Evidence and determinants of consumer sentiment as a leading or coincident indicator of economic activity

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ABSTRACT: Based on the data from ten Organization for Economic Co-operation and Development (OECD) countries, this paper explores the evidence as to whether a consumer confidence indicator is a leading, coincident, or lagging measurement of economic activity, and examines factors that affect the consumer sentiment index (CSI). Determinants of CSI and the causal relationship between CSI and economic activity vary across countries. In some countries, however, evidence is found that CSI contains not only leading information but also coincident information, which acts as a mood signal. Moreover, it is found that consumer sentiment can be driven by both economic factors such as wealth and interest rate, as well as non-economic factors such as emotional state.

JEL Classification: E21; C32; D12

KEY WORDS: consumer sentiment index; leading/coincident information; share price index

I. Introduction

Consumers are regularly surveyed in many countries to assess the past, current, and future economic and financial conditions and to publish the consumer sentiment index (CSI) by compiling survey data well before official data on consumer spending becomes available. One of the advantages of the sentiment data is that it is "timely" (i.e., available monthly), making it a good measure for predicting economic activity.

In general, measures of consumer confidence or sentiment tend to be perceived as barometers of the state of the economy. But do consumers anticipate or react to changes in the state of the economy? The answer to this question is important because leading information may be useful for forecasting purposes, while lagging or coincident

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information is more useful as a mood signal for assessing the changes in economic activity.

In literature, a number of empirical studies have examined the role of information and the effectiveness of consumer sentiment as sources of aggregate economic movements. The studies have stressed the role of consumer sentiment as a tool for predicting economic activity. In particular, CSI is described as an important determinant of consumer spending as a leading indicator that can forecast consumption (for the U.S., Bram and Ludvigson, 1998; Carroll et al., 1994; Ludvigson, 2004; Fuhrer, 1993; Matsusaka and Sbordone, 1995, for the U.S. and the U.K., Easaw et al., 2005; for the U.S. and Europe, Dees and Brinca, 2013). From a similar perspective, this paper explores the causal relationship between movements in CSI and economic activity. Specifically, the present paper seeks to find an answer to the following question: does an increase in sentiment cause the gross domestic product (GDP) to increase because people feel optimistic about the economic outlook and spend more, or does an increase in GDP cause a rise in sentiment because people are (or feel) wealthier?

In previous analyses performed with data from multiple countries, the association between CSI and GDP appears to vary substantially across countries. For example, Golinelli and Parigi (2004) find that among the nine countries they singled out, CSI possesses both coincident and leading information for output in Germany, the U.K., and the U.S.. Santero and Westerlund (1996) also find that among the eleven countries they studied, there is a correlation between consumer sentiment and economic output, but it is weaker than the correlation between business sentiment and economic output.[1] Even after controlling for economic fundamentals, such as money supply, government spending, and material prices, CSI is still identified as an important source of variations in economic output (Matsusaka and Sbordone, 1995).

[1] Christiansen et al. (2014) find that business confidence is a better predictive indicator of the U.S. recession than consumer confidence.

Previous studies have focused primarily on investigating the role of sentiment as a leading indicator of economic activity. However, this paper focuses more on the role of sentiment as a coincident or lagging indicator of economic activity and on finding economic and non-economic determinants of CSI in various countries.

To distinguish this study from previous ones, I have taken a relatively large sample consisting of ten Organization for Economic Co-operation and Development (OECD) countries in various regions of the world: four in Europe (Germany, the U.K., France, and Italy), two in Oceania (Australia and New Zealand), three in North America (the U.S., Canada, and Mexico), and one in Asia (Japan). Based on the data from these countries, this study estimates a non-linear model using Marquardt's nonlinear least square algorithm to resolve the autocorrelation in the regression model presented in Section 3.[2]

Estimation is performed with macroeconomic and financial variables such as CSI, GDP, share price index (SHPI), short-term interest rate (STIR), inflation rate (INFR), and unemployment rate (UEMR), as well as a non-economic variable of emotional state, proxied by smoothed probabilities for CSI, which are extracted from a simple Markov switching model. It is found that CSIs of all countries except Australia and Mexico measure leading economic activity. Moreover, in the univariate regression of CSI only on GDP, or the multivariate regression with aforementioned other variables as control variables, CSIs of all countries except Australia, New Zealand, and Italy are found to contain coincident information that corresponds to the current economic activity. These results suggest that consumers react to the changes in the state of economy.

Although consumer sentiment is usually driven by systematically varying economic factors, it may be also driven by non-systematically varying non-economic factors, including psychological factors such as emotions and consumer expectations. Katona

[2] Lovell and Tien (2000) also take into account autocorrelation in their regressions.

(1968 and 1975) argues that CSI measures attitudes and expectations of consumers about financial and economic conditions and may not be a precise measurement of economic evolution because it relies on the subjective nature of consumers. Doms and Morin (2004) and Starr (2012) find that news coverage of non-fundamental factors about economic activity exerts a significant effect on changes in consumer sentiment. Moreover, assuming that the residuals from regression of CSI on its economic determinants contain non-economic information, Garner (1981) finds that non-fundamental unique events, such as Watergate and OPEC in 1973–1974, affect CSI. These studies suggest that CSI is likely to contain non-economic information. In turn, this paper also examines whether consumer confidence can be explained by non-economic factors such as emotional state, in addition to standard economic determinants of consumption, such as wealth and interest rate.

Given a set of potential macroeconomic determinants of CSI in a vector autoregressive (VAR) model in multiple countries, Golinelli and Parigi (2004) find that the determinants are time- and country-specific. In the U.S., an increase in stock prices causes the wealth effect on CSI and acts as a leading indicator of future income growth (Otoo, 1999). In Europe, stock prices have a less of wealth effect on CSI, whereas the expenditure effect is greater and more dispersed, which implies that stock prices play a dominant role as a leading indicator rather than producing the wealth effect (Jansen and Nahis, 2003). In general, an increase in stock prices makes consumers feel wealthier and can lead to increase in their consumer sentiment, suggesting that the wealth effect plays a significant role in changing the consumer sentiment.

Similar to the findings of Golinelli and Parigi (2004), the present study also finds that the determinants of CSI vary across countries. Nevertheless, SHPI and STIR are identified as most significant factors in all countries, except for Mexico in the case of SHPI and except for Germany, France, Italy, and Japan in the case of STIR, while

INFR is identified as such only in the U.S.. More importantly, both contractionary economic state, proxied by a dummy variable for periods of negative GDP growth and a contractionary emotional state, proxied by smoothed probabilities for CSI in downturn periods of GDP, are found to be important factors in Germany and Mexico. These findings suggest that both economic and non-economic factors are partially responsible for the changes in CSI.

The remainder of this paper is organized as follows. In Chapter 2, the variables and data used in this study are explained. Chapter 3 presents the empirical analysis, including prior evidence, regression model, estimation results, and the determinants of CSI. Chapter 4 concludes the paper.

2. Variables and Data

The variables for the present study were selected based on previous empirical studies (Fuhrer, 1993; Garner, 1981; Golinelli and Parigi 2004; Jansen and Nahuis, 2003; Lovell, 1975; Otoo, 1999). The variables include CSI, GDP, SHPI, STIR, INFR, and UEMR. In particular, the last four variables are singled out as potential forces driving consumer sentiment since they are the determinants of consumption, which is known to be highly correlated with CSI.

Share price index is used as a proxy variable of income (wealth), which has a positive relationship with consumption. Short-term interest rate is one of the important factors relevant to consumption. Inflation rate based on consumer price index (CPI) is known to have a direct relationship with consumption. Unemployment rate contains information as a lagging indicator about future economic conditions (Vuchelen, 2004). A high UEMR indicates that economy has performed poorly, which implies a lower future income level for consumers, presumably leading to decreases in current and

future consumption.

Data regarding all these variables come from OECD's database OECD.Stat and they are compiled from ten major OECD countries: four from Europe (Germany, the U.K., France, and Italy), three from North America (the U.S., Canada, and Mexico), two from Oceania (Australia and New Zealand), and one from Asia (Japan). Among these countries, Mexico is the only emerging country, so my initial conjecture on empirical results is that the role and the determinants of CSI in Mexico would be different from those of other countries.

The monthly data for some variables, such as CSI, CPI, and SHPI, are converted into quarterly data by simply averaging the three-month values in each quarter. The consumer sentiment index is calculated from the survey data related to the past, current, and future economic and financial situations. It is in general measured as a balanced score, which is the percentage of positive responses (or increases) minus the percentage of negative responses (or decreases), plus 100.[3] However, survey questions and computing methods for CSI somewhat differ between European and non-European countries, resulting in different index scales.[4] Thus, to make the regression results of various countries more comparable, the standardized CSI of OECD is used, which is seasonally adjusted.

Likewise, the seasonally adjusted and standardized UEMR is used, which is defined as a percentage of the unemployed people to the civilian labor force, except in Germany. German unemployment data are only available from the first quarter of 1991, causing a reduced sample period in the empirical analysis. To extend the sample period, a seasonally adjusted UEMR for people aged 15 and over is used. Short-term interest

[3] An index number above the threshold (100) indicates that the economy will improve because the number of consumers with a positive outlook on the economy outnumbers those with a negative outlook.

[4] For the method of calculating the index, refer to Bram and Ludvigson (1998) and Ludvigson (2004) for the U.S. and Golinelli and Parigi (2004) for other countries.

Table 1
Description of country-specific samples for estimation

Countries	**Sample period**	**Variables**	**Data Frequency**
Australia	1974:Q4 - 2012:Q4	{GDP, CSI, STIR SHPI, INFR, UEMR}	Quartly
New Zealand	1988:Q3 - 2012:Q4		Quartly
Germany	1973:Q1 - 2012:Q4		Quartly
United Kingdom	1974:Q1 - 2012:Q4		Quartly
France	1973:Q1 - 2012:Q4		Quartly
Italy	1981:Q2 - 2012:Q4		Quartly
United States	1978:Q1 - 2012:Q4		Quartly
Canada	1980:Q1 - 2012:Q4		Quartly
Mexico	2001:Q2 - 2012:Q4		Quartly
Japan	1982:Q3 - 2012:Q4		Quartly

Note: The U.K.'s STIR and France's UEMR start from 1978:Q1, and Japan's GDP and STIR start from 1994:Q1 and 2002:Q2, respectively.

rate is the money market rate per annum, i.e., the short-term borrowing rate between financial institutions, typically referred to as the call rate or the interbank rate. Inflation rate is defined as the quarterly percentage change in CPI measured by "all items" with the OECD base year 2005 as 100. Share price index is the national share price index with the OECD base year 2005 as 100. The real GDP is also seasonally adjusted.

The initial sample period varies depending on the availability of data in each country, while the final period is 2012:Q4 for all countries. In some countries, sample periods for some variables are not consistent due to the limitation of data. For example, the U.K.'s STIR and France's UEMR start from 1978:Q1, and Japan's GDP and STIR start from 1994:Q1 and 2002:Q2, respectively. Therefore, the sample periods for these countries are reduced whenever the variables are included in regression analysis. The description of variables and the sample periods for each country are summarized in Table 1.

3. Empirical Analysis

3-1. Prior Evidence

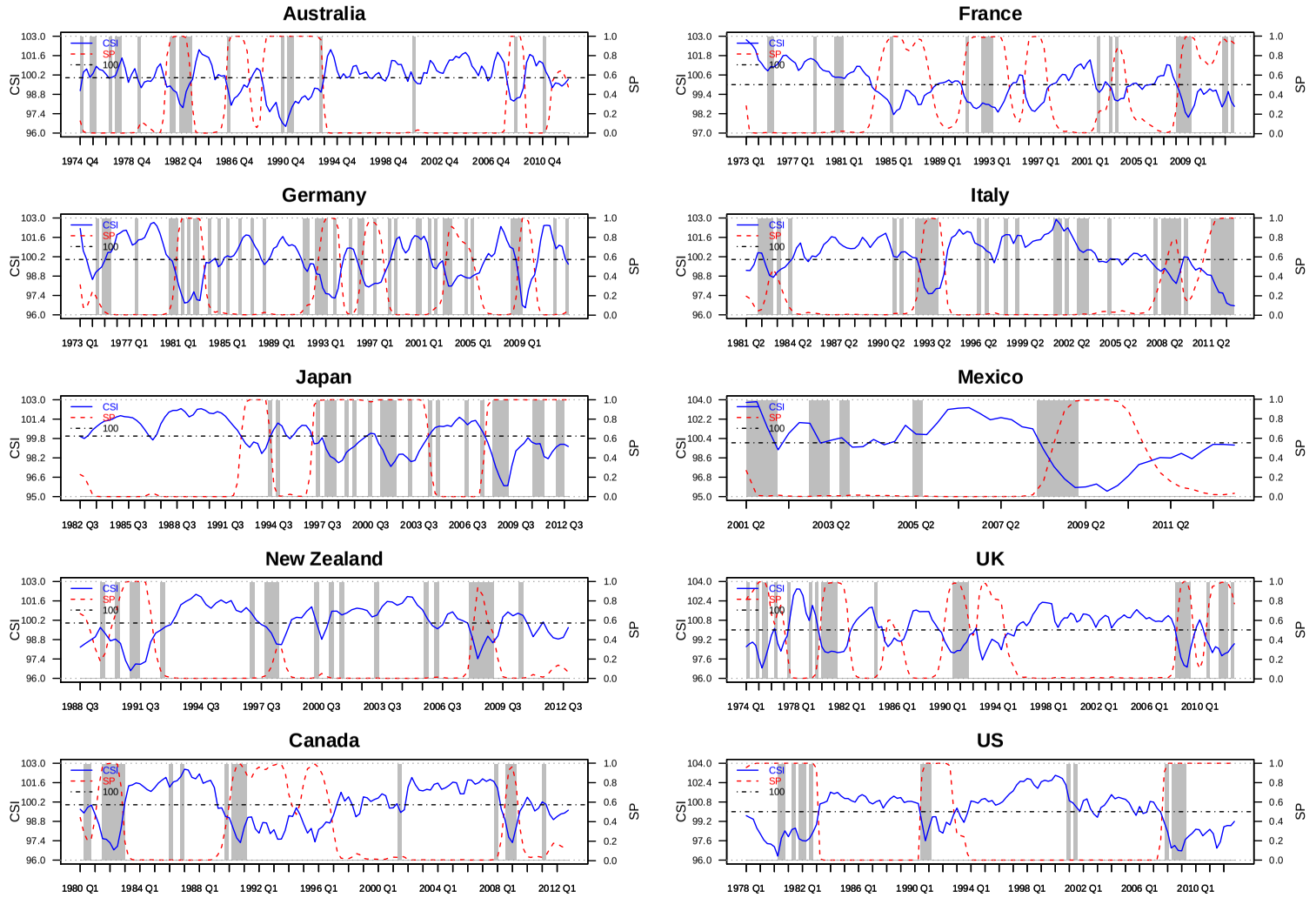
To observe the preliminary evidence of the causal relationship between CSI and GDP, I first have to compare the time series of CSI with the historical quarter-to-quarter GDP growth rate. The gray bars in Figure 1 indicate the periods of negative growth. The figure shows that in all countries, negative GDP growth periods coincide with most of CSI downturn periods. This presents evidence that there is likely to be a coincident and positive correlation between CSI and GDP. However, the relationship between CSI and one-quarter-lagged or -leading GDP growth rate, i.e., lagging or leading information of CSI, is not clearly identifiable in the figure.

Even when CSI shows a downturn trend, the economy is not necessarily in contraction if the index is above the baseline of 100 (i.e., the number of positive consumer responses is greater than the number of negative responses). To explicitly identify true contractionary periods, the smoothed probabilities (SPs) for the contractionary state are extracted from CSI using a simple Markov switching regression model and the contraction periods are compared with the periods of negative growth.[5] Smoothed probabiliy is defined as the smoothed inference about the state at time t using information available regarding a future period.[6]

As shown in Figure 1, SPs describe the state of contraction in most of the periods when CSI is below 100 and the state of expansion (i.e., non-contraction) in most of the periods when CSI is above 100. In most countries, negative GDP growth periods, in particular at least two consecutive quarters of negative GDP growth, coincide with the periods of SPs for a contractionary state. Similar to the previous outcomes regarding the association between GDP growth rate and CSI, this also presents evidence

[5] The model is specified as $CSI_t = \beta_{s_t} + u_t$ where $u_t \sim N(0, \sigma^2_{s_t})$, s_t = states 1 and 2 for time t.
[6] For further details, refer to Hamilton (1989 and 1993).

Figure 1
Consumer sentiment index (CSI) and smoothed probability (SP)



Note: Gray bars represent the periods of negative quarter-to-quarter GDP growth.

Table 2
Cross-correlation between CSI and GDP and Granger causality tests of CSI and GDP

	Panel A: Cross Correlation				
	CSI_t and $GDP_{t\pm i}$ for i= 0,1,2		CSI_t and $GDP_{t\pm i}$ for i= 0,1,2		
Australia	-0.048	-0.031	0.084	0.107	0.030
New Zealand	0.022	0.049	0.104	0.187	0.172
Germany	-0.067	0.157	0.336	0.240	0.135
UK	-0.125	0.019	0.247	0.180	0.275
France	-0.050	0.139	0.243	0.324	0.246
Italy	0.044	0.180	0.232	0.234	0.186
US	-0.135	0.000	0.229	0.338	0.216
Canada	-0.294	-0.193	0.170	0.322	0.440
Mexico	-0.008	0.214	0.409	0.289	0.297
Japan	-0.162	0.017	0.242	0.377	0.326

	Panel B: Granger-Causality Null Hypothesis	
	CSI does not granger-cause GDP	GDP does not granger-cause CSI
Australia	0.016	0.547
New Zealand	0.002	0.299
Germany	0.002	0.344
UK	0.001	0.860
France	0.002	0.015
Italy	0.031	0.075
US	0.000	0.791
Canada	0.000	0.267
Mexico	0.464	0.371
Japan	0.004	0.622

Note: GDP and CSI are indicated in log values and the quarter-to-quarter growth rate (i.e., the difference in log values) is shown in Panel A. Based on the Schwarz information criterion for the optimal lag length test, lag 2 is used in the Granger-Causality test. *P*-values are presented in Panel B.

that there is likely to be a coincident and positive correlation between the SPs for a contractionary state and negative GDP growth, (i.e., a positive correlation between CSI and GDP), while the lagging or leading information of CSI is not still apparent. These findings suggest that the current state of the economy, such as a contraction or a recession, is likely to contemporaneously affect the mood of consumers.

To further identify the causal relationship, the cross-correlation between CSI and GDP is examined. Panel A of Table 2 shows that in all countries, CSI at time t has the highest correlation with current or future GDP rather than past GDP.[7] This indicates that CSI presumably contains coincident or leading information for economic activity.

Lastly, the Granger-causality test is performed. Variable X is said to Granger-cause variable Y if and only if lagged variable X helps to predict Y. Panel B of Table

[7] Cross-correlation is provided for up to two quarters, within which the highest correlation appears in all countries.

2 displays the results of the test performed with optimal lag 2, based on the Schwarz information criterion (SIC). Consumer sentiment index Granger-causes GDP in all countries, except for Mexico, which implies that CSI may lead GDP. On the contrary, GDP does not Granger-cause CSI in all countries, except for France and Italy. This does not necessarily mean that GDP does not truly lead CSI, because Granger-causality is neither a necessary nor sufficient condition for a genuine causal relationship between two variables. Thus, to identify their relationship more rigorously, regression analysis is performed in the next section.

3-2. Regression Model

It has been well documented in literature that CSI is capable of predicting economic activity, i.e., it contains leading information. Nonetheless, it is also possible that there is a reverse causality between CSI and economic activity: current and past performances in output may influence consumers' mood. In such cases, CSI can possess coincident and/or lagging information of economic activity.

To find this evidence, estimation models are set as in Equations 1 and 2, where error terms are detected as autocorrelated AR(1)[8] and further transformed into a nonlinear model as in Equation 3. Coefficients of $\beta^{\top}$ and μ are simultaneously estimated using Marquardt's nonlinear least square algorithm by correcting for the serial correlation in error terms.[9] To make the estimation results of each country comparable, the same set of explanatory variables is applied to all countries.

[8] Ordinary least square estimation of Equation 1 produces a Durbin Watson statistic significantly less than 2, which indicates that there is a positive autocorrelation in error terms.

[9] When a lagged dependent variable is included in the model as a regressor, the conditional covariance matrices estimated from the Cochrane-Orcutt and Hildreth-Lu procedures of linear regression are known to be invalid (Davidson and Mackinnon, 1993, pp. 339-340). This is why a nonlinear estimation procedure is used.

$$y_t = \beta^\top \mathbf{x_t} + u_t \quad (1)$$

$$u_t = \mu u_{t-1} + \varepsilon_t, \ where \ -1 < \mu < 1 \quad (2)$$

$$\rightarrow y_t = \mu y_{t-1} + \beta^\top (\mathbf{x_t} - \mu \mathbf{x_{t-1}}) + \varepsilon_t \quad (3)$$

where $\mathbf{x_t}$ is a $k \times 1$ vector of economic variables described in Section 2, including lagged dependent variable, and β is a $k \times 1$ vector.

Before estimating the model, the augmented Dickey-Fuller unit root test is performed for all variables.[10] In all countries, most of the variables are identified as having a unit root, so GDP and SHPI are first-differenced in log value, while STIR and UEMR are only level-differenced because they are in the form of percentage. On the contrary, INFR is not identified as having a unit root in all countries except for Australia and France, so INFR is used at level. Consumer sentiment index is also not identified as having a unit root in all countries, except for the U.S. and Mexico. Survey data are known to be free from issues of trends and seasonality since they depend on consumers' subjective judgment regarding the economic condition (Santero and Westerlund, 1996). Nonetheless, CSI is first-differenced in log value in order to eliminate this factor if mood is constant over time.[11]

3-3. Estimation Results

To scrutinize the association between CSI and GDP, a regression of GDP is performed on its own lagged variable and CSI, followed by a regression of CSI on its own lagged

[10] The results will be presented upon request.

[11] The use of CSI varies in empirical studies. Matsusaka and Sbordone (1995) and Lovell and Tien (2000) use CSI at level since the index is a measure of the changes in consumer sentiment and is trendless. Jansen and Nahis (2003) and Vuchelen (2004) use first-differenced CSI at level due to its non-stationarity and autoregressivity, respectively, while Otto (1999) and Carroll et. al. (1994) use the first-differenced of CSI in the form of logarithm.

Table 3
Estimation results of GDP on CSI

Country	Variable	GDP(t-1)	CSI(t-1)	C	$Adj - R^2$	DW
Australia	GDP	-0.015	0.162	0.008***	-0.002	1.944
		(0.082)	(0.123)	(0.001)		
New Zealand	GDP	0.015	0.363*	0.006***	0.015	2.033
		(0.102)	(0.198)	(0.001)		
Germany	GDP	0.026	0.371***	0.004***	0.046	2.000
		(0.083)	(0.133)	(0.001)		
UK	GDP	0.186**	0.191*	0.004***	0.053	2.148
		(0.081)	(0.115)	(0.001)		
France	GDP	0.477***	0.354***	0.003***	0.317	2.263
		(0.067)	(0.112)	(0.001)		
Italy	GDP	0.382***	0.225*	0.002***	0.176	2.067
		(0.085)	(0.129)	(0.001)		
US	GDP	0.318***	0.379***	0.004***	0.227	2.112
		(0.073)	(0.104)	(0.001)		
Canada	GDP	0.501***	0.301***	0.003***	0.340	2.188
		(0.072)	(0.092)	(0.001)		
Mexico	GDP	0.260	0.271	0.004**	0.100	1.971
		(0.156)	(0.232)	(0.002)		
Japan	GDP	0.107	0.693***	0.002	0.132	2.012
		(0.111)	(0.220)	(0.001)		

Note: CSI and GDP are the first-differences in log value. Standard errors are in parentheses. $Adj - R^2$ and DW represent adjusted R^2 and the Durbin-Watson statistic, respectively. ***, **, and * represent $p < 0.01$, $p < 0.05$, and $p < 0.1$, respectively.

variable and GDP. The lagged dependent variable is included as an explanatory variable not only to reduce the omitted variable bias, but also to capture a "mood formation" similar to a habit formation in an economic consumption model because the current mood of consumers is likely to be influenced by the consumer sentiment in the previous period. According to Lovell (1975), a lagged variable captures the contagious disillusionment and the persistent mood of consumers.

Table 3 shows the results of the regression of GDP on GDP_{t-1} and CSI_{t-1}, which are very similar to the findings from the Granger-causality test in Panel B of Table 2.[12] In all countries except for Australia and Mexico, CSI exerts a lagged effect on GDP with a statistical significance, which implies that CSI contains leading information for economic activity.

On the contrary, Table 4 shows the results of the regression of CSI on CSI_{t-1}, GDP_t, and GDP_{t-1}.[13] In Germany, the U.K., France, the U.S., Canada, Mexico, and Japan, GDP has a contemporaneous effect on CSI with a statistical significance. This

[12] Durbin-Watson statistics from OLS regression are close to 2 in all countries, so the results come from OLS estimation rather than non-linear least squares estimation that takes into account AR(1).

[13] To be consistent with the sample period in the multivariate regression, the sample periods of the U.K. and France and Japan start with 1978:Q3 and 2002:Q4, respectively.

Table 4
Estimation results of CSI on GDP

Country	variable	CSI(t-1)	GDP	GDP(t-1)	AR(1)	C	$Adj - R^2$	DW
Australia	CSI	0.191	0.044	-0.028	0.186	-0.0002	0.100	1.896
		(2.683)	(0.052)	(0.138)	(2.686)	(0.001)		
		0.181	0.049		0.194	-0.0004	0.104	1.892
		(1.054)	(0.052)		(1.056)	(0.001)		
New Zealand	CSI	0.203	0.019	0.012	0.202	-0.0001	0.092	1.803
		(3.234)	(0.052)	(0.072)	(3.238)	(0.001)		
		0.205	0.016		0.203	0.000	0.101	1.802
		(3.089)	(0.051)		(3.097)	(0.001)		
Germany	CSI	0.266	0.139***	0.049	0.398	-0.001	0.411	1.783
		(0.379)	(0.039)	(0.055)	(0.369)	(0.001)		
		0.340	0.126***		0.336	-0.001	0.410	1.816
		(0.307)	(0.038)		(0.326)	(0.001)		
UK	CSI	0.268	0.152***	-0.082	0.210	-0.001	0.227	1.919
		(0.949)	(0.053)	(0.156)	(0.966)	(0.001)		
		0.165	0.164***		0.307	-0.001*	0.223	1.877
		(0.301)	(0.053)		(0.303)	(0.001)		
France	CSI	0.094	0.131*	0.118	0.267	-0.001**	0.196	1.912
		(0.360)	(0.068)	(0.079)	(0.349)	(0.001)		
		0.215	0.16**		0.138	-0.001*	0.188	1.955
		(0.328)	(0.068)		(0.335)	(0.0005)		
Italy	CSI	0.188	0.076	0.064	0.223	-0.001	0.164	1.897
		(0.698)	(0.059)	(0.084)	(0.696)	(0.001)		
		0.229	0.088		0.185	-0.0005	0.163	1.913
		(0.564)	(0.059)		(0.575)	(0.001)		
US	CSI	0.119	0.190***	-0.093	0.027	-0.001	0.065	1.959
		(0.612)	(0.071)	(0.131)	(0.623)	(0.001)		
		0.036	0.164**		0.120	-0.001	0.063	1.927
		(0.420)	(0.070)		(0.422)	(0.001)		
Canada	CSI	0.279	0.233***	-0.311***	0.008	0.0005	0.190	1.989
		(0.195)	(0.079)	(0.077)	(0.212)	(0.001)		
		0.038	0.145*		0.288	-0.001	0.106	1.891
		(0.336)	(0.078)		(0.331)	(0.001)		
Mexico	CSI	0.115	0.210**	0.023	0.122	-0.002	0.128	2.045
		(1.989)	(0.099)	(0.451)	(2.001)	(0.003)		
		0.133	0.214**		0.110	-0.001	0.149	2.058
		(0.415)	(0.095)		(0.444)	(0.001)		
Japan	CSI	0.303	0.110*	-0.004	0.440	-0.0001	0.416	1.812
		(1.081)	(0.063)	(0.113)	(1.037)	(0.001)		
		0.294	0.111*		0.448	-0.0001	0.432	1.807
		(0.546)	(0.061)		(0.549)	(0.001)		

Note: CSI and GDP are the first-differences in log value. Standard errors are in parentheses. $Adj - R^2$ and DW represent adjusted R^2 and the Durbin-Watson statistic, respectively. ***, **, and * represent $p < 0.01$, $p < 0.05$, and $p < 0.1$, respectively.

presents evidence that current economic activity affects consumer sentiment, and suggests that CSIs contain coincident information of economic activity. However, only in Canada does lagged GDP appear to be statistically significant with a negative coefficient. This suggests that in all countries except for Canada, past realization of economic development does not contemporaneously affect the consumer sentiment. In the regressions, GDP_t, and GDP_{t-1} are likely to correlate with each other, which presumably leads to spurious results. In order to check the robustness of the results, regression is re-run after dropping GDP_{t-1}. As shown in the next line, the outcome of

estimation is consistent with previous results.[14]

In addition to GDP, macroeconomic information regarding financial and labor markets in relation to the state of economy may also influence consumer sentiment. Thus, to control its effect and confirm the results on robustness, SHPI, which captures financial condition of consumers, as well as STIR, UEMR, and INFR, which capture information about the current and future state of economy, are added to the previous univariate regression model before regressions are re-run.

The estimation results in Table 5 show that, as in the univariate model in Table 4, the current GDP growth rates of Germany, the U.K., France, and Mexico are still statistically significant. Accordingly, the GDP growths in these countries are very likely to have an contemporaneous effect on CSI. Unlike in the univariate model, the current GDP growths in the U.S., Canada, and Japan do not appear to be statistically significant. Thus, the effect of GDP on CSI is ambiguous in these countries and their CSIs should be cautiously regarded as coincident indicators. These findings confirm that in some countries, CSI contains coincident information that can be useful as a mood signal for assessing the changes in economic activity.

3-4. Determinants of CSI

A. Economic Factors

The control variables in Table 5 can also be regarded as potential determinants of CSI in the countries. Thus, we shall examine which factors are important in determining consumer sentiment. One conspicuous result is that SHPI exerts a significant and positive effect on CSI in all countries except for Mexico. This implies that increased income due to the wealth effect is a highly relevant factor in establishing consumer

[14] Regression results only with GDP_{t-1} is also consistent with the previous ones except that in France. They will be available upon request.

Table 5
Estimation results of CSI on GDP and control variables and determinants of CSI

Country	Australia	New Zealand	Germany	UK	France	Italy	US	Canada	Mexico	Japan
variable					Panel A: CSI					
CSI(t-1)	0.253	0.205	0.444***	0.284**	0.228	0.192	-0.036	0.270**	0.192	0.364**
	(0.192)	(0.203)	(0.103)	(0.141)	(0.242)	(0.233)	(0.137)	(0.123)	(0.306)	(0.151)
GDP	0.055	0.020	0.125***	0.137**	0.150**	0.047	0.006	0.113	0.213*	0.090
	(0.054)	(0.052)	(0.039)	(0.055)	(0.074)	(0.061)	(0.077)	(0.078)	(0.106)	(0.054)
SHPI	1.963***	3.14***	2.072***	2.296***	0.929***	1.550***	4.328***	2.785***	-1.246	2.601***
	(0.544)	(0.882)	(0.422)	(0.661)	(0.329)	(0.414)	(0.669)	(0.624)	(1.626)	(0.683)
STIR	-0.102**	-0.186**	-0.13**	-0.172***	0.015	0.017	0.088*	-0.206***	-0.465**	-1.834
	(0.045)	(0.079)	(0.057)	(0.049)	(0.037)	(0.054)	(0.049)	(0.051)	(0.219)	(1.146)
INFR	-0.018	-0.069	-0.058	-0.020	-0.064*	-0.061	-0.202***	-0.043	-0.050	-0.259
	(0.044)	(0.100)	(0.060)	(0.038)	(0.035)	(0.059)	(0.057)	(0.058)	(0.197)	(0.164)
UEMR	0.064	-0.155	-0.101	0.122	0.103	-0.050	-0.098	0.144	-0.552	0.785**
	(0.162)	(0.154)	(0.158)	(0.176)	(0.126)	(0.158)	(0.196)	(0.161)	(0.591)	(0.374)
AR(1)	0.089	0.036	0.094	0.156	0.109	0.241	0.241	-0.074	0.160	0.038
	(0.211)	(0.227)	(0.129)	(0.167)	(0.252)	(0.245)	(0.152)	(0.146)	(0.331)	(0.279)
Constant	-0.001	0.0001	-0.001	-0.001*	-0.0005	0.0001	0.001	-0.001	-0.001	0.0003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)
$Adj - R^2$	0.191	0.252	0.487	0.359	0.227	0.239	0.296	0.331	0.184	0.642
DW	1.939	1.958	1.903	1.908	1.964	1.924	1.914	1.993	2.122	1.973
Variables					Panel B: CSI					
CSI(t-1)	0.246	0.210	0.441***	0.313**	0.252	0.199	-0.036	0.291**	0.283	0.442***
	(0.199)	(0.192)	(0.122)	(0.143)	(0.268)	(0.230)	(0.134)	(0.120)	(0.340)	(0.129)
SHPI	1.984***	3.147***	2.269***	2.749***	1.073***	1.621***	4.341***	2.959***	0.120	2.905***
	(0.543)	(0.872)	(0.432)	(0.645)	(0.331)	(0.406)	(0.649)	(0.615)	(1.568)	(0.675)
STIR	-0.102**	-0.182**	-0.082	-0.171***	0.026	0.025	0.089*	-0.194***	-0.378*	-1.67
	(0.045)	(0.078)	(0.058)	(0.050)	(0.037)	(0.053)	(0.048)	(0.050)	(0.219)	(1.118)
INFR	-0.021	-0.079	-0.069	-0.044	-0.055	-0.056	-0.203***	-0.042	-0.114	-0.228
	(0.044)	(0.097)	(0.063)	(0.037)	(0.037)	(0.059)	(0.057)	(0.058)	(0.205)	(0.166)
UEMR	-0.001	-0.165	-0.195	-0.028	0.0003	-0.066	-0.106	0.021	-0.948	0.771**
	(0.150)	(0.151)	(0.163)	(0.165)	(0.123)	(0.157)	(0.176)	(0.136)	(0.598)	(0.367)
AR(1)	0.096	0.029	0.136	0.112	0.156	0.245	0.241	-0.080	0.048	-0.065
	(0.218)	(0.215)	(0.145)	(0.169)	(0.283)	(0.244)	(0.151)	(0.143)	(0.381)	(0.238)
Constant	-0.0002	0.0003	0.0001	-0.0004	0.0001	0.0003	0.001	-0.0002	0.001	0.0005
	(0.001)	(0.001)	(0.001)	(0.001)	(0.0004)	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)
$Adj - R^2$	0.191	0.259	0.455	0.334	0.206	0.241	0.301	0.325	0.118	0.622
DW	1.926	1.966	1.884	1.934	1.950	1.923	1.914	1.992	2.176	1.983

Note: CSI and GDP are the first-differences in log value. SHPI, STIRS, INFR and UEMR are divided by 100. Standard errors are in parentheses. $Adj - R^2$ and DW represent adjusted R^2 and the Durbin-Watson statistic, respectively. ***, **, and * represent $p < 0.01$, $p < 0.05$, and $p < 0.1$, respectively.

sentiment. In this case, we must also take into account that Mexico is an emerging country and its stock market is not highly developed and therefore, consumer sentiment may be less influenced by the changes in share prices compared to other developed countries.

According to conventional wisdom, a rise in STIR has both negative and positive effects on consumption. On the negative side, it increases interest rate payments on consumers' short-term debts, having an adverse impact on their cash flow. On a positive side, their interest incomes increase. In general, the negative effect is known to be greater than the positive effect. Thus, an increase in interest rate can lead to reduced overall consumption and subsequently a deline in consumer sentiment. In all countries except for France, Italy, and Japan, STIR is statistically significant with a negative coefficient. However, its sign in the U.S. appears to be positive. It is likely that the positive effect of higher interest rates outweighs the negative impact in the U.S., resulting in a positive effect on CSI.

In France and the U.S., INFR is statistically significant at levels of 10% and 1%, respectively. The result of the U.S. is consistent with the finding of Garner (1981). Aggregate household consumption accounts for about 70% of GDP in the U.S., which is the highest among all sampled countries and it has a high correlation with consumer sentiment. Therefore, consumer sentiment appears to be very sensitive to INFR. Unemployment rate turns out to have a positive relationship with CSI only in Japan with a statistical significance. These results suggest that in most of countries macroeconomic variables such as INFR and UEMR are not significant factors that affect consumer sentiment.

To examine the robustness of these CSI determinants, regression is re-run after dropping GDP and only with potential determinants. Panel B of Table 5 shows that the estimates are very similar to previous results: SHPI is statistically significant in all

countries except for Mexico; STIR is significant in Australia, New Zealand, the U.K., the U.S., Canada, and Mexico; and INFR and UEMR are not statistically significant in all countries except for the U.S. and Japan, respectively.[15]

In a nutshell, the determinants of CSI vary across countries. Nevertheless, there are some common features: SHPI and STIR are most likely to be significant factors of CSI in most countries, whereas INFR and UEMR may not be. Overall, we found previous outcomes to be quite robust.

B. Non-Economic Factors

It has been previously found that SHPI and STIR are the major driving economic forces of CSI. Nevertheless, non-economic factors such as psychological sentiment may also play a role. For example, when an economy is in a downturn, consumers are more likely to be in a depressed mood and their responses to a sentiment survey would be negative, causing the CSI to fall. To capture this emotional effect, a dummy variable is generated, which is assigned a value of 1 for quarters of negative GDP growth, and 0 otherwise. In addition, Okun's economic misery index, which indicates the overall level of economic uncomfortability in a country, is generated by simply summing INFR and UEMR.

The dummy variable (NGWR) and the misery index (MI) are added to the previous regression equation instead of dropping INFR and UEMR. Regression results in Panel A of Table 6 show that the negative GDP growth dummy variable (NGWR) is statistically significant in Germany and Mexico. This suggests that an economic state reflecting the contraction of economy exerts a significant effect on consumer sentiment.

To delve deeper into this contractionary state effect, the SPs previously extracted

[15] There are minor differences among the results of interest rate and inflation rate: interest rate in Germany and inflation rate in France do not turn out to be statistically significant. These marginal differences do not significantly change the overall outcomes.

Table 6
Estimation results of economic and psychological states' effect on CSI

Country	Australia	New Zealand	Germany	UK	France	Italy	US	Canada	Mexico	Japan
Variables	Panel A: CSI									
CSI(t-1)	0.232	0.230	0.467***	0.288*	0.284	0.218	-0.003	0.240*	0.325	0.319
	(0.209)	(0.196)	(0.105)	(0.157)	(0.261)	(0.251)	(0.152)	(0.132)	(0.217)	(0.205)
SHPI	1.878***	3.096***	2.077***	2.631***	0.880***	1.616***	4.267***	2.703***	-1.568	2.448***
	(0.542)	(0.855)	(0.43)	(0.656)	(0.315)	(0.409)	(0.704)	(0.631)	(1.463)	(0.736)
STIR	-0.109**	-0.180**	-0.083	-0.177***	0.020	0.025	0.102**	-0.203***	-0.297*	-2.728**
	(0.044)	(0.073)	(0.055)	(0.047)	(0.035)	(0.053)	(0.047)	(0.047)	(0.168)	(1.253)
MI	0.026	0.012	0.011	-0.001	0.051	-0.010	0.002	0.023	-0.055	0.004
	(0.026)	(0.028)	(0.017)	(0.019)	(0.034)	(0.032)	(0.030)	(0.024)	(0.104)	(0.132)
NGWR	-0.187	-0.156	-0.173**	-0.167	0.063	0.0122	0.200	-0.135	-1.227***	-0.155
	(0.133)	(0.134)	(0.078)	(0.12)	(0.086)	(0.094)	(0.166)	(0.143)	(0.319)	(0.132)
AR(1)	0.137	0.050	0.092	0.146	0.125	0.223	0.240	-0.026	-0.010	0.252
	(0.230)	(0.227)	(0.133)	(0.181)	(0.273)	(0.264)	(0.162)	(0.156)	(0.275)	(0.293)
Constant	-0.002	-0.0007	-0.001	-0.0005	-0.005	0.0006	-0.001	-0.002	0.005	0.0007
	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.006)	(0.006)
$Adj - R^2$	0.205	0.257	0.462	0.336	0.206	0.234	0.235	0.330	0.318	0.583
DW	1.910	1.936	1.900	1.920	1.955	1.910	1.900	1.978	2.196	1.934
Variables	Panel B: CSI									
CSI(t-1)	0.240	0.228	0.457***	0.318**	0.280	0.183	0.021	0.261*	0.093	0.376*
	(0.216)	(0.223)	(0.106)	(0.154)	(0.265)	(0.243)	(0.143)	(0.134)	(0.349)	(0.189)
SHPI	1.893***	3.219***	2.097***	2.692***	0.893***	1.521***	4.514***	2.831***	-2.015	2.659***
	(0.546)	(0.852)	(0.426)	(0.660)	(0.316)	(0.411)	(0.695)	(0.637)	(1.910)	(0.734)
STIR	-0.103**	-0.168**	-0.082	-0.176***	0.018	0.010	0.119**	-0.197***	-0.398*	-3.354**
	(0.045)	(0.077)	(0.054)	(0.048)	(0.035)	(0.054)	(0.047)	(0.048)	(0.205)	(1.305)
MI	0.023	0.014	0.016	-0.004	0.048	-0.01	-0.010	0.019	0.024	-0.029
	(0.027)	(0.029)	(0.017)	(0.019)	(0.035)	(0.032)	(0.031)	(0.025)	(0.136)	(0.132)
PSI	-0.072	-0.089	-0.320**	-0.0496	0.075	-0.206	0.410**	-0.0424	-1.691*	0.178
	(0.181)	(0.303)	(0.136)	(0.144)	(0.104)	(0.178)	(0.183)	(0.190)	(0.912)	(0.252)
AR(1)	0.120	0.059	0.094	0.121	0.130	0.234	0.259*	-0.050	0.235	0.194
	(0.238)	(0.244)	(0.132)	(0.178)	(0.277)	(0.252)	(0.153)	(0.154)	(0.329)	(0.273)
Constant	-0.002	-0.001	-0.001	-0.0004	-0.005	0.001	-0.0004	-0.002	0.0001	0.002
	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.007)	(0.006)
$Adj - R^2$	0.195	0.246	0.464	0.327	0.206	0.244	0.255	0.326	0.139	0.572
DW	1.915	1.927	1.906	1.934	1.954	1.904	1.892	1.983	2.125	1.942

Note: CSI and GDP are the first-differences in log value. SHPI, STIR, MI, NGWR, and PSI are divided by 100. Standard errors are in parentheses. $Adj - R^2$ and DW represent adjusted R^2 and the Durbin-Watson statistic, respectively. NGWR and MI represent a dummy variable for quarters of negative GDP growth and a misery index, respectively. PSI represents an ad-hoc variable for the psychological indicator. ***, **, and * represent $p < 0.01$, $p < 0.05$, and $p < 0.1$, respectively.

from CSI are used as a proxy variable for a psychological indicator. As seen in Figure 2, SPs indicate the likelihood that CSI falls into a contractionary state at any given period t. Thus, it is assumed that the probability reflects consumers' emotional state about the economic condition for each period; the higher the probability, the worse the consumer mood is likely to be. To further extract the information reflecting consumers' gloomy mood only in downturn periods, SPs are multiplied by the dummy variable explained above. This new indicator is used as an ad-hoc variable for measuring consumer sentiment during an economic contraction.

Panel B of Table 6 shows the results of a regression performed with the pseudo psychological indicator (PSI). Similar to the results estimated for NGWR in Panel A, estimations of PSI have negative effects on CSI with statistical significances in Germany and Mexico.[16] This presents evidence that consumers' gloomy mood in an economic recession can aggravate their sentiment, i.e., non-economic factors such as psychological state can affect CSI. Furthermore, in both Panels A and B, SHPI is still statistically significant in all countries except for Mexico, as are STIR in Australia, New Zealand, the U.K., the U.S., Canada, and Mexico.[17] The misery index is not estimated to be statistically significant in both Panels A and B. This is not surprising because in most of the countries, INFR and UEMR are not found to be significant economic determinants of CSI, as shown in Table 5.

To summarize, although there are some variations of CSI determinants across the countries, consumer sentiment can be driven by both economic forces such as wealth effects and by non-economic forces such as emotional effects.

[16] In the U.S., the estimated coefficient of PSI appears to be positive with a statistical significance. The current contractionary state may cause the U.S. consumers to expect the economy to improve in the near future, so PSI seems to have a positive effect on CSI.

[17] In Japan, interest rate turns out to be significant, which contradicts the outcomes in Table 5, so it is not considered a significant factor of CSI.

4. Conclusion

A number of previous studies have primarily focused on the role of information and the effectiveness of consumer sentiment as sources of aggregate economnic movements; consumers anticipate changes in the state of economy, so variation in CSI as a leading indicator precedes changes in the overall economy. In this case, the leading information is useful for predicting the changes that are likely to occur in the economy.

On the contrary, consumers may also react to changes in the state of economy; an improvement in economic activity is likely to lead a rise in consumer sentiment. That is, it is possible that there is a reverse causality between CSI and economic activity. If so, CSI can also be a coincident or lagging indicator that follows the changes in economic activity. In this case, the coincident or lagging information is more useful as a mood signal for assessing the changes in the economy. Based on the data from ten OECD countries, this paper explored the causal relationship between CSI and GDP, and found some evidence that CSI contains not only leading information but also coincident information in Germany, the U.K., France, the U.S., Canada, Mexico, and Japan.

When people feel wealthier they tend to increase their spending and their sentiment is more likely to be elevated. On the other hand, when the economy as a whole declines, consumers feel worse and their sentiment about the economy tends to decline. These economic and non-economic forces can influence consumer sentiment. Thus, this paper also examined whether consumer confidence can be explained by non-economic factors such as state of the economy and psychological state, as well as standard economic determinants such as income and interest rate.

We found that in most of the countries, SHPI and STIR reflect the changes in CSI very well, which suggests that wealth and financial effects play an important role on consumer sentiment. Moreover, consumer sentiment depends on their judgment

and expectations about the economy. That is, consumers seem to be sensitive to both economic and psychological states. Therefore, CSI is also likely to be driven by non-economic factors, such as emotional responses to economic realizations or uncertainty. In a regression analysis of economic determinants, a contractionary state indicator, defined as a dummy variable for the quarters of negative GDP growth, and an ad-hoc psychological indicator, defined as the probabilities of the contractionary state of CSI for economic downturn, were found to have a negative and significant effect on CSI in Germany and Mexico, which suggests that non-economic factors also play an important role on consumer sentiment.

In conclusion, CSI is identified as a leading and/or coincident indicators of economic activity. Both economic factors such as wealth and interest rate and non-economic factors such as economic and psychological states are identified as driving forces of consumer sentiment.

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