

## ECONOMIC GROWTH DETERMINANTS IN NEW AND OLD EU COUNTRIES WITH FOCUS ON CONSTRUCTION

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**Abstract.** Classical, neoclassical, institutional and other schools have debated what is crucial for economic growth. Literature review related to economic growth models is extensive. The objective of our paper is to construct a model of economic growth determinants in EU countries, with focus on construction. Our model includes determinants that reflect the impact of construction on economic growth, which is the contribution to existing literature. It has been created for three groups of countries: EU28, old EU and new EU countries. We believe that this has improved the quality of the results and enabled a comparative analysis of the old and new EU countries. In order to create a model, we used a strongly balanced panel of 28 EU countries in the period 1995–2019 and employed the difference-in-differences approach. Our results for EU28 confirm positive effect of industry, gross fixed capital formation, production in construction and cost construction index on GDP, while gross wages are statistically insignificant. FDIs have low negative impact on economic growth in EU28 and old EU, but statistically insignificant in new EU countries. CO<sub>2</sub> is significant and positively correlated with economic growth in all countries. Based on empirical results, we propose policy relevance in concluding remarks.

**Keywords:** economic growth, construction, gross domestic product, differences-in-difference approach, new EU countries, old EU countries.

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## **Introduction**

Recent economic growth theories are based on the Solow growth model and all arose as a result of criticism of that model. Neoclassical and endogenous theories of economic growth have assigned different specific weight (emphasis) to certain determinants of economic growth. The methodological basis of neoclassical theory was grounded on the classical theory of production factors as well as the theory of marginal productivity. The dominant determinants of economic growth, according to endogenous growth theory, are human capital and technological progress which have been the leading drivers of economic growth in most countries. Endogenous growth models are similar to the neo-classical ones, but starting from different assumptions compared to neoclassical growth models. According to the endogenous growth theory, technological progress is not the only possible cause of economic growth in the long term. Knowledge and information are a key growth factor in Romer's endogenous growth theory. On the other hand, Lucas's theory of growth (Lucas, 1988) highlights education and human capital as the main attributes of the production function, which is the basis of growth. Thus, endogenous growth theories acknowledged establishment of the relationship between the economic growth mechanisms and the process of new knowledge accumulation, which is reflected in technological innovations. At the end of the twentieth and the twenty-first century, attention, in that sense, shifted from macroeconomic factors to non-economic factors of economic growth.

Numerous theoretical and empirical studies in the past period have analysed a large number of variables that have an impact on economic growth, while not always a consensus was reached on the direction and strength of the impact of individual variables on growth. In this regard, some research was focused on examining the relationship between construction and economic growth in different countries and in different periods of development. Study investigating the impact of construction industry development on economic growth (Ramachandra et al., 2013a), proved that there is a positive relationship between construction sector development and overall output performance. Some of the earlier studies (Wong et al., 2008) did not find a strong link between investment in the construction sector and economic growth.

According to the Eurostat (2020a) analysis size of the construction sector in the EU over 2010–2019 period was generally constant and amounted between 5 and 6% of GDP. The percentage reached its peak at 5.8% in 2010, decreasing to 5.1% in 2014 to 2017 and then rising to 5.5% in 2019. In this period, 16 countries recorded fall with the largest declines in Spain, Greece and Bulgaria, while Denmark, Hungary, Lithuania and Latvia registered increase. In 2019, 5 EU countries had the size of construction sector above 7% of GDP – 4 new EU (Slovakia, Lithuania, Poland and Romania) and 1 old EU country (Finland).

It is indisputable that the construction sector strongly determines economic growth in all EU countries, both old and new EU countries. Official data suggest that in 2019 total investment in construction in the EU amounted approximately EUR 1.3 billion, which is close to 10% of EU's GDP (European Construction Industry Federation, 2020). Germany and the Netherlands recorded growth (4% and 3.8%, respectively), followed by Spain and Italy, while investments in Sweden and Finland fell. In new EU countries, Romania and

Hungary recorded spectacular growth rates (10.9% and 16.8%, respectively), while only Slovenia recorded a negative growth rate. Housebuilding was the main driver of growth of this sector in 2019, with 21.6% of the EU's total investment in construction. Rehabilitation and maintenance activities represented 28% of the total investment in construction, while the non-residential segment recorded 31.6% of total investment in construction. Investments in civil engineering represented 18.8% of the total investment in construction in 2019. In the same year, at a slightly lower rate (compared to 2018), employment in this sector continued to grow, and employment growth recorded a rate of +1.5%. The total number of employees in the EU construction sector was estimated at 12.7 million workers, employed in over 3 million construction companies (which is about 6% of total employment in the EU). However, the COVID-19 crisis in the following year stopped the growth trend of this sector.

Construction is essential for economic growth and its activities affect nearly every aspect of the economy in a way that industry represents one of the driving factors of the economic growth. Construction sector activities in the EU in the last quarter of 2019 increased by 1.4% compared to the same period in 2018 in all EU countries except Italy, the Netherlands, Poland and Slovakia but this was still lower than 3.8% registered in the preceding quarter of 2019. Contrary, gross fixed investment in construction, according to the European Steel Association's Economic Report (European Steel Association, 2021), rose by 2.5% in the last quarter of 2019, and compared to the same period of the previous year they increased by 3.5%. Compared to the old EU countries, new EU countries generally have higher growth rates (Eurostat, 2021a). Looking at the performance of individual countries, as in previous quarters, new EU countries generally recorded higher growth rates.

As the impact of construction on economic growth is significant, our research paper's goal is to create a model of economic growth determinants with focus on construction, on a sample of EU countries over the 1995–2019 period. Determinants, included in our model, which reflect the impact of construction on economic growth are the following: industry (including construction), gross fixed capital formation, wages in construction, production in construction, cost construction index, foreign direct investments and CO<sub>2</sub> emissions. We created a model for three groups of countries which has enhanced the quality of results and allowed a comparative analysis between these groups of countries. This represents a contribution to existing literature. Empirical research of economic growth most noticeably proves that panel regression, cross-country and single-country analysis dominate in the methodological framework. We opted for the differences-in-difference (DD) method as one of the most used methods in applied economics.

The structure of the paper is as follows. First, we briefly articulate some old and recent theories of economic growth, point out the importance of construction in generating GDP and cover statistics on construction in the previous period. We then offer a detailed overview of the results of recent empirical research on GDP determinants with a focus on construction, for EU countries. Following the presented empirical background, the authors defined hypotheses that were the subject of further testing in the paper. In Section 2, we present the data and methodology which we used in the model creation. The following section outlines our results accompanied by discussion, and the final section concludes with policy and managerial recommendations.

## 1. Literature review

In this section, we focus on the key results of previous empirical research that primarily relate to the impact estimates of our model determinants on economic growth in EU, which is why special attention is paid to these determinants. We emphasize that presented results of empirical research are related to the time period covered by our model, i.e. 1995–2019.

Output from the construction industry is a basic integral part of the national product, with a significant share in GDP. As previously mentioned, in EU countries, the construction industry generates about 10% of GDP and employs about 7% of the workforce (Stasiak-Betlejewska & Potkány, 2015). Due to strong links with other sectors, the construction sector is considered as an essential component of national economic growth and development (Ewing & Wang, 2005; Khan, 2008; Jackman, 2010), generating high multiplicative effects (Hongyu et al., 2002). Numerous studies have confirmed that construction noticeably contributes to national economic growth, especially in developed countries (Hillebrandt, 2000; Lean, 2001; Rameezdeen, 2007; Myers, 2016; Dlamini, 2012). On the other hand, some research has confirmed that in periods of accelerated economic growth, the construction sector rises faster than other sectors, but in periods of stagnation and decline, construction is first to be hit by the shocks of the crisis (Ramachandra et al., 2013b; Mavridis & Vatalis, 2015).

Construction sector as one of the basic sectors is certainly a strong driver of the industrial sector development and the ground of the strategic plans in a number of countries. This sector is referred to as an economic activity spanning on primary, secondary and tertiary economic sector (Gruneberg, 1997), although according to the UN, construction is perceived as an economic activity “directed to the creation, renovation, repair or extension of fixed assets in the form of buildings, land improvements of an engineering nature and other such engineering constructions as roads, bridges, dams” (United Nations, 2021). As construction products are predominantly labour-intensive (Ive & Gruneberg, 2000), this sector is heavily dependent on human labour, mostly on low-skilled workers. However, there is an evident problem of lack of skilled workers (Ceric & Ivic, 2020; Karimi et al., 2018), which is reflected in the quality of investment projects, and causally consequentially with the costs and prolongation of project completion deadlines (Karimi et al., 2018; Aiyetan & Dillip, 2018). This sector has an impact on job creation, multiplicative effects on the national economy, as well as manifests high flexibility in different conditions. The effects of changes in construction are reflected in the economy at all levels and in various aspects of life (Chen, 1998; Rameezdeen, 2007). Therefore, the construction industry has a significant role in the development strategy of each country and is frequently used as a tool by government to manage the local/national economy (Wibowo, 2009).

Industry, including construction, represents one of the leading sectors of economic development. European Commission (2021) suggests that industry is the foundation of the European economy with its socioeconomic development indicators reaching high growth rate. It's perspective on growth and the sources of growth are essential because of the great diversity in the drivers of growth in agriculture, manufacturing, and services industries, including trade, transport, financial, business and personal services. Industry was always on the list of major growth drivers in the economy being a vital part for further development. In developed

countries, Kniivilä (2007) found a close relation between the level of industrial development and the level of national and per capita income. In old EU countries, the contribution of the industrial sector (including manufacturing, construction, mining and utilities) to economic growth has increased over time, while in new EU countries it was decreasing. Therefore, the industry itself was always seen as an economic growth driver primarily in the new EU countries. The construction industry growth was halted with the global financial crisis over the period 2008–2013, while this industry recorded negative growth rates. Construction recovery lasted from the financial to the onset of the health crisis, which ceased further recovery. Thus, Lithuania, in this period, registered the largest decline in building production, while Germany and Luxembourg registered the smallest activities' decreases. Building production continued to further increase.

The process of investing in physical capital stocks, including infrastructure, is measured by gross fixed capital formation. It is noticeable that within the EU there is a clear difference in investment rates between the old and new EU member countries. In this regard, in the period 1995–2013 investment rates in OMS (old EU) were about 4% lower compared to crisis period of same countries and 6% lower compared to NMS (new EU) countries which is explained by different development levels of countries in these groups. Apart from the intensity, differences in the investment structure are also present. Thus, investment rates “in the NMS in machinery and equipment and non-residential construction are 6% higher than in the OMS. In contrast, the investment rate in dwellings is about 2% higher in the OMS than in the NMS” (Kolev et al., 2013). We observe that EU fixed investment were more unstable than GDP. However, in the long run, fixed investment has increased in a stable and anticipated way as well as GDP, so the gross fixed capital formation in the EU in the fourth quarter of 2019 increased by 3.6% compared to the same period of 2018 (Eurostat, 2021b).

The relationship between gross fixed capital formation and economic growth has always been a subject of constant interest. One of the later studies, using a multivariate autoregressive VAR model for Greece, showed that in the long run an increase of 1% on the ratio of gross fixed capital formation to GDP will lead to increase of 0.09% on GDP per capita (Dritsakis et al., 2006). One of the studies, conducted on the sample of EU member countries from the Southeast Europe (SEE) countries, with different development levels in the period 1996–2012, showed that gross fixed capital formation, trade openness, the initial level of GDP per capita, human capital development and foreign direct investment significantly and positively affect economic growth (Fetahi-Vehapi et al., 2015). Furthermore, a study conducted on the sample of Central and East European countries individually, in the period 2003–2009 showed a direct and strong relationship between gross fixed capital formation and economic growth, with a high correlation coefficient, almost 1 (Gibescu, 2010). Research focused on the new EU countries also showed that gross fixed capital formation has positive effects on economic growth, for the period 1995–2016 (Vlahinić Lenz et al., 2018). Also, one of the most recent studies confirmed the hypothesis that gross fixed capital formation has a positive impact on GDP in the Eurozone during 2002–2017 (Lymonova, 2019).

Numerous studies have pointed out that about half of the investments in gross fixed capital formation come from construction, which is why the construction industry has a dominant influence on the growth rate of gross fixed capital formation (Gruneberg, 1997;

Hillebrandt, 2000; Ruddock & Lopes, 2006). The impact of construction, i.e. investments in construction on economic growth has been the subject of particular interest of many researchers, as well as international bodies. Earlier research has supported the classical approach in growth theory according to which capital formation is the main engine of economic growth and development. Subsequent research has examined the interdependence between investment in construction and GDP per capita and it has confirmed that there is a 5% threshold level of Construction Value Added/GDP (Lopes et al., 2002). In case of a reduction in construction volume, this results in a fall of GDP per capita growth, while the converse does not appear to be true.

Construction is a major component of investment. Some studies, estimating the impact of investments in construction on economic growth, have concluded that the impact of housing investments on GDP is more visible than non-residential investments, especially in conditions of high and low unemployment (Green, 1997; Coulson & Kim, 2000; Wilhelmsson & Wigren, 2011). Wigren and Wilhelmsson (2007) examined the relationship between GDP and construction in old EU countries and concluded that public infrastructure policies have an impact on short-term economic growth, but weak impact on long-term. The impact of housing investment on GDP is more obvious than non-residential investment, especially in the long run. On the other hand, residential construction will have little or no impact on economic growth if the housing stock per capita is already high or the state with a large social housing sector has already intervened in the housing market (Wilhelmsson & Wigren, 2011). A significant part of gross fixed capital formation in EU countries in the past period was related to infrastructure investments, which supported economic growth (Badalyan et al., 2014). It is not disputed that some types of infrastructure have a greater impact than others. Moreover, construction strongly contributed to transport infrastructure. Some empirical studies have identified transport infrastructure (Snieška & Bruneckienė, 2009) as a key mechanism for increasing economic growth (Crescenzi & Rodríguez-Pose, 2012).

As the construction is labour and capital-dependent, this sector strongly contributes to employment (Erol & Unal, 2015). The construction industry represents a prime source of employment. The effects of changes in the construction industry on the economy manifest at all levels. European Commission determined that developed economies and construction sectors in old EU countries are able to meet their needs and partially fill the workforce shortages with the workforce migrating from new EU countries (European Migration Network, 2015). Some of the previous research (Dustmann et al., 2013) indicate that a 10% rise in foreign employment leads to drop of domestic labour force wages in construction by 0.6%. Thereby, the main outcome of foreign employment growth in old EU countries, results in the increase of wages for lower qualified labour force in new EU (Bratsberg & Raaum, 2012). It should not be obliterated that the construction sector has a strong potential to employ a large number of unemployed unskilled or temporary/seasonal workers (Galic et al., 2014). Furthermore, the necessary skills will probably need to be upgraded in order to meet the requirements of “green” construction and energy efficiency.

In conditions of positive economic growth, it is expected to have growth in real wages, but this as such is not guaranteed. In this regard, in certain economies it was recorded that when GDP increases average wages stagnate or even decline. Also, in conditions of equal

growth rates of GDP and population, GDP per capita remains the same with no increase in average real wages. In addition, in some EU countries recently, trends in wages have been influenced by non-wage rewards – the provision of private health care insurance and private pensions by some companies. Thus, in the period from 2010 until 2015 the United Kingdom (UK) recorded an unusual experience – positive economic growth (real GDP growth) and decline of average wages. Certain research indicates factors of increased underemployment and low productivity that have put pressure on wages in the UK (Bell & Blanchflower, 2018). However, the improvement in labour market conditions in advanced Europe has not been accompanied by the expected growth of wages. Official data show that employment has grown, while in many EU countries a problem of labour shortage is evident. According to Eurostat (2020b), in the EU, the unemployment rate decreased from 11% in 2013 to almost 8% five years later. As in previous years, the unemployment decline was stronger than expected based on the pace of economic growth. It is obvious that the decline in the unemployment rate was not accompanied by a corresponding increase in wages and currently, it is at half of the growth rate that was before the economic crisis. Namely, one of the surveys conducted in old EU members, indicated that nominal wage growth remained under 2% in 2012 and 1.7% in 2018 (Branten et al., 2018). Considering that long-term wage growth depends on inflationary expectations that are low in the long run, there are sporadic cases of nominal wage growth accompanied by low price inflation and productivity growth.

Regarding the relationship between wages in construction and economic growth, Eurostat data suggests that, in most old EU countries, wages in construction growth rates are increasing faster than the GDP growth rates after the crisis period, while in the Scandinavian countries this trend is characteristic of both the pre-crisis and post-crisis period. In some old EU countries (Benelux countries) and new EU countries (Czech Republic, Slovenia and Malta), economic growth was not accompanied by wage growth. Interestingly, most new EU countries are characterized by significant wages in construction growth in such a way that wage growth rates in these countries were on average up to 3 times higher than GDP growth rates which certainly indicates on the expansion of construction in these countries. It should come as no surprise that in the EU, both old and new EU countries, the wage growth rate lagged behind the economic growth rate in the crisis period.

Some of the recent research has focused on establishing a relationship between production in construction and GDP. The construction sector has two major divisions of activity level – the civil/heavy engineering construction and building construction. Civil engineering is associated with infrastructure development, i.e. roads, railways and bridges, among other heavy construction outfits. On the other hand, building construction is related with the construction of residential and commercial buildings. Interestingly, during the period of economic prosperity and stability, construction output increases at a higher rate than the whole economy. Pheng and Hou (2019) dealt with determining the significant relationship between the construction activity and economic development. They concluded that in the first phases of development, the participation of construction production in GDP rises, while in the full-grown phases it begins to drop with other implications related to market competitiveness and contribution to the national economy. Their results suggest that there is a causality between the economic growth and construction with a very strong influence of residential invest-

ments on growth, which has been confirmed on the sample of old EU countries. Moreover, Granger's causality has been found to be bidirectional, so that public infrastructure impacts economic growth, but economic growth also influences public infrastructure. Considering whether the construction, which typically engages a large number of the workforce, when operating at maximum capacity, can be used to emerge from the recession, Dlamini (2012) points out that policymakers need to be especially careful, which has not been the case so far. Although the construction is obviously an important sector in the economy, especially in terms of job creation, capital and effects it has on another sectors, it is extremely important that policy makers secure conditions to provoke positive effect of construction sector on economic growth. A study conducted by Wilhelmsson and Wigren (2011) confirmed that a 1% increase in construction affects GDP growth by maximum 0.15%, which is notable particularly in the countries with high unemployment.

Eurostat defines the construction cost index as a measure of cost increase/decrease for residential buildings. Countries without statistics on construction costs use the construction producer price indices (or "construction output price index"). One of the most recent studies showed that consumer price index has the highest impact on construction price index compared to other factors (such as GDP, basic interest rate, foreign exchange rate and total export and import) (Nguyen & Nguyen, 2020). Kodrič and Bregar (2012) in their research related to Slovenia showed that the compilation of construction price indices for the period 1995–2008, in the hypothetical scenario, could affect the growth path of consumer price index if productivity, profit rate and quality changes are used. Kargi (2013) on the case of Turkey for the period 2000–2012, confirmed that infrastructure predominantly affects the growth along with the public sector expenditure. Official European statistics suggests that growth rates of cost construction and GDP were different over the period from 1995 until 2019. Namely, during the crisis period from 2008 until 2012, GDP grew slowly compared to the cost construction in both, old and new EU countries. In most EU countries, however, increase of cost construction was higher than GDP growth in both, pre-crisis and post-crisis period. Recently, with the actualization of the sustainable development concept (Naciążek, 2015), the requirements of energy efficiency in construction are being forced, in order to optimize the level of construction costs.

From 1980, FDI began to grow strongly, prompting theoretical and empirical research on the effects of FDI on economic growth. Theoretically, in the neoclassical growth model, FDI leads to an increase in economic growth in terms of increased volume of investment and efficiency. Contrary, Borensztein et al. (1998) in the endogenous growth model, found that FDI leads to creation of technological diffusion from the developed countries to the host country. We observe that the empirical evidence is mixed – from positive, negative, to the neutral impact of FDI on economic growth. Some research in developed and developing countries has shown a significant relationship between FDI and economic growth that is complementary in both groups of countries (Li & Liu, 2005; Şenalp, 2019). A more detailed review of the literature on this topic suggest that country-specific evidence is mixed (Ericsson & Irandoust, 2004; Chowdhury & Mavrotas, 2006). Analysing the economic growth determinants in the period from 2003 to 2016, on the sample of several Central European countries (including Romania), Simionescu et al. (2017) determined that FDI has a positive impact on



economic growth. At the same time, not a small number of studies indicate that the quality of institutions and economic structures is important for attracting FDI inflows in advanced economies (Dellis et al., 2017). FDI in countries with better institutional quality leads to stronger economic growth, compared to countries with lower institutional quality (Hayat, 2016). Some studies showed that institutional quality is a more important determinant of FDI in developed countries compared to developing countries (Sabir et al., 2019). Furthermore, some research (Carkovic & Levine, 2005) indicates no or little impact of FDI on economic growth. Similarly, in a study on the sample of several SEE countries, a positive relationship between economic growth and FDI was not confirmed (Stanišić, 2008). Lyroudi et al. (2004) reported similar conclusion for countries with low and high income and growth.

When observing the sectoral disaggregation of FDI stocks, we note that changes in the structure of FDI during 2003–2008 are indicative. Namely, in some new EU countries (Estonia, Latvia Lithuania, Romania, Bulgaria and Slovenia) there was a decrease in the share of FDI in production and services, but an increase in FDI inflows into construction and real estate. In the same period, differences in the sectoral share of the FDI in Visegrad countries were slighter and took the form of enlarged real estate FDI. Regarding the impact of FDI in construction on economic growth, it is worth mentioning a study conducted on a sample of 10 new EU countries for the period 2000–2012, which showed that the impact of FDI inflows into construction and real estate on real GDP growth is statistically significant at 10% level (Bogumil, 2014).

The relationship between global temperatures and greenhouse gas concentrations, especially CO<sub>2</sub>, has been a subject of numerous studies (Lacis et al., 2010). Greenhouse gases emissions represent main cause of climate change and combating this problem is one of the main challenges of modern society. According to official data of Energy Protection Agency, in the last 50 years, there was an evident increase of carbon emissions, in a way that CO<sub>2</sub> emissions grew by about 90%, while the share of industry and non-renewable fuel sources amounted to about three quarters of total emissions. Emissions of non-CO<sub>2</sub> greenhouse gases have also increased significantly. Regarding this matter, the United Nations Framework Convention on Climate Change (UNFCCC) for recent years arranged numerous conferences for agreement among nations for controlling the CO<sub>2</sub> emissions. At the twenty-first Conference of the Parties (COP) of the UNFCCC (2015), the Paris Agreement was signed with aim to reinforce society's struggle against the climate change. The key aim that was recognized by the countries was "to keep the average global temperature increase below 2 °C compared to the pre-industrial period, and to make efforts to limit that rise to 1.5 °C above pre-industrial levels. As of June 2021, the Agreement has 195 signatories. By 2020, countries submit their plans for climate action and CO<sub>2</sub> reduction known as nationally determined contributions (NDCs). Since the Agreement, subsequent COPs have reviewed implementation progress across its signatories (Palmer et al., 2019). This is especially important given the aggregate of the NDCs are predicted to underperform against the Agreement's target. This emissions gap needs to be closed with further NDC target updates. Today, the EU leads in implementing Paris climate commitments, as a global green player.

Monitoring the relationship between CO<sub>2</sub> emissions and economic growth is a good prerequisite for defining different economic policies on a sustainable basis. Numerous research

studies examined the relationship between economic growth and CO<sub>2</sub> emissions (Mardani et al., 2019). Different studies confirmed the existence of three outcomes for growth and CO<sub>2</sub> emissions relationship. First group of studies proved that higher the growth, higher CO<sub>2</sub> emissions. In addition, the second group demonstrated the existence of bidirectional relationship between economic growth and greenhouse gas emissions, while the third group of studies supported the stance of no direct link between economic growth and CO<sub>2</sub> emissions. Recent studies on the EU sample (Gardiner & Hajek, 2020; Dogan & Aslan, 2017) demonstrated that CO<sub>2</sub> emissions affect GDP in both the old and new EU countries with the negative relationship confirmed in the old EU countries. Interestingly, Badulescu et al. (2021) examined the nexus between tourism, GDP growth and CO<sub>2</sub> emissions in 27 EU member states for the 1995–2016 period. They noted the negative impact of GDP growth and CO<sub>2</sub> emissions on tourism development. However, Lapinskienė et al. (2014) noted that, in 29 European countries (out of which 27 are from the EU) over the period 1995–2010, at a higher development level, further economic growth is positively correlated with the environment. In addition, a study conducted on a sample of new EU countries and EU candidate countries showed that the amount of carbon dioxide emissions in the sampled countries will not decrease in the near future if their economic outputs continue to increase (Kasman & Duman, 2015). Therefore, it is recommended that policy makers in these countries implement policies to control carbon dioxide emissions.

Construction represents the most notable global carbon emitting sector. The impact of construction on global GHG emissions is significant, with indirect CO<sub>2</sub> emissions dominating. Some recent research clearly indicates that the growth of the construction sector has had a significant positive impact on CO<sub>2</sub> emissions (Ahmad et al., 2019). Huang et al. (2018) proved that the EU27 construction sector is the second largest direct and second largest indirect CO<sub>2</sub> emission contributor in the world. With the process of urbanization, it is obvious that the development of the construction sector and economic growth have been stimulated, which has led to an increase in the consumption of fuel-based energy, due to which CO<sub>2</sub> emissions have increased. The use of low embodied carbon building materials and services, the energy efficiency of construction machinery and the use of renewable energy sources are considered as key opportunities for reducing emissions from construction.

According to official data (United Nations Environment Program, 2020) in 2019 global construction accounts 38% of total global emissions, of which 28% derive from building operation and 10% from materials used in their construction and maintenance. Reducing emissions from construction is vital if we want to keep emissions below 1.5–2 Celsius degrees. The construction industry needs to adopt a clear definition of what are the net-zero carbon means. Half of all emissions are embodied in buildings, which means that they are caused by the production of materials and the construction process. According to the latest report, published by the World Business Council for Sustainable Development (2021), the building industry causes 14 gigatons of GHG emissions each year. Furthermore, 70% of emissions are caused by only six materials related to construction, while cement, which is a key component of concrete, is responsible for about 8% of total emissions. In six case studies, i.e. construction projects, an average lifetime carbon footprint of 1,800 kgCO<sub>2</sub>e/m<sup>2</sup> was estimated. Therefore, architects have to make greater efforts in order to eliminate emissions

from construction, while building. Industry needs to adopt lifelong carbon assessments and define clear targets for decarbonisation of the sector. Broad cooperation of all parties in the building value chain is necessary in order to move towards “net-zero carbon”. It must be ensured that the building does not add emissions during its construction and operation, or during demolition, i.e. during the whole life-cycle carbon.

Based on empirical background, which is presented ahead, we formulate the following hypotheses:

- H1. Determinants through which the impact of the construction industry is reflected on economic growth (industry including construction, gross fixed capital formation, gross wages in construction, production in construction and construction cost index) positively influence GDP growth in both old and new EU countries;
- H2. FDI, including investment in construction, has no statistically significant positive impact on GDP growth, while CO<sub>2</sub> emissions, covering construction, are positively correlated with economic growth in both old and new EU countries;
- H3. EU membership has a higher positive impact on GDP growth in new EU countries, while crisis has negative effect on growth regardless of EU membership.

In the continuation of the paper, we present procedures and results of the hypotheses. Namely, we analyse the results of three estimated group of countries: EU28, new EU and old EU member states.

## 2. Data and methodology

In this study, as aforementioned, we used a strongly balanced panel of 28 EU countries in the period 1995–2019. The data provided are mainly derived from the database of the World Bank (World Development Indicators), but also from the Eurostat as shown in details in Table 1.

In Table 1 we provide definition of all variables used and the explanations of their measurement. The last two variables (Table 1) are dummy variables and have binary values of 0 and 1. In Table 2 some basic descriptive statistics are listed for the variables.

Our paper deals with the multiple linear regression model for  $i = 1, \dots, N$  identities (countries in our case), observed at time periods  $t = 1, \dots, T$ . This model can be presented as in Eq. (1):

$$Y_{it} = \alpha + \beta X'_{it} + \gamma Z'_{it} + u_i + \varepsilon_{it}. \quad (1)$$

In this model  $Y_{it}$  represents the dependent variable while  $X'_{it}$  is a K-dimensional row vector of time-varying explanatory variables and  $Z'_{it}$  being a M-dimensional row vector of time-invariant explanatory variables which excludes the constant term,  $\alpha$  represents the intercept,  $\beta$  stands for a K-dimensional column vector of parameters,  $\gamma$  defines a M-dimensional column vector of parameters with the  $u_i$  as an identity-specific effect and  $\varepsilon_{it}$  as the error term. The main characteristic of balanced panel is presumption that each identity is observed in all time periods. First, we estimated our model with the pooled OLS estimator, fixed effects estimator and random effects estimator.

Table 1. Description and sources of data (source: \*World Bank, \*\*Eurostat, \*\*\*Our World in Data Database)

Series	Abbreviation	Definition (taken from the official statistics)
GDP growth rate*	gdpgrowth	Annual percentage growth rate of GDP at market prices, based on constant local currency.*
Industry (including construction), value added*	industrygdp	Comprises value added in mining, manufacturing, construction, electricity, water, and gas (NACE divisions 05-43). Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. NACE divisions covered by the construction (41-43) are reflected by the following: 41 – construction of buildings: development of building projects and construction of residential and non-residential buildings, 42 – civil engineering: construction of roads and railways and construction of utility projects for fluids, electricity and telecommunications, and other civil engineering projects and 43 – specialised construction activities: demolition and site preparation, electrical plumbing and other construction installation activities.*
Gross fixed capital formation*	gfcf	It includes land improvements, plant, machinery, and equipment purchases, construction of roads, railways, including schools, offices, hospitals, private residential dwellings and commercial and industrial buildings. According to the 1993 SNA, net acquisitions of valuables are also considered capital formation.*
Gross wages in construction**	wages	Total remuneration payable to all persons counted on the payroll employees in construction (section F of NACE).**
Production in construction**	prodinconstr	The production in construction shows the output and activity of the construction sector. It measures changes in the volume of output on a monthly/annual basis.**
Construction cost index**	costindex	This index serves to present the costs incurred by the contractor to carry out the construction process. It is mandatory for new residential buildings and its cost component shows the price developments of production factors in the construction industry. The construction cost index is a European Union business cycle indicator showing the trend in the cost for new residential buildings.**
Foreign direct investments*	fdi	Foreign direct investment represents net inflows in the economy from foreign investors, and is divided by GDP. Classification of FDI by economy and industry (including construction), compile data by industries that correspond to the major tabulation categories (NACE F).*
CO <sub>2</sub> emission growth***	co2	Emissions as a percentage change compared to previous year, originally expressed in mega tons. Construction industry has significant share in these emissions, which is the most notable carbon emitting sector.***
Crisis	crisis	Refers to the global financial and sovereign debt crisis. It takes value 1 when referring to years 2008 to 2012, otherwise, it takes value 0.
New vs. old group of EU countries	newold	Takes value 1 if the country is a new member of the EU (acceded after 2004), otherwise 0 (acceded prior to 2004).

Table 2. Descriptive statistics (source: Stata, Authors' calculation)

Variable	Obs	Mean	Std. Dev.	Min	Max
gdpgrowth	697	2.7222	3.3958	-14.8142	25.1625
industrygdp	686	-0.0089	0.0497	-0.4453	0.5414
gfcf	690	4.1350	12.4878	-67.6848	150.4733
wages	542	5.1565	11.7261	-47	72.8
prodinconstr	572	1.867	10.7916	-48.2	39.1
costindex	589	3.0537	4.317	-14.5	39.8
fdi	688	1.1827	20.9655	-14.9069	544.4478
co2	700	-0.6769	5.6422	-28.951	31.006

In this paper, we use the difference-in-differences (DD) approach as the applied economists' most used econometric methods (Athey & Imbens, 2017; Blundell & Dias, 2002) with a broad application in linear regression models. This technique includes two periods: period zero, referring to the period before the treatment, and period one, referring to the period after the treatment, with the existence of two groups – treatment and control. Precisely, the control group informs on the effects in the treatment group in situation of no treatment. The main idea of this technique is to determine the effect of a treatment comparing the average change over time in the treatment group, compared to the average change in the control group.

### 3. Empirical results and discussion

The econometric model we used to assess the effects of determinants on economic growth for EU countries, explained in Table 1, is specified as in the following Eq. (2):

$$\begin{aligned}
 GDPgrowth_{it} = & \alpha_0 + \beta_1 industrygdp_{it} + \beta_2 gfcf_{it} + \\
 & \beta_3 wages_{it} + \beta_4 prodinconstr_{it} + \beta_5 costindex_{it} + \\
 & \beta_6 fdi_{it} + \beta_7 co2_{it} + \beta_8 newold_{it} + \beta_9 crisis_{it} + \varepsilon_{it},
 \end{aligned} \tag{2}$$

where *gdpgrowth* refers to GDP growth rate, *industrygdp* is industry as GDP percentage, *gfcf* represents gross fixed capital formation, *wages* stands for wages in construction, *prodinconstr* refers to production in construction, *costindex* is cost construction index, *fdi* represents foreign direct investments, *co2* refers to CO<sub>2</sub> emission growth. Two dummy variables are *crisis* relates to global financial and sovereign debt crisis and *newold* refers to new and old EU countries and they both take values 0 or 1. All variables used in our models represent growth rates i.e. annual percentage change compared to previous year.

In our paper, we assessed multicollinearity with the Variance Inflation Factor (VIF) for each variable. These test results presented in Table 3 indicate that all VIF values are significantly less than 5 as well as all 1/VIF values higher than 0.2. The average VIF value is 1.84 and is notably less than 5. Therefore, our conclusion is that determinants in our model are independent and they affect the dependent variable.

Table 3. Multicollinearity test results (source: Stata, Authors' calculation)

Variable	VIF	1/VIF
wages	3.46	0.28913
prodinconst	2.44	0.409185
costindex	2.29	0.436933
gfcf	1.93	0.516798
crisis	1.24	0.803322
industrygdp	1.19	0.840105
co2	1.13	0.88301
fdi	1.01	0.991922
Mean VIF	1.84	

By adding two dummy variables to the model representing the impact of the 2008 economic crisis and operating from 2008 until 2012 and distinction between new and old EU countries, we have improved the existing model. Adding dummy variables to the model is justified due to the statistical significance of the added variables, as well as the achievement of the statistical significance of the lagged value of the dependent variable.

In the process of our further econometric analysis, we have tested the robustness of our model. From our robustness check, we have realised that robust and default standard errors do not significantly deviate from each other. Their values are approximate, before and after running the regression with robust standard errors. However, we conclude that the standard errors are higher after running the robust regression compared to default standard errors. Our performed robustness checks confirm the robustness of this model. Differences between the two types of standard errors for all three groups of countries are shown in Table 4.

Table 4. Differences between the standard errors (source: Stata, Authors' calculation)

Variable	Standard errors		
	EU28 group	Old EU group	New EU group
industrygdp robust	4.701358	3.875226	4.79663
industrygdp	2.013192	3.296523	2.988401
gfcf robust	0.0209085	0.0256781	0.0434444
gfcf	0.0099306	0.0200525	0.0122995
wages robust	0.015809	0.029194	0.0177755
wages	0.117076	0.0325251	0.0198128
prodinconst robust	0.0153444	0.0302117	0.0306274
prodinconst	0.0117076	0.0283219	0.0194074
costindex robust	0.0397566	0.0511348	0.0394574
costindex	0.0244844	0.065414	0.0378938
fdi robust	0.0008121	0.0008304	0.0804676
fdi	0.0034081	0.0054821	0.0667757
co2 robust	0.0189458	0.0301715	0.0336669
co2	0.0152587	0.0205462	0.0273029
crisis robust	0.1920709	0.362558	0.1151277
crisis	0.2023853	0.2825559	0.253095

In Table 5 we present regression results of pooled OLS and fixed effects model which was applied as a result of Hausman test which rejected random effects model.

Table 5. Regression results for EU28 (source: Stata, Authors' calculation)

gdpgrowth	Coeff.	Std. Err.	T	P >  t	[95% Conf. Interval]	
industrygdp	18.52876	4.701358	3.94	0.000***	9.29281	27.76471
gfcf	0.098657	0.020909	4.72	0.000***	0.057582	0.139732
wages	0.022811	0.014581	1.56	0.118	-0.00583	0.051455
prodinconstr	0.063955	0.015344	4.17	0.000***	0.033811	0.0941
costindex	0.097017	0.039757	2.44	0.015**	0.018914	0.17512
fdi	-0.00235	0.000812	-2.9	0.004***	-0.00395	-0.00076
co2	0.061667	0.018946	3.25	0.001***	0.024447	0.098886
newold	0.798993	0.173137	4.61	0.000***	0.458861	1.139124
crisis	-1.30933	0.192071	-6.82	0.000***	-1.68666	-0.93201

Note: For the specification tests, p-values are reported. \*, \*\* and \*\*\* indicate that the coefficients are significant at the 10%, 5% and 1% level of significance, respectively.

As previously emphasized, at the beginning of the econometric process, we have checked the pooled OLS regression. The process included performance of individual effects' F test which defines the null hypothesis to have no evidence of significant differences across countries and that simple OLS can be applied. Our results indicate that the null hypothesis is rejected and the random effects have to be considered.

Following phase in our econometric process is the estimation of cross-section check and time fixed and random effect. We have run the redundant fixed effect test to estimate fixed effect specification and our results suggested that the independent variables reliably predict the dependent variable, i.e. GDP growth in our model.

In the next phase, we applied the Hausman test to test the random effects. The Hausman test is a very useful tool in choosing between fixed effects model and random effects model in panel data. The null hypothesis of this test preferred random effects model, contrary to alternative hypothesis which favours the fixed effects model. The Hausman test unequivocally suggests the rejection of null hypothesis with no correlation between errors in the model and regressors, therefore the preferred model is fixed effect.

The results of our model in Table 5 show the significant and positive effect of industry, gross fixed capital formation, production in construction and CO<sub>2</sub> on growth, with the 1% significance level. FDI's have negative impact with 1% significance level. On the other hand, cost construction index has a significant positive impact on GDP growth, with a statistical significance of 5%. Gross wages in construction positively influences GDP growth but statistically insignificant. Our dummy variables have opposite direction of influence on economic growth, i.e. EU membership positively affects GDP growth, while crisis negatively, both at the 1% significance level.

In Table 6, we present results of our economic growth model determinants in EU28, old EU and new EU group. Data included in this table display coefficients and statistical significance in two cases: robust and non-robust.

Table 6. Results of our economic growth model determinants in EU28, old EU and new EU group (source: Stata, Authors' calculation)

Variable	Coefficient (statistical significance)		
	EU28 group	Old EU group	New EU group
industrygdp robust	18.52876 (0.000)***	27.68038 (0.000)***	-8.122163 (0.091)*
industrygdp	18.73582 (0.000)***	26.23182 (0.000)***	-5.982053 (0.027)*
gfcf robust	0.098657 (0.000)***	0.0898301 (0.000)***	0.0293078 (0.500)
gfcf	0.0961053 (0.000)***	0.0688485 (0.000)***	0.0151758 (0.167)
wages robust	0.0228107 (0.118)	-0.0010896 (0.970)	0.0312066 (0.000)***
wages	0.0243744 (0.571)	-0.0112783 (0.712)	0.0657906 (0.000)***
prodinconstr robust	0.0639553 (0.000)***	0.1021655 (0.001)***	0.14333 (0.000)***
prodinconstr	0.0631298 (0.000)***	0.0648056 (0.016)*	0.109786 (0.000)***
costindex robust	0.0970167 (0.015)*	-0.1120681 (0.029)*	0.094085 (0.017)*
costindex	0.099164 (0.000)***	-0.0795782 (0.030)*	0.0854209 (0.015)*
fdi robust	-0.0023548 (0.004)***	-0.0035553 (0.000)***	0.1033871 (0.199)
fdi	-0.0019162 (0.000)***	-0.0063135 (0.000)***	0.0899962 (0.233)
co2 robust	0.0616665 (0.001)***	0.1145894 (0.000)***	0.133327 (0.000)***
co2	0.0618588 (0.000)***	0.0817705 (0.004)***	0.0700336 (0.000)***
crisis robust	-1.309334 (0.001)***	-2.754772 (0.000)***	-2.795311 (0.000)***
crisis	-1.3198 (0.000)***	-2.754772 (0.000)***	-2.821342 (0.000)***

Note: For the specification tests, p-values are reported. \*, \*\* and \*\*\* indicate that the coefficients are significant at the 10%, 5% and 1% level of significance, respectively.

Our results suggest that all determinants, reflecting the construction impact on economic growth positively influence GDP growth in EU28. Regarding industry, including construction, the results of our model indicates that this variable is statistically significant and positively correlated with growth in old EU, while statistically significant and negatively correlated in the new EU countries. Construction is an important sector of the industry which generates 10% of GDP and engages 7% of the labour force in the EU. Therefore, its contribution to national economic growth is indisputable. Thus, Wilhelmsson and Wigren (2011) determined that a 1% increase in housing construction affects GDP growth by maximum 0.15%. Outputs from construction represents one of the key shares in industry and GDP structure.



Gross fixed capital formation is found to be statistically significant and positively correlated with growth in old EU, while insignificant in new EU countries. Positive correlation between gross fixed capital formation and economic growth has been confirmed in other empirical studies. As presented in literature review, Fetahi-Vehapi et al. (2015) determined the positive and significant relationship between gross fixed capital formation and economic growth for EU member countries from SEE, over the 1996–2012 period. Błazejowski et al. (2019), in a study covering all 28 EU countries in the 2002–2013 period, identified gross fixed capital formation to be one of the most probable economic growth factors. Additionally, a recent study confirmed the hypothesis that gross fixed capital formation has a positive impact on economic growth in the Eurozone in the period 2002–2017 (Lymonova, 2019).

Gross wages in construction are statistically significant and positively correlated with growth in new EU countries, while insignificant in old EU countries. As Erol and Unal (2015) noted that construction is also a prime source of jobs creation which positively contributes to economic growth. However, some research on several sectors, including construction, has indicated that economic growth is not always accompanied by corresponding growth in nominal wages (Branten et al., 2018).

When it comes to comparison between old and new EU countries, our results suggest that production in construction is statistically significant and have positive correlation with the growth for both groups. However, some research on the sample of developed countries indicates that in the first stages of development, participation of production in construction in GDP rises, while in full-grown phases, the participation begins to fall (Pheng & Hou, 2019). In addition, our model indicates statistically significant and positive correlation between the cost construction index and economic growth in new EU countries, while in old EU countries is found to be statistically significant and negative. Based on all the above interpretations, we conclude that our H1 is partially confirmed.

Intention of this paper is to determine influence of the rest of our model determinants, through which the impact of construction on economic growth is also reflected. We assessed the impact of FDI and CO<sub>2</sub> on GDP and our model offered interesting results. FDIs are found to have statistically significant and low negative impact on growth in EU28 and old EU countries. The positive relationship between FDI and GDP growth is found to be valid in new EU countries only, but statistically insignificant. Such results are not surprising, as in the other empirical research we found that the nexus between these two variables is mixed and ranges from positive, through neutral, to negative. Carkovic and Levine (2005) indicate no or little impact of FDI on economic growth. In a study on the sample of several countries from South-East Europe, Stanišić (2008) did not found a positive relationship between economic growth and FDI. Similar results are drawn for countries with low and high income and growth (Lyroudi et al., 2004). Simionescu (2016) confirmed that, in the period 2008–2014, FDI negatively affected GDP growth in Austria, Denmark, Estonia, Cyprus, Portugal, Sweden, United Kingdom, Malta and the Netherlands, while in rest of the EU countries it had the opposite direction.

Contrary to FDIs, CO<sub>2</sub> is found to have statistically significant and positive correlation with economic growth in all targeted groups of countries in our model. This indicates that growth in the EU has not sufficiently supported the concept of sustainable economic growth

so far. Furthermore, empirical results on the European level confirm that the correlation between economic growth and CO<sub>2</sub> emissions is positive and statistically significant (Saidi & Hammami, 2015). Similarly, another research suggests that CO<sub>2</sub> emissions are not likely to fall in case of further GDP rise (Kasman & Duman, 2015). Empirical study related to 10 old EU countries, suggests that CO<sub>2</sub> emissions in countries above the old EU average income are higher than emissions in countries below the average level, independent of their income level (Bengochea-Morancho et al., 2001). Thus, the results obtained in our model, regarding FDI and CO<sub>2</sub>, partially confirmed our H2.

It has been for a long debated in the economic and political public whether the EU membership has benefited more to new or old EU countries. Our model indicates that EU membership has benefited both, old and new EU countries, with a higher positive impact in new EU countries. Similar results (Campos et al., 2019) are found in other economic research on the EU sample as this issue has always been on the top of EU agendas. Regarding EU membership, we also found empirical evidence which supports our results. Rapacki and Próchniak (2009) concluded in their research over the 1996–2007 that EU membership has significantly contributed to economic growth of the new EU countries. Crespo-Cuaresma et al. (2008) focused on old EU countries and confirmed that the longer a country has been a member of the EU, the more it profits from membership.

Our results suggest that crisis has been statistically very significant with almost equal negative impact on growth in the old EU and new EU countries. Asteriou and Spanos (2019) proved, on the sample of 26 EU countries, that when the crisis period is not included, financial development promoted economic growth, while during the crisis periods has an adverse effect on economic activity. Similarly, Breitenlechner et al. (2015) found that larger financial sectors lead to significantly worse economic outcomes in the case of a banking crisis. The impact of the global financial crisis on the fiscal situation has primarily been indirect via economic growth and other variables. All new EU countries, with the exception of Poland, had substantial GDP falls during the crisis (Staehr, 2010). In old EU countries, Ireland, Spain, Italy, Portugal and Greece were affected the most by the crisis, which created the weakest financial sustainability causing the largest GDP declines in this group of countries (Dimitras et al., 2015). Global financial and European sovereign debt crisis from 2008 until 2012 left serious consequences on economic growth in most of Europe. The crisis in Europe primarily started as a financial (Craig, 2015; Matousek et al., 2015), but its nature changed afterwards. Moreover, Europe was facing with political crisis, especially in the integration process. The whole EU was affected by the crisis which severely jeopardized economic growth. Therefore, the results from our model, regarding EU membership and crisis confirm our H3.

## **Conclusions**

Determinants of economic growth are constantly being assessed and used in determination of economic growth and they are among top priorities of most governments, but also they were subject of special attention of the economic literature. Reviewed literature suggests that determinants covered by our model have a good theoretical and empirical basis. Even growth determinants are among the most researched economic topics, still there is no theoretical

or empirical consensus on the unified impact and direction of economic growth factors on GDP growth. We find it necessary to examine the relationship between economic variables with focus on construction impact on growth and GDP growth. Therefore, we constructed economic growth model not only on the EU28 sample, but also on the new and old EU countries that are on different development stages and which represent an important contribution to the growth literature in EU countries.

By applying DD methodology, we have assessed the significance of impact of our variables on economic growth in the EU countries and have come to interesting results. Additionally, our contribution is also added in terms of determined influence direction of selected variables on economic growth. Our model suggests that on the EU28 level, industry, gross fixed capital formation, production in construction and construction cost index have positive effect on economic growth, while gross wages in construction also positively affect growth, but with no statistical significance. Unlikely, FDIs negatively influence the GDP growth in the same group of countries. When it comes to differences between old and new EU countries, we observe that the impact of industry on economic growth is positive in old, but negative in new EU countries. Contrary, cost construction index is found to be positively correlated with growth in new, but negative in old EU countries. Production in construction is found to be with positive impact in both groups. We also recorded positive impact of gross fixed capital formation on growth in old, while insignificant impact is noted in new EU countries. Oppositely, we found wages in construction to positively influence the growth in new, while insignificant in old EU countries. A negative and low impact of FDIs on GDP growth is observed in old, while insignificant in new EU countries. Even though, green economy is in full swing nowadays, CO<sub>2</sub> emissions significantly follow economic growth and they are found to have statistically significant and positive correlation with the GDP growth in all three targeted groups of countries. We confirmed that EU membership benefits both old and new EU countries, especially in new member states. However, we have determined that global financial and sovereign debt crisis have been statistically very significant and negative impact on growth in all three groups. Based on our results, we conclude that H1 and H2 are partially confirmed, while H3 was fully confirmed.

As this research has been carried on the sample of EU member states, we find that it might be useful to the governments of candidate countries negotiating on the EU membership. Our model can supply decision makers within these groups of countries. Policymakers should constantly strive to create a favourable framework that can provide long-term sustainable economic growth and increase employment, thereby hastening the country's transition to a more sustainable, resilient, and inclusive development.

Based on our findings, we provide the following managerial and political implications:

- As the economic growth in the previous period was followed by the CO<sub>2</sub> emissions growth, it demonstrates that the brown investments were dominant, while the EU countries should focus on green investment and green economy. Policymakers should focus more on sustainable construction as it can assist in reducing negative effects on environment and healthy economy, and creating competitive advantages. Development and use of low embodied carbon building materials and services, increasing energy efficiency, as well as promoting renewable energy sources are key opportunities

- for reducing CO<sub>2</sub> emissions from construction and securing environmental sustainability. One of the concrete measures should be transparent carbon intensity certification for components, systems and materials used by the construction industry;
- In old EU countries policymakers should concentrate more on cost construction index as its increase contributes to decline of GDP growth and should focus on lowering the cost component. Recently, there has been an increase in the cost of materials used in construction, which leads to increase in cost construction. We recommend governments to continue to provide additional stimulus in the coming period until the consequences of the current health crisis are remedied. Also, it should be noted that raising the level of innovation can significantly contribute to reducing costs in this sector, and that the intensification of innovation and the introduction of new technologies not rarely ensure sustainable growth of this sector. In addition, different models of raising efficiency levels should provide cost reduction as well as affirm strategies to reduce the burden on the environment;
  - In terms of gross wages in construction, countries should consider improvements in budgetary and monetary policies in order to increase employment and secure economic benefits. We advise for further development of secondary and higher vocational education in order to overcome the problem of staff shortages for certain professions. Building renovation schemes should lead to new job openings in the field of construction, energy savings, better living conditions and prevent energy poverty, in order to achieve economic rehabilitation;
  - Policymakers should provide conditions for increasing FDI in order that construction sector benefits from foreign investment, and thus contribute to increasing economic growth. Setting up policies and accelerating reforms should serve as a solid ground for further FDI promotion and the governments should direct significant activities towards creating the most favourable environment for attracting investors in construction sector. Particularly the new EU and aspiring candidate countries have to do more in order to reduce administrative barriers and corruption. We advise for further synchronizing of activities at national and local level, but also defining priority investments in construction sector with the further increase of competitive advantages. Additional suggestion is improvement of the regulatory framework in the construction sector, particularly in the new EU countries. We also recommend strengthening of institutional capacities at the national and local level for attracting FDI and improvement of partnership relations in construction sector, with the support of economic diplomacy. Raising the positive impact of FDI in the construction sector in the future will be secured by improved promotional measures;
  - Production in construction plays an important and positive role in contributing the economy with a positive impact on GDP in all EU countries, generating high turnovers. Careful policy shape for increase of production in construction is crucial in its further development. It should be noted that further growth in production in construction should be based on the industry development of the sustainable building materials. Moreover, we recommend a joint presence in third markets and going beyond the framework of domestic markets;

- Share of construction activities in industry is constantly growing in EU28 and therefore the share of industry as percentage of GDP. Thus, decision makers should devote more to research and development in order to create sustainable construction approaches. Given that the industry, including construction, has an impact on economic growth, the investment should be accompanied by the necessary regulatory reforms;
- Considering that construction provides constructed assets which constitutes significant share of the EU's gross fixed capital formation, it is evident that gross fixed capital formation positively affects economic growth. Policymakers should formulate policies that would offer incentives for both private and public investment, but also for application of advanced technologies.

Finally, we point out to readers that minor limitations in this paper exist which mainly relate to different approaches and techniques in data collection methodology across the countries which did not impact accuracy of the model itself and obtained results. Availability of valid, reliable and transparent data is a prerequisite for relevant comparisons of national construction sectors. Certain macroeconomic analysis had issues of this type. As this research has been performed on the level of group of countries, further recommendation is to develop similar research on an individual country level or smaller group of countries among the new and old EU countries, where results might differ. In addition, our model did not cover the period of the latest health crisis during which the construction sector was severely affected. It merits for further research.

### Author contributions

The paper is a result of a collaborative work. MŽ, JĆ and SR conceived the study and were responsible for the development of the data analysis. MŽ, JĆ, SR and RV reviewed the literature. MŽ and GĐ were responsible for data collection and analysis. JĆ, RV and AŽ were responsible for data interpretation. MŽ, JĆ, SR, GĐ and AŽ wrote the first draft of the article. All authors revised the paper and prepared the final article.

### Disclosure statement

Authors declare they have no competing financial, professional, or personal interests from other parties.

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