Economic sentiment and the recession depth in Croatia: a structural break analysis

Petar Soric and Mirjana CiZmesija
Department of Statistics.University of Zagreb, Croatia

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Abstract

This paper aims to shed some light on the cause-and-effect relationship between economic sentiment and the GDP growth rates in Croatia. The authors focus on the Economic Sentiment Indicator data gathered from Business Surveys and question whether its comovement with GDP is time-stable. Applying the Andrews-Quandt and Bai-Perron structural break tests, it is found that the interdependence between the two observed variables changes substantially in the dawn of the economic crisis in 2008. That way the sample period is split into two subparts. The pre-recession period offers no evidence of Granger causality in any direction, while the recession period strongly confirms economic sentiment as a valuable predictor of actual economic tendencies.

1. Introduction

In the third quarter of 2014 Croatia is recording a negative GDP growth rate for the 12th consecutive quarter. This fact positions Croatia not only among the currently worst economic performers in Europe, but it also gives evidence to one of the longest negative economic streaks in modern Europe. Therefore it is necessary to shed some light on the possible causes of such horrible long-term trends. This paper concentrates on the phenomenon of economic sentiment (reflecting the level of overall uncertainty in the national economy) and its role in determining actual Croatian economic performance. This kind of causal linkage between economic sentiment and agents' actual decision making is well established in many economic fields: stock market bull/bear trends, consumer behavior, investment/saving decision making, etc. The idea of psychological factors ruling the behavior of economic agents is in any case not a new paradigm. It was brought to economists' attention rather early by Keynes (1936) and his "animal spirits" syntagm. A certain revival of his ideas is brought about by the global financial crisis (Akerlof and Shiller, 2009), providing strong motivation for this research. This paper focuses on the issue of causality between Croatian economic sentiment and GDP growth. Its basic premise is that the recent economic crisis has intensified the relationship between the two variables. Namely, it is hypothesized that the longevity and depth of the economic hardship and downfall in Croatia have mainly been caused by historically low levels of economic agents' confidence and an extremely high level of uncertainty in the national economy. Such tendencies have generated an atmosphere of collective risk aversion and nipped every economic initiative in the bud. In order to examine the stated hypothesis, the existence of structural breaks in the relationship between economic sentiment (quantified through Business Surveys) and GDP growth is tested by Andrews-Quandt and Bai-Perron tests. Upon proving the existence of a structural break at the sole beginning of crisis, Granger causality tests are conducted for both pre-crisis and crisis period. The obtained results uniformly demonstrate that the recession was highly magnified through a severe lack of economic confidence by all the agents in the system.

The paper is organized as follows. The following section offers a review of related literature. Section 3 briefly describes the analyzed dataset and introduces the main utilized methodological

concepts. Section 4 presents the obtained empirical results, while the last section deals with the economic interpretations of these conclusions, along with policy implications.

2. Literature review

The empirical literature on the influence of economic sentiment on actual economic behavior is mostly focused on Business and Consumer Survey (BCS) data. In that sense it is crucial to mention the milestone paper of Gayer (2005), who performed one of the first holistic studies of leading properties of BCS composite indicators at the Euro area level. Out of the observed BCS indicators, he found that the Economic Sentiment Indicator (ESI) adds the most to the prediction of Euro area GDP growth. Perhaps the most voluminous and detailed study on the same topic is done by Sorić, Škrabić and Čižmešija (2013). Using panel vector autogressions, they apply a sectoral analysis for 27 EU countries, comparing the predictive characteristics of BCS leading indicators in old and new member states. The analysis is done separately for individual sector of the EU economy: construction sector, manufacturing industry, retail trade, consumer sector and the economy as a whole. It is shown (almost uniformly) that there are no significant differences between the quality of BCS leading indicators of old and new member states. BCS leading indicators serve their primary purpose of preceding actual economic developments by four quarters (one year) ahead.

Van Aarle and Kappler (2012) also provide an influential study on the role of economic sentiment in governing the time dynamics of the Euro area industrial production, retail trade and unemployment. The authors employ vector autogressions to prove that shocks in ESI significantly and positively feed into industrial production and retail trade, while the relationship with respect to unemployment turns out to be negative. The exact same conclusions are also corroborated on USA data, as well as for individual Euro area countries, demonstrating the robustness of the obtained results.

Regarding Croatian studies, it is worthwhile mentioning the paper by Čižmešija and Sorić (2011), focusing on the predictive characteristics of Croatian ESI with respect to individual GDP components (private consumption, investments, government consumption, exports and imports). The authors also utilize vector autoregression models to confirm that ESI serves as a timely and efficient leading indicator of Croatian GDP (for two quarters ahead) and private consumption (for one year ahead). On the other hand, other GDP components do not exhibit a significant feedback as a result of an ESI shock.

However, all the mentioned studies focus mostly on the time period before the recent economic crisis, or at least do not make an effort to examine whether the crisis has had any impact on the magnitude of the relationship between economic sentiment and actual macro tendencies. Namely, it is well established in the theoretical literature that major financial crisis tend to boost the effect of economic agents' psychological sentiment on their actual behavior and decision-making (Kindleberger and Aliber, 2011). In that sense it is more probable to observe evidence of herding behavior in times of crisis, meaning that risk aversion is permanently built deeply in the collective consciousness of the national economy. As a result, people do not make the effort to engage in entrepreneurial activities, invest in risky assets, or make investments of any kind. All of the stated consequentially leads to lowering the overall level of economic activity and decreases GDP.

Despite the well-defined theoretical framework, empirical literature seems to be silent on the topic. To the best of the authors' knowledge, the only study dealing with the impact of crisis on economic sentiment is done by Galati, Poelhekke and Zhou (2011), and is only tangentially related to the topic of this paper. Galati, Poelhekke and Zhou (2011) employ a structural break test to demonstrate that the recent economic crisis has caused a substantial and persistent

downfall of consumers' inflation expectations in the United Kingdom, the USA and Euro area. This paper aims to examine whether the same happened with the economic sentiment/optimism in general and to analyze whether the intensity and the longevity of Croatian crisis was "stirred up" by the drastic downfall of economic confidence.

3. Data and methodology

This section offers a brief description of the analyzed dataset and introduces an overview of the employed econometric techniques.

3.1. Data

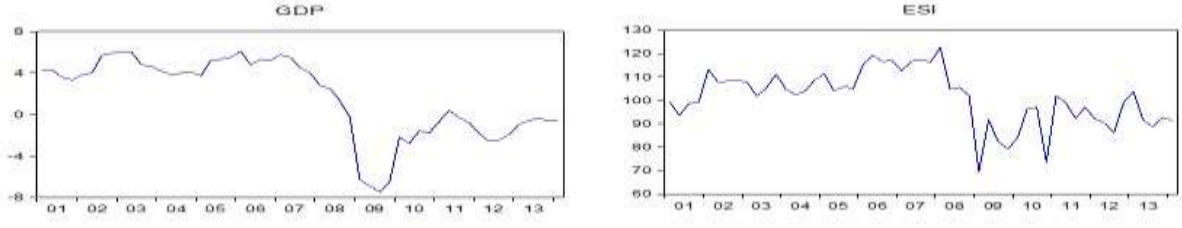
The most direct way to assess economic agents' perceptions of the prevailing economic conditions is to consult the data gathered from BS. BS rely on the concept of regular monthly/quarterly surveys aimed at obtaining managers' attitudes on inflation, unemployment, general economic situation in the country, as well as various other relevant variables form their economic environment. In Croatia the BS are regularly conducted on a quarterly basis since 1995 by *Privredni vjesnik*. They were firstly introduced in the manufacturing industry sector, followed by the retail trade and construction sector in the same year.

Following the practice of developed western countries, Croatia also started to calculate and regularly publish the Economic Sentiment Indicator (ESI) as a standard composite indicator of the prevailing macro and micro conditions in the national economy as a whole. ESI is calculated on the basis of seasonally adjusted response balances[1] on three BS question from the industrial sector (orders, expected production and stock levels of finished goods (with a negative sign)), the construction sector (orders and expected business results), and the retail trade sector (current business position, stocks and expected business position). The final ESI score is obtained by weighting each of the variables from three sectors of the national economy. The industrial sector balances are assigned a weight of 0.4, the construction sector balances are given a weight of 0.25; while the retail trade weigh is 0.35. The stated weights roughly correspond to each sector's share in the Croatian GDP. The detailed methodology of ESI calculation can be found in European Commission (2014).

As far as the other variable of interest is concerned, GDP is expressed in the form of year-on-year growth rates. Such procedure is standard in the practice of BS research since the survey questions are generally aimed at expressing agents' views on the changes of economic variables today in comparison to the same period last year.

ESI data is obtained from *Privredni vjesnik*, while the source of GDP data is Eurostat. The analyzed time period is directly conditioned by GDP data availability, so it comes down to 2001Q1 - 2014Q1.

Both ESI and GDP are graphically depicted in Figure 1.



[1] The balance of responses is defined the difference between positive and negative response shares ($B = P - M$), where B is the balance statistics, P is the weighted share of respondents that replied positively and M is the weighted share of negative answers.

Figure 1. Graphical presentations of the analyzed variables

It is quite evident from Figure 1 that both series of interest exhibit some kind of a structural break, presumably at the beginning of the 2008 crisis. Namely, it seems that both observed series are characterized by a shift in the mean during 2008. These inferences most directly influence the authors' choice of the appropriate methodological framework used in the forthcoming part of the paper.

Also, it is evident that the two observed series share a common time dynamics. Just as the GDP growth rate are still in the negative domain, ESI is also permanently below 100 index points throughout the crisis period (2008 onwards). It would therefore be interesting to explore whether the Croatian inability to tackle the crisis stems exactly from the historically low levels of economic confidence.

3.2. Methodology

Ever since the Perron (1989) influential paper, it is commonly known that conventional (linear) unit root tests (such as the Augmented Dickey-Fuller (ADF) or Kwiatkowski-Phillips-Schmidt-Shin test) are misguiding in case of an $I(0)$ series with a structural break. The common (but wrong) conclusion of standard unit root tests would be that the variable of interest is $I(1)$. In order to circumvent the stated shortcoming, this study employs the Zivot and Andrews (1992) test, which allows the researcher to endogenously determine the potential breakpoint. Zivot and Andrews (1992) start from the basic ADF test equation:

$$\Delta y_t = \mu + \alpha y_{t-1} + \beta t + \sum_{i=1}^{k} \varphi_i \Delta y_{t-i} + v_t, \quad (1)$$

where y_t is the analyzed time series, μ is the constant term, t is the time trend, v_t is the error term, while μ, α, β and φ_i are the model parameters. This equation can then be augmented by the dummy variable $DL_t(TB)$ for the break in the constant term ($DL_t(TB)=1$ if $t > TB$, 0 otherwise):

$$\Delta y_t = \mu + \theta DL_t(TB) \alpha y_{t-1} + \beta t + \sum_{i=1}^{k} \varphi_i \Delta y_{t-i} + v_t, \quad (2)$$

where TB is the breakpoint date. On the other hand, equation (1) can also be specified to include a dummy variable $DT_t(TB)$ for the break in the trend function ($DT_t(TB) = t - TB$ if $t > TB$, 0 otherwise):

$$\Delta y_t = \mu + \gamma DT_t(TB) + \alpha y_{t-1} + \beta t + \sum_{i=1}^{k} \varphi_i \Delta y_{t-i} + v_t, \quad (3)$$

or it can comprise both mentioned dummy variables:

$$\Delta y_t = \mu + \theta DL_t(TB) + \gamma DT_t(TB) + \alpha y_{t-1} + \beta t + \sum_{i=1}^{k} \varphi_i \Delta y_{t-i} + v_t. \quad (4)$$

The estimate of primary interest here is α, enabling to test the null hypothesis of nonstationarity against the alternative of a stationary process with a structural break in the constant term/trend/both.

After establishing the true order of integration of ESI and GDP, it is crucial to determine whether the dynamic relationship between the observed two variables is stable through time, or has the economic crisis had an impact on it.

Several structural break tests with unknown break date are applicable in this case. One of the popular tests was introduced by Quandt (1960) and Andrews (1993). The stated test allows only the possibility of one break in the model. Since there is no *a priori* theoretical justification for more than one break in the model, the Andrews-Quandt test is applied here.

The Andrews-Quandt test relies on the classical Chow (1960) test with a known break date. The Chow test is conducted by comparing the sum of squared residuals obtained by fitting a single equation to the entire sample with the sum of squared residuals obtained when separate equations are estimated separately for pre-break and post-break subsamples of data. The test itself can be performed either through a Wald F statistic or through a likelihood ratio F statistic. Andrews-Quandt test continues on Chow (1960) in the sense that it performs a Chow test for each data point as the potential break, and then summarizes the obtained F statistics in order to locate the "optimal" break date. The first test statistic is $MaxF$, obtained as follows:

$$MaxF = \max_{\tau_1 \le \tau \le \tau_2} (F_\tau), \tag{5}$$

where τ is the potential break point between observations τ_1 and τ_2, and F_τ is the F test statistic obtained by running a Chow test at point τ. The second test statistic is $AveF$, obtained as the simple artithmetic mean of individual Chow F statistics:

$$AveF = \frac{1}{k}\sum_{\tau=\tau_1}^{\tau_2} F_\tau . \tag{6}$$

Finally, it is possible to employ the $ExpF$ statistic, defined as:

$$ExpF = ln\left(\frac{1}{k}\sum_{\tau=\tau_1}^{\tau_2} exp\left(\frac{1}{2}F_\tau\right)\right). \tag{7}$$

Andrews and Ploberger (1994) derive the limiting distributions of these test statistics[2], while Hansen (1997) derives the asymptotic p-values for examining their significance. Extreme data points near sample beginning and sample end are not plausible candidates for a breakpoint. Therefore a trimming area of 15% is usually applied in determining τ_1 and τ_2. The same is also done here.

Additionally, there is the possibility of employing the Bai and Perron (2003) test, allowing for more than one break in the model. The Bai-Perron test will be used here only for the purpose of robustness check; hence its methodological characteristics are left out here for brevity purposes.

4. Empirical results

Considering the graphical presentations of both GDP and ESI, it is evident that the observed time series exhibit a structural break only in the mean, not in their trending properties. Therefore it is plausible to estimate the Zivot-Andrews test in terms of equation (2). The obtained empirical results are given in Table 1.

Variable	Break date	t-statistic
GDP	2008Q3	-5.1454**
ESI	2009Q1	-6.9936***

Note: * (**, ***) denotes the 10% (5%, 1%) statistical significance. The chosen lag length (according to the Bayes information criteria) is given in the parentheses.

Table 1. Zivot-Andrews unit root test results

[2] This is why the Andrews-Quandt test is sometimes reffered to as the Andrews-Ploberger test.

It is quite evident from Table 1 that the null hypothesis of nonstationarity can be firmly rejected for both observed variables. Therefore the empirical analysis further on is continued using the observed series in levels. Instead of modeling the breaks in the mean of both individual variables, the road taken here was to test for potential breaks in the sole relationship between the two variables. To be more specific, the issue of highest interest here is Granger causality. Namely, it is hypothesized that a shift has occurred in the relationship between ESI and GDP in the sense that ESI has much pronounced predictive characteristics in the crisis period than in the pre-crisis era. In order to test the stated hypothesis a simple Granger causality test is conducted on the whole observed time period (2001 Q1- 2014 Q1). The lag length is chosen on the basis of Bayes information criterion (BIC), and the results are given in table 2. The maximal number of potential lags is set according to the formula $T^{1/3}$ (Enders, 2010), which in this case equals approximately 4.

Lag number	1	2	3	4
BIC	239.4050	238.9490	239.3828	225.8329

Table 2. Lag length determination for the Granger causality test

Therefore the optimal lag length is set to 4, obtained by minimizing BIC. It should also be noted that the chosen 4 lags directly correspond to the nature of BCS questions, reflecting the year-on-year changes of economic variables.

Null hypothesis	*F*-test statistic	χ^2-test statistic
ESI does not Granger cause GDP	4.16692 (4,40)***	16.1670 (4)***
GDP does not Granger cause ESI	5.6746 (4,41)***	22.6982 (4)***

Note: * (**,***) denotes the 10% (5%, 1%) statistical significance. Degrees of freedom are given in the parentheses.

Table 3. Granger causality test results (whole sample)

A glance at Table 3 reveals that the causality exists (at any conventional significance level) in both directions: ESI Granger causes GDP and vice versa. However, it is crucial to determine whether this relationship breaks down during the economic crisis, segregating the model into two separate "regimes". With that in mind the Andrews-Quandt test is employed, allowing all parameters of the starting Granger causality equation (comprising four lags of each variable) to vary with time. The obtained results are given in table 4.

Optimal break date	2008 Q4
Likelihood ratio *MaxF*	5.5385***
Wald *MaxF*	22.1540***
Likelihood ratio *ExpF*	1.2330*
Wald *ExpF*	8.3140***
Likelihood ratio *AveF*	1.8258*
Wald *AveF*	7.3034*

Note: * (**,***) denotes the 10% (5%, 1%) statistical significance.

Table 4. Andrews-Quandt structural break test results

In order to test for the potential existence of more than one structural break, the Bai and Perron (2003) test is conducted on the Granger causality equation with four lags of each variable.

Breaks	BIC	Break dates
0	0.72	
1	0.66	2008 Q2
2	0.02	2010 Q3

Table 5. Bai-Perron structural break test results

The Bai-Perron test shows evidence that the relationship of interest is characterized by two distinct breaks; in 2008 Q2 and 2010 Q3. Since the second break (2010 Q3) would leave only 14 observations for the estimation of the Granger causality equation with 9 parameters, the analysis is continued by simply splitting the sample in two parts with 2008 Q2 as the break point. As the last empirical step of this study, the starting Granger causality equation is again re-estimated separately for the pre-crisis and the crisis period. Two different break dates are considered, as shown by the Andrews-Quandt and Bai-Perron test (2008 Q4 and 2008 Q2). The obtained Granger causality results are shown in tables 6 and 7.

Sample partition according to the Andrews-Quandt test results	2001Q1-2008Q3	
Null hypothesis	*F*-test statistic	χ^2 -test statistic
ESI does not Granger cause GDP GDP does not Granger cause ESI	1.1222 (4,18) 0.7337 (4,18)	4.4887 (4) 2.9348 (4)
Sample partition according to Bai-Perron test results	2001Q1-2008Q1	
Null hypothesis	*F*-test statistic	χ^2 -test statistic
ESI does not Granger cause GDP GDP does not Granger cause ESI	0.8943 (4,16) 0.4037 (4,16)	3.5772 (4) 1.6147 (4)

Note: * (**,***) denotes the 10% (5%, 1%) statistical significance. Degrees of freedom are given in the parentheses.

Table 6. Granger causality test results for the pre-crisis period

It is evident from table 6 that, regardless of the chosen break date (2008 Q2 or 2008 Q4), there is no firm evidence of causality between ESI and GDP in either direction.

Sample partition according to the Andrews-Quandt test results	2008Q4-2014Q1	
Null hypothesis	*F*-test statistic	χ^2 -test statistic
ESI does not Granger cause GDP GDP does not Granger cause ESI	2.8934 (4,13)* 6.1903 (4,13)***	11.5737 (4)** 24.7613 (4)***
Sample partition according to the Bai-Perron test results	2008Q2-2014Q1	
Null hypothesis	*F*-test statistic	χ^2 -test statistic
ESI does not Granger cause GDP GDP does not Granger cause ESI	2.4397 (4,15)* 3.8405 (4,15)**	9.7589 (4)** 15.3619 (4)***

Note: * (**,***) denotes the 10% (5%, 1%) statistical significance. Degrees of freedom are given in the parentheses.

Table 7. Granger causality test results for the crisis period

Table 7, on the other hand, reveals quite the opposite results. The existence of causality is proven in both directions. More importantly, the main hypothesis of this paper is proven through the fact that ESI Granger-causes GDP in the crisis period at conventional significance levels.

5. Conclusion

Although the recent crisis has been resolved in the majority of European countries, Croatia is still recording negative GDP growth rates. Relying on a unique dataset gathered from BCS, this paper examines the time dynamics of Croatian ESI. The main contribution of this paper is the application of structural break tests in order to examine the time stability of the relationship between ESI and GDP. Both Andrews-Quandt and Bai-Perron tests clearly point to the existence of a structural break in 2008. In the period after the break (times of economic hardship) ESI considerably gains in significance in terms of its predictive characteristics vis-à-vis GDP. While there is no evidence of Granger causality in the pre-2008 period, ESI does Granger-cause GDP during the crisis. It is therefore evident that the longevity and depth of this crisis is, among other factors, strongly influenced by the lack of economic confidence and an extremely high level of uncertainty in the system. Namely, in order to counteract the recession, Croatian authorities have taken a large number of (often conflicting) initiatives. They introduced multiple reforms of the tax system (e.g. VAT changes), repeatedly changed the legal framework of business conduct (e.g. fiscalization and Pre-Bankruptcy Settlements), introduced the Strategic Investments Act, frequently changed health care and pension contributions, etc. Without passing normative judgments on the mentioned initiatives, most of them were accompanied by a rather weak communication strategy. Perhaps the best example is the Property tax introduction, which was strongly announced and then prolonged several times since 2011.

All of these inferences point to a strong policy implication. The fact that economic sentiment strongly influences GDP movements is today considered to be common knowledge. Therefore, in order to stabilize the economic sentiment (or at least to stop it from drastically and permanently falling) it is crucial to design an appropriate communication strategy. It should be clear what policy goals are planned to be achieved by each economic measure and strict deadlines should be set for achieving them. That should keep the economic agents (domestic and foreign investors, commercial banks, consumers, etc.) well informed, as well as prevent them from behaving herd-like and blowing any negative economic incident out of proportion. That condition being satisfied should be enough to give a chance to the economic policy holders for a proper counter-cyclical reaction.

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