on the Japanese respondents' issues, the simple relative score of positive minus negative answers, like in Utaka (2003) and SRC, should be carefully reconsidered.

To summarize the above, (1) the number and contents of questions differ between CaO and SRC, (2) Jiji data is thought to have commonality with SRC even without the question of durables, (3) Utaka (2003)'s indexing using Jiji data is expected to be improved by introducing three questions regarding economic assessments, and (4) in addition to the conventional SRC's indexing, CaO's measurement should be examined. With the above considerations, the procedure to identify the most validated CCI will be set as follows:

1. The Jiji-CCI with three variables (living, business conditions, and price) from December 1963 to December 2016 is computed, based on both definitions by SRC (Eq(1)) and CaO (Eq(2)).
2. The Jiji-CCI with four variables (living, business conditions, price, and prospects) from April 1980 to December 2016 is computed, based on both definitions.
3. Six indices are compared: (1) the conventional CaO-CCI, (2) Utaka (2003)'s index, (3) Jiji-CCI

with four variables with SRC method, (4) Jiji-CCI with three variables with SRC, (5) Jiji-CCI with four variables with CaO, and (6) Jiji-CCI with three variables with CaO ; with TSCA. Assessments regarding which method of indexing demonstrates similarity with the conventional CaO index are performed.

4. Jiji-CCI with three variables and CaO-CCI are compared for the period after April 2004, when both series are available. If this comparison has sufficient similarity, the validity of employing Jiji-CCI with three variables for the period before April 1980, when only three economic assessments' components of Jiji exist, is implied.

5. If the similarity between Jiji-CCI with three variables and CaO-CCI is confirmed in the above process, we combine Jiji-CCI with three variables (December 1963—March 1980) and one with four variables (April 1980—present) and this combined series is the newly defined Jiji-CCI.

3 Japan's consumer confidence index with new data

This section proposes a new CCI index by using economic questionnaires in Jiji data. In this article, $\text{CCI}_{\text{JijiSRC}}$ is defined as follows:

$$\text{CCI}_{\text{JijiSRC}} = \frac{x_{living} + x_{price} + x_{business} + x_{prospect}}{4}, \tag{4}$$

where x_k = (positive answer of x_k − negative answer of x_k) + 100. In relation to the limitation of observations, before March 1980, the formulation is defined as $\frac{x_{living} + x_{price} + x_{business}}{3}$. This indexing calculation is based on the SRC; however, in Jiji data, the percentage of positive responses was significantly lower than that of negative responses, with many middle responses ("neither good nor bad"). Therefore, it is difficult to set the computable relative score and the base score of the denominator depending on the relative score. The denominator is, hence, set as the number of questions to be a simple average, while basically relying on the relative score of the SRC
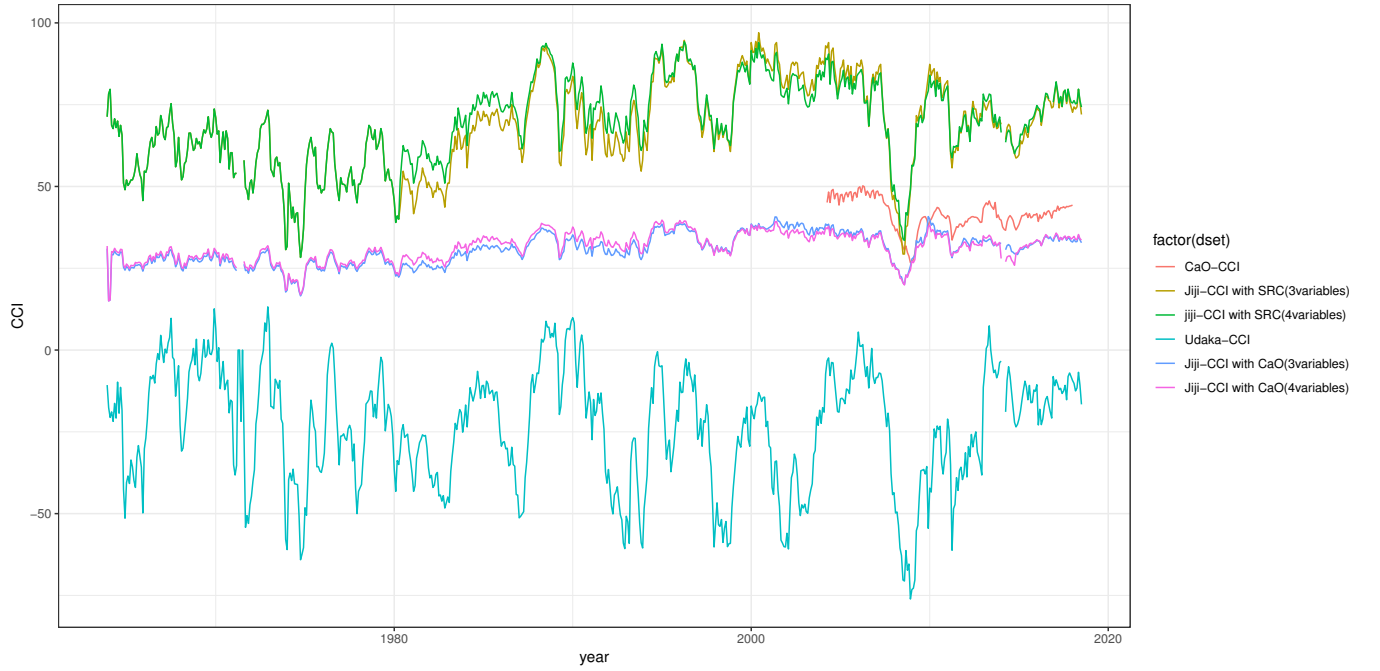
Figure 1: Comparison among indices

method.

Next, based on the CaO's calculation, $CCI_{JijiCao}$ is defined as follows:

$$\text{CCI}_{\text{JijiCaO}} = \frac{X_{living} + X_{business} + X_{price} + X_{prospect}}{4}, \tag{5}$$

where for example X_{living} is followed by Eq(3).[2]

Figure 1 shows the conventional Cao-CCI, the Utaka (2003)'s CCI, and several patterns of indicators using Jiji data. From Figure 1, we can intuitively see that the index that is most similar to CaO-CCI is Jiji-CCI with CaO's measurement. The most dissimilar series seems to be Utaka (2003).

To scrutinize the dis-/similarity between time-series variables in this paper, time-series clus-

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[2]Answer alternatives differed across questions. Although X_{living} and $X_{business}$ are computed along Eq(3), $X_{price} = p_{better\,off} \times 1 + p_{stable} \times 0.5$ and $X_{prospect} = p_{better\,off} \times 1 + p_{status\,quo} \times 0.5$, since price and prospect questions are followed by three alternatives.

ter analysis with the derivative dynamic time warping (DDTW) method will be adopted (Keogh and Pazzani, 2001; Keogh and Ratanamahatana, 2005; Górecki and Łuczak, 2015), apart from the conventional DTW method (Berndt and Clifford, 1994; Oates et al., 1999). The DTW enables efficient calculations of the distance $\delta(i, j) = w_k = |s_i - t_j|$ between both sequences $S = s_1, s_2, \ldots s_m$ and $T = t_1, t_2, \ldots, t_n$ to achieve a better alignment;

$$DTW(S, T) = min_w \sum_{k=1}^{P} \delta(w_k). \tag{6}$$

While the DTW can compute the distance based on the *points* between sequences, warping by DDTW can take into account the *shape* between three adjacent points ($t - 1$, t and $t + 1$) by considering the local derivatives, $S' = s_1', s_2', \ldots, s_m'$, where

$$s_i' = \frac{(s_i - s_{i-1}) + \frac{(s_{i+1} - s_{i-1})}{2}}{2}. \tag{7}$$

Furthermore, setting the derivatives T' and based on Eq(6), DDTW(S', T') can be calculated. From this DDTW distance, the dendrogram by TSCA will demonstrate which indices have the highest similarity.

Table 2 summarizes the DDTW distances for each combination of indices. Figure 2 is a dendrogram based on this DTW distance. From 2 and the dendrogram in Figure 2, the shortest distance from the conventional CaO-CCI is Jiji-CCI calculated by CaO's definition.[3] The farthest is Utaka (2003)'s, even using the same Jiji data. These results endorse the intuitive visualization in Figure 1. Importantly, both the distance between Jiji-CCI with three/four components and between Jiji-CCI with three components and the conventional CaO-CCI are sufficiently similar.

Analysis on similarity based on TSCA with DDTW indicates that both three-variable and four-variable indices are sufficiently similar. This suggests that three-variable indices can be

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[3]Instead of DDTW, the estimation using DTW calculations shows the same result. The result is reported in the Online Appendix.

employed for the period before March 1980 when only the three questions-answers are available. For the period from April 1980 onward, the index consisting of four variables should be adopted. The combined index of three-variables (until March 1980) and four-variables (after April 1980) enables a higher cross-referenced validity.

Table 2: Distances among 3 indices based on DDTW method

	Udaka-CCI	CaO-CCI	Jiji-CCI with SRC(3variables)	Jiji-CCI with SRC(4variables)	Jiji-CCI with CaO(3variables)
CaO-CCI	171.10				
Jiji-CCI with SRC(3variables)	174.07	121.49			
jiji-CCI with SRC(4variables)	184.95	138.80	114.29		
Jiji-CCI with CaO(3variables)	170.52	45.75	124.65	136.67	
Jiji-CCI with CaO(4variables)	171.32	45.95	123.24	138.73	27.19

4 Conclusion

This paper proposes the availability of long-term monthly data for Japan's CCI by using Jiji data rather than the conventional CaO survey data. This paper shows that all four economic evaluation questions in Jiji data enable the index construction that can match the cross-referenced validity with the conventional CaO index. Future work should address the micro/macroeconomic causality surrounding the newly defined CCI, using tools such as VAR-related models.

References

Akerlof, G. A. and Shiller, R. J. (2009), *Animal spirits: How human psychology drives the economy, and why it matters*, Princeton University Press, Princeton.

Bachmann, R. and Sims, E. R. (2012), 'Confidence and the transmission of government spending shocks', *Journal of Monetary Economics* **59**(3), 235–249.

Barsky, R. B. and Sims, E. R. (2012), 'Information, animal spirits, and the meaning of innovations in consumer confidence'.

Berndt, D. J. and Clifford, J. (1994), Using dynamic time warping to find patterns in time seires, *in* 'KDD workshop', pp. Vo.10, No.16.

Duch, R. M. and Kellstedt, P. M. (2011), 'The heterogeneity of consumer sentiment in an increasingly homogenous global economy', *Electoral Studies* **30**(3), 399–405.

Górecki, T. and Łuczak, M. (2015), 'Multivariate time series classification with parametric derivative dynamic time warping', *Expert Systems with Applications* **42**(5), 2305–2312.

Harzing, A.-W. (2006), 'Response styles in cross-national survey research', *International Journal of Cross Cultural Management* **6**(2), 243–266.

Keogh, E. J. and Pazzani, M. J. (2001), Derivative dynamic time warping, *in* 'Proceedings of the 2001 SIAM International Conference on Data Mining', Society for Industrial & Applied Mathematics (SIAM), pp. 1–11.

Keogh, E. and Ratanamahatana, C. A. (2005), 'Exact indexing of dynamic time warping', *Knowledge and Information Systems* **7**(3), 358–386.

Kilic, E. and Cankaya, S. (2016), 'Consumer confidence and economic activity: a factor augmented VAR approach', *Applied Economics* **48**(32), 3062–3080.
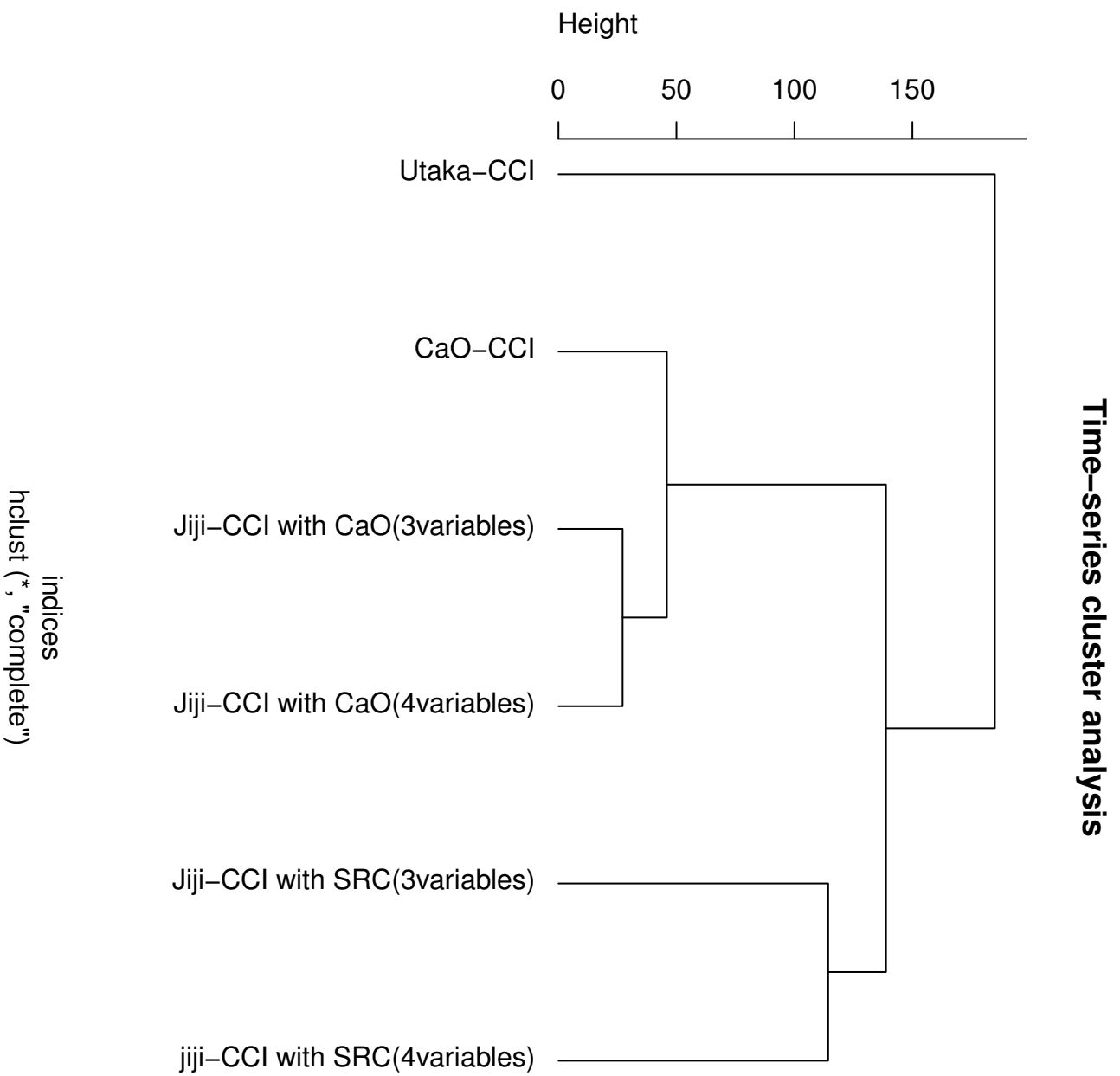
Figure 2: Time-series cluster analysis with DDTW distance method

Lahiri, K., Monokroussos, G. and Zhao, Y. (2016), 'Forecasting consumption: The role of consumer confidence in real time with many predictors', *Journal of Applied Econometrics* **31**(7), 1254–1275.

Ludvigson, S. C. (2004), 'Consumer confidence and consumer spending', *Journal of Economic Perspectives* **18**(2), 29–50.

Manski, C. F. (2018), 'Survey measurement of probabilistic macroeconomic expectations: Progress and promise', *NBER Macroeconomics Annual* **32**(1), 411–471.

Masuda, S., Sakagami, T., Kawabata, H., Kijima, N. and Hoshino, T. (2017), 'Respondents with low motivation tend to choose middle category: survey questions on happiness in Japan', *Behaviormetrika* **44**(2), 593–605.

Matsusaka, J. G. and Sbordone, A. M. (1995), 'Consumer confidence and economic fluctuations', *Economic Inquiry* **33**(2), 296–318.

Oates, T., Firoiu, L. and Cohen, P. R. (1999), Clustering time series with hidden markov models and dynamic time warping, *in* 'Proceedings of the IJCAI-99 workshop on neural, symbolic and reinforcement learning methods for sequence learning', Stockholm.

Schmeling, M. (2009), 'Investor sentiment and stock returns: Some international evidence', *Journal of Empirical Finance* **16**(3), 394–408.

Utaka, A. (2003), 'Confidence and the real economy - the Japanese case', *Applied Economics* **35**(3), 337–342.

Utaka, A. (2014), 'Consumer confidence and the Japanese economy: Comparison of pre- and post-bubble period', *Economics Bulletin* **34**(2), 1165–1173.