

Review

UDK: 624:338(497.5)

DOI: <https://doi.org/10.32676/n.12.1.2>

## IMPORTANCE OF CONSTRUCTION SECTOR FOR CROATIAN ECONOMY

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### ABSTRACT

Construction sector plays a significant role in GDP growth and economy development of Croatian economy and on European union level driven by growth of construction activities in last two decades. From 1980 until 2024 Croatian economy passed through transition process in order to become developed EU member in which construction sector currently contributes to Croatian GDP with 5% and contributes with 8% in total national employment. Paper provides analysis of construction sector movements from 2011 till 2024 explaining periods of growth, recession and recovery as well as period of COVID crisis. Conducting multiple regression analysis paper provides correlation between key performance indicators of construction sector like number of new apartments, number of issued construction permits, real estate price indicators and macroeconomic indicators. There is evidence of positive influence of between realized construction works and GDP growth. Additionally, construction sector demonstrated strong resistance to COVID crisis with positive contribution to post-COVID economy recovery as well as unemployment rate reduction.

**KEY WORDS:** construction sector, GDP, COVID crisis, regression analysis, Croatia

**JEL CLASSIFICATION:** M2

### 1. Introduction

Croatia as a country and economy passed through different economy cycles over last 20-25 years and become developed EU member. Construction sector always had significant share in GDP of Croatian national economy. For example, in 1980 this share was more than 12% (Butković, 2014) while in 2023 it was 4,9% (Ekonomski institut Zagreb, 2024). After independence, construction sector performed boom from 2001 mainly driven by construction of subsidised apartments and due to beginning of highways construction (Butković, 2014). On world basis construction industry generates approximately 100 million jobs and comprise 6% of global GDP. In highly developed countries this share is bit less and on level of 5% while in

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developing countries is around 8%. In future period it is expected that construction sector will be engaged in rinsing investments in renewable energy sources, especially in western Europe and reconstructions due to energy efficiency increase. Regarding number of construction companies from 2010 to 2020 there were 11,6% less construction companies due to decreased number of manufacturing companies and decreased real estate activities. In recent period there were several significant events which strongly influenced Croatian construction sector. At first, Zagreb and Petrinja earthquake which occurred in 2020 and 2021 caused serious damage on buildings and other public infrastructure. Estimate cost of reconstruction is greater than 11 billion EUR. These funds will have significant and strong influence on Croatian construction sector and will be driver of sector development. Apart from two earthquakes, construction sector faced with COVID 19 crisis, Euro currency introduction and inflationary shocks which caused significant challenges and changes for sector on overall level. In last three years construction sector is faced to lack of workers while in same period there is increased demand for construction services (Pamić, 2023). Based on recent data by the end of 2024 there were around 130.000 foreign workers in Croatia (Hrvatska narodna banka, 2024), while most of them works in construction services. In addition, it is worth to mention that Croatian GDP is greater for 0,1% annually in period from 2018-2023 due to import of foreign workers into Croatia (Hrvatska narodna banka, 2023). Importance of construction for GDP comes not only from direct influence through value of construction works, as well as indirectly through interaction among other sectors like transport, mining, engineering and other less important segments. In further period, sector will strongly be under influence of Croatia's National Recovery and Resilience Plan and will be very active in energy efficiency building renovation and increase. After introduction, in next chapter there will be briefly literature review how construction sector influence on GDP and economy development and which part of construction services are mostly important for economy growth. In third part author will present collected data and empirical methodology while before conclusion there will be results discussion about which factor of construction services is mostly correlated to Croatian GDP and how construction sector is related to inflation rate as well as to unemployment.

## 2. Literature overview

As mentioned in introduction, construction sector is one of the key drivers and determine of economic growth. On European union level (28 EU countries) production in construction sector is positively correlated to economic growth and generates high turnover. Due to constant growth of construction activities in EU countries construction sector will remain as one of the most important (Žarković, 2022). Construction sector generally includes lot of other and supporting activities like raw material procurement, wholesale, retail and distribution of construction materials, architects and project management services, recycling and waste management and other minor activities. Climate changes and EU dedication to energy efficiency has significant impact to renovate and build new buildings which are efficient to use. After latest financial crisis which occurred in 2008 EU countries recorded constant growth of added value produced by construction sector. On EU level in 2018 construction sector accounts for almost 9% of EU GDP and employee almost 18 million people. Most of companies in construction sector are segmented as SME companies which under scope of EU strategy (Badiu, 2022). Building materials and other components are usually procured from various industries and construction industry can be significant supporter of these industries. On the other hand, construction sector demand depends strongly on infrastructure investments which are related to transport improvement, better water and electricity usage efficiency, better living conditions and generally to productivity improvement. Apart from economy growth construction sector is also

very important for employment rate of particular economy. Construction industry is labour intensive, especially in developing countries, and construction workers spend part of their income on local market in order to stimulate local economy. This is great example how government with financing of public works can generate multiple GDP growth through different channels in the same period, mainly in developing countries in which construction sector is more significant for GDP growth than in developed countries. In later stages of development level, construction sector is not significant for GDP growth as at first stages. (Giang, 2011). Similarly, to previous study, public infrastructure investment has significant positive effect on economic growth only in short term economic run while investments in residential construction buildings have positive effect in long term economic run. In addition, government support through public work support and stimulation can only have positive influence on GDP growth in short term run while for a long-term economy growth structural change in economic policy will be required (Wigren, 2007). Both investments, in residential and non-residential construction has positive effect on GDP growth but residential are even more significant (Coulson, 2000). In USA economy before latest crisis in 2008, housing construction had significant positive effect on GDP growth on short term basis. There is similar situation in less developed countries like India in which construction in housing sector should have positive influence in short term period due to less influence on business cycle of construction sector (Mallick, 2010). Apart from time frame, construction sector has stronger influence on GDP growth during expansion of the economy while during economy downturn period there were no significant influence. This confirms that construction sector is pro-cycle oriented in a relation to macroeconomic situation. Apart from GDP, in developed countries like Hong Kong, increased employment and increase in absolute number of employees require more work spaces and indirectly support construction sector through increased demand for office spaces (Chiang, 2015). Real estate market is strongly linked to construction sector. Regardless the economy, real estate prices are determined by macroeconomic factors like consumer price index, unemployment rate, GDP movement and government bonds prices movement. In comparison of UK and German market which are totally structurally different, on a long-term basis markets are similar while distinctive characteristic can be viable only in short term period (Schätz, 2009). Prices of real estate are under strong impact of unemployment rate. For example, in Warsaw from 2003 to 2012, unemployment changes by one unit cause real estate price change by 0,389 units. During same period of time, in Greece correlation between unemployment rate and real estate price is not so significant mainly due to greater unemployment rate in Greece compared to Poland (Grum, B, 2016). There is similar case in US and UK in which employment rate particularly influence adjustments on real estate market and particularly determine real estate prices. Furthermore, real income which depends on real economy and employment rate is driver of real estate prices. Negative movements in real income leads to real estate market contraction and vice-versa in US what was confirmed with latest subprime mortgages crisis in 2008. On UK market, GDP growth tends to be more significant as real estate market creator rather than unemployment rate (Bouchouicha, 2012). European real estate market is also under influence of different cultural mentalities. In southern Europe there is intention to become owner of the house and this is considered as a family achievement while in Germany there is more intention to rent entire flat or house. On overall European level, approximately 25% of people have mortgage on their living place, but in some countries like Sweden, Netherlands or Denmark this share is above 50%. On overall EU level housing prices, mortgages movements and GDP are linked but there are some country or regional specifics due to different development stages and different lending policy which could have some influence on economic growth but to real estate price increase. It would be also recommended that policies are aligned among EU countries because economies are tightly

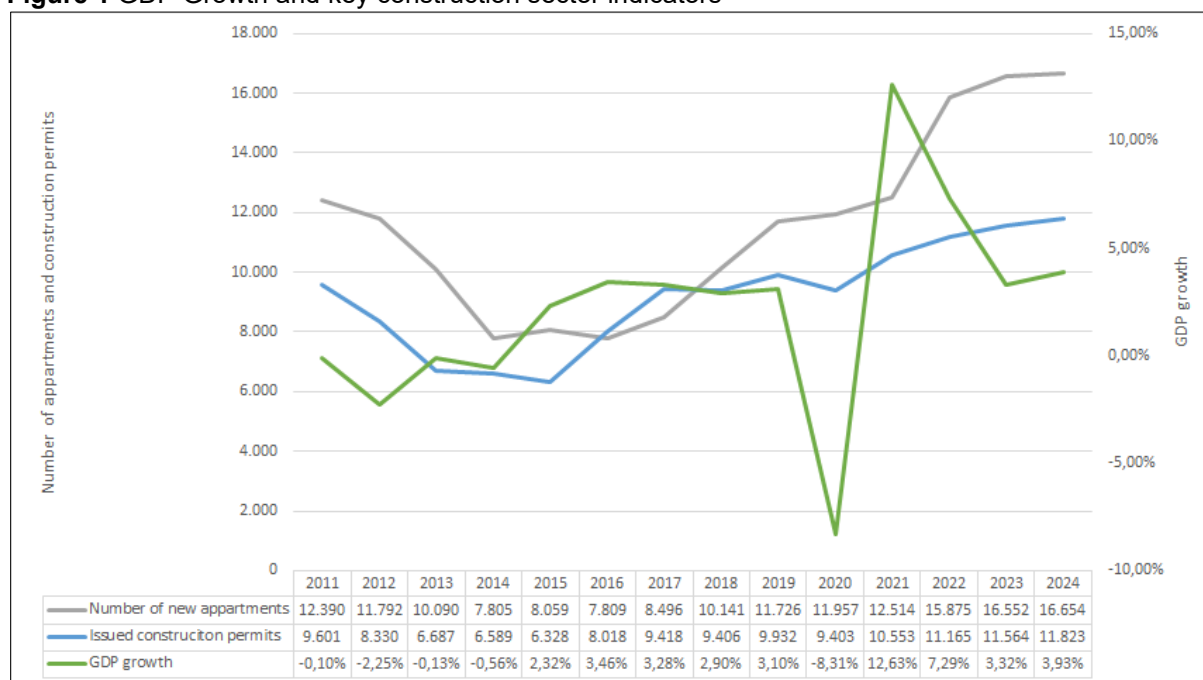
linked toward each other and contagion will spread immediately (Filotto, 2018). In central and eastern European countries (CEE) housing market and real estate house prices responded strongly to real wages increase. Apart from real wages increase, financial institutions, especially banks, also had strong impact on house prices increase through loan approval to natural persona as well as investor financing. Furthermore, like in developed countries, GDP per capita is positively associated with real estate price changes as well as decrease in real interest rate decrease (Égert, 2007). Different real estate markets responded differently to global financial crisis. On European level there were four group of countries analysed and in first group which includes Austria, Germany, Switzerland and Norway witnessed only minor price drop and fast recovery after global financial crisis. On the other hand, Greece, Ireland, the Netherland and Spain had significant price drop as a result of global financial crisis in 2008 while countries like Belgium, Denmark, Finland, France and some other had short recovery after 2008, but second wave of price decrease after 2012. Recovery started in 2014. Last group of counties includes non-EU countries like Serbia and North Macedonia which showed totally unstable real estate market after global financial crisis (Melecky, 2023). COVID crisis which occurred in 2020. All over the world significantly influenced whole economy as well as construction and real estate market. One of the main challenges during latest crisis were difficulties in supply chains what caused delays in construction material procurement processes. Apart from delays in raw material procurement, COVID crisis and lockdown period made difficulties in construction workers transport from home to construction sites. As a result of COVID crisis in Italy 44% of construction companies claimed that they have some damage, in Australia construction losses caused by COVID crisis are estimated on level of 5 billion US dollars while in Russia construction sector faced 10% financial recession (Biswas, 2021). In order to reduce COVID 19 risks companies needed to pay attention to social distances between workers, promote usage innovative technologies which reduce workforce and disinfecting tools after work. These guidelines should be applied if similar crisis appear again (Iqbal, 2021). Regarding the type of real estate, empirical research showed that hospitality and retail segment is more resistant than office sector during latest pandemic. Valuation of office buildings might be volatile in next period due to changes in shopping patterns (switch to online shopping), work from home policy's introduction and business travel habits change. As a result of previous mentioned, greater risk premium could be applied in real estate valuations (Hoesli, 2022).

### 3. Methodology

Construction sector face positive movements over last several years with contribution in Croatian GDP of approximately 5% and 9% of total employment. Croatian construction sector passed through four phasis from 2001 to 2024. Significant growth of construction sector is recorded from 2001 until 2008 and from 2021 till today while from 2009 until 2014 sector was under recession period. From 2015 until 2020 sector was in recovery phasis after big financial crisis which occurred in 2008. From 2001 until 2008 share of construction sector in Croatian GDP increased from 4,4% to 6,5% while employment in this sector was increased by 61%. Based on recent data and after recovery period, in first 6 months of 2024 most of the construction works are related to non-residential buildings (34,7%); traffic infrastructure (26,3%), residential buildings (20,3%) and others (18,7%). Compared to previous periods it is worth to mention there is increase of residential building development and slight decrease of traffic infrastructure development. One of the significant drivers of greater constructions works share in traffic infrastructure and non-residential building are EU funds (Ekonomski institut Zagreb, 2024). Good indicators regarding movements in construction sector can be number

of the apartments and number of issued construction permits. There is chart below which presents correlation between these two indicators and GDP growth from 2011 until 2024.

**Figure 1** GDP Growth and key construction sector indicators



**Source:** Prepared by author based on data available from: Croatian Bureau of Statistics.

Empirical research is based on publicly available data which will be analysed with descriptive statistics methodology. Construction sector data are collected from annual analysis of Croatian construction sector prepared by The Institute of Economics Zagreb which every year in October prepare deep analysis. Analysis is available from 2013 till 2024, but not all data were in scope of analysis. Macroeconomic data were collected from publicly available data provided by Croatian National Bank and Croatian Bureau of Statistics. Apart from previous mention, in paper it will be partly used data collected by Croatian chamber of commerce. Regarding methodology, empirical analysis will be conducted in order to identify relationship between following:

- GDP;<sup>4</sup>
- Annual number of new built apartments;
- Annual number of new built square meters;
- Average apartment price per square meter;
- Annual number of issued construction permits;
- Annual value of realised construction works.

<sup>4</sup> Real GDP in absolute amount, base year is 2021.

**Table 1** GDP and key construction sector indicators

| Year | GDP <sup>1</sup> (000 000 EUR) | New built apartments | New built square meters (000) | Average apartment price per square meter (EUR) | Issued construction permits | Annual value of realised construction works (000 EUR) |
|------|--------------------------------|----------------------|-------------------------------|--|-----------------------------|---|
| 2011 | 41.967,59                      | 12.390               | 1.120                         | 1.568  | 9.601                       | 1.979.755   |
| 2012 | 40.578,28                      | 11.792               | 1.017                         | 1.563  | 8.330                       | 1.897.906   |
| 2013 | 40.381,60                      | 10.090               | 917                           | 1.415  | 6.687                       | 1.780.705   |
| 2014 | 40.120,10                      | 7.805                | 739                           | 1.481  | 6.589                       | 1.656.906   |
| 2015 | 41.025,12                      | 8.059                | 733                           | 1.510  | 6.328                       | 1.778.466   |
| 2016 | 42.463,77                      | 7.809                | 740                           | 1.464  | 8.018                       | 1.862.511   |
| 2017 | 43.654,21                      | 8.496                | 775                           | 1.477  | 9.418                       | 1.904.184   |
| 2018 | 44.743,07                      | 10.141               | 920                           | 1.569  | 9.406                       | 2.061.370   |
| 2019 | 46.188,72                      | 11.726               | 1.065                         | 1.664  | 9.932                       | 2.379.320   |
| 2020 | 42.829,04                      | 11.957               | 1.114                         | 1.708  | 9.403                       | 2.540.556   |
| 2021 | 47.837,75                      | 12.514               | 1.187                         | 1.837  | 10.553                      | 2.891.910   |
| 2022 | 51.846,88                      | 15.875               | 1.462                         | 2.237  | 11.165                      | 3.264.158   |
| 2023 | 53.929,31                      | 16.552               | 1.499                         | 2.342  | 11.564                      | 4.285.321   |
| 2024 | 55.669,24                      | 16.654               | 1.582                         | 2.571  | 11.823                      | 4.885.197   |

Source: Prepared by author based on data available from: Croatian Bureau of Statistics and Croatian central bank.

**Table 2** Inflation and unemployment rate from 2011- 2022

| Year | Inflation rate | Unemployment rate |
|------|----------------|-------------------|
| 2011 | 2,20%          | 13,70%            |
| 2012 | 3,40%          | 15,90%            |
| 2013 | 2,30%          | 17,30%            |
| 2014 | 0,20%          | 17,30%            |
| 2015 | -0,30%         | 16,20%            |
| 2016 | -0,60%         | 13,03%            |
| 2017 | 1,30%          | 11,08%            |
| 2018 | 1,60%          | 8,32%             |
| 2019 | 0,80%          | 6,56%             |
| 2020 | 0,00%          | 7,39%             |
| 2021 | 2,70%          | 7,49%             |
| 2022 | 10,70%         | 6,80%             |
| 2023 | 8,40%          | 6,13%             |
| 2024 | 4,00%          | 5,03%             |

Source: Croatian central bank.

## 4. Empirical evidence

At first step multiple regression analysis with confidence level of 95% among variables were performed and results are as it follows.

Mathematical formula for linear regression in general form is as it follows:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_j x_j + \varepsilon$$

In this model, regression formula is as it follows:

$$\begin{aligned}
 GDP = & \beta_0 + \beta_1 \text{New built apartments} + \beta_2 \text{New built square meters (000)} \\
 & + \beta_3 \text{Average apartment price per square meter} \\
 & + \beta_4 \text{Issued construction permit} \\
 & + \beta_5 \text{Annual value of realised construction works (000 EUR)}
 \end{aligned}$$

Dependent variable is GDP in absolute amount, as well as all independent variables which are: Annual number of new built apartments; Annual number of new built square meters; Average apartment price per square meter; Annual number of issued construction permits; Annual value of realised construction works. Results are as it follows:

**Table 3** Results of regression analysis

| SUMMARY OUTPUT  |              |                |              |             |              |                |              |             |
|---|--------------|----------------|--------------|-------------|--------------|----------------|--------------|-------------|
| Regression Statistics                                 |              |                |              |             |              |                |              |             |
| Multiple R  |              | 0,98284186     |              |             |              |                |              |             |
| R Square  |              | 0,965978122    |              |             |              |                |              |             |
| Adjusted R Square                                     |              | 0,944714448    |              |             |              |                |              |             |
| Standard Error  |              | 1223,288763    |              |             |              |                |              |             |
| Observations  |              | 14             |              |             |              |                |              |             |
| ANOVA   |              |                |              |             |              |                |              |             |
|   |              | df             | SS           | MS          | F            | Significance F |              |             |
| Regression  |              | 5              | 339904542    | 67980908,41 | 45,4285621   | 1,15994E-05    |              |             |
| Residual  |              | 8              | 11971483,18  | 1496435,398 |              |                |              |             |
| Total   |              | 13             | 351876025,2  |             |              |                |              |             |
|   | Coefficients | Standard Error | t Stat       | P-value     | Lower 95%    | Upper 95%      | Lower 95,0%  | Upper 95,0% |
| Intercept   | 19358,20865  | 4547,565589    | 4,256828906  | 0,002773305 | 8871,503598  | 29844,9137     | 8871,503598  | 29844,9137  |
| New built apartments                                  | 0,043753411  | 1,298107298    | 0,033705543  | 0,973937751 | -2,949687385 | 3,037194207    | -2,949687385 | 3,037194207 |
| New built square meters (000)                         | -7,968890928 | 16,23903483    | -0,490724419 | 0,636797874 | -45,4161724  | 29,47839054    | -45,4161724  | 29,47839054 |
| Average apartment price per square meter              | 11,96588414  | 5,356556328    | 2,233876284  | 0,055957549 | -0,3863569   | 24,31812519    | -0,3863569   | 24,31812519 |
| Issued construction permits                           | 1,171693301  | 0,384631979    | 3,046271153  | 0,01591092  | 0,284730368  | 2,058656235    | 0,284730368  | 2,058656235 |
| Annual value of realised construction works (000 EUR) | 0,000872313  | 0,001807147    | 0,482701829  | 0,642238979 | -0,003294976 | 0,005039602    | -0,003294976 | 0,005039602 |

**Source:** Prepared by author in MS Excel based on data available from: Croatian Bureau of Statistics and Croatian central bank.

Based on table above it can be concluded that more than 98% of variation are explained in model p-value < 0.00001 of F statistics (45,42) confirms overall model significance. Upon regression analysis it can be concluded that independent variable Issued construction permit is significant in model and have strong influence and positive strong correlation with GDP what is confirmed on significance level of 95%. On the other hand, unfortunately, it cannot be concluded which variable is most significant due to multicollinearity among independent variables. Following VIF values indicates multicollinearity problems:

**Table 4** VIF indicator of independent variables

| Variable  | VIF value |
|---|-----------|
| New built apartments                                  | 191,19    |
| New built square meters (000)                         | 141,11    |
| Average apartment price per square meter              | 34,08     |
| Annual value of realised construction works (000 EUR) | 28,29     |
| Issued construction permits                           | 4,20      |

**Source:** Prepared by author in MS Excel based on data available from: Croatian Bureau of Statistics and Croatian central bank.

Correlation matrix is as it follows:

**Table 5** Regression analysis correlation matrix

|  | <i>GDP</i>  | <i>New built apartments</i> | <i>New built square meters (000)</i> | <i>Average apartment price per square meter</i> | <i>Issued construction permits</i> | <i>Annual value of realised construction works (000 EUR)</i> |
|--|-------------|-----------------------------|--------------------------------------|---|------------------------------------|--|
| <i>GDP</i>   | 1           |                             |                                      |   |                                    |  |
| <i>New built apartments</i>                                  | 0,857159245 | 1                           |                                      |   |                                    |  |
| <i>New built square meters (000)</i>                         | 0,882867057 | 0,994939112                 | 1                                    |   |                                    |  |
| <i>Average apartment price per square meter</i>              | 0,958489768 | 0,911595738                 | 0,934219579                          | 1   |                                    |  |
| <i>Issued construction permits</i>                           | 0,881758097 | 0,853332037                 | 0,864041431                          | 0,818952013                                     | 1                                  |  |
| <i>Annual value of realised construction works (000 EUR)</i> | 0,955562989 | 0,886873961                 | 0,913617445                          | 0,980017156                                     | 0,824476543                        | 1  |

**Source:** Prepared by author in MS Excel based on data available from: Croatian Bureau of Statistics and Croatian central bank.

Based on correlation matrix there is strongest correlation between value of realised construction works and GDP what implies that construction sector is positively associated with Croatian GDP and Croatian economy. In addition, all other components which are closely related to construction sector also have positive influence on GDP. It is worth to mention that construction sector was very resistant to COVID crisis when Croatian economy faced plunge of 8,5% while there were increased number new apartments for almost 2%, there were 4% growth in number of built squares, average price of the apartment also increased for 2,64% while value of realised construction works were greater for 6,78% despite lower number of issued construction permits. In this concrete crisis (COVID crisis) construction sector moved in opposite way to GDP direction what was not in case of financial crisis 2008. In order to confirm above correlation matrix table and having in mind high multicollinearity among independent variables, there will be performed simple linear regression in order to find out relations between GDP and each particular independent variable.

**Table 6** Simple linear regression analysis

| <i>Regression Statistics - New built apartments</i>                     |                     |                       |               |                |                       |                  |                    |                    |
|---|---------------------|-----------------------|---------------|----------------|-----------------------|------------------|--------------------|--------------------|
| Multiple R  | 0,857159245         |                       |               |                |                       |                  |                    |                    |
| R Square  | 0,734721971         |                       |               |                |                       |                  |                    |                    |
| Adjusted R Square   | 0,712615468         |                       |               |                |                       |                  |                    |                    |
| Standard Error  | 2789,040732         |                       |               |                |                       |                  |                    |                    |
| Observations  | 14                  |                       |               |                |                       |                  |                    |                    |
| ANOVA   |                     |                       |               |                |                       |                  |                    |                    |
|   | <i>df</i>           | <i>SS</i>             | <i>MS</i>     | <i>F</i>       | <i>Significance F</i> |                  |                    |                    |
| Regression  | 1                   | 258531046,8           | 258531046,8   | 33,23555924    | 8,94992E-05           |                  |                    |                    |
| Residual  | 12                  | 93344978,45           | 7778748,204   |                |                       |                  |                    |                    |
| Total   | 13                  | 351876025,2           |               |                |                       |                  |                    |                    |
|   | <i>Coefficients</i> | <i>Standard Error</i> | <i>t Stat</i> | <i>P-value</i> | <i>Lower 95%</i>      | <i>Upper 95%</i> | <i>Lower 95,0%</i> | <i>Upper 95,0%</i> |
| Intercept   | 28625,04425         | 2975,355969           | 9,620712464   | 5,42975E-07    | 22142,30049           | 35107,78801      | 22142,30049        | 35107,78801        |
| New built apartments  | 1,436328028         | 0,249144979           | 5,765028989   | 8,94992E-05    | 0,893487751           | 1,979168306      | 0,893487751        | 1,979168306        |
| <i>Regression Statistics - new built square meters</i>                  |                     |                       |               |                |                       |                  |                    |                    |
| Multiple R  | 0,882867057         |                       |               |                |                       |                  |                    |                    |
| R Square  | 0,77945424          |                       |               |                |                       |                  |                    |                    |
| Adjusted R Square   | 0,761075427         |                       |               |                |                       |                  |                    |                    |
| Standard Error  | 2543,042227         |                       |               |                |                       |                  |                    |                    |
| Observations  | 14                  |                       |               |                |                       |                  |                    |                    |
| ANOVA   |                     |                       |               |                |                       |                  |                    |                    |
|   | <i>df</i>           | <i>SS</i>             | <i>MS</i>     | <i>F</i>       | <i>Significance F</i> |                  |                    |                    |
| Regression  | 1                   | 274271260             | 274271260     | 42,4104771     | 2,88392E-05           |                  |                    |                    |
| Residual  | 12                  | 77604765,25           | 6467063,77    |                |                       |                  |                    |                    |
| Total   | 13                  | 351876025,2           |               |                |                       |                  |                    |                    |
|   | <i>Coefficients</i> | <i>Standard Error</i> | <i>t Stat</i> | <i>P-value</i> | <i>Lower 95%</i>      | <i>Upper 95%</i> | <i>Lower 95,0%</i> | <i>Upper 95,0%</i> |
| Intercept   | 28343,10786         | 2680,810721           | 10,57258822   | 1,95601E-07    | 22502,12307           | 34184,09265      | 22502,12307        | 34184,09265        |
| New built square meters (000)   | 15,89987654         | 2,441502499           | 6,512332693   | 2,88392E-05    | 10,58029957           | 21,21945351      | 10,58029957        | 21,21945351        |
| <i>Regression Statistics - average apartment price per square meter</i> |                     |                       |               |                |                       |                  |                    |                    |
| Multiple R  | 0,958489768         |                       |               |                |                       |                  |                    |                    |
| R Square  | 0,918702634         |                       |               |                |                       |                  |                    |                    |
| Adjusted R Square   | 0,911927854         |                       |               |                |                       |                  |                    |                    |
| Standard Error  | 1543,982779         |                       |               |                |                       |                  |                    |                    |
| Observations  | 14                  |                       |               |                |                       |                  |                    |                    |
| ANOVA   |                     |                       |               |                |                       |                  |                    |                    |
|   | <i>df</i>           | <i>SS</i>             | <i>MS</i>     | <i>F</i>       | <i>Significance F</i> |                  |                    |                    |
| Regression  | 1                   | 323269431,3           | 323269431,3   | 135,606259     | 6,75265E-08           |                  |                    |                    |
| Residual  | 12                  | 28606593,87           | 2383882,822   |                |                       |                  |                    |                    |
| Total   | 13                  | 351876025,2           |               |                |                       |                  |                    |                    |
|   | <i>Coefficients</i> | <i>Standard Error</i> | <i>t Stat</i> | <i>P-value</i> | <i>Lower 95%</i>      | <i>Upper 95%</i> | <i>Lower 95,0%</i> | <i>Upper 95,0%</i> |
| Intercept   | 21721,09322         | 2060,626244           | 10,54101552   | 2,02092E-07    | 17231,37432           | 26210,81212      | 17231,37432        | 26210,81212        |
| Average apartment price per square meter                                | 13,48673623         | 1,158155826           | 11,64501005   | 6,75265E-08    | 10,96333145           | 16,010141        | 10,96333145        | 16,010141          |

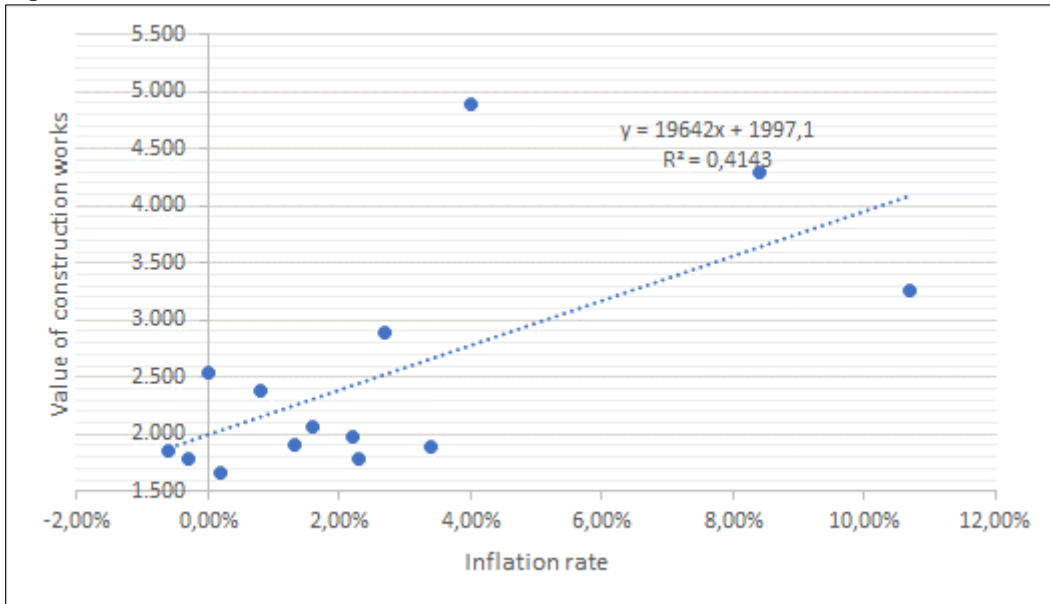
| Regression Statistics - issued construction permits                 |  |              |                |             |             |                |             |             |             |
|---|--|--------------|----------------|-------------|-------------|----------------|-------------|-------------|-------------|
| Multiple R  |  | 0,881758097  |                |             |             |                |             |             |             |
| R Square  |  | 0,777497342  |                |             |             |                |             |             |             |
| Adjusted R Square   |  | 0,758955454  |                |             |             |                |             |             |             |
| Standard Error  |  | 2554,299495  |                |             |             |                |             |             |             |
| Observations  |  | 14           |                |             |             |                |             |             |             |
| ANOVA   |  |              |                |             |             |                |             |             |             |
|   |  | df           | SS             | MS          | F           | Significance F |             |             |             |
| Regression  |  | 1            | 273582674,3    | 273582674,3 | 41,93193998 | 3,04407E-05    |             |             |             |
| Residual  |  | 12           | 78293350,92    | 6524445,91  |             |                |             |             |             |
| Total   |  | 13           | 351876025,2    |             |             |                |             |             |             |
|   |  | Coefficients | Standard Error | t Stat      | P-value     | Lower 95%      | Upper 95%   | Lower 95,0% | Upper 95,0% |
| Intercept   |  | 21892,3393   | 3668,244577    | 5,968069696 | 6,52938E-05 | 13899,92095    | 29884,75765 | 13899,92095 | 29884,75765 |
| Issued construction permits   |  | 2,536481396  | 0,39170508     | 6,475487625 | 3,04407E-05 | 1,683029343    | 3,389933449 | 1,683029343 | 3,389933449 |
| Regression Statistics - annual value of realised construction works |  |              |                |             |             |                |             |             |             |
| Multiple R  |  | 0,955562989  |                |             |             |                |             |             |             |
| R Square  |  | 0,913100627  |                |             |             |                |             |             |             |
| Adjusted R Square   |  | 0,905859012  |                |             |             |                |             |             |             |
| Standard Error  |  | 1596,292738  |                |             |             |                |             |             |             |
| Observations  |  | 14           |                |             |             |                |             |             |             |
| ANOVA   |  |              |                |             |             |                |             |             |             |
|   |  | df           | SS             | MS          | F           | Significance F |             |             |             |
| Regression  |  | 1            | 321298219,2    | 321298219,2 | 126,0907543 | 1,00982E-07    |             |             |             |
| Residual  |  | 12           | 30577806,05    | 2548150,505 |             |                |             |             |             |
| Total   |  | 13           | 351876025,2    |             |             |                |             |             |             |
|   |  | Coefficients | Standard Error | t Stat      | P-value     | Lower 95%      | Upper 95%   | Lower 95,0% | Upper 95,0% |
| Intercept   |  | 32725,3684   | 1192,612236    | 27,44007433 | 3,38466E-12 | 30126,88956    | 35323,84724 | 30126,88956 | 35323,84724 |
| Annual value of realised construction works (000 EUR)               |  | 0,004978338  | 0,000443346    | 11,22901395 | 1,00982E-07 | 0,00401237     | 0,005944306 | 0,00401237  | 0,005944306 |

**Source:** Prepared by author in MS Excel based on data available from: Croatian Bureau of Statistics and Croatian central bank.

As it can be noticed from above tables which presents regression analysis, the lowest R-Square indicator is 0,73 which confirms goodness of model. In addition to R-square indicator, it is worth to mention that P-value is around 0 (zero) at significance level of 95% which confirms that each independent variable has influence of GDP as a dependent variable.

Regarding other macroeconomic indicators, it can be concluded that increasing activity in construction sector increase inflation on overall level. There is positive correlation between value of realised construction works and inflation rate of 0,64 for the period from 2011-2024. It is necessary to mention that between 2021 and 2023 construction materials like steel, timber, cement and generally energy costs significantly increased up to 60% in some fields which also had some influence on inflation rates. Despite prices increase and cost pressures, there were above 15% of construction works growth in 2022 and 2023.

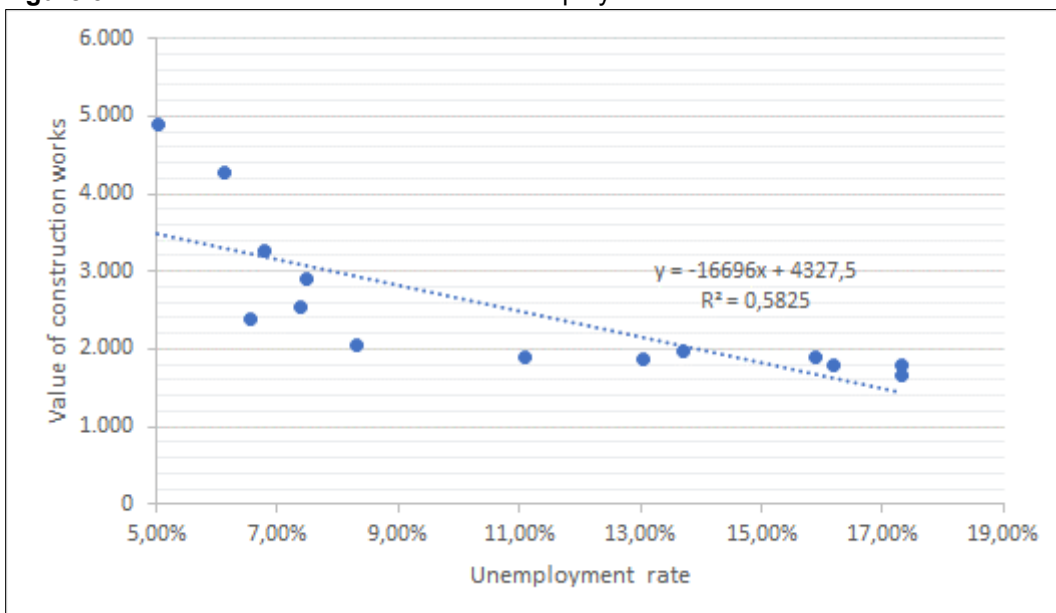
**Figure 2** Correlation between value of construction works and inflation rate



**Source:** Prepared by author in MS Excel based on data available from: Croatian Bureau of Statistics and Croatian central bank.

On the other hand, construction sector has positive effect on overall employment of Croatian economy what can be confirmed with significant negative relationship between unemployment rate and value of construction works. Correlation coefficient between these two variables is -0,76. Apart from direct effect of construction sector, it can be noticed that construction sector is considered as a pro-cyclical industry having in mind multiplier on job creation in other sectors like transport, design, construction materials, wood industry and etc.

**Figure 3** Value of construction works and unemployment rate



**Source:** Prepared by author in MS Excel based on data available from: Croatian Bureau of Statistics and Croatian central bank.

## 5. Conclusion

Construction sector is one of the most important for particular economy development and GDP growth. Positive correlation between construction sector and investment cycle comes from fact that construction sector is necessary for building of new production facilities, production capacities, accommodation units, tourism sector development as well as for improvement of residential facilities and living standards. Apart from significant GDP and employment contribution construction sector also contributes to environmental improvement and energy efficiency what is European union one of strategic goals. In addition to previous mentioned benefits, lot of other industries are strongly linked to movements on construction market. Employment in construction material traders, architects, transportation companies, project managers, recycling industry and other less significant industries partly depends on activities in construction sector. Governments can support sector development through public works organization what generally leads to greater GDP and economy development, especially in short term. On a long-term basis, influence of public works was not significant even for GDP even for construction companies. Another driver of construction sector and consequently GDP growth is housing market which are also associated with macroeconomic situation in general and employment rate. During latest COVID crisis, construction sites were not closed, but construction companies had problems with delays in raw material procurement caused by difficulties in supply chain and by lack of workers due to travel limitation which caused difficulties workers movements. In some countries, like Australia and Russia, construction companies faced some loses while in Croatia despite lower number of issued construction permits construction sector faced strong resilience and, in the end, operated better in 2020 compared to year before. Croatian construction companies are significant for Croatian economy development, what is confirmed through correlation analysis in which all indicators are positively associated with GDP growth and value of construction services is negatively associated with unemployment rate. High inflation in recent period might be challenge for sector and as recommendation for further research it will be highly recommended to analyse how construction sector contributes to real GDP and real GDP growth in high inflation conditions. COVID crisis had only short negative influence to Croatian GDP in which construction sector was very resistance. For further research it could be interesting to analyse sector resistance in longer crisis or longer GDP decline period. Also, it will be interesting to compare Croatian market with other countries, especially in CEE region which are similar to Croatia based on macroeconomic indicators. Apart from that, further research can be extended on other significant sectors in Croatia, like tourism, or some other indicators can be included in model in order to realise which one is most significant for Croatian GDP.

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