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Economic situation, forecasts, business and consumer surveys

Methodological note

Restoration of consistent consumer survey time series for Romania

April 2024

This methodological note accompanies the release of harmonised consumer survey data for the month of April 2024.

1. Background

The Harmonised EU Programme of Business and Consumer Surveys (BCS) covers all EU Member States and Candidate Countries, allowing for meaningful comparisons of business cycle developments across countries and the derivation of consistent European aggregates.

In May 2020, the Romanian provider of consumer survey (CONS) data withdrew from the BCS programme. The BCS programme could thus not track post-pandemic developments of consumer sentiment in Romania, and the Economic Sentiment Indicator (ESI)[1] for Romania could no longer include the consumer perspective. Furthermore, all EU CONS aggregates as well as the EU ESI had to be computed without Romanian CONS data.[2] Harmonised Romanian CONS data has eventually been collected again by a new provider since May 2023 (i.e. after 3 years of missing data). However, it could not be disseminated to the public yet, because with only 10 months of observations (at the time of writing) the data could not be included in the regular seasonal adjustment, aggregation and dissemination processes of BCS data. The minimum length of a survey time series before it is published by DG ECFIN of the European Commission is three years, imposed predominantly[3] by the need for reliable seasonal adjustment. Clearly, for meaningful business cycle analysis and now- and forecasting purposes, even much longer time series are needed to be able to assess the current situation against historical developments, not least in the country surveillance work of DG ECFIN.

To balance user needs and data quality requirements, DG ECFIN undertook to link the new data collected as from May 2023 to the historical data series available up to April 2020, using econometric techniques to estimate the missing data in the three-year break period. This process allowed to address the issues mentioned above: enabling the seasonal adjustment of the new Romanian data points and reinstating the full coverage of the Romanian ESI and EU aggregates. A precedent to this approach was the restoration of results for the Irish business and consumer surveys in 2019 for the period between 2008 and 2015. [4]

2. General approach to the restoration of time series

The Commission strived to generate consistent times series for all 12 monthly[5] and three quarterly survey questions. In line with the UN's 'Modelled data approach' for backcasting,[6] the first step was to extend the historical data series over the period of missing data and into the period covered by the new data, based on available information and using regression-based forecasting techniques. In a second step, if required, the extended historical series were adjusted in level so as to match them to the level of the newly collected CONS data. A level shift can be required to align series collected by

[1] See BCS User guide.

[2] In the BCS data processing, the impact of the absence of certain data on the EU aggregates is mitigated by the application of an automatic level correction mechanism. Being based on the comparison of data levels in the last period of complete data, the mechanism assumes a constant gap between the missing data and the remaining EU aggregate over the entire correction period. While justifiable for short spells of missing data, this assumption becomes more and more disputable as the period of missing data increases.

[3] Clearly, the quality check of the data in terms of ability to track trends, absence of excessive sampling volatility and general plausibility (cross-question and cross-country) also requires a certain number of observations. The quality of the newly collected RO CONS so far data has been assessed as satisfactory along all three criteria.

[4] See methodological note 'Restoration of consistent business and consumer surveys for Ireland' (2019). As in the case of Ireland, Romanian CONS data are reconstructed for TOTAL balances only, i.e. no imputation of results for individual percentages of responses or sociodemographic breakdowns.

[5] See the list of questions in Annex 1, and the BCS User guide for details. The monthly question on consumer uncertainty (question 2.1 of the harmonised questionnaire) was only introduced in May 2021 to the BCS Programme. Historical data from the previous RO CONS provider are therefore not available.

[6] 'Backcasting' refers to the retrospective (back) adjustment of historical data, including the use of econometric techniques to impute missing data and correct for conceptual changes, see UN Handbook on Backcasting.

different providers using different data collection techniques, in particular different survey modes.[7] It must be noted that while previous Romanian CONS data were collected through face-to-face interviews, the newly collected data are based on telephone interviews – this change in survey mode alone may entail a level shift in the observed variables, which may have needed correction even in the absence of missing data. Finally, seasonal adjustment is performed on the complete restored time series.

3. Caveats and aim of the methodological note

Obviously, it is impossible to generate 'true' data for the missing periods; all estimated data rest on the observed co-movement with other data in previous periods. With this limitation in mind, the aim of the present note is to describe the employed techniques in detail and series by series, in full transparency. It must be emphasised that the analytical interest in Romanian CONS data going forward will not be in the month-on-month developments during the past period 2020:5-2023:4, but in the new data points that will accumulate. The presented methodology ensures their correct assessment, based on properly seasonally adjusted series and against a consistent historical benchmark.

4. Backcasting of Romanian CONS data: methodological details

Each individual Romanian consumer surveys series (assessments of households' financial situation, the general economic situation, unemployment, prices, savings and spending intentions, see full list in Annex 1) has been regressed on a combination of (i) relevant hard statistical data and (ii) corresponding consumer survey series from peer countries.

(i) In terms of hard data, growth rates of GDP, compensation of employees and private consumption, unemployment and inflation rates are used as a standard set of regressors. The selection for the individual series is based on standard economic relationships.

(ii) The exceptional nature of the period of missing data, however, required to go beyond the historical relationships between economic variables and sentiment data. Between 2020:5 and 2023:4, two major global shocks (COVID-19 and Russia's war on Ukraine with the ensuing energy crisis and a rapid rise in inflation) arguably dominated consumers' perceptions and expectations in a very similar way across countries, especially across economically or regionally 'close' countries. The consumer survey series of the ten central and eastern European countries (CEEs), all geographically close to the conflict in Ukraine, have therefore also been used as regressors to inform the estimates of the CONS series for Romania.[8]

The work focusses on restoring non-seasonally adjusted (NSA) data, such that seasonal adjustment can be consistently applied to the reconstructed series subsequently (see section 5). For each total balance series (NSA) of the monthly questions Q1-12 and, analogously, quarterly questions Q13-15, the following procedure is applied:

1) Run an OLS regression of each series on the set of regressors mentioned above and detailed in Table 1 over the period 2005:5 to 2020:4.[9] General-to-specific model selection with a 5% level for the significance of individual regressors results in the final specifications reported in

[7] For mode effects in sampling (social desirability and non-response bias) see e.g. Rybak A (2023), Survey mode and nonresponse bias: A meta-analysis based on the data from the international social survey programme waves 1996–2018 and the European social survey rounds 1 to 9.

[8] Correlation analysis of CONS data over the sample to 2020:4 points to the highest level of RO data similarity (69-79%) with SK, PL, LT and BG.

[9] Quarterly data (GDP, compensation, consumption) was linearly interpolated to monthly frequency. The start of the common sample was determined by the availability of CONS data for Croatia as from May 2005.

Annex 2.[10] All regressors have the expected sign, and the explanatory power of the regressions, as measured by R^2, is high, between 65% and 89%, with an average of 81% (median: 83.5%).

2) Use the regression to generate static forecasts (and 95% confidence intervals based on 2 standard forecast errors (S.E.)) for the period 2020:5-2023:12.[11] Note that this period includes 8 months (2 quarters) of data overlapping with data collected by the new partner (from May 2023).

3) Compare the level of the generated forecasts to the newly collected CONS data in the overlapping period 2023:5-2023:12. Graphs for all questions with historic, forecast (+/- 2 S.E.) and newly collected data are shown in Annex 3.

   a) An average difference exceeding one standard forecast error[12] is considered as a significant level difference, warranting a level shift of the historical data to achieve consistency with the new data. The level shift equals the mean difference between the series in the overlapping period. This applies to questions Q2, Q3, Q7, Q10, Q11, Q12 (upwards shift) and Q5, Q6, Q9 (downward shift).

   b) Acknowledging the uncertainty around the estimations and projections, an average difference smaller than one standard error leads to no level correction. The new data points are regarded as a statistically sufficiently consistent continuation of previously collected data. This applies to questions Q1, Q4, Q8.

Table 1: List of regressors (for monthly questions)

Concept	Question #	Time horizon	Regressors (hard statistical data)			CONS survey data
Financial situation	Q1	past	Compensation of employees	Unemployment	Inflation	Corresponding question for BG, CZ, EE, HR, HU, LT, LV, PL, SI, SK
	Q2	future				
General economic situation	Q3	past	GDP	Inflation		
	Q4	future				
Prices/inflation	Q5	past	Inflation			
	Q6	future				
Unemployment	Q7	future	Unemployment			
Spending	Q8	currrent	Compensation of employees	Unemployment	Consumption	
	Q9	future			Inflation	
Saving	Q10	currrent	Unemployment	Inflation	Consumption	
	Q11	future				
Saving vs. dissaving	Q12	current	Unemployment	Inflation	Consumption	

Data sources: ESTAT, European Commission

Graph 1 presents the outcome of the procedure for the Consumer Confidence Indicator (NSA) for Romania, which is calculated as a simple average of the questions Q1, Q2, Q4 and Q9. The combined series appears visually seamless over time, both in terms of levels and typical volatility. The upward shift of historical observations for Q2 is almost fully compensated by the downward shift for Q9 (Q1 and Q4 remain unshifted). As a result, the historical values of the Romanian Confidence Indicator remain practically unaffected by the backcasting exercise.

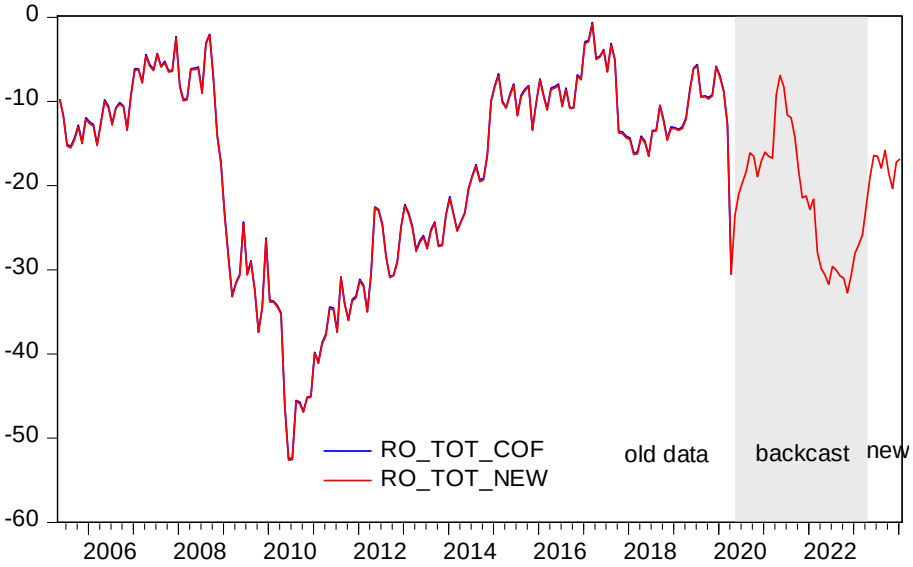
[10] Only positive regression coefficients are admissible for CONS survey results in peer countries. As explained above, the rationale for including results from the peer countries is the assumption that major economic trends and shocks have a similar impact on Romanian consumers as in its peer countries. A negative regression coefficient would contradict this essential assumption.

[11] To produce the forecast over the full forecast sample, the monthly regressors GDP, compensation of employees and consumption had to be projected over the period 2023:9-12 using seasonal ARMA models.

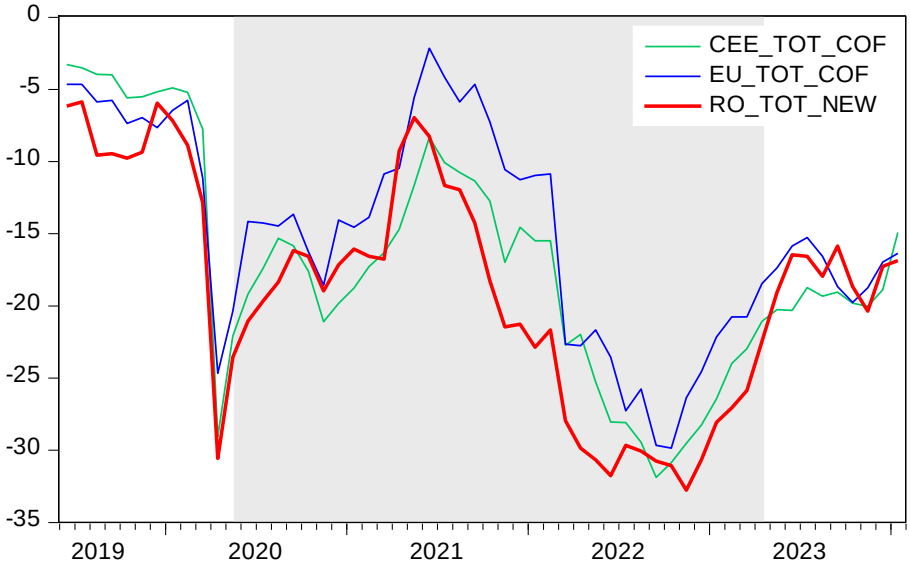
[12] Standard forecast errors correspond approximately to the standard error of the underlying regression.

Graph 2 compares the development of consumer confidence in Romania to the EU and the aggregate[13] of CEE peer countries, focussing on the period of missing observations. The evolution of the series before, during (May 2020-April 2023) and after that period is consistent, displaying shared trends driven by the COVID-19 and Ukraine shocks, and comparable swings.

Graph 1: Romanian confidence Indicator (NSA) before and after the restoration



Graph 2: Consumer confidence in Romania vs. EU and CEE aggregate



5. Seasonal adjustment

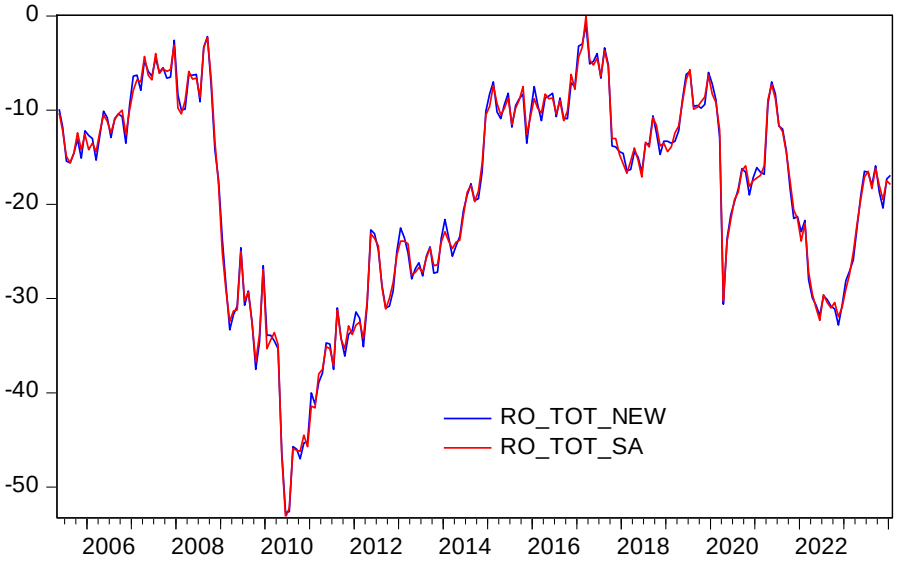
A potential weakness of the presented estimations concerns seasonal adjustment. All calculations are based on seasonally unadjusted data. The assumption is that the survey responses collected by the previous and new data providers display (despite possible level differences) a shared seasonal component, governed by Romanian consumers' exposure to seasonal effects.[14] Moreover, it is assumed that the seasonality incorporated in the regressors (hard data on GDP, unemployment,

[13] Computed as the simple average of country results.

[14] In fact, 7 of the historic Romanian series have no significant seasonal component according to the standard BCS seasonal adjustment routine (TramoSeats in JDemetra), i.e. the NSA and SA series are identical.

inflation etc. as well as consumers' assessments in regionally close peer countries) approximates the seasonality in the Romanian survey data over the estimation period. Graph 3 displays the reconstructed confidence indicator in both unadjusted and seasonally adjusted form. It illustrates that the seasonal component in the original series is small and has an insignificant bearing on both the trend and typical month-on-month changes. Inaccuracies in the seasonally adjusted results due to the blending of potentially diverging seasonal components over the combined sample can therefore be considered as negligible. To the extent they are present, their importance will decline over time, the more data points collected by the new data provider will be added to the series.

Graph 3: Seasonally adjusted (SA) vs. NSA Confidence Indicator



6. Quarterly questions

The three quarterly harmonised questions (intentions to buy a car (Q13), buy or build a house (Q14), spend on renovations (Q15)) were treated analogously. As additional regressors, new car registrations (Q13), building permits and real long-term interest rates (Q14) were added to the equations. The forecasts generated by the equations for the overlapping period 2023Q3 to 2023Q4 were not significantly different from the new data collected by the new Romanian provider (the average difference being smaller than the standard forecast errors). Thus, no level correction had to be applied to generate consistent backcast series. Annex 4 shows the detailed regression outcomes and the graphs of the historic, forecast (+/- 2 S.E.) and newly collected series.

Annex 1: Consumer survey - Questionnaire

Monthly questions

Q1 How has the financial situation of your household changed over the last 12 months?

Q2 How do you expect the financial position of your household to change over the next 12 months?

Q3 How do you think the general economic situation in the country has changed over the past 12 months?

Q4 How do you expect the general economic situation in this country to develop over the next 12 months?

Q5 How do you think that consumer prices have developed over the last 12 months?

Q6 By comparison with the past 12 months, how do you expect that consumer prices will develop in the next 12 months?

Q7 How do you expect the number of people unemployed in this country to change over the next 12 months?

Q8 In view of the general economic situation, do you think that now it is the right moment for people to make major purchases such as furniture, electrical/electronic devices, etc.?

Q9 Compared to the past 12 months, do you expect to spend more or less money on major purchases (furniture, electrical/electronic devices, etc.) over the next 12 months?

Q10 In view of the general economic situation, do you think that now is...?

Q11 Over the next 12 months, how likely is it that you save any money?

Q12 Which of these statements best describes the current financial situation of your household?

Quarterly questions (January, April, July and October)

Q13 How likely are you to buy a car over the next 12 months?

Q14 Are you planning to buy or build a home over the next 12 months (to live in yourself, for a member of your family, as a holiday home, to let etc.)?

Q15 How likely are you to spend any large sums of money on home improvements or renovations over the next 12 months?

Annex 2: monthly regression results over 2005-2020

Dependent Variable: RO_TOT_1
Method: Least Squares
Date: 02/20/24 Time: 17:43
Sample: 2005M05 2020M04
Included observations: 180

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	45.09024	2.613217	17.25469	0.0000
BG_TOT_1	0.223489	0.079004	2.828830	0.0052
LT_TOT_1	0.229631	0.039588	5.800457	0.0000
RO_INC	14.76817	4.223058	3.497033	0.0006
RO_HICP	-2.065341	0.161586	-12.78169	0.0000
RO_UNEMP	-6.293615	0.484621	-12.98669	0.0000

R-squared	0.894564	Mean dependent var	-17.31833
Adjusted R-squared	0.891534	S.D. dependent var	15.97931
S.E. of regression	5.262649	Akaike info criterion	6.191911
Sum squared resid	4819.012	Schwarz criterion	6.298343
Log likelihood	-551.2720	Hannan-Quinn criter.	6.235065
F-statistic	295.2580	Durbin-Watson stat	0.498800
Prob(F-statistic)	0.000000		

Dependent Variable: RO_TOT_2
Method: Least Squares
Date: 02/20/24 Time: 17:44
Sample: 2005M05 2020M04
Included observations: 180

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	22.35034	4.073195	5.487177	0.0000
LT_TOT_2	0.161500	0.060931	2.650536	0.0088
PL_TOT_2	0.249461	0.105669	2.360769	0.0193
RO_INC	25.20974	4.958990	5.083644	0.0000
RO_HICP	-1.295195	0.182198	-7.108726	0.0000
RO_UNEMP	-3.273760	0.539577	-6.067267	0.0000

R-squared	0.711761	Mean dependent var	-5.848333
Adjusted R-squared	0.703478	S.D. dependent var	11.86006
S.E. of regression	6.458259	Akaike info criterion	6.601362
Sum squared resid	7257.384	Schwarz criterion	6.707794
Log likelihood	-588.1225	Hannan-Quinn criter.	6.644515
F-statistic	85.93301	Durbin-Watson stat	0.377526
Prob(F-statistic)	0.000000		

Dependent Variable: RO_TOT_3
Method: Least Squares
Date: 02/20/24 Time: 17:45
Sample: 2005M05 2020M04
Included observations: 180

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.240677	3.581796	-0.904763	0.3668
BG_TOT_3	0.354661	0.095081	3.730116	0.0003
SK_TOT_3	0.550752	0.070130	7.853344	0.0000
RO_Y	77.41226	22.84209	3.389019	0.0009
RO_HICP	-1.193508	0.242973	-4.912094	0.0000

R-squared	0.744898	Mean dependent var	-31.57778
Adjusted R-squared	0.739067	S.D. dependent var	18.82219
S.E. of regression	9.614683	Akaike info criterion	7.391845
Sum squared resid	16177.37	Schwarz criterion	7.480538
Log likelihood	-660.2660	Hannan-Quinn criter.	7.427806
F-statistic	127.7497	Durbin-Watson stat	0.243333
Prob(F-statistic)	0.000000		

Dependent Variable: RO_TOT_4
Method: Least Squares
Date: 02/20/24 Time: 17:48
Sample: 2005M05 2020M04
Included observations: 180

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-16.66069	1.988085	-8.380272	0.0000
CZ_TOT_4	0.373209	0.083694	4.459228	0.0000
LV_TOT_4	0.356130	0.070033	5.085147	0.0000
HU_TOT_4	0.430968	0.055448	7.772486	0.0000
SK_TOT_4	0.263189	0.087489	3.008254	0.0030
RO_Y	99.97982	21.40102	4.671732	0.0000
RO_HICP	-0.681735	0.246303	-2.767866	0.0063

R-squared	0.651045	Mean dependent var	-18.49833
Adjusted R-squared	0.638943	S.D. dependent var	15.23896
S.E. of regression	9.156794	Akaike info criterion	7.304982
Sum squared resid	14505.51	Schwarz criterion	7.429152
Log likelihood	-650.4484	Hannan-Quinn criter.	7.355328
F-statistic	53.79433	Durbin-Watson stat	0.401763
Prob(F-statistic)	0.000000		

Dependent Variable: RO_TOT_5
Method: Least Squares
Date: 02/20/24 Time: 17:51
Sample: 2005M05 2020M04
Included observations: 180

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-8.809691	1.697566	-5.189601	0.0000
EE_TOT_5	0.160081	0.027218	5.881490	0.0000
HR_TOT_5	0.325129	0.064315	5.055228	0.0000
HU_TOT_5	0.359712	0.058856	6.111754	0.0000
RO_HICP	4.109518	0.282464	14.54881	0.0000

R-squared	0.893290	Mean dependent var	38.42500
Adjusted R-squared	0.890851	S.D. dependent var	26.36599
S.E. of regression	8.710731	Akaike info criterion	7.194373
Sum squared resid	13278.44	Schwarz criterion	7.283066
Log likelihood	-642.4936	Hannan-Quinn criter.	7.230334
F-statistic	366.2387	Durbin-Watson stat	0.456119
Prob(F-statistic)	0.000000		

Dependent Variable: RO_TOT_6
Method: Least Squares
Date: 02/20/24 Time: 17:55
Sample: 2005M05 2020M04
Included observations: 180

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.756164	2.164122	-0.811490	0.4182
LT_TOT_6	0.144518	0.055663	2.596326	0.0102
HR_TOT_6	0.368771	0.095201	3.873590	0.0002
HU_TOT_6	0.207230	0.058793	3.524716	0.0005
SK_TOT_6	0.119687	0.054959	2.177752	0.0308
RO_HICP	2.530705	0.336779	7.514434	0.0000

R-squared	0.813302	Mean dependent var	34.81778
Adjusted R-squared	0.807938	S.D. dependent var	18.83233
S.E. of regression	8.253253	Akaike info criterion	7.091857
Sum squared resid	11852.22	Schwarz criterion	7.198289
Log likelihood	-632.2671	Hannan-Quinn criter.	7.135011
F-statistic	151.5978	Durbin-Watson stat	0.603142
Prob(F-statistic)	0.000000		

Dependent Variable: RO_TOT_7
Method: Least Squares
Date: 02/20/24 Time: 17:56
Sample: 2005M05 2020M04
Included observations: 180

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.038397	3.353753	-1.204143	0.2302
LT_TOT_7	0.252460	0.026914	9.380110	0.0000
SI_TOT_7	0.447663	0.043740	10.23464	0.0000
RO_UNEMP	3.487853	0.525447	6.637873	0.0000

R-squared	0.842330	Mean dependent var	34.76889
Adjusted R-squared	0.839643	S.D. dependent var	19.03811
S.E. of regression	7.623745	Akaike info criterion	6.922384
Sum squared resid	10229.38	Schwarz criterion	6.993339
Log likelihood	-619.0146	Hannan-Quinn criter.	6.951153
F-statistic	313.4189	Durbin-Watson stat	0.423381
Prob(F-statistic)	0.000000		

Dependent Variable: RO_TOT_8
Method: Least Squares
Date: 02/20/24 Time: 17:57
Sample: 2005M05 2020M04
Included observations: 180

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-26.36926	2.852965	-9.242757	0.0000
BG_TOT_8	0.177029	0.073094	2.421923	0.0165
CZ_TOT_8	0.126084	0.059500	2.119040	0.0355
EE_TOT_8	0.161665	0.041264	3.917774	0.0001
LT_TOT_8	0.209172	0.039170	5.340164	0.0000
RO_C	20.20984	9.132143	2.213045	0.0282
RO_INC	14.69810	4.053762	3.625793	0.0004
RO_UNEMP	-1.960059	0.390636	-5.017606	0.0000

R-squared	0.859356	Mean dependent var	-38.82611
Adjusted R-squared	0.853632	S.D. dependent var	11.99498
S.E. of regression	4.589055	Akaike info criterion	5.928652
Sum squared resid	3622.221	Schwarz criterion	6.070561
Log likelihood	-525.5787	Hannan-Quinn criter.	5.986190
F-statistic	150.1345	Durbin-Watson stat	0.950317
Prob(F-statistic)	0.000000		

Dependent Variable: RO_TOT_9
Method: Least Squares
Date: 02/20/24 Time: 17:59
Sample: 2005M05 2020M04
Included observations: 180

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.206763	2.050791	1.076054	0.2834
LV_TOT_9	0.095805	0.028365	3.377650	0.0009
SI_TOT_9	0.136078	0.057162	2.380567	0.0184
RO_INC	9.090809	3.287364	2.765379	0.0063
RO_UNEMP	-3.396307	0.304214	-11.16419	0.0000
RO_HICP	-0.842102	0.104564	-8.053472	0.0000

R-squared	0.789819	Mean dependent var	-30.62722
Adjusted R-squared	0.783779	S.D. dependent var	8.115877
S.E. of regression	3.773849	Akaike info criterion	5.526833
Sum squared resid	2478.096	Schwarz criterion	5.633265
Log likelihood	-491.4150	Hannan-Quinn criter.	5.569986
F-statistic	130.7713	Durbin-Watson stat	1.181125
Prob(F-statistic)	0.000000		

Dependent Variable: RO_TOT_10
Method: Least Squares
Date: 02/20/24 Time: 18:02
Sample: 2005M05 2020M04
Included observations: 180

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.332087	1.906995	1.222912	0.2230
LV_TOT_10	0.157717	0.037286	4.229863	0.0000
LT_TOT_10	0.170232	0.032109	5.301766	0.0000
RO_UNEMP	-4.282178	0.293437	-14.59315	0.0000
RO_HICP	-0.479235	0.144882	-3.307767	0.0011
RO_C	-16.68002	5.984693	-2.787113	0.0059

R-squared	0.864616	Mean dependent var	-42.81444
Adjusted R-squared	0.860726	S.D. dependent var	9.205476
S.E. of regression	3.435437	Akaike info criterion	5.338931
Sum squared resid	2053.588	Schwarz criterion	5.445363
Log likelihood	-474.5038	Hannan-Quinn criter.	5.382084
F-statistic	222.2464	Durbin-Watson stat	1.528025
Prob(F-statistic)	0.000000		

Dependent Variable: RO TOT 11
Method: Least Squares
Date: 02/20/24 Time: 18:11
Sample: 2005M05 2020M04
Included observations: 180

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.077190	2.268056	-2.238565	0.0265
EE_TOT_11	0.139812	0.057368	2.437107	0.0158
LV_TOT_11	0.170168	0.038383	4.433466	0.0000
RO_C	-19.52067	5.677520	-3.438238	0.0007
RO_UNEMP	-4.399398	0.314487	-13.98910	0.0000
RO_HICP	-0.755750	0.151087	-5.002069	0.0000

R-squared	0.826802	Mean dependent var	-50.99278
Adjusted R-squared	0.821825	S.D. dependent var	9.017531
S.E. of regression	3.806368	Akaike info criterion	5.543993
Sum squared resid	2520.988	Schwarz criterion	5.650425
Log likelihood	-492.9594	Hannan-Quinn criter.	5.587146
F-statistic	166.1263	Durbin-Watson stat	1.097755
Prob(F-statistic)	0.000000		

Dependent Variable: RO_TOT_12
Method: Least Squares
Date: 02/20/24 Time: 18:16
Sample: 2005M05 2020M04
Included observations: 180

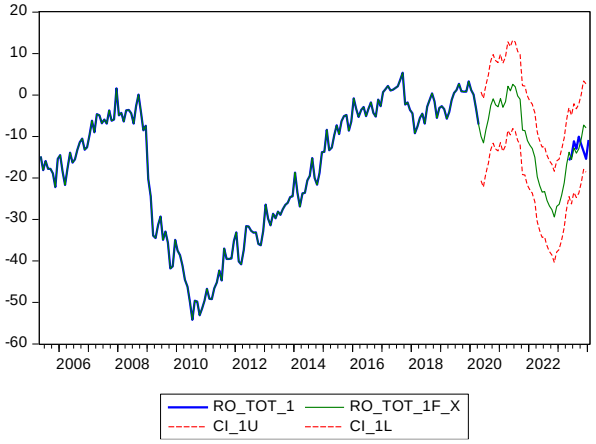
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	21.04614	3.852929	5.462373	0.0000
LV_TOT_12	0.127741	0.051733	2.469251	0.0145
SK TOT 12	0.197203	0.094632	2.083886	0.0386
HR TOT 12	0.159892	0.059325	2.695194	0.0077
RO_C	-21.58140	4.621661	-4.669621	0.0000
RO_UNEMP	-3.652348	0.410417	-8.899115	0.0000
RO_HICP	-0.602065	0.119024	-5.058362	0.0000

R-squared	0.865995	Mean dependent var	-9.531111
Adjusted R-squared	0.861348	S.D. dependent var	7.846006
S.E. of regression	2.921542	Akaike info criterion	5.020213
Sum squared resid	1476.626	Schwarz criterion	5.144383
Log likelihood	-444.8191	Hannan-Quinn criter.	5.070559
F-statistic	186.3332	Durbin-Watson stat	1.316252
Prob(F-statistic)	0.000000		

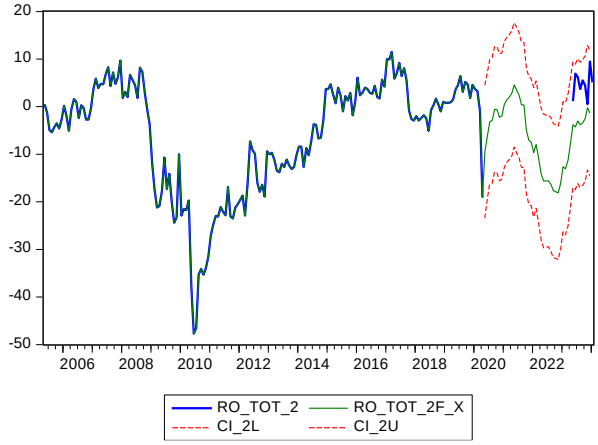
Note: RO_Y: annual growth of real GDP, RO_C: annual growth of real household consumption, RO_INC: annual growth of compensation of employees, RO_UNEMP: unemployment rate, RO_HICP: annual HICP inflation rate (Source: ESTAT, European Commission)

Annex 3: historic, forecast (incl. +/- 2 S.E. confidence interval (CI), 95%) and newly collected data (monthly)

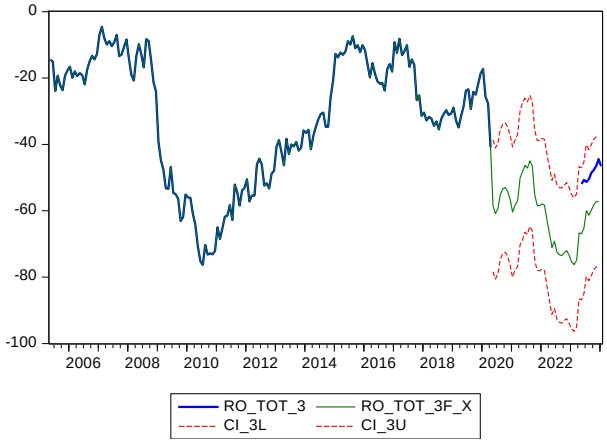
Q1: mean difference: -1.33< S.E. (5.3): NO shift



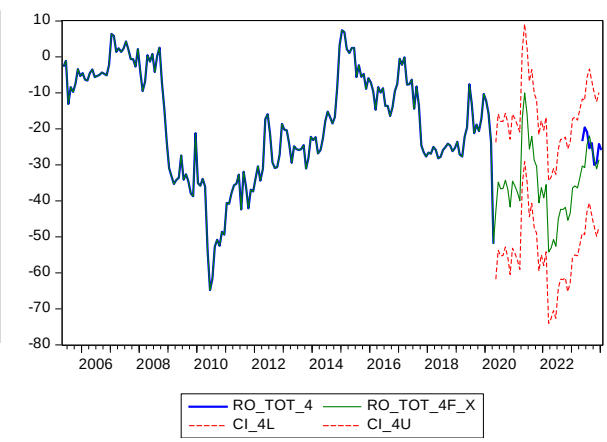
Q2: mean difference: 7.5> S.E. (6.5): upwards shift



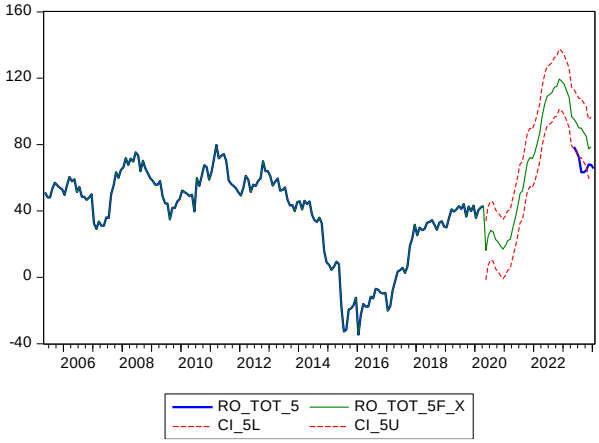
Q3: mean difference: 11.8> S.E. (9.6): upwards shift



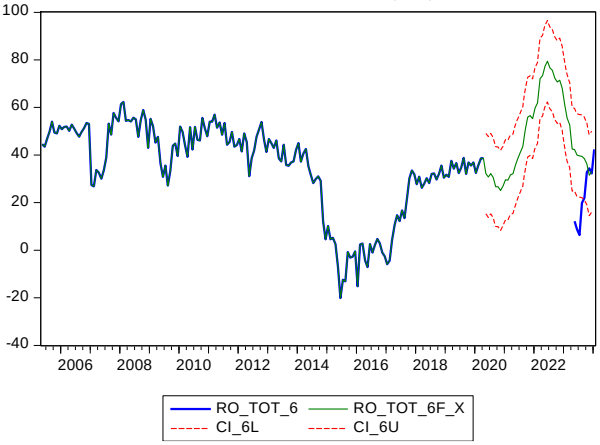
Q4: mean difference: 3.0< S.E. (9.2): NO shift



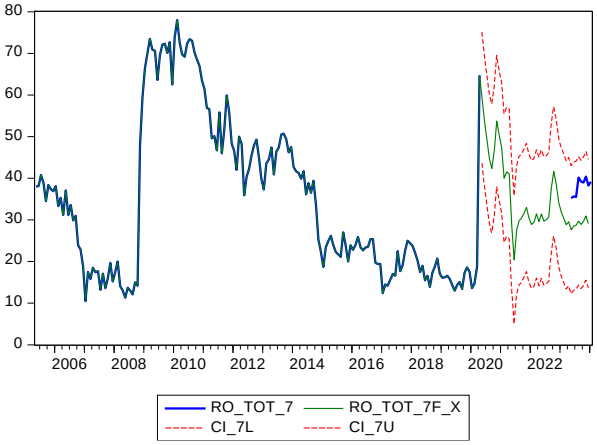
Q5: mean difference: -17.9 > S.E. (8.7): downwards shift



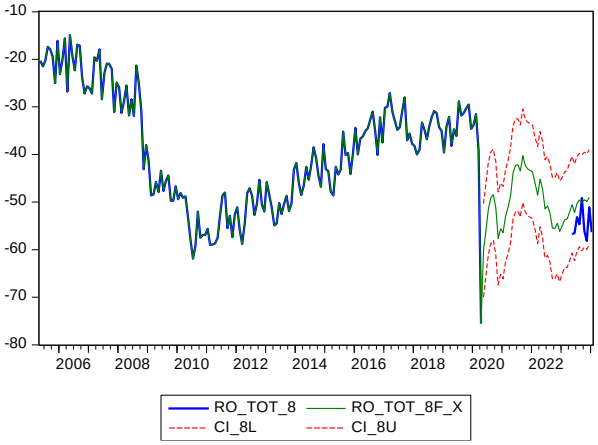
Q6: mean difference: -16.5> S.E. (6.5): downwards shift



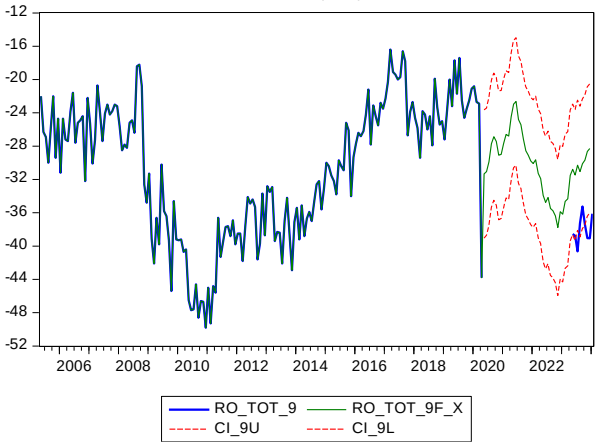
Q7: mean difference: 8.8 > S.E. (7.6): upwards shift



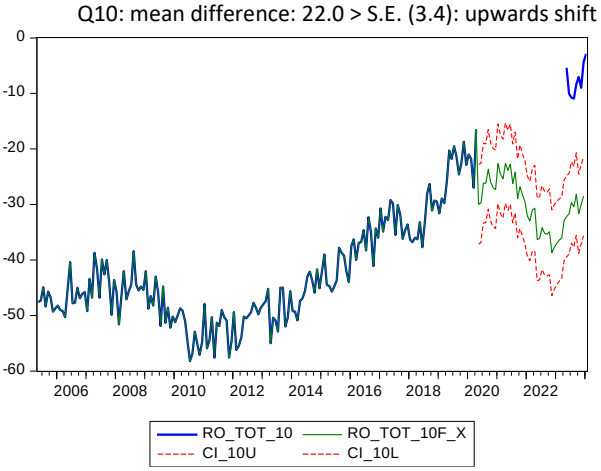
Q8: mean difference: -4.3 < S.E. (4.6): NO shift



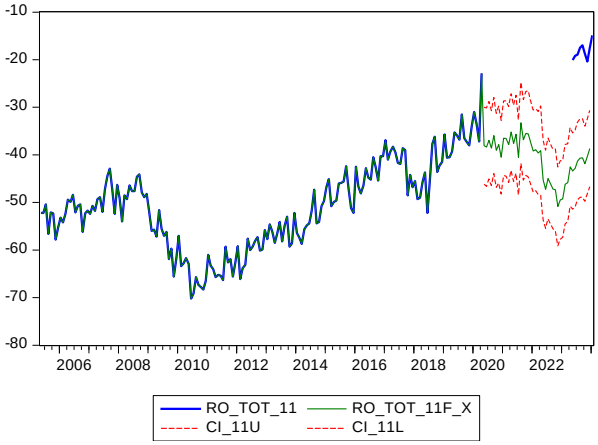
Q9: mean difference: -8.2 > S.E. (3.8): downwards shift



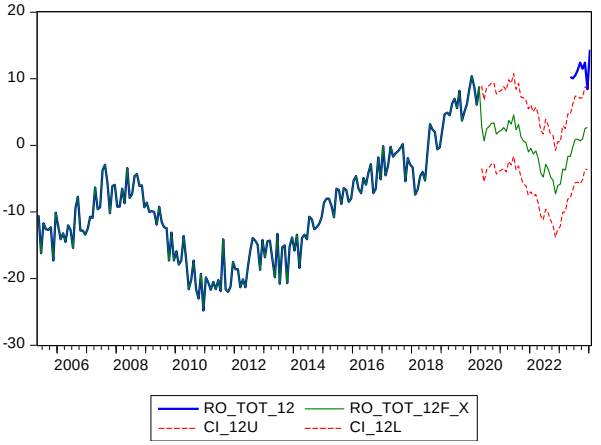
Q10: mean difference: 22.0 > S.E. (3.4): upwards shift



Q11: mean difference: 22.6 > S.E. (3.8): upwards shift



Q12: mean difference: 10.0 > S.E. (2.9): upwards shift



Annex 4: Quarterly results

A: quarterly regression results over 2005-2020

Dependent Variable: RO_TOT_13
Method: Least Squares
Date: 03/20/24 Time: 12:20
Sample: 2005Q3 2020Q2
Included observations: 59

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LV_TOT_13	0.205607	0.072984	2.817147	0.0067
BG_TOT_13	0.177150	0.085323	2.076228	0.0426
RO_CARS	3.27E-05	3.44E-06	9.500395	0.0000
C	-55.86109	6.954544	-8.032315	0.0000

R-squared	0.762558	Mean dependent var	-75.13559
Adjusted R-squared	0.749607	S.D. dependent var	6.401071
S.E. of regression	3.203052	Akaike info criterion	5.231474
Sum squared resid	564.2748	Schwarz criterion	5.372324
Log likelihood	-150.3285	Hannan-Quinn criter.	5.286456
F-statistic	58.87853	Durbin-Watson stat	1.263238
Prob(F-statistic)	0.000000		

Dependent Variable: RO_TOT_14
Method: Least Squares
Date: 03/20/24 Time: 18:37
Sample: 2005Q3 2020Q2
Included observations: 59

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-12.70448	23.48894	-0.540871	0.5908
EE_TOT_14	0.412671	0.114601	3.600920	0.0007
SK_TOT_14	0.424891	0.214688	1.979113	0.0529
RO_PERMITS(1)	0.042199	0.021334	1.978060	0.0530
RO_REAL(-2)	-0.462626	0.133403	-3.467887	0.0010

R-squared	0.561502	Mean dependent var	-84.19831
Adjusted R-squared	0.529020	S.D. dependent var	4.151173
S.E. of regression	2.848865	Akaike info criterion	5.012657
Sum squared resid	438.2658	Schwarz criterion	5.188719
Log likelihood	-142.8734	Hannan-Quinn criter.	5.081384
F-statistic	17.28689	Durbin-Watson stat	1.020080
Prob(F-statistic)	0.000000		

Dependent Variable: RO_TOT_15
Method: Least Squares
Date: 02/20/24 Time: 19:42
Sample: 2005Q3 2020Q2
Included observations: 59

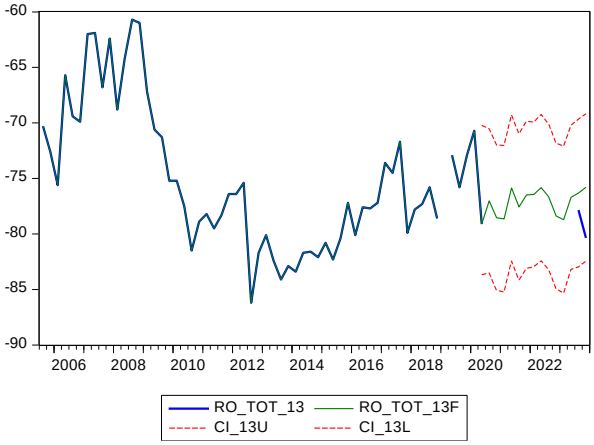
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CZ_TOT_15	0.196253	0.079298	2.474891	0.0166
HR_TOT_15	0.284526	0.132666	2.144673	0.0366
LT_TOT_15	0.380402	0.138478	2.747021	0.0082
SK_TOT_15	0.348772	0.114838	3.037084	0.0037
RO_INC	6.787996	4.648090	1.460384	0.1501
C	16.31934	8.632410	1.890473	0.0642

R-squared	0.772538	Mean dependent var	-52.85085
Adjusted R-squared	0.751079	S.D. dependent var	7.490877
S.E. of regression	3.737343	Akaike info criterion	5.570771
Sum squared resid	740.2900	Schwarz criterion	5.782046
Log likelihood	-158.3378	Hannan-Quinn criter.	5.653245
F-statistic	36.00122	Durbin-Watson stat	1.455584
Prob(F-statistic)	0.000000		

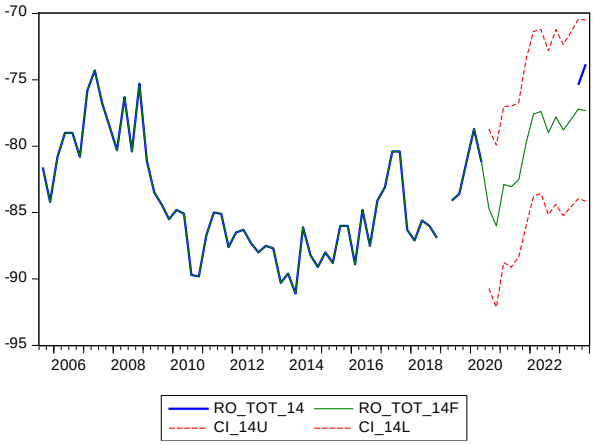
Note: RO_Cars: new passenger cars, RO_Permits: Building permits, residential buildings, RO_Real: long-term real interest rates (10y, GDP deflator), RO_INC: annual growth of compensation of employees. Source: ESTAT, European Commission, World Bank.

B: historic, forecast (incl. +/- 2 S.E. confidence interval (CI), 95%) and newly collected data (quarterly)

Q13: mean difference: -3.0 < S.E. (3.2): NO shift



Q14: mean difference: 2.7 < S.E. (2.8): NO shift



Q15: mean difference: 2.5 < S.E. (3.7): NO shift