

XLI Encuentro de Economistas *

**Dynamic Relationship between Credit and Economic Growth
(preliminary results)**

Nicolás Butrón & Jorge Pozo (BCRP)

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* Las opiniones expresadas en este estudio corresponden a los autores y no deben ser atribuidos al BCRP

Motivation and Research Question

Previous work

Data

Empirical analysis

Conclusions

Motivation and Research Question

- Credit is an important macroeconomic variable that can contribute to boost economic growth.
- Several authors indicate these variables have an important relationship between them, credit indicators are suggested to help explain and/or predict the evolution of economic activity.
- Credit information is published earlier than economic activity information.
- Research Question:
 - ¿What is the impact of credit on economic activity?
- Main Result:
 - We find evidence of a positive impact of credit on economic growth.
- With these preliminary findings, we would like to predict economic activity (future research).

Previous work

- Antoshin et al. (2017) find that bank credit positively, but moderately influences economic activity in Europe. In that sense, an increase in domestic bank credit by 10 percent would increase real GDP by 0.6 to 1 percent, mainly through the private investment channel, as it would increase by 2 to 2.5 percent.
- Armeanu et al. (2015) use the year-on-year growth rates of credit (which is segmented by individuals, firms and public sector) and GDP. Thus, they calculate that a 1 percent increase in any of these 3 components has an impact of 0.17 percentage points (p.p.), 0.25 p.p. and 0.0225 p.p., respectively, on the annual growth of economic activity in Romania.

Data

- Credit database is constructed from the credit registry (RCC). Includes the following dimensions: time (monthly frequency), entity that granted the credit, region where the entity that received the credit operates, economic sector to which the borrowing entity's activity belongs, credit segment and currency.
- Information on GDP by sector and region is obtained from BCRP and INEI, respectively. Also, CPI by region data is obtained from BCRP.
- Period of analysis: 2012:m1 - 2019:m12.

Data I

- The table summarizes the main statistics of the variables used in the econometric regressions.

Table: Summary Statistics

	Obs.	Mean	SD.	Min	Max
<i>Observations at region-economic sector-year level</i>					
RGDPG _{rst} ^{aa} (%)	1 291	3.684	9.488	-28.390	49.015
CREG _{rst} ^a (%)	1 291	12.967	34.524	-109.738	148.027
INF _{rt} (%)	1 291	0.330	0.515	-1.133	3.173
<i>Observations at economic sector-month level</i>					
RGDPG _{st} ^{mm} (%)	693	1.388	7.909	-19.941	29.984
CREG _{st} ^m (%)	693	0.654	3.020	-13.214	14.227
<i>Observations at economic sector-month level</i>					
RGDPG _{st} ^{aa} (%)	731	3.851	4.835	-15.117	24.519
CREG _{st} ^a (%)	731	8.572	12.992	-55.830	50.552

Sources: BCRP, INEI. We remove outliers or extreme values.

Data II

- Credit to GDP ratios are shown for each sector in the following table.

Table: Credit to GDP Ratios

	2012	2019	2020	2022	Mar-23
<i>By Sector</i>					
Agriculture (%)	13.3	26.2	33.1	37.9	35.8
Fisheries (%)	45.5	37.1	54.8	63.8	54.9
Mining (%)	6.9	11.3	15.7	14.3	13.9
Manufacturing (%)	32.6	59.1	73.0	70.6	70.3
Energy (%)	83.8	63.6	83.9	88.8	84.6
Construction (%)	10.8	15.7	27.9	16.3	15.5
Commerce (%)	39.7	60.0	98.1	81.0	77.7
Services (%)	14.8	20.8	30.1	22.9	22.7

Source: BCRP.

Empirical analysis

- Some significant correlation coefficients between credit and GDP by sector are found.

Table: Correlation between Credit and GDP

	t-12	t-3	t	t+3	t+12
<i>By Sector</i>					
Agriculture (%)	-0.66**	-0.20*	0.00	0.12	0.25**
Fisheries (%)	-0.25**	-0.34**	-0.18	0.02	0.02
Mining (%)	0.18	-0.18**	-0.18	-0.22**	-0.30**
Manufacturing (%)	-0.60**	-0.21**	-0.24**	-0.28**	0.11
Energy (%)	0.56**	0.44**	0.13	-0.17	-0.30**
Construction (%)	-0.04	0.13	0.21**	0.30**	0.54**
Commerce (%)	0.21**	0.55**	0.61**	0.58**	0.55**
Services (%)	-0.15	0.16	0.22**	0.32**	0.59**

Variables are expressed in real annual growth. Only credit in national currency is considered. Source: BCRP.

Empirical analysis I

- We propose the following econometric model:

$$RGDPG_{rst}^{aa} = \alpha + \beta_1 CREG_{rst}^a + \epsilon_{rst}$$

- r : region; s : economic sector; t : a sample year
- $RGDPG_{rst}^{aa}$: annual growth rate of the real annual GDP.
- $CREG_{rst}^a$: annual nominal credit growth
- ϵ_{rst} : random error that has a normal distribution.
- Region fixed effects, sector fixed effects or region-sector fixed effects might be included.

Empirical Results I

- **Results** suggest that a one percent annual increase of the credit, leads to an annual increase of 0.02 percent of the real GDP.
- According to Panel B, results hold when controlling by inflation.

Table: Regression Results

	1	2	3	4	5	6	7	8
Panel A								
RGDPG ^{aa} _{rst-1}					0.000529	-0.00398	-0.00555	-0.0102
CREG ^a _{rst}	0.0168**	0.0163**	0.0156**	0.0151*	0.0173**	0.0170**	0.0164**	0.0160**
Observations	1 291	1 291	1 291	1 291	1 276	1 276	1 276	1 276
Panel B								
RGDPG ^{aa} _{rst-1}					0.000345	-0.00450	-0.00568	-0.0106
CREG ^a _{rst}	0.0169**	0.0164**	0.0157**	0.0152*	0.0174**	0.0171**	0.0165**	0.0161**
INF _{rt}	-0.259	-0.381	-0.220	-0.356	-0.418	-0.557	-0.349	-0.498
Observations	1 290	1 290	1 290	1 290	1 276	1 276	1 276	1 276
Region FE	No	Yes	No	No	No	Yes	No	No
Sector FE	No	No	Yes	No	No	No	Yes	No
Region-Sector	No	No	No	Yes	No	No	No	Yes

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

Empirical analysis II

- Taking advantage of the credit information at monthly frequency, we also propose the following alternative econometric model:

$$RGDPG_{st}^{mm} = \alpha + \beta_1 CREG_{st}^m + \beta_2 CREG_{st-1}^m + \dots + \beta_{k+1} CREG_{st-k}^m + \epsilon_{st}$$

- s : economic sector; t : a sample month
- $RGDPG_{st}^{mm}$: monthly growth rate of the real monthly GDP.
- $CREG_{st}^m$: monthly nominal credit growth.
- ϵ_{st} : random error that has a normal distribution.
- Sector fixed effects and lags on credit variables are included.

Empirical Results II

- Results:** The credit growth has a statistically significant impact on GDP at the contemporaneous level, and with a lag up to four months.

Table: Regression Results

	1	2	3	4	5	6
$RGDPG_{st-1}^{mm}$		-0.000126	0.00828	0.00971	0.00598	0.0114
$CREDG_{st}^m$	0.209**	0.209**	0.214**	0.227**	0.237**	0.227**
$CREDG_{st-1}^m$			-0.201**	-0.203**	-0.193*	-0.208**
$CREDG_{st-2}^m$				-0.281***	-0.283***	-0.292***
$CREDG_{st-3}^m$					-0.119	-0.118
$CREDG_{st-4}^m$						0.205**
Observations	693	693	693	693	693	693
R-squared	0.054	0.054	0.059	0.070	0.072	0.078
F test (ρ -value)	0.0341	0.106	0.0364	0.00275	0.00346	0.00111
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

Empirical Results II.1

- This time we use annualized GDP, and annual growth rates for both GDP and credit.
- Results:** GDP growth is statistically and economically persistent. Also, the impact of credit growth on GDP is quantitatively less significant, but still statistically significant.

Table: Regression Results

	1	2	3	4	5	6
RGDPG _{st-1} ^{aa}		0.724***	0.734***	0.740***	0.739***	0.738***
CREDG _{st} ^a	0.0819***	0.0392***	0.121***	0.116***	0.117***	0.120***
CREDG _{st-1} ^a			-0.0876***	-0.0302	-0.0302	-0.0304
CREDG _{st-2} ^a				-0.0559**	-0.0679**	-0.0666*
CREDG _{st-3} ^a					0.0121	-0.00743
CREDG _{st-4} ^a						0.0177
Observations	731	731	731	731	731	724
R-squared	0.109	0.698	0.704	0.706	0.706	0.705
F test (ρ -value)	3.31e-09	0	0	0	0	0
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

Conclusions

- Econometric regressions confirm that credit dynamics might help us to explain and hence to predict GDP dynamics, when using information at sectoral and regional levels.
- We find a positive impact of credit on economic growth, also when controlling the heterogeneity across region and/or sector.
- **Pending agenda:** improve sectorization of credit data, use the models to predict economic growth, include additional control variables.