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Abstract

This research empirically investigates whether consumer confidence is affected by seasonal weather fluctuations. Cross-country panel regressions are run with two different data sets. It is found that both solar elevation and sunlight duration positively affect consumer confidence. The presence of country and year-by-quarter fixed effects as well as controls for the business cycle help rule out alternative explanations. A one standard deviation increase in solar elevation or sunlight duration is associated with a 0.02-0.04 SD increase in consumer confidence.

Keywords: consumer confidence, seasonality, seasonal affective disorder, behavioural bias.

JEL classification: E03, D12, D91, E20.

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1 Introduction

It has long been hypothesised that seasonal weather variations lead to seasonal changes in human behaviour. Several such phenomena have been proposed. Seasonal affective disorder (SAD) is an increase in depressive symptoms during times with low daylight (Meesters and Gordijn, 2016; Øverland et al., 2020; Winkler et al., 2017). Springtime lethargy is a state of fatigue and potential depressive symptoms purported to be common in the spring. Proposed causes include hormonal fluctuations (Nicholson, 2008), and reverse SAD, that is groups of people disliking sunnier and warmer weather as opposed to seasons with low daylight (Klimstra et al., 2011). Incidentally, there is also a springtime peak in suicides that appears to hold across a variety of countries (Petridou et al., 2002).

However, there is debate in the psychological literature about the importance of seasonal factors to depressive symptoms. Some authors have failed to find consistent evidence for such cyclicity at the population level (Kerr et al., 2013; Traffanstedt et al., 2016; LoBello and Mehta, 2019), but comparability between studies is difficult due to them considering different symptoms and disorder definitions (Øverland et al., 2020). A potential solution to this puzzle may be the heterogeneity observed across groups of people in when they experience depressive symptoms and bad mood (Klimstra et al., 2011). Further, the possible lack of a seasonal pattern in depression does not necessarily rule out milder seasonal swings in mood at the population level (Kasper et al., 1989; Keller et al., 2005; Denissen et al., 2008).

This paper contributes to the literature on seasonal variations in mood in two ways. First, it examines whether seasonal mood fluctuations can be observed in the data indirectly by looking at whether households' confidence in the economy exhibits seasonal patterns. Second, it investigates a tangible consequence of seasonal mood swings as fluctuations in consumer confidence can have real economic consequences by impacting consumers' willingness to spend.

Seasonal variations in economic variables have been observed in the context of stock prices (Bouman and Jacobsen, 2002; Hirshleifer et al., 2020; Zhang and Jacobsen, 2021), initial public offerings (Dolvin and Pyles, 2007; Dolvin and Fernhaber, 2014; Keef et al., 2015), real estate (Kaplanski and Levy, 2012), art auctions (Kliger et al., 2015), and US Treasury bonds (Kamstra et al., 2015). Some studies attribute these effects to seasonal affective disorder (SAD) – people exhibiting depressive symptoms in certain seasons (Kamstra et al., 2003; Škrinjarić, 2018). The channel proposed by these papers is that depressive symptoms increase individuals' risk aversion leading to worse asset price performance. However, some authors explicitly reject the conclusion that the seasonal behaviour of asset prices is driven by SAD (Jacobsen and Marquering, 2008; Kelly and Meschke, 2010).

This paper, on the other hand, examines whether seasonality has an effect on consumer confi-

dence. People’s perceptions about the economic situation in a country are arguably more malleable than their trading decisions, and are thus potentially more sensitive to seasonal mood swings than asset prices even if these swings are not large enough to produce depressive symptoms detectable at the population level.

There is one existing study looking at consumer confidence: [Sekizawa and Konishi \(2021\)](#) find that consumer confidence and asset value expectations exhibit seasonal patterns within Japan. The present study contributes to existing work by examining whether this seasonal cycle in consumer confidence generalises to a global context, and how important it is quantitatively in comparison to other predictors of consumer confidence.

Methodologically, the paper relies on country-level panel data at a monthly frequency. Consumer confidence is regressed on seasonality metrics, country and time fixed effects as well as control variables. Seasonality is measured by solar elevation and sunlight duration. The inclusion of country and year-by-quarter fixed effects ensures that a host of alternative explanations are accounted for in the analysis. The findings are established in two separate data sets: one using Ipsos consumer confidence data and one using OECD consumer confidence data.

Both solar elevation and sunlight duration have a significant positive relationship with consumer confidence. The evidence is more robust for solar elevation. The size of the effect is about a 5% of the size of GDP growth’s: a one standard deviation increase in solar elevation or sunlight duration is associated with a 0.02-0.04 SD increase in consumer confidence.

2 Methodology

This section discusses the empirical strategy behind the paper as well as the data sources used in the analyses.

2.1 Empirical strategy

Country-level panel data regressions are run to evaluate the effect of seasonality on consumer confidence. These models take the form

$$CCI_{it} = \alpha_i + \gamma_t + \beta \cdot Seasonality_{it} + X_{it} \delta + \varepsilon_{it}, \quad (1)$$

where CCI_{it} is consumer confidence in country i at time t , $Seasonality_{it}$ is a measurement of seasonality, X_{it} are control variables, α_i and γ_t are country and year fixed effects, and ε_{it} are robust standard errors clustered at the country level.

The country fixed effects control for any country-specific time-invariant characteristic such as

culture or institutions. The time fixed effects control for any common global shocks such as oil price shocks. Seasonality is an exogenous explanatory variable in the sense that consumer confidence cannot affect seasonality ruling out reverse causality. The additional control variables (X_{it}) include GDP growth, inflation and unemployment. These variables aim to account for the business cycle, and rule out the possibility that seasonality only affects consumer confidence through a direct effect on the business cycle.

The biggest challenge to identifying the causal effect of seasonality on consumer confidence is that different measures of seasonality are likely to be highly correlated with each other. For instance, it is hard to disentangle whether the results are driven by solar elevation, sunlight duration, temperature, precipitation, sun exposure or some other dimension of seasonality. Ultimately, the paper's primary goal is to estimate the effect of natural seasonal weather fluctuations in general on consumer confidence, and not the effect of any specific dimension of seasonality per se.

While data are available up to the present, observations from 2020 onward are excluded to ensure the results are not driven solely by the large swings in consumer confidence during the COVID-19 pandemic.

2.2 Data

Consumer confidence is observed at the monthly level from two separate data sets: Ipsos surveys and the OECD. Ipsos conducts its own surveys in 24 countries, while the OECD combines data collected by national authorities for 42 countries. For a list of countries, see Table A.3. The Ipsos data are available from 2010 onward, while the OECD data's availability varies a lot by country with good coverage for most countries by the year 2004. Both Ipsos and the OECD produce a number of different confidence measures, which are detailed further in Appendix B.

Seasonality is proxied by two measures: solar elevation and sunlight duration. Solar elevation is the angle between the sun and a horizontal line on the ground. It essentially measures how high on the sky the sun is at a certain place and time. Sunlight duration is the duration of potential sunshine on a given day, unadjusted for cloud cover. These two measures of seasonality are calculated for each country in each month in the data set – evaluated at a country's centre of population at noon on the first day of the month. The calculations follow the worksheet provided by the [National Oceanic and Atmospheric Administration \(2022\)](#).

Control variables include GDP growth, inflation, and unemployment. These are sourced from the IMF and the OECD. Further details are provided in Appendix B.

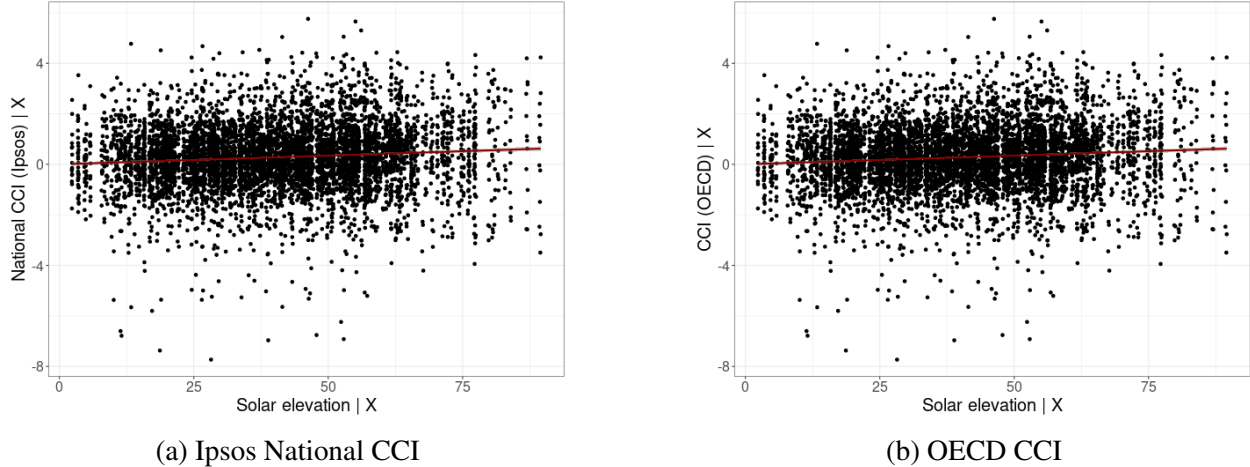


Figure 1: Conditional scatter plot of consumer confidence and solar elevation

3 Results

After a brief overview of descriptive statistics, this section describes the results of the analysis using the Ipsos and OECD data sets, respectively.

3.1 Descriptive statistics

Table A.1 provides descriptive statistics for the consumer confidence indices by country. It shows that consumer confidence behaves similarly across countries with some cross-country variation in volatility, which will be controlled for by the country fixed effects in the regressions. Further, the correlation between the Ipsos and OECD data sets (shown in the last column) is fairly high in most cases suggesting that the two measures capture similar dimensions of consumer confidence.

Table A.2 provides similar summary statistics by country for solar elevation and sunlight duration. It shows that there are level differences between countries in both variables, and that some countries are more seasonal than others – time-invariant factors that should be captured by country fixed effects. The last column shows the correlation between the two seasonality metrics: it is extremely high which illustrates the difficulty of disentangling which dimension of seasonality exactly drives the dependent variable.

Finally, Table A.3 shows the number of observations by country in the Ipsos and OECD data sets. This gives an idea of which countries are behind the results.

3.2 Regression results

Table A.4 shows the coefficients from estimating (1) on the Ipsos data using solar elevation to measure seasonality. The coefficient on solar elevation is positive and significant even after adding

the control variables. The size of the effect is fairly stable across the columns. And the relationship is observed for a wide variety of confidence metrics. Interestingly, seasonality affects sentiment about investment prospects rather strongly, but it does not have a robust association with sentiment about the labour market. This corresponds well to earlier studies that find a seasonal pattern in financial markets. Figure 1a shows the conditional scatter plot corresponding to Column (2) of Table A.4.

Reassuringly, the signs of the coefficients on the control variables also agree with intuition: GDP growth increases, while unemployment decreases consumer confidence. Inflation has an ambiguous effect, perhaps because higher inflation can both be associated with booming economic times and with a lack of price stability.

The coefficients on solar elevation imply that a one standard deviation (18.5) increase in solar elevation leads to a 0.025 standard deviation increase in national, 0.027 SD increase in current, 0.041 SD increase in expectations, and 0.029 SD increase in investment consumer confidence. For comparison, a one standard deviation (4.3) increase in GDP growth is associated with a 0.53 SD increase in national consumer confidence, while a one standard deviation (4.2) increase in unemployment is associated with a 0.65 SD decrease in national consumer confidence.

The insights from the solar elevation regressions largely carry over if sunlight duration is used to measure seasonality instead, as shown in Table A.5. A one standard deviation (2.25) increase in sunlight duration is associated with a 0.022 SD increase in national consumer confidence, which is also in line with the estimates for solar elevation.

Table A.6 shows the results of the regressions using OECD data. The OECD consumer confidence index (CCI) has a significant positive relationship with solar elevation even after adding the control variables. Figure 1b shows the conditional scatter plot corresponding to Column (2) of Table A.6. The effect for sunlight duration is less robust. A one standard deviation (18.4) increase in solar elevation is associated with a 0.060 SD increase in consumer confidence. Interestingly, seasonality also influences readings of the OECD's business confidence index (BCI). A one standard deviation increase in solar elevation is associated with a 0.037 SD increase in business confidence.

3.3 Robustness

These results are robust to a wide range of robustness checks. To conserve space, robustness checks are shown for the preferred specification: Column (2) of Table A.4. This specification uses the Ipsos data with National CCI as the dependent variable, solar elevation as the key independent variable, and the full set of controls.

Column (1) in Table A.7 shows that the results are robust to adding much more restrictive year-

by-month fixed effects. Columns (2) and (3) illustrate that the results hold separately in the first and second half of the sample time period. Column (4) shows that the results if middle-income countries are excluded (there are now low-income countries in the data set). Column (5) shows that limiting the sample to only middle latitudes does not meaningfully alter the results either.¹

Table A.8 shows that the results are also robust to the exclusion of all world regions except for Europe and Central Asia. High-income and European countries cannot easily be excluded without affecting the results as they make up the bulk of the sample.

These robustness checks also hold for other specifications. Namely, if sunlight duration is considered instead of solar elevation, and if the OECD data set is used instead of the Ipsos one. Results are available upon request.

4 Discussion

This paper established a significant relationship between consumer confidence and seasonality. Solar elevation and sunlight duration were both found to be positively associated with consumer confidence. The quantitative size of the estimate is that a one standard deviation increase in solar elevation or sunlight duration is associated with a 0.02-0.04 SD increase in consumer confidence. This is about a 5% of the effect size of GDP growth on consumer confidence. It is reassuring that the effect is quantitatively small, as factors other than seasonality should clearly explain the vast majority of consumer confidence fluctuations. Nevertheless, there is a small but statistically detectable influence of seasonality on consumer confidence across the world.

There are two reasons in favour of interpreting this association in a causal way. First, the analysis includes for country and year-by-quarter fixed effects which ensure any time-invariant country-specific characteristic as well as common global shocks to confidence are explicitly controlled for. The business cycle itself is also controlled for with the inclusion of GDP growth, inflation and unemployment as controls. These controls leave little room for candidates for omitted variable bias. Second, reverse causality can be ruled out as consumer confidence cannot drive seasonality.

There are two limitations to the paper's analysis. First, since different measures of seasonality are highly correlated with each other, disentangling which dimensions of seasonality matter the most is difficult and lies behind the scope of this paper. Second, given the nature of the analysis, only a cross-country average relationship can be estimated. That is to say, these results do not guarantee that consumer confidence has a seasonal component in all countries considered, or that the size of the seasonal component is the same in all countries.

Overall, it can be concluded that consumer confidence has a seasonal component that spans

¹Middle latitudes are located between the Tropic of Cancer and the Arctic Circle in the Northern Hemisphere, and between the Tropic of Capricorn and the Antarctic Circle in the Southern Hemisphere.

across a wide swath of countries. This seasonal component is small but statistically significant. Whether driven by a form of seasonal affective disorder (SAD) or milder seasonal mood swings, it appears that individuals' perceptions about the economy do respond to seasonal weather fluctuations, which can affect spending and investment decisions down the line.

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A Tables

Table A.1: Descriptive statistics for consumer confidence indices

Country	Ipsos National CCI				OECD CCI				Cor.
	Min.	Med.	Max.	S.D.	Min.	Med.	Max.	S.D.	
ARG	33.1	43.8	52.3	4.9					
AUS	45.1	49.3	56.0	2.7	96.0	100.1	102.4	1.2	0.573
AUT					96.5	99.9	104.9	1.6	
BEL	35.7	43.1	49.9	3.5	96.3	100.3	103.3	1.5	0.481
BRA	35.0	50.5	65.7	9.5	96.5	99.9	104.1	1.8	0.941
CAN	47.9	53.6	56.2	1.5	95.8	100.0	103.8	1.7	0.440
CHE					95.8	100.2	103.4	1.6	
CHL					96.1	100.8	104.5	2.1	
CHN	53.1	63.1	75.6	5.6	95.4	99.7	105.1	2.2	0.829
COL					95.5	100.9	104.0	2.2	
CRI					96.7	100.0	104.4	1.7	
CZE					95.5	100.2	104.1	2.2	
DEU	46.3	54.1	58.1	2.9	95.8	100.2	103.8	1.6	0.787
DNK					95.4	100.4	102.1	1.4	
ESP	20.8	35.2	47.3	7.8	91.7	101.0	104.7	3.1	0.950
EST					87.6	100.4	107.5	3.7	
FIN					94.7	100.4	106.3	2.2	
FRA	32.2	37.5	45.7	3.6	95.0	100.1	106.4	1.8	0.896
GBR	35.5	49.0	55.5	5.6	94.8	100.5	105.2	2.0	0.953
GRC					93.9	100.9	104.3	2.5	
HUN	19.1	33.1	47.0	7.9	96.0	100.3	103.6	2.0	0.945
IDN					97.1	100.3	101.8	1.2	
IND	54.9	64.7	70.7	3.3	86.4	100.6	105.1	4.1	0.825
IRL					94.2	100.3	103.9	2.4	
ISR	45.4	52.7	56.4	2.7	96.4	100.7	102.5	1.8	0.621
ITA	24.4	34.3	45.6	5.9	93.7	100.4	103.5	2.0	0.849
JPN	34.7	41.6	45.2	3.2	95.9	100.1	102.4	1.3	0.626
KOR	36.0	40.4	47.7	2.8	95.8	100.1	102.7	1.2	0.628
LTU					89.1	100.7	106.6	3.8	
LUX					95.5	100.3	103.8	1.8	
LVA					85.3	101.5	108.0	4.6	
MEX	35.9	42.7	58.1	4.2	94.4	99.9	105.3	2.4	0.784
NLD					95.8	100.3	102.3	1.5	
NZL					96.3	100.2	102.4	1.2	
POL	28.0	39.5	53.2	7.8	97.1	100.1	102.8	1.6	0.964
PRT					93.4	100.1	104.1	2.4	
RUS	36.0	40.6	48.1	2.3	89.7	100.6	103.8	2.8	0.446
SAU	52.6	60.4	66.0	3.4					
SVK					95.2	100.1	104.8	2.4	
SVN					93.7	100.9	104.8	2.5	
SWE	55.3	60.4	63.9	2.1	95.5	100.2	102.6	1.5	0.073
TUR	31.7	42.4	50.1	4.1	92.8	100.9	108.8	3.0	0.720
USA	43.0	54.2	63.6	6.2	96.0	100.5	103.0	1.5	0.955
ZAF	37.7	41.9	48.4	2.5	94.9	99.9	104.2	1.7	0.652

Table A.2: Descriptive statistics for solar metrics

Country	Solar elevation (degrees)				Sunlight duration (hours)				Cor.
	Min.	Med.	Max.	S.D.	Min.	Med.	Max.	S.D.	
ARG	30.7	48.4	73.9	15.3	9.9	11.7	14.4	1.6	0.997
AUS	32.6	53.2	72.9	11.1	9.9	12.4	14.4	1.4	0.976
AUT	19.3	41.1	62.0	15.1	8.5	12.3	15.9	2.6	1.000
BEL	15.4	35.7	55.8	14.1	8.0	12.3	16.5	2.9	0.999
BRA	47.4	70.9	87.2	11.9	11.0	12.0	13.3	0.6	0.951
CAN	3.4	28.7	62.3	16.6	5.2	12.3	19.8	4.4	0.839
CHE	19.9	37.5	60.2	14.2	8.6	11.7	15.8	2.5	0.999
CHL	28.8	45.0	58.1	9.8	9.9	11.7	14.4	1.6	0.969
CHN	27.8	54.1	80.8	16.2	9.6	12.2	14.7	1.7	0.961
COL	61.7	73.2	89.5	8.4	11.8	12.1	12.4	0.2	0.550
CRI	56.8	74.5	84.0	9.5	11.6	12.0	12.7	0.4	0.841
CZE	17.3	39.5	60.7	15.5	8.2	12.3	16.3	2.8	1.000
DEU	15.7	37.0	57.8	14.8	8.0	12.3	16.5	3.0	1.000
DNK	11.0	32.8	54.1	15.2	7.1	12.3	17.5	3.6	1.000
ESP	24.0	42.2	57.3	11.1	9.3	12.6	15.0	2.0	0.995
EST	8.4	26.9	51.6	15.3	6.4	11.5	18.2	4.0	0.999
FIN	2.3	21.0	46.2	15.6	4.0	11.4	21.5	5.8	0.997
FRA	17.7	38.0	57.8	13.3	8.4	12.3	16.0	2.5	0.996
GBR	12.1	35.3	57.9	15.3	7.3	12.3	17.3	3.4	0.996
GRC	28.3	48.0	66.2	13.3	9.5	12.2	14.8	1.8	0.999
HUN	19.2	45.6	64.2	15.9	8.5	12.8	15.9	2.6	0.999
IDN	61.7	67.6	78.2	5.1	12.0	12.1	12.3	0.1	0.265
IND	43.0	70.3	87.2	15.9	10.7	12.4	13.6	1.0	0.999
IRL	13.3	34.1	54.7	14.6	7.6	12.3	16.9	3.2	0.999
ISR	34.9	60.6	77.0	15.1	10.1	12.5	14.2	1.4	0.999
ITA	23.2	45.2	65.6	14.5	9.0	12.2	15.4	2.1	0.998
JPN	31.1	58.5	77.4	16.4	9.8	12.6	14.6	1.7	1.000
KOR	28.6	50.7	75.2	16.1	9.6	11.8	14.7	1.7	0.997
LTU	11.5	36.2	53.9	15.0	7.2	13.1	17.3	3.5	1.000
LUX	16.7	37.0	57.0	14.2	8.2	12.3	16.3	2.8	0.999
LVA	10.1	35.0	52.9	15.2	6.9	13.1	17.7	3.7	0.999
MEX	41.4	58.9	66.2	7.4	10.7	12.3	13.6	0.9	0.936
NLD	14.3	34.8	55.1	14.3	7.8	12.3	16.7	3.1	0.999
NZL	25.2	43.9	64.8	13.7	9.2	11.6	15.1	2.0	0.996
POL	14.9	41.5	60.3	16.0	7.8	12.9	16.7	3.0	0.999
PRT	26.8	45.0	58.8	10.9	9.6	12.6	14.8	1.8	0.995
RUS	-4.7	24.0	57.1	18.3	5.5	11.6	19.3	4.2	0.855
SAU	42.1	69.4	86.5	16.0	10.6	12.4	13.6	1.1	0.999
SVK	18.2	44.7	62.9	15.9	8.3	12.8	16.1	2.7	1.000
SVN	20.9	46.0	63.6	15.2	8.7	12.8	15.7	2.4	1.000
SWE	4.7	26.9	52.4	16.1	5.1	11.5	19.8	4.7	0.991
TUR	25.8	49.8	71.6	15.8	9.4	12.2	15.0	1.9	0.998
USA	15.5	29.5	69.0	12.9	9.1	12.2	15.2	2.1	0.763
ZAF	34.1	58.5	85.7	16.5	10.0	11.8	14.3	1.4	0.983

Table A.3: Observations by country for the Ipsos and OECD data sets

Country	Ipsos	OECD
AUT		324
BEL	118	288
BRA	94	
CAN		480
CHL		214
COL		156
CRI		113
CZE		276
DEU	118	336
DNK		288
ESP	118	288
EST		264
FIN		348
FRA	118	444
GBR	118	444
GRC		261
HUN	118	288
IRL		264
ISR		96
ITA	118	444
JPN	118	300
KOR	118	253
LTU		224
LUX		216
LVA		224
MEX		225
NLD		372
POL	118	224
PRT		288
RUS	118	
SVK		249
SVN		286
SWE	118	291
TUR	118	180
USA	118	720

Table A.4: Solar elevation and the Ipsos CCI

	<i>Dependent variable:</i>									
	National		Current		Expectations		Investment		Jobs	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sol. elev.	0.021*** (0.004)	0.014*** (0.004)	0.027*** (0.005)	0.019*** (0.006)	0.019*** (0.004)	0.019*** (0.004)	0.026*** (0.005)	0.019*** (0.006)	0.015*** (0.004)	0.001 (0.006)
GDP growth		1.050*** (0.288)		1.256*** (0.343)		0.775*** (0.201)		1.083*** (0.297)		1.164*** (0.348)
Inflation		0.129 (0.172)		0.061 (0.209)		0.154 (0.151)		-0.070 (0.188)		0.320* (0.151)
Unemployment		-1.571*** (0.212)		-1.587*** (0.229)		-1.135*** (0.165)		-1.425*** (0.198)		-2.064*** (0.277)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year x Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,773	1,746	2,773	1,746	2,773	1,746	2,773	1,746	2,773	1,746
R ²	0.812	0.914	0.849	0.923	0.798	0.867	0.861	0.927	0.769	0.931
Adjusted R ²	0.807	0.912	0.845	0.920	0.793	0.862	0.858	0.924	0.764	0.928

Note:

*p<0.1; **p<0.05; ***p<0.01

Note: This table shows the positive association between different measures of consumer confidence from the Ipsos data set and solar elevation. Robust standard errors are clustered at the country level.

Table A.5: Sunlight duration and the Ipsos CCI

	<i>Dependent variable:</i>									
	National		Current		Expectations		Investment		Jobs	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sunlight dur.	0.143*** (0.030)	0.101*** (0.027)	0.170*** (0.037)	0.119** (0.045)	0.142*** (0.028)	0.139*** (0.024)	0.158*** (0.037)	0.102** (0.045)	0.117*** (0.025)	0.063 (0.041)
GDP growth		1.050*** (0.288)		1.256*** (0.343)		0.775*** (0.202)		1.083*** (0.298)		1.164*** (0.348)
Inflation		0.129 (0.172)		0.061 (0.209)		0.154 (0.151)		-0.070 (0.188)		0.320* (0.151)
Unemployment		-1.572*** (0.213)		-1.588*** (0.230)		-1.136*** (0.165)		-1.427*** (0.198)		-2.063*** (0.276)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year x Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,773	1,746	2,773	1,746	2,773	1,746	2,773	1,746	2,773	1,746
R ²	0.812	0.915	0.849	0.923	0.798	0.867	0.861	0.927	0.769	0.931
Adjusted R ²	0.807	0.912	0.845	0.921	0.793	0.862	0.857	0.924	0.764	0.928

Note:

*p<0.1; **p<0.05; ***p<0.01

Note: This table shows the positive association between different measures of consumer confidence from the Ipsos data set and sunlight duration. Robust standard errors are clustered at the country level.

Table A.6: Solar elevation, sunlight duration, and the OECD CCI and BCI

	<i>Dependent variable:</i>							
	CCI				BCI			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sol. elev.	0.004** (0.002)	0.007* (0.004)			0.003*** (0.001)	0.004*** (0.001)		
Sunlight dur.			0.024** (0.010)	0.024 (0.015)			0.013*** (0.005)	0.013* (0.007)
GDP growth		0.327*** (0.066)		0.327*** (0.066)		0.335*** (0.042)		0.335*** (0.042)
Inflation		-0.156** (0.062)		-0.156** (0.062)		-0.043 (0.041)		-0.043 (0.041)
Unemployment		-0.289*** (0.049)		-0.289*** (0.049)		-0.019 (0.019)		-0.019 (0.019)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year x Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,875	6,113	7,875	6,113	7,799	6,113	7,799	6,113
R ²	0.336	0.658	0.336	0.658	0.532	0.747	0.532	0.747
Adjusted R ²	0.327	0.652	0.327	0.652	0.525	0.743	0.525	0.743

Note:

*p<0.1; **p<0.05; ***p<0.01

Note: This table shows the positive association between different measures of consumer/business confidence from the OECD data set and solar elevation/sunlight duration. “CCI” stands for “consumer confidence index”, “BCI” stands for “business confidence index”. Robust standard errors are clustered at the country level.

Table A.7: Robustness of the relationship between Ipsos CCI and solar elevation

	<i>Dependent variable:</i>				
	National CCI (Ipsos)				
	Year/month FE	2010-2014	2015-2019	High income	Middle latitudes
	(1)	(2)	(3)	(4)	(5)
Sol. elev.	0.016*** (0.005)	0.013** (0.005)	0.024*** (0.007)	0.016*** (0.005)	0.012** (0.006)
GDP growth	1.050*** (0.289)	0.664*** (0.162)	0.740** (0.339)	0.934*** (0.190)	0.842*** (0.215)
Inflation	0.130 (0.173)	0.046 (0.143)	0.125 (0.257)	0.113 (0.256)	0.117 (0.192)
Unemployment	-1.573*** (0.212)	-1.436*** (0.175)	-0.854*** (0.207)	-1.306*** (0.243)	-1.495*** (0.252)
Country FE	Yes	Yes	Yes	Yes	Yes
Year x Quarter FE	No	Yes	Yes	Yes	Yes
Year x Month FE	Yes	No	No	No	No
Observations	1,746	846	900	1,416	1,652
R ²	0.915	0.951	0.914	0.947	0.929
Adjusted R ²	0.908	0.949	0.911	0.945	0.927

Note:

*p<0.1; **p<0.05; ***p<0.01

Note: This table illustrates the robustness of the positive association between the national consumer confidence index from the Ipsos data set and solar elevation. Column (1) uses year-by-month fixed effects instead of year-by-quarter. Columns (2)-(3) restrict the sample to the 2010-2014 and 2015-2019 time periods, respectively. Column (4) includes high-income countries only. Column (5) includes countries at middle latitudes only. Robust standard errors are clustered at the country level.

Table A.8: Robustness to excluding world regions

	<i>Dependent variable:</i>					
	National CCI (Ipsos)					
	No LAC (1)	No MENA (2)	No NAM (3)	No SAS (4)	No SSA (5)	No EAP (6)
Sol. elev.	0.012** (0.006)	0.014*** (0.004)	0.013*** (0.004)	0.014*** (0.004)	0.014*** (0.004)	0.013** (0.005)
GDP growth	0.842*** (0.215)	1.050*** (0.288)	1.074*** (0.298)	1.050*** (0.288)	1.050*** (0.288)	1.087*** (0.323)
Inflation	0.117 (0.192)	0.129 (0.172)	0.131 (0.170)	0.129 (0.172)	0.129 (0.172)	0.130 (0.197)
Unemployment	-1.495*** (0.252)	-1.571*** (0.212)	-1.531*** (0.204)	-1.571*** (0.212)	-1.571*** (0.212)	-1.565*** (0.222)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year x Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,652	1,746	1,628	1,746	1,746	1,510
R ²	0.929	0.914	0.906	0.914	0.914	0.920
Adjusted R ²	0.927	0.912	0.903	0.912	0.912	0.917

Note:

*p<0.1; **p<0.05; ***p<0.01

Note: This table illustrates the robustness of the positive association between the national consumer confidence index from the Ipsos data set and solar elevation. Each column excludes countries from a given world region. “LAC” stands for Latin America and the Caribbean, “MENA” stands for Middle East and North Africa, “NAM” stands for North America, “SAS” stands for South Asia, “SSA” stands for Sub-Saharan Africa, and “EAP” stands for East Asia Pacific. Region definitions follow the World Bank. Robust standard errors are clustered at the country level.

B Data description

B.1 Dependent variables

Ipsos National Index: Reflects attitudes about the current and future economic situation. Available from March 2010 to date.

Ipsos Current Index: Reflects attitudes about the current economic situation. Available from March 2010 to date.

Ipsos Expectations Index: Reflects attitudes about the future economic situation. Available from March 2010 to date.

Ipsos Investment Index: Reflects attitudes about households' current and future financial situation, major purchase comfort, purchase confidence, and investment confidence. Available from March 2010 to date.

Ipsos Jobs Index: Reflects attitudes about households' perceptions regarding job security, and job loss experience and expectation. Available from March 2010 to date.

OECD Consumer Confidence Index: Reflects households' perceptions regarding their expected financial situation, sentiment about the economy, unemployment and capability of savings. Availability varies by country. Observations from January 2004 to December 2019 are considered.

OECD Business Confidence Index: Reflects businesses' perceptions regarding their current and future performance. Also available separately for the following sectors: construction, retail, services. Availability varies by country. Observations from January 2004 to December 2019 are considered.

B.2 Independent variables

Solar elevation: The angle between the sun and a horizontal line on the ground, corrected for atmospheric refraction. This metric is calculated at each country's centre of population at noon on the first day of each month. Source: [National Oceanic and Atmospheric Administration \(2022\)](#).

Sunlight duration: The number of potential sunshine hours at a given time and place, unadjusted for cloud cover. This metric is calculated at each country's centre of population at noon on the first day of each month. Source: [National Oceanic and Atmospheric Administration \(2022\)](#).

GDP growth: Quarterly real GDP's percent change from the same period in the previous year. The data are

obtained from the IMF for the analysis using the Ipsos data set, and from the OECD for the analysis using the OECD data set.

Inflation: The percent change in the Consumer Price Index from the same month in the previous year. The data are obtained from the IMF for the analysis using the Ipsos data set, and from the OECD for the analysis using the OECD data set.

Unemployment: The percent of the labour force classified as unemployed. The data are obtained from the IMF for the analysis using the Ipsos data set, and from the OECD for the analysis using the OECD data set.