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SECTORAL LENDING AND VALUE ADDED: THE CROATIAN CASE

Abstract

Purpose: The paper deals with the impact of bank loans to corporations and households on gross value added (GVA) in Croatia. The research covers the period from the second quarter of 2016 to the fourth quarter of 2024. The aim of the research is to determine the significance, direction, and strength of the relationship between lending to various economic sectors and households and the development of GVA.

Methodology: This research uses the ARIMAX (Autoregressive Integrated Moving Average with Exogenous Variables) model, which enables quantitative analysis of time series with the simultaneous inclusion of exogenous variables that can affect the dependent variable.

Results: The results show that loans to the manufacturing sector and the accommodation and food sector have the strongest positive impact on GVA, while the trade sector has the largest negative impact. Loans to households have a weaker impact, with housing loans having a positive impact and cash loans having a negative impact on GVA.

Conclusion: The results support the idea that the structural orientation of bank lending policies can have an important impact on economic growth, not only through the volume but also through the allocation. This research provides a basis for the implementation of policies aimed at lending to sectors with high growth potential, while controlling consumer debt. This can support long-term sustainable and structurally sound economic growth. Further research can focus on the components of sectoral GVA to see the financial effects on real values of sectoral productivity growth and eliminate the effects of net prices on GVA growth.

Keywords: Bank loans, corporations, households, gross value added, Croatia

1. *Introduction*

The role that lending plays in promoting economic growth, particularly in small open economies, i.e. Croatia, has long been controversial. Bank lending plays a vital role in financial intermediation, driving investment and consumption choices, and, in some cases, stimulating the formation of gross value added (GVA). However, an empirical understanding of the contributions of loans to firms and households to real aggregate growth is still limited by differences in the economic structure and the business cycles (King & Levine, 1993; Levine, 2005). Much of previous research has examined aggregated lending (Beck et al., 2000; Bernanke & Gertler, 1995), ignoring the heterogeneity of sectors. These aggregated data may conceal dissimilarity within the industry, with the most pronounced differences in the case of Croatia, where construction, trade, tourism, and manufacturing contribute to distinct economic processes (World Bank, 2020).

To bridge the gap, this research examines two channels of transmission: a) corporate lending by sector, and b) household lending by loan type, and then measures the effects on GVA. In the period 2016–2024, the share of private sector loans in GDP decreased from 60% to 46%, reflecting reduced financialisation amid rapid GDP growth (Croatian National Bank, 2020; 2025). Total bank loans increased slightly, from €28bn to €40bn, as GDP nearly doubled, prompting speculation about how bank intermediation has underpinned real growth. Given Croatia's recovery from the 2008–2015 downturn, the period provides an interesting setting in which to test the role of sectoral and household lending in GVA dynamics (Ekanayake & Thaver, 2021; Estrada et al., 2015).

Research questions are: a) How do loans to non-financial corporations by sector affect GVA?, b) Do household loans, especially housing and consumer, impact aggregate growth?, c) Do the intensity and direction of the effects differ between corporate and household lending?, and d) Are effects immediate or lagged, as captured by ARIMAX dynamics?

Drawing from theory and prior studies (Demirgüç-Kunt & Maksimovic, 2002; Mian & Sufi, 2014), we hypothesise that:

H1: Loans to non-financial corporations have a statistically significant, positive impact on GVA;

H2: Household loans have differentiated impacts.

In particular, the works of King and Levine (1993), Levine (2005), and Mian and Sufi (2014) provide the key theoretical basis for these hypotheses, emphasising the role of financial development, credit allocation, and household borrowing in shaping economic growth. For the purpose of this study, the hypotheses are considered confirmed if the estimated coefficients are statistically significant at the 5% level ($p < 0.05$).

The research applies ARIMAX models, which incorporate time-series dependence and exogenous effects, as well as absolute and relative effects that are distinguished by means of log-linear and log-log specifications (Enders, 2014; Gujarati & Porter, 2009). By doing so, the study adds to the understanding of the intricate financial–real sector linkage and sector-level asymmetries in credit effects. The findings are also of policy relevance, showing how to steer lending to sectors with high growth multipliers and towards household borrowing that is conducive to sustainable development.

2. Theoretical and conceptual background

The link between bank lending and economic growth has been widely examined in financial development theory. Credit activity is now regarded by empirical evidence as a significant productivity and GVA growth booster, particularly in developing and transition economies. Among the extensive literature, three works are particularly relevant for this study and directly underpin our hypotheses: King and Levine (1993), Levine (2005), and Mian and Sufi (2014). These three works form the theoretical foundation of our hypotheses. As Bernanke and Gertler (1995) suggest, the bank credit channel magnifies the effect of monetary policy, and King and Levine (1993) and Levine (2005) stress the function of the financial system in capital allocation, supervision, and risk management. Other studies have shown that lending promotes investment and growth (Arrfelt et al., 2014; Beck et al., 2000; Bernstein & Barrett, 2011; Charoenwong et al., 2024; Coen & Maritan, 2010; Maritan & Lee, 2017; Sirmon & Hitt, 2009; Zhao et al., 2021; Aghion & Howitt, 2009; Demirgüç-Kunt & Maksimovic, 1998; 2002; Holmström & Tirole, 1997; Ekanayake & Thaver, 2021; Estrada et al., 2015; Ghamati & Mehrara, 2014; Hamdaoui & Márquez, 2024; Idun, 2021; Soedarmono et al., 2016; Xie et al., 2022).

Despite widespread investigation into aggregate lending (Cetorelli, 2012; Hamdaoui & Márquez, 2024; Le et al., 2022; Sant'Anna et al., 2021; Win, 2013; Xie et al., 2022), emerging evidence highlights heterogeneity across sectors. Kalemli-Ozcan et al. (2019) demonstrate that corporate indebtedness reduces investment in times of crisis, whereas Bijsterbosch and Kolasa (2010) highlight the sectoral variation in credit transmission. Mian and Sufi (2014) show that for households, non-purpose loans may enhance short-term consumption but heighten longterm vulnerability. Likewise, the International Monetary Fund (2017) warns that cash loans may engender systemic risk, whereas housing loans encourage investment and multiplier effects in construction.

After the start of QE and then QT, central banks' stance towards monetary policy changed further. A study by Holm-Hadulla and Pool (2025) found that interest rate volatility reduces monetary transmission, while Herbst et al. (2025) find monetary policy to be more influential on bank rates than macroprudential policy. Asriyan et al. (2025) warn that low interest rates could drive away productive

investment, whereas Amado et al. (2025), Daoui (2023), Dlamini and Mashau (2022), Farajnezhad (2022), Idris (2019), James et al. (2013), Radman Peša et al. (2015), Mehar (2022), Moyo and Phiri (2024), Mwange (2022), Nwagu et al. (2023), Ofoi and Sharma (2021), Rathnayaka et al. (2024), and Sari et al. (2022) highlight the different effects of monetary policy on growth. Schnabel (2025) also points out that the European Central Bank policies reached households faster than the companies indicating the institutional risk and bank caution (Altavilla et al., 2019; Araujo et al., 2019; Blickle & Santos, 2020; Bonfim, 2008; Fraisse & Thesmar, 2019; Gopalakrishnan & Mohapatra, 2020; Harrison et al., 2022; Jing, 2020; Lilienfeld-Toal et al., 2012; Lobo et al., 2020; Qi et al., 2016; Santos & Cincera, 2021; Thapa et al., 2020).

The European Central Bank (2025) survey reveals that lending standards in the euro area vary among member countries. However, empirical research on sectoral lending and GVA is limited in Croatia, where most of the analyses are performed by the CNB in its Macroprudential Diagnostics and Financial Stability reports (Croatian National Bank, 2021; 2022; 2023; 2024a; 2024b; 2024c; 2025). Those list trends like strong growth in cash loans and construction lending. Complementary studies (World Bank, 2020; Filip & Setzer, 2025) connect the institutional quality with GDP growth, stressing asymmetries between regions across Europe (Anthony-Orji et al., 2018; Chinoda & Kapingura, 2023; Dwumfour & Gyamfi, 2020; Haini, 2019; Jiménez & Muñoz, 2022; Miao et al., 2023; Ru & Qamruzzaman, 2022; Udeaja, 2021; Van et al., 2022; Barbero & Rodríguez-Crespo, 2022; Batrancea et al., 2023; d'Agostino & Scarlato, 2013; Razak et al., 2021).

Overall, this paper contributes by applying the ARIMAX methodology to quarterly data, thereby capturing short-term dynamics and providing insights into sectoral asymmetries in Croatia's lending–growth nexus.

3. Data and methodology

This study leverages quarterly data from Q2/2016 to Q4/2024. These sources mainly come from the Central Bureau of Statistics (CBS), which reports gross value added (GVA) by activity, and the Croatian National Bank (CNB), which provides data on loans to non-financial corporations (by sector) and households (housing and consumer loans). Corporate loans to corporations went up from €13.1bn in 2016 to €15.9bn in 2024 (+20%). The analysis initially included seven sectors, manufacturing, electricity and gas, construction, trade, transport and storage, accommodation and food, and real estate, which by end-2024 represented €13.2bn or 83% of all corporate loans. Household lending increased from €15.8bn in 2016 to €24.4bn in 2024 (+54%). By end-2024, housing loans reached €11.9bn (49% of household loans), while cash loans equalled €9.2bn (38%). Household loans, for the most part, were over twice the number of corporate loans.

The research discusses €9.4bn of corporate credit and €21.1bn of household credit, which together account for 76% of private sector credit (€40.3bn in 2024). The dependent variable, GVA, ranged between €8.7bn (Q1/2017) and €19.3bn (Q3/2024), with an average value on a quarter basis being €12.1bn. It was thus better suited for statistical analysis to express all variables in symbolic form.

Table 1 Loans to corporations and households

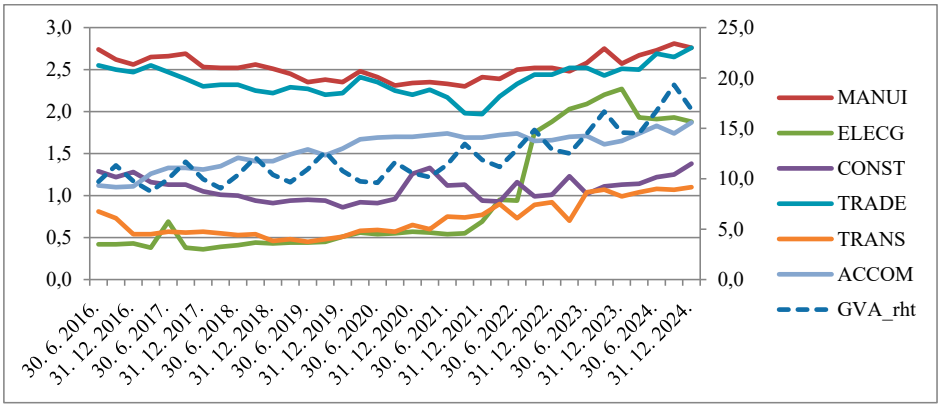
Corporate loans by sector	
Variables	**Symbol**
Gross value added (*dependent variable*)	GVA
Manufacturing industry	MANUI
Electricity, gas, steam, and air conditioning supply	ELECG
Wholesale and retail trade	TRADE
Activities of providing accommodation and preparing and serving food	ACCOM
Construction	CONST
Transportation and warehousing	TRANS
Real estate	REALE

Loans to households	
Variables	**Symbol**
Gross value added (*dependent variable*)	GVA
Housing loans	HOUSL
Cash non-purpose loans	CASHL

Source: Created by the authors

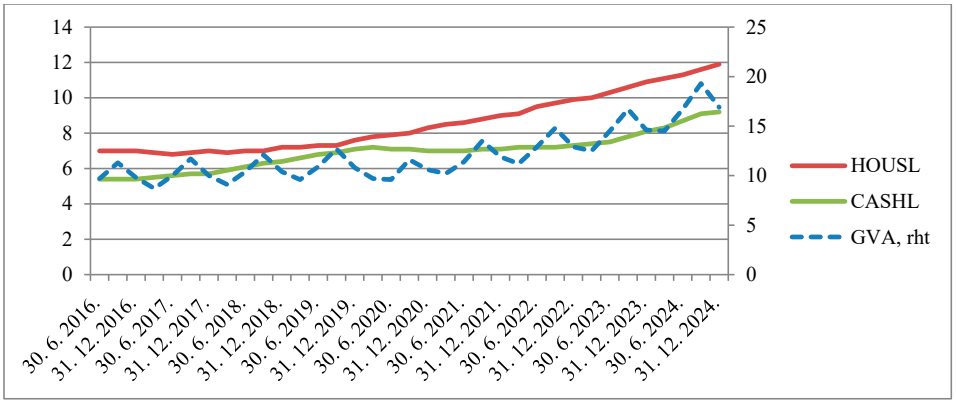
The first step in creating a model is to examine the trends of the variables in the observed period.

Figure 1 Variable trends for loans to corporations and GVA, billion EUR



Source: www.hnb.hr/en/statistics/statistical-data, created by the authors

Figure 2 Variable trends for loans to households and GVA, billion EUR



Source: www.hnb.hr/en/statistics/statistical-data, created by the authors

The analysis showed that construction, transport and warehousing and real estate, all areas of business finance, had no statistically significant impact on GVA in either log-linear or log-log models. At the beginning of the period (Q2/2016), these sectors represented about 30% of the loan volume (€3bn of €10bn) and their share remained the same up to Q4/2024 (€4bn of €13.2bn). The lack of significance suggests structural inefficiency in capital allocation:

Construction is a cyclical and government-dependent activity. Real estate represents capital accu-

mulation without directly producing output. This reinforces that just volume of loans is not enough to drive economic growth. While these sectors continue to hold almost one-third of corporate loans, there is no evidence that they create value. Thus, lending policy should favour sectors with larger productive multipliers. The remaining insignificant variables (CONST, TRANS, REALE) were discarded for analysis and the descriptive statistics were prepared for significant variables of corporate and household loans GVA trends.

Table 2 Descriptive statistics for the defined variables

Variable	Corporations			
	Min	**Max**	**Mean**	**Std_dev**
GVA	8.70	19.30	12.09	2.55
MANUI	2.30	2.80	2.53	0.15
ELECG	0.40	2.30	0.94	0.69
TRADE	2.00	2.80	2.37	0.18
ACCOM	1.10	1.90	1.56	
	Households			
HOUSL	6.80	11.90	8.54	1.61
CASHL	5.40	9.20	6.93	1.01

Source: Created by the authors

There are 35 observations in the dataset for each variable. Gross value added (GVA) shows the highest variance with a mean of 12.10 and standard deviation of 2.55, a strong fluctuation in the observed time. On the other hand, the manufacturing and trade industry remains the most constant, with only normal standard deviations of 0.15 and 0.18, respectively. The electricity sector has the highest sectoral volatility (std. dev. 0.69; range 1.90), while the accommodation sector shows a relatively low mean (1.56) and moderate variability (std. dev. 0.21), partially demonstrating its seasonal nature. On the household side, housing loans average 8.54 (std. dev. 1.62), indicating sensitivity to real estate market or interest rate changes, while cash loans continue to be the most stable component (mean 6.93; std. dev. 1.01). Generally, GVA presents these ups and downs while cash loans have experienced a stable and consistent trend. A comprehensive ARIMAX (Autoregressive Integrated Moving Average with Exogenous Variables) model is used to investigate such phenomena; it compares the relationship between GVA and bank lending across four dimensions in the economies: manufacturing, electricity supply, trade, and accommodation. The ARIMAX model is suitable because it considers the time-series dependence as well as the effect of the exogenous variables simultaneously. First, it incorporates the strong autocorrelation characteristic of GVA using both AR and MA components (Enders, 2014). Second, lending actions are treated as purely exogenous variables and they do not encounter simultaneity issues, which occurs in VAR models. Third, log transformation and differencing are used to ensure stationarity, avoiding problems concerning nonlinearity and heteroskedasticity. Finally, two model specifications are applied: a log-linear form, according to which coefficients can be perceived as semi-elasticities, and a log-log form, which yields elasticities (Gujarati & Porter, 2009).

The models can be formally presented as:

a) M1-models for corporations:
a1) log-linear; a2) log-log

$$\textbf{a1)}\quad \log\mathrm{GVA}_{t\,(\mathrm{CORP})} = \alpha + \sum_{i=1}^{p} \phi_i \log(GVA_{t-1}) + \sum_{i=1}^{q} \theta_j\ \varepsilon_{t-1} + \sum_{k=1}^{K} \beta_k\ X_{k,t} + \varepsilon_t$$

$$\textbf{a2)}\quad \Delta\log\mathrm{GVA}_{t\,(\mathrm{CORP})} = \alpha + \sum_{i=1}^{p} \phi_i \Delta \log(GVA_{t-1}) + \sum_{i=1}^{q} \theta_j\ \varepsilon_{t-1} + \ \beta_1 log X_{k,t} \ldots + \varepsilon_t$$

b) M2-household models:
b1) log-linear; b2) log-log

$$\textbf{a1)}\quad \log\mathrm{GVA}_{t\,(\mathrm{HOUSE})} = \alpha + \sum_{K}^{p} \phi_i \log(GVA_{t-1}) + \sum_{k=1}^{\beta=1} \beta_k\ X_{k,t} + \varepsilon_t$$

$$\text{a2)}\ \Delta\log\text{GVA}_{\text{t (HOUSE)}} = \alpha + \sum_{i=1}^{p} \phi_i\, \Delta\log(GVA_{t-1}) + \beta_1 \Delta\log X_{k,t} \ldots +$$

where:

$\log\text{GVA}_t$ – the natural logarithm of gross value added at the moment t

$X_{k,t}$ – exogenous variables – loans to companies by sector and loans to households at the moment t

ϕ_i – coefficient of the autoregressive part of the model (AR)

θ_j – coefficient of the moving average component (MA)

β_k – regression coefficients of exogenous variables

ε_t – random model error.

The models combine the ability to model the endogenous variable over time with the ability to quantify the impact of external factors, making them suitable for investigating economic dynamics in the context of sectoral credit activity. The log transformed GVA smooths out trends and variability in the main series, which improves the stability of the model. Also, ARIMAX allows for the removal of the autocorrelation effect from the residuals, which increases the reliability of the estimates of the impact of credit variables. Econometric robustness is achieved because, in addition to the usual stationarity tests (Dickey & Fuller 1979), the model ensures the coherence of the time structures and allows for consistent estimation of the regression coefficients. To ensure the validity of the model, the stationarity of the time series was previously tested using the Augmented Dickey-Fuller (ADF) test. The GVA series was logarithmically transformed and differentiated as necessary to achieve stationarity. Exogenous variables (loans by sector) are not differentiated because it is assumed that short-term changes in the level of loans have an immediate economic impact on GVA, which corresponds to the real transmission channels of credit activity. In conclusion, using the ARIMA structure in the dependent variable component takes into account the internal dynamics of economic activity (e.g., GVA lags and past shocks), thereby increasing the robustness and interpretative value of the model.

4. Results

Both models were estimated using log-linear and log-log specifications. Statistical indicators of model quality show a high level of fit in all variants, with some differences in performance.

Table 3 Model quality statistics

Fit Statistic	Loans to corporations (model M1)		Loans to households (model M2)	
	Log-Linear	Log-Log	Log-Linear	Log-Log
	Mean	Mean	Mean	Mean
Stationary R-sq.	0.895	0.899	0.871	0.822
R-squared	0.904	0.914	0.956	0.943
RMSE	0.887	0.840	0.592	0.665
MAPE	4.628	4.568	2.881	3.653
MaxAPE	17.842	18.325	17.775	17.978
MAE	0.574	0.555	0.337	0.416
MaxAE	2.105	2.071	1.742	1.762
Normalised BIC	0.573	0.463	-0.323	-0.192

Source: Calculated by the authors with the support of IBM SPSS Statistics

In terms of explained variance (R-squared and stationary R-squared), Model 1 has a slightly lower R-squared (0.904–0.914) compared to Model 2 (0.943–0.956), although the explanation is also very high in M1. The stationary R-squared, which shows how well the model tracks fluctuations in station-

ary series, is also slightly higher in M1 (0.895–0.899 versus 0.822–0.871 in M2), suggesting that corporate loans are more strongly associated with quarterly GVA variations. In terms of model precision (prediction errors), Model 2 shows lower prediction error values, especially in the log-linear specification: RMSE: 0.592 (M2) vs. 0.887 (M1), MAE: 0.337 (M2) vs. 0.574 (M1), MAPE: 2.881% (M2) vs. 4.628% (M1). This indicates that Model 2 is more accurate in predicting GVA, which may be more useful for short-term projections and operational applications. The largest absolute errors (MaxAPE and MaxAE) are very similar in both models and both shapes, which means that neither model suffers from serious outliers or unstable episodes in the predictions. Finally, the information criterion (normalised BIC) of Model 1 shows lower BIC values in the log-log variant, which indicates a better balance between complexity and adaptation. In Model 2, the log-linear specification is more efficient (lower BIC: -0.323), which additionally supports the previous conclusion about its usability for precise estimations with a smaller number of parameters. The results of the estimated ARIMAX (2,0,1) model with logarithmic values of GVA, with untransformed (loglinear) and with logarithmic amounts of sector loans to companies (log-log) are shown in Table 4. The model includes autoregressive components up to the second order (AR(2)), one moving average component (MA(1)), and four exogenous variables in log-linear and log-log specifications.

Table 4 GVA and sector loans to corporations

Model 1 _ARIMA (2,0,1)								
Log-linear specification					**Estimate**	**SE**	**t**	**Sig.**
Dependent	GVA	Log (natural)	Constant		.687	.315	2.180	.038
			AR	Lag 1	.141	.137	1.027	.313
				Lag 2	-.817	.118	-6.922	< .001
			MA	Lag 1	-.456	.216	-2.115	.044
Variables	MANUI	No Transform.	Coefficient	Lag 0	.612	.103	5.924	< .001
	ELECG	No Transform.	Coefficient	Lag 0	.140	.025	5.622	< .001
	TRADE	No Transform.	Coefficient	Lag 0	-.226	.086	-2.624	.014
	ACCOM	No Transform.	Coefficient	Lag 0	.407	.076	5.353	< .001
Log-log specification					**Estimate**	**SE**	**t**	**Sig.**
Dependent	GVA	Log (natural)	Constant		1.180	.218	5.420	< .001
			AR	Lag 1	.141	.128	1.095	.283
				Lag 2	-.823	.112	-7.334	< .001
			MA	Lag 1	-.567	.192	-2.951	.006
Variables	MANUI	Log (natural)	Coefficient	Lag 0	1.528	.224	6.823	< .001
	ELECG	Log (natural)	Coefficient	Lag 0	.146	.021	6.855	< .001
	TRADE	Log (natural)	Coefficient	Lag 0	-.379	.187	-2.027	.053
	ACCOM	Log (natural)	Coefficient	Lag 0	.553	.097	5.704	< .001

Source: Calculated by the authors with the support of IBM SPSS Statistics

According to the results obtained, it was shown that the M1 model relies on two previous GVA values to predict the current value. In the model, AR(1) = 0.141 (p = 0.313) is not statistically significant, while AR(2) = -0.817 (p < 0.001) is highly significant and shows a strong negative influence of the GVA values from two periods back. In other words, if GVA was high two quarters ago, it has a negative influence today, i.e., there is a reversion to the mean value. This indicates a cyclical reversion where, after the growth of GVA, there is often a correction in the opposite direction. In the MA (Moving Average) component, lag 1 uses the error (residual) from the previous period to correct the forecast in the current period -0.456 (p = 0.044). At the log-linear specification level, since the dependent variable is log(GVA), and the exogenous variables are loans in billions of euros, the coefficients are interpreted as approximate percentage changes in GVA with a change in loans by 1 billion euros. For example, if loans to the processing

sector increase by 1 billion euros in a quarter, GVA increases by approximately 61.2%, etc. In nature, the coefficients show the elasticity of GDP on lending to individual sectors. Since loans change is expressed in absolute amounts and GVA in log form, these are semi-elasticities. The results imply that the largest marginal contribution to GVA growth is made by loans to the manufacturing industry and tourism, while lending to trade has a negative effect, which may signal saturation or inefficiency in that sector. At the log-log specification level, the dependent variable (GVA) and the independent variables (loans by sector) are transformed by their natural logarithms. This allows the interpretation of the estimated coefficients as elasticity, i.e., how much GVA changes in response to a percentage change in the amount of loans to a particular sector. Specifically, a 1% increase in loans to the manufacturing sector results in an average 1.53% increase in GVA, with high statistical significance ($p < 0.001$), or a 1% increase in loans to the electricity supply sector contributes to a 0.15% increase in GVA, also with high reliability, etc. However, a 1% increase in loans to the trade sector has a negative coefficient (-0.379) and marginal statistical significance ($p \approx 0.053$), which may indicate a glut or inefficient lending in that sector. The results obtained at both log-linear and log-log specification levels indicate that the effects of lending activity are sector-specific. The manufacturing industry and the accommodation and food sector (tourism) have a significantly positive effect on the growth of GVA, which supports the arguments for targeting credit policy, particularly towards the manufacturing sectors. The negative (and borderline significant) relationship between loans to the trade sector and GVA suggests the need for additional structural analysis of investment efficiency in this segment. In the context of the Croatian economy, which is characterised by pronounced seasonality and reliance on services, the results for the tourism sector further confirm its high multiplicative value. In order to examine the impact of household lending on economic growth, an ARIMAX (3,1,0) model was applied. The dependent variable in the model is the logarithm of gross value added (GVA), while the exogenous variables are housing loans and cash non-purpose loans presented in loglinear and log-log specifications. The model is specified with three autoregressive components (AR(3)), order 1 differencing (to ensure stationarity), no moving average (MA), and with exogenous variables without time lag.

Table 5 GVA and household loans

Model 2 _ARIMA (3,1,0)								
Log-linear specification					**Estimate**	**SE**	**t**	**Sig.**
Dependent	GVA	Natural Log.	Constant		-.015	.017	-.891	,381
			AR	Lag 1	-.774	.133	-5.832	<.001
				Lag 2	-.985	.038	-26.207	<.001
				Lag 3	-.758	.130	-5.826	<.001
			Difference		1			
Variable	HOUSL	No Transform.	Coefficient	Lag 0	.013	.003	4.528	<.001
	CASHL	No Transform.	Coefficient	Lag 0	-.011	.005	-2.213	.036
Log-log specification					**Estimate**	**SE**	**t**	**Sig.**
Dependent	GVA	Natural Log.	Constant		-.067	.041	-1.614	.118
			AR	Lag 1	-.726	.133	-5.445	< .001
				Lag 2	-.945	.054	-17.546	< .001
				Lag 3	-.728	.130	-5.614	< .001
			Difference		1			
Variable	HOUSL	Natural Log.	Coefficient	Lag 0	.132	.034	3.886	< .001
	CASHL	Natural Log.	Coefficient	Lag 0	-.101	.047	-2.138	.041

Source: Calculated by the authors with the support of IBM SPSS Statistics

According to the results obtained, it turned out that the M2 model relies on AR(3) – the three previous quarters are used, in I(1) – the first difference of log(GVA) is used (i.e., the change is modelled,

not the level), while MA(0), does not have a "moving average" component. Since the increase in log(GVA) is modelled (due to the difference I(1)), the model actually says that the change in log(GVA) in the current quarter depends on the changes in log(GVA) in the previous 3 quarters. All AR coefficients are negative and significant, which implies that the changes in GVA are reversible, i.e., corrective. In other words, if GVA increased last quarter, the model expects a decrease in the current quarter and vice versa. This is a typical dynamic in economic series, which exhibit seasonality and cyclicality. At the log-linear specification level, the results show that both forms of lending have a statistically significant impact on GVA. An increase in housing loans to households by EUR 1 billion is associated with a growth in GVA of approximately 1.3% ($p < 0.001$), indicating a strong positive effect of housing finance on real economic activity. In contrast, an increase in cash loans by the same amount leads to a decrease in GVA of approximately 1.1% ($p = 0.036$), which may indicate an unfavourable macroeconomic effect of non-purpose (cash) borrowing, especially if it is not directed towards productive investments.

At the log-log specification level, the results indicate that housing loans (HOUSL) have a positive and statistically significant impact on gross value added. The estimated coefficient of 0.132 means that a 1% increase in household loans leads to an increase in GVA of approximately 0.13%, with other factors held constant. However, cash loans (CASHL) have a negative and significant impact, which may indicate an adverse effect of household consumer debt on the productive capacity of the economy or a reduction in disposable income. The application of the ARIMAX(3,1,0) model with log-linear and log-log transformation shows that household loan dynamics have differentiated effects on economic growth: while housing loans stimulate GVA, consumer loans can be counterproductive. These findings may be useful in shaping macroprudential policy and loan regulation.

5. Discussion

The ARIMAX, which is estimated with log-linear and log-log specifications, finds a differentiated relationship between corporate and household lending and the dynamics of gross value added (GVA) in Croatia. Although the main findings are presented in Tables 4 and 5, the results can also be visualised by comparing actual and predicted GVA values from both models. These visual comparisons (not shown here) confirm that the ARIMAX specifications closely track the observed fluctuations in GVA, with only limited deviations. Such representations provide an intuitive confirmation of the robustness of the statistical estimations. In this regard, three main findings (corporate lending, household lending) are relevant. GVA is strongly, significantly impacted by manufacturing and electricity loans. Manufacturing loans (avg. €2.5bn a quarter) for those years 2016–2024 stagnated at a very low clip (2.5%), pointing to low capacity to absorb and a low willingness of banks to expand credit further. Electricity and gas supply loans (avg. €0.9bn quarterly) grew rapidly (225%), indicating both sectoral growth potential and creditor readiness. These findings offer support for targeted policy measures (taxation relief, guarantees, and development banks) to boost lending in sectors with high multipliers of productivity. Secondly, loans to accommodation and food industry (tourism), are positively associated with GVA. Average quarterly loans stood at €1.56bn, with a combined growth of 55%. Although this validates the centrality of tourism, its seasonal nature and sensitivity to shocks require careful credit allocation and diversification of assets toward sustainable and year-round activities. Thirdly, the trade sector shows a negative coefficient which seems to indicate a bad allocation of credit. This is on average €2.4bn a quarter (11% growth), but additional lending is still not associated with a rise in GVA, and could be reflecting overcapacity, sluggish productivity, or reliance on short-term working capital. It indicates that sectoral investments require further structural scrutiny. Housing loans exert a positive relationship with households, while consumer loans have a negative one. The coefficients for housing and consumer in the log-linear model are 0.013 and -0.011, respectively; log-log models 0.132 and -0.101, respectively. Housing loans (avg. €8.5bn quarterly) provide support to the construction and related sectors, while consumer loans (avg. €7bn quarterly) may increase short-term demand, but can undermine long-term savings and stability. Both categories expanded by 54% from 2016–2024, mirroring banks' lending policies and household expectations for future income growth. All of these reinforce that sectoral differentiation is an important component of economic performance. Regulatory efforts should focus more on the

sectors with the highest growth multipliers, providing for an even distribution of resources to use in support of efficiency and resilience.

6. Conclusion

This research analysed the impact of bank lending on gross value added (GVA) in Croatia, distinguishing between loans to non-financial corporations and loans to households. By applying the ARIMAX methodology, which incorporates both time dynamics and exogenous shocks, the study was able to capture the differentiated effects of sectoral and household lending on aggregate economic activity. The results show that loans to the manufacturing industry, the energy sector, and accommodation services have a strong and positive impact on GVA, while loans to the trade sector exert a negative effect. Among households, housing loans contribute positively to GVA, whereas cash loans have an adverse impact.

In summary, 45% of all private loans (€18.5bn) favour economic growth, while 30% (€12bn) exert a negative influence, 10% are statistically insignificant, and 15% (€5.9bn) fall outside the scope of this analysis. These results suggest that not only the volume, but also the structure and allocation of lending, matter for economic performance.

From a policy perspective, the findings indicate that the Croatian National Bank (CNB) could strengthen its credit policy framework by promoting lending to sectors with higher growth multipliers, such as manufacturing, energy, and accommodation. At the same time, stricter monitoring of trade and cash lending is recommended in order to limit potential inefficiencies and reduce systemic risk. A balanced approach could contribute to building a more sustainable and resilient economic structure.

Nevertheless, some limitations must be acknowledged. The analysis is based on aggregate quarterly data, which may mask firm-level heterogeneity and informal credit flows. Moreover, the study focuses on the period 2016–2024, without explicitly accounting for structural breaks. Future research could therefore test the model separately for the pre- and post-COVID periods, explore the long-term efficiency of lending in the trade sector, and examine the interaction of bank lending with institutional quality and consumption patterns.

Overall, this study contributes to the understanding of how sectoral and household lending affects economic growth in Croatia, while offering insights that may help policymakers align credit allocation with sustainable development goals.

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