New Industrial Confidence Indicators and Croatian Industrial Production (Les nouveaux indicateurs de confiance industriel et la production industrielle croate)

Cizmesija, Mirjana
Faculty of Economics and Business, Department of Statistics
Kennedy Square 6
Zagreb (10000), Croatia
E-mail: mcizmesija@efzg.hr

Erjavec, Natasa
Faculty of Economics and Business, Department of Statistics
Kennedy Square 6
Zagreb (10000), Croatia
E-mail: nerjavec@efzg.hr

Bahovec, Vlasta
Faculty of Economics and Business, Department of Statistics
Kennedy Square 6
Zagreb (10000), Croatia
E-mail: vbahovec@efzg.hr

1. Introduction

Business survey is, in essence, qualitative survey, designed to deal with managers´ judgments and expectations about production trends in recent past, order books, export order books, stocks of finished products, production expectations for the months or quarters ahead, selling price expectations, liquidity in the last month or quarter and so on. Survey results are available before the same or the similar data from the official statistics is published. Although, using official statistical data various econometric models can be defined and trend forecasting can be performed, such forecasts (based on econometric models) are usually not appropriate in signalling the directions of changes in the economy. The survey results are intended for short-term economic analysis and forecasting especially for predicting and signalling the direction of changes in the economy. On the basis of the Business survey results, expressed as confidence indicators, changes in the referent macroeconomic series can be predicted correctly one or two quarters ahead. Thus, business survey indicators are complement of official statistical results.

2. Business survey composite indicators

Most of the questions in the business survey are of qualitative nature with three replay options: positive (“increase”, “more than sufficient”, etc.), equal (“remain unchanged”, “sufficient”, etc.) and negative (“decrease”, “not sufficient”, etc.) and relative frequencies calculated for each answer options (positive, equal, negative). The common way of presenting business survey data is the balance. If P, E and M denote percentages of respondents’ chosen options: positive, equal and negative (respectively) with the sum equals 100 for each variable, the balance is a difference between P and M. In the Croatian business survey, weighted counting of answers is used. It means that for each firm in the survey weighting coefficient is determined in accordance with its size measured with its turnover. Balance (B) is calculated for all questions (variables).

With the aim to summarise managers´ subjective assessments of the economic variables, various indicators can be calculated with continuous revision of their calculation. Balance series are used to calculate composite indicators. Confidence indicators are produced to reflect overall perceptions and expectations at the individual sector level in a one-dimensional index (European Commission, 2007). Industrial Confidence Indicator (ICI) is a simple average of seasonally adjusted balances of three selected variables[1]: production expectations, order books and stocks of finished products (the last one with inverted sign). Some empirical results (Čiţmešija, Erjavec and Bahovec, 2010; Čiţmešija, 2001; Nikić, Šošić and Čiţmešija, 2002; Gayer, 2005) show that the Industrial Confidence Indicator correctly predicts changes in industrial production with up to two quarters ahead.

In order to define a composite indicator with better leading performances which reduce the risk of false signals in macroeconomic variables trends in manufacturing industry, especially in recession period, two modifications in calculation of a standard composite indicator[2] are proposed in this paper.

3. Methodology and empirical results

The aim of this paper is to suggest two modifications in calculation of the Croatian ICI. In accordance with the specificity of the Croatian economy, two new indicators are proposed. The first one is calculated as a simple arithmetic average of seasonally adjusted weighted relative frequencies of negative answers on three variables (components of ICI). The second one is a simple arithmetic average of seasonally adjusted weighted relative frequencies of positive answers on the same variables. Analysing correlations between Croatian industrial production (expressed as a growth rate compared to the same quarter of the previous year, y-o-y) and ICIs, we proposed two modified indicators with better leading performances.

The empirical analysis was performed using quarterly data covering the period from the first quarter 2005 to the first quarter 2010[3]. In order to analyse the relationship between Croatian industrial production and ICI, several econometric models were estimated.

In the empirical analysis we used abbreviations for variables, such as; RATE – for Croatian industrial production expressed as a growth rate compared to the same quarter of the previous year, M – for Industrial Confidence Indicator calculated on the basis of relative frequencies of negative answers on three variables components of ICI; production expectations, order books and stocks of finished products (the last one with inverted sign), P – for Industrial Confidence Indicator calculated on the basis of relative frequencies of positive answers on three variables components of ICI and B – for a standard ICI indicator calculated on the basis of balances for three variables components of ICI.

The importance of Business survey indicators rises extensively in a time of recession which started in Croatia in the third quarter of 2008. The obtained results suggest that the econometric models with new Composite indicators are more appropriate in explaining and predicting changes in Croatian industrial production with one and two quarters ahead in both periods; before and during recession.

In order to analyse relationships between industrial production and ICIs (both standard and modified) for one quarter lead (for the whole period under the observation), several econometric models were estimated and the most appropriate one was selected as a final model. For one quarter lead it was a model:

---

[1] The selection of variables is conducted with the aim to achieve correlations between a confidence indicator and referent macroeconomic variables as high as possible. In manufacturing industry survey the referent series is year-on-year growth rate of industrial production.

[2] Composite indicators in Croatian Business Survey are calculated in accordance with the Joint Harmonised EU Programme of Business and Consumer Surveys. The User Guide to the harmonised survey programme is available at: http://ec.europa.eu/economy_and_finance/indicators/businessandconsumersurveys_en.htm

[3] Data Sources are Privredni vjesnik and Croatian Bureau of Statistics.

$$RATE_t = \beta_0 + \beta_1 M_{t-1} + u_t \quad (1)$$

The estimation results for model (1) are presented in table 1 with diagnostic statistics in table 2.

Table 1 Estimates of the regression model for M_{t-1}, dependent Variable RATE

Variable	Parameter	Estimate	Std. Error	t-Statistic	p-value
Constant	β_0	6.405562	0.947109	6.763277	0.0000
M_{t-1}	β_1	0.716090	0.091117	7.859012	0.0000

Table 2 Diagnostic statistics – regression for M_{t-1}, dependent Variable RATE

R-squared	0.774334	Mean dependent var	1.373360
Adjusted R-squared	0.761797	S.D. dependent var	6.394623
S.E. of regression	3.120959	Akaike info criterion	5.208797
Sum squared resid	175.3270	Schwarz criterion	5.308371
Log likelihood	-50.08797	Hannan-Quinn criter.	5.228235
F-statistic	61.76406	Durbin-Watson stat	1.303567
Prob(F-statistic)	0.000000		

The results show that changes in ICI calculated on the basis of relative frequencies of negative answers on three variables components of ICI have a significant impact on industrial growth rate (in the whole period under the observation) with the lag of one quarter, (variable M_{t-1}). The direction of changes of modified ICI are (mainly) the same as the direction of changes in industrial growth rate which is in accordance with the primarily tasks of business survey indicators. It means that if ICI rises in the current quarter, industrial grow rate will rise in the next quarter, as well, Figure 1.

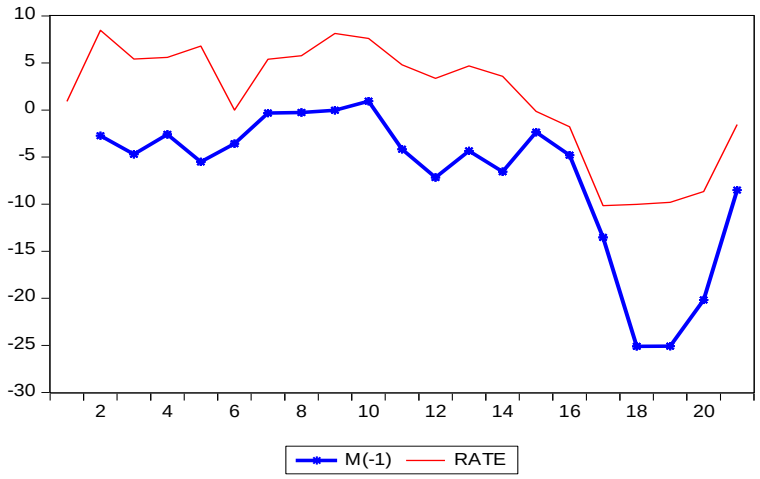

Figure 1 Industrial growth rate and modified ICI with one quarter lead, 2005/I-2010/I

When analysing the relationships between growth rate of industrial production, ICI and modified ICIs for two quarter lead (for the whole period under the observation), the regression model with AR(1) errors showed to be the most adequate. The selected model was:

$$RATE_t = \beta_0 + \beta_1 P_{t-2} + u_t, \tag{2}$$

where u_t is AR(1) process, i.e. the process defined as:

$$u_t = \rho u_{t-1} + \varepsilon_t \tag{3}$$

The results obtained from estimating the model (2) are given in table 3 with diagnostic statistics in table 4.

Table 3 Estimates of the regression model for P_{t-2}, dependent Variable RATE

Variable	Parameter	Estimate	Std. Error	t-Statistic	p-value
Constant	β_0	-9.392655	4.047018	-2.320883	0.0348
P_{t-2}	β_1	0.400002	0.158092	2.530185	0.0231
AR(1)	β_2	0.591583	0.242817	2.436333	0.0278

Table 4 Diagnostic statistics – regression for P_{t-2}, dependent Variable RATE

R-squared	0.792204	Mean dependent var	0.754928
Adjusted R-squared	0.764498	S.D. dependent var	6.432631
S.E. of regression	3.121661	Akaike info criterion	5.265619
Sum squared resid	146.1715	Schwarz criterion	5.414014
Log likelihood	-44.39057	Hannan-Quinn criter.	5.286081
F-statistic	28.59316	Durbin-Watson stat	1.886419
Prob(F-statistic)	0.000008		

On the basis of the results presented in table 3 and in table 4 it can be concluded that modified ICI, which is calculated on the basis of relative frequencies of positive answers on three variables components of ICI, has a significant impact on industrial growth rate (in the whole period under the observation) with the lag of two quarters, (variable P_{t-2}). The obtained results suggest that for forecasting changes in industrial production two quarters ahead, it is more appropriate to apply the modified ICI, calculated on the basis of positive manager's answers, Figure 2.

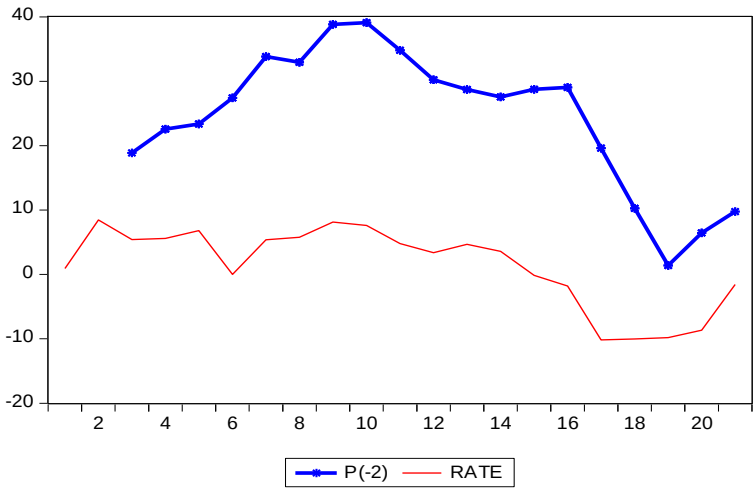

Figure 2 Industrial growth rate and modified ICI with two quarter lead, 2005/I-2010/I

The second part of the analysis investigates the relationship between standard ICI and newly proposed ICIs with industrial growth rate in a recession period in Croatia. In order to achieve that, we performed the same analysis for the recession period in Croatia (2008, third quarter to 2010, first quarter). The most appropriate econometric model for one quarter lead in the recession period was the same as for the whole period, *i.e.* a model (1). The results from estimating the model 1 in a recession period are presented in table 5 with diagnostic statistic in table 6.

Table 5 Estimates of the regression model for M_{t-1}, dependent Variable RATE, recession period

Variable	Parameter	Estimate	Std. Error	t-Statistic	p-value
Constant	β_0	0.169511	1.636368	0.103590	0.9215
M_{t-1}	β_1	0.435261	0.098045	4.439395	0.0068

As it can be seen, in the recession period a modification of ICI (calculated with negative answers) from the previous quarter (variable M_{t-1}) is a significant variable in explaining changes in Croatian industrial production.

Table 6 Diagnostic statistics – regression for M_{t-1}, dependent Variable RATE, recession period

R-squared	0.797638	Mean dependent var	-6.019482
Adjusted R-squared	0.757166	S.D. dependent var	4.600355
S.E. of regression	2.266972	Akaike info criterion	4.709724
Sum squared resid	25.69582	Schwarz criterion	4.694269
Log likelihood	-14.48403	Hannan-Quinn criter.	4.518712
F-statistic	19.70823	Durbin-Watson stat	2.083534
Prob(F-statistic)	0.006769		

Using observations from the recession period and two quarter lag for the ICIs, we were unable to find appropriate models for analysing correlations between ICIs and industrial production (see table 7, table 8 and table 9)[4]. The results suggest that the two quarter lags of ICIs (expressed as M, P or B) are not statistically significant variables for Croatian industrial production.

Table 7 Estimates of the regression model for M_{t-2}, dependent Variable RATE, recession period

Variable	Parameter	Estimate	Std. Error	t-Statistic	p-value
Constant	β_0	-3.609688	3.287169	-1.098115	0.3222
M_{t-2}	β_1	0.172834	0.198441	0.870955	0.4236

Table 8 Estimates of the regression model for P_{t-2}, dependent Variable RATE, recession period

Variable	Parameter	Estimate	Std. Error	t-Statistic	p-value
Constant	β_0	-10.02766	2.642186	-3.795213	0.0127
P_{t-2}	β_1	0.266619	0.145837	1.828199	0.1271

[4] The result is not unexpected because of the limited availability of the data.

Table 9 Estimates of the regression model for B_{t-2}, dependent Variable RATE, recession period

Variable	Parameter	Estimate	Std. Error	t-Statistic	p-value
Constant	β_0	-6.173379	1.600678	-3.856727	0.0119
B_{t-2}	β_1	0.127439	0.087711	1.452945	0.2060

On the basis of the results presented in table 7 to table 9 it can be concluded that in the recession period it is appropriate to predict changes in Croatian industrial growth rate only one quarter ahead.

4. Conclusion

Croatian manager's assessments and expectations in industrial production can be optimistic or pessimistic. Composite indicator, derived from business survey results is calculated on the balances, as the differences between positive and negative manager's answers. In this paper we proposed two modification of a standard Industrial Confidence Indicator. The obtained results suggest that if we are interested in forecasting changes in Croatian industrial production in the next quarter, it is appropriate to employ ICI calculated on the basis of negative manager's answers. However, for two quarter ahead forecasts ICI calculated on the basis of positive manager's answers is better indicator. On the other hand, in the recession period, it is advisable to use a modification of ICI (calculated with negative answers) for obtaining the one quarter ahead forecasts of changes in Croatian industrial production. However, ICI (standard or modified) is not a useful variable in predicting the changes (in the recession period) two quarters ahead.

REFERENCES

Biau, O. and D'Elia, A. (2010). A non-balanced survey-based indicator to track industrial production. https://www.ciret.org/conferences/newyork_2010/papers/

Crosill, L., Malgarini, M. (2010). Behavioural models for manufacturing firms: an analysis based on ISAE survey data.http://ec.europa.eu/economy_finance/db_indicators/surveys/documents/workshops/2010/ec_meeting/

Čitmešija, M., Erjavec, N. and Bahovec, V. (2010). EU Business and Consumer Survey Indicators and Croatian Economy. Zagreb International Review of Economics ¸Business, Vol. XIII, No.2, November 2010, pp. 15-25.

Čitmešija, M., Kurnoga Ţivadinović, N.; Sorić, P. (2010), Business Climate Indicator as a Predictor of Croatian Industrial Production. Croatian Operational Research Review (CRORR), Vol. 1. 2010, Split. pp. 202-209

Čitmešija, M. (2001). Industrial Confidence Indicator (ICI). Croatian Economic Outlook, 8/2001, pp. 8, Ekonomski institut. Zagreb

European Comssion (2007). The Joint Harmonized EU Programme of Business and Consumer Surveys. User Guide.

Gayer, C. (2005). Forecast Evaluation of European Commission Survey Indicators. Journal of Business Cycle Measurement and Analysis. 2. pp. 157-183

Goldrian, G., Lindlbauer, D., Nerb,G. (2001). Evaluation and development of confidence indicators based on harmonised business and consumer surveys, Study of the IFO Institute for Economic Research. http://europa.eu.int

Kl'učik, M. (2010). Composite Indicators for Small Open Economy, The Case of Slovakia. https://www.ciret.org/conferences/newyork_2010/papers/

Nikić, G., Šošić, I., Čitmešija, M. (2002). Business and investment surveys in Croatia – a case study of an economy in transition. http://www.ciret.org/conferences/taipei_2002/c26_papers