The Macroeconomics and the Construction Sector: Evidence from Portugal

Construction activity is considered one of the main indicators of a country's global economic evolution. This article aims to study the cyclical fluctuations of construction production and its relationship with the aggregate business cycles in Portugal over the last six decades. We started by analysing the evolution of a set of indicators inherent to the functioning of the construction sector in the recent past. Then, we extracted the construction output cycles and examined their association with the Portuguese business cycles since the 1960s, focusing on crisis times. The results demonstrate that the construction sector contributes significantly to the Portuguese economy and the cyclical construction activity fluctuations correlate strongly with the aggregate fluctuations, although exhibits much greater instability. Finally, we discuss the current problems the construction sector faces and the pandemic crisis's effects.

Keywords: *Construction sector, business cycles, volatility, synchronisation, crisis*

Introduction

The construction sector mobilises significant material and human resources, making it a human activity with substantial economic and social importance. In many countries, construction output is considered a primary indicator of global economic activity evolution, usually accounting for up to 5–10% of the overall gross domestic product (GDP) (Park et al., 2012). According to the European Construction Sector Observatory (ECSO), the broad construction sector has a vital role in the European Union (EU) economy, representing approximately 9% of GDP, 18 million direct jobs and 3 million enterprises.[1]

The construction industry is also an essential component of national output in Portugal. This sector provides private and public infrastructures with the products needed for various activities and services, such as trade and other industries (Baganha et al., 2002). It is a sector with its own specificities, which distinguishes from other sectors by presenting a very extensive value chain and a vast network of inputs, providing a set of positive externalities to other activities and generating significant multiplier effects (Nunes, 2001). The economic conjuncture, demographic conditions, quality of life, environmental preservation and energy consumption are the main socio-economic factors that influence the evolution of the construction sector (Nunes, 2001).

Construction output is an integral part of national output and it is possible that, in most cases, a shock in construction output will eventually affect the aggregate economy (Tse & Ganesan, 1997). On the other hand, it is well accepted that construction activity is more volatile than the aggregate

[1]https://ec.europa.eu/growth/sectors/construction/observatory/objectives_en. Accessed 10 May 2021.

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economy, experiencing more pronounced expansions in growth phases and deeper recessions during periods of crisis (Baganha et al., 2002). It is also aggred that a major reason for the procyclical nature of construction activity is its sensitivity to credit conditions.

The procyclicality and pronounced volatility of construction output imply that periods of crisis could negatively influence this sector. This effect was apparent in the Portuguese construction market during the last global financial crisis, which spread to the EU after 2008. Notably, besides the 2008 Great Recession, Portugal has experienced a sovereign debt crisis since 2011 that required subsequent fiscal consolidation measures in the form of Economic and Financial Assistance Programmes provided by the International Monetary Fund, European Commission and European Central Bank from 2011–2014 period (Correia, 2016; Correia & Martins, 2019).

Notwithstanding the interest of this issue, few empirical studies have investigated the cyclical associations between the construction sector and the aggregate economy. In this sense, the main objective of this study is to analyse the cyclical fluctuations of construction production and evaluate thir degree of association with the aggregate business cycles in Portugal over the last six decades. We employed a set of indicators inherent to construction activity that allowed us to visualise the sector's evolution. We then used statistical methods to extract the cycles, standard deviations to measure the cyclical volatility and correlation coefficients to investigate the lead-lag associations between the cycles of construction output and the aggregate output business cycles, paying particular attention to the periods of economic crisis. Furthermore, we discuss the problems the construction sector is facing and we emphasised the effects of the current COVID-19 pandemic crisis.

Following this introduction, Section 2 presents a succinct characterisation of the construction industry in Portugal based on some relevant indicators. Section 3 contains the empirical analysis, envolving a description of the data and methodologies used and a discussion of the volatility and correlations results. Finally, in Section 4 we expose the conclusions of this study.

The Portuguese Construction Sector: Analysis of some Relevant Indicators

To provide a succinct characterisation of the evolution of the construction sector in Portugal, we analysed some relevant indicators, which included enterprises, employment and GDP percentages. The National Institute of Statistics (INE - Instituto Nacional de Estatística), published by the Database of Contemporary Portugal (PORDATA - Base de Dados Portugal Contemporâneo), was the primary source of the original data used in this section.[2] The definition adopted throughout the compilation of the data correspond to a narrow definition of the construction sector, i.e., this refers to sector "F - Construction" as defined by the most recent revision, Rev.2, of the NACE - European

[2] https://www.pordata.pt/en/Portugal, accessed in May 2021.

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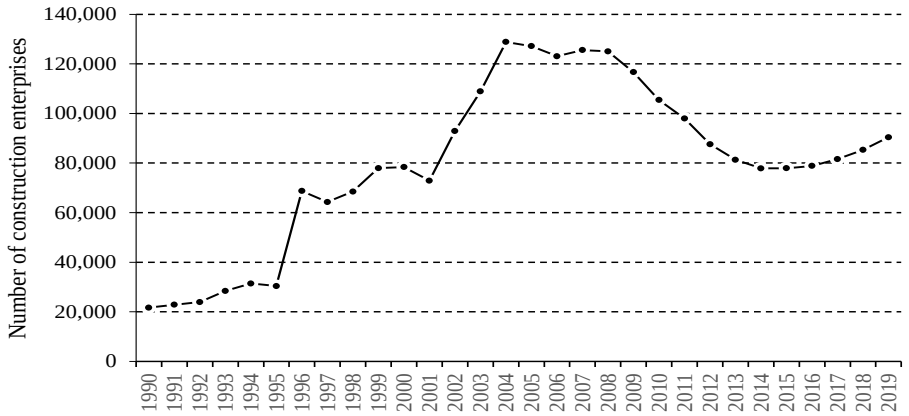
Classification of Economic Activities (European Commission, 2008).[3] According to NACE-Rev.2, the construction sector includes: developing and constructing residential and non-residential buildings, roads, railways, utility projects, demolition and site preparation, electrical plumbing, and other installation and specialised construction activities.

Enterprises

Over the 1990–2019 period, the number of enterprises in the Portuguese construction sector more than quadruplicated (Figure 1). The sector experienced overall growth (479%) from 1990 to 2007, with more intense growth observed in the 2001–2004 period. Notably, in 2004, the construction industry reached a maximum of 128,832 firms. However, the number of firms was drastically reduced from 2007 to 2014 due to the global crisis that spread to Europe and strongly affected the Portuguese economy. In fact, in 2014, there were only 77,844 Portuguese construction firms, 38% below the 2007 level. As the country's economic situation began to recover after 2014, the number of enterprises experienced gradual growth, reaching 90,430 firms in 2019.

Figure 1. *Number of enterprises in the construction sector, 1990–2019*



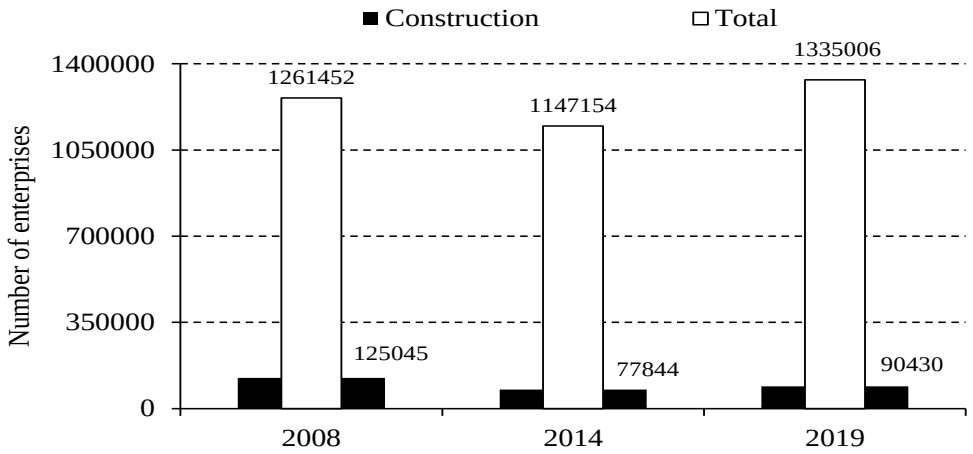
Source: INE/PORDATA.

Analysing the evolution between 2008 and 2014 (Figure 2), corresponding to the financial and economic crisis period, we observed that the crisis had a significant impact on the number of construction enterprises, as evidenced by a 38% decrease. This reduction in the number of firms is primarily due to difficulties in obtaining credit by the clients of this sector, especially households in the housing segment. These results also show that as the aggregate economic activity recovered in 2014, there is a concomitant increase in the total number of firms (i.e., growth of enterprises) in the construction industry. Additionally, from 2014 to 2019, there was a positive evolution in the

[3]NACE is the acronym for "Nomenclature statistique des activités économiques dans la Communauté européenne".

number of total and construction sector firms (16% for both); however, these numbers failed to reach pre-crisis levels.

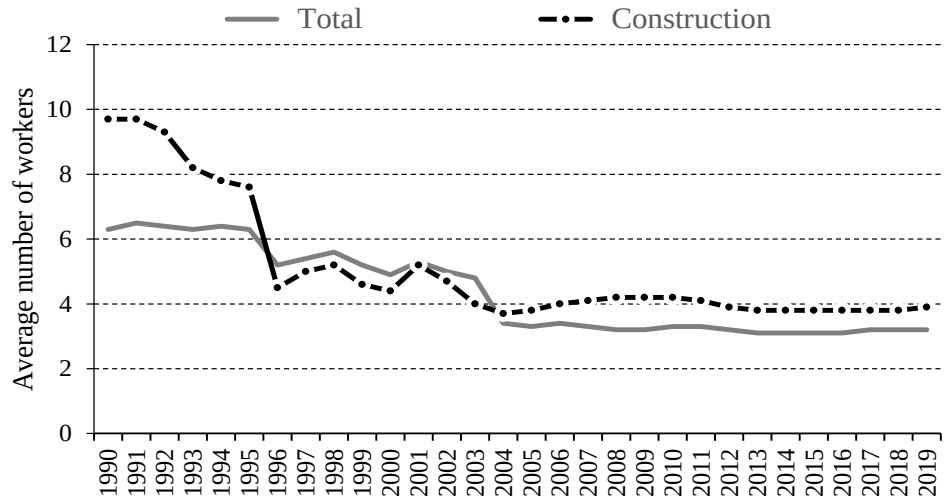
Figure 2. *Number of enterprises, total and in the construction sector, 2008, 2014 and 2019*



Source: INE/PORDATA.

The construction sector is mainly composed of small and medium-sized enterprises (SMEs) and microenterprises. Comparing the average size of construction sector enterprises (i.e., personnel) and the total of economy (Figure 3) we see that this sector follows the evolution of the total economy over time. In other words, as the average size of firms in Portugal goes up or down, the same occurs in the construction sector.

Figure 3. *Average size of enterprises, total and in the construction sector, 1990–2019*



Source: INE/PORDATA.

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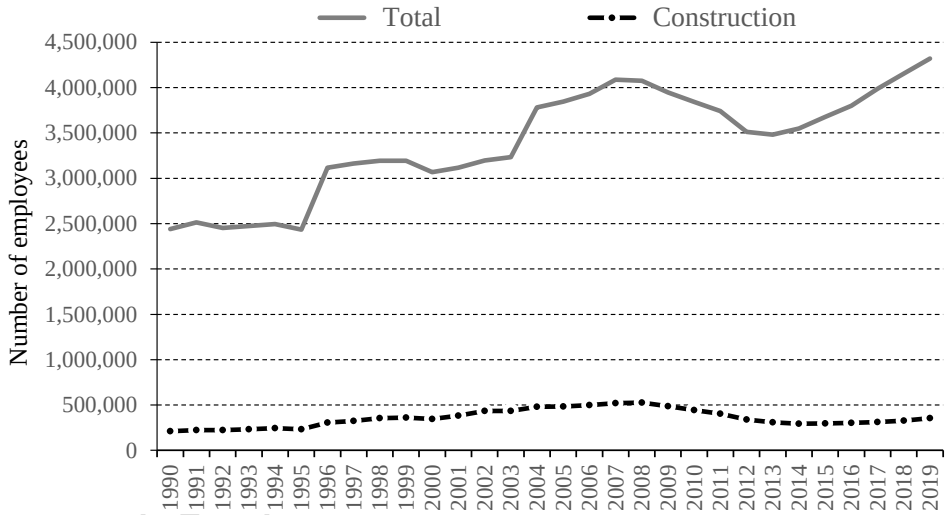
It should be noted that in the 1990–1996 and 2001–2004 periods, the average size of enterprises in the construction sector was significantly attenuated from 9.7 to 4.5 and 5.2 to 3.7 workers on average, respectively. After 2004, the average size of enterprises remained constant, with no significant changes (about four workers) and slightly above the average size for the total national (about three workers). Thus, this feature was not affected during the crisis period.

Employment

Concerning the labour market, the evolution of the number of workers employed in the construction sector and the total number of workers employed in Portugal, from 1990–2019 (Figure 4) tended to exhibit a growth until the 2008 Great Recession.

Figure 4. *Employees in enterprises: total and in the construction sector, 1990–2019*



Source: INE/PORDATA

During the crisis, the lack of funds, drop in prices and reduced work for construction enterprises resulted in many firms closing and laying off employees, consequently reducing construction employment by 44% over the 2008–2014 period. It should be pointed out that this observed decrease was much more pronounced than at the national level, where the total number of employees decreased by only 13% in the same period. After 2015, following the aggregate economic recuperation, construction employment improved and grew by 19% until 2019 with notable growth in 2019 (8%). A similar rise in total employment growth was also observed (18%).

Therefore, and contrary to what happened with total employment, the growth during this period (i.e., 2015–2019) was not robust enough to reestablish the number of workers employed in the construction sector in 2008

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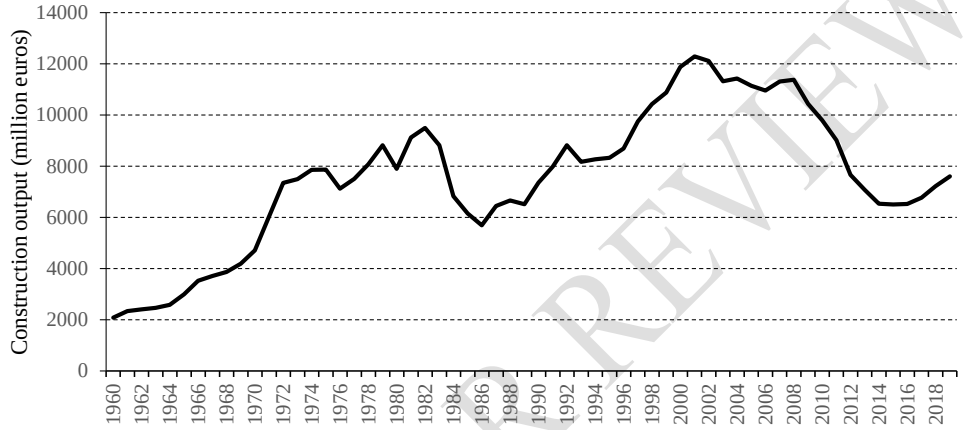
(353.4 thousand and 525.5 thousand in 2018 and 2019, respectively) or back to the levels reported two decades previously.

Share in GDP

Next, we calculated the share of Gross Value Added (GVA) of the construction sector according to the total GVA[4], at 2016 constant prices in millions of euros, to analyse the importance of the construction sector to the Portuguese GDP. As shown in Figure 5, plotting these variables allows us to visualise the evolution of the construction output since 1960 until 2019.

Figure 5. *Construction output, millions of euros, 1960–2019*



Source: INE/PORDATA

Between 1960 and 2002, construction production tended to grow, despite a significant reduction detected in the 1983–1986 period. After the entrance of Portugal into the European Economic Community (EEC) in 1986, the country benefited from substantial structural funds, that promoted infrastructure development and stimulated construction sector development, especially during the 1990s. With the deepening of the European integration process and incorporation of new countries into the EU, Portuguese construction enterprises broadened their horizons, expanding within the national territory and throughout EU member states. However, this evolution progressively decreased up to 2008.

Over the 2008–2014 period, the Portuguese construction sector experienced a drastic decline in construction activity, falling by about 43% and around 15% decrease in 2012 alone. However, the construction GVA started to evolve positively in 2016, growing by 0.3%. From 2016 until 2019, as the Portuguese economy improved, the sector also showed evidence of a growth phase due to the increased demand for construction-related services. In 2019, the growth rate was around 5%.

[4] We computed the share of the GVA of narrow construction sector in the total GVA at basic prices (GDP at basic prices) and not at market prices (GDP at market prices) since market prices also includes taxes and excludes subsidies.

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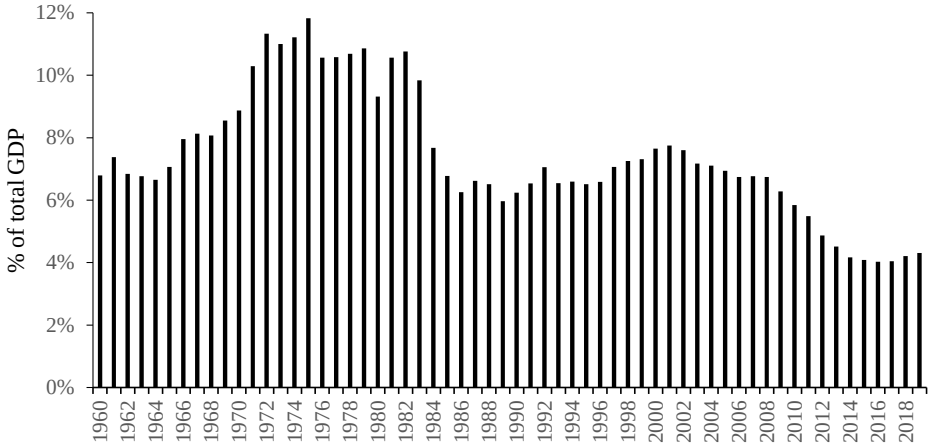
The share of the construction GVA in the GDP (Figure 6) oscillated during the 1960–2019 period.

Figure 6. *Share of the construction output in GDP (% of total), 1960–2019*



Source: INE/PORDATA

There was a positive evolution in the share of the GDP between 1960 and 1975, after which it decreased until 1996, falling by half (12% of the GDP in 1975 versus 6% in 1996). Increased investment and demand for construction for large-scale projects (e.g., EXPO 98) during the last half of the 1990s increased the construction sector's share of the GDP. After obtaining an 8% share of the GDP at the beginning of the 2000s, the construction sector progressively contributed less to the GDP, a decrease that became more accentuated after 2008. This behaviour was driven mainly by the financial, economic and sovereign debt crises that affected the Portuguese economy between 2008 and 2014 and, albeit to a lesser extent, the development of other sectors. According to the most recent figures in 2019, the construction output was about 4% of the total GDP.

Cycles of the Construction Sector: Volatility and Synchronisation with the Portuguese Business Cycles

This section analyses the cyclical fluctuations of the construction sector over the 1960–2019 period and compares the volatility and the co-movements with the Portuguese business cycles.

Data and Methods

The annual time series of the GVA of this sector to measure the construction production cycles and the total national GVA (GDP at basic prices) was used to obtain the Portuguese business cycles, both at 2016 constant prices, in millions of euros in the 1960–2019 period. Data are obtained

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from the PORDATA database (pordata.pt/en/Portugal). Table A.1 in the Appendix contains the descriptive statistics for the time series used.

We used two of the more popular trend-cycle decompositions methods to extract the cyclical component of both variables: the Hodrick-Prescott (HP) filter (Hodrick & Prescott, 1997) and the Baxter-King band-pass (BK) filter (Baxter & King, 1999). As the results obtained are qualitatively similar and because the BK filter is preferable from a theoretical point of view (Stock & Watson, 1998), for simplicity, we will only present the outputs generated using the BK filter.[5] This filter was configured to extract cycles with a periodicity of between 1.5 and 8 years, corresponding to a typical business cycle duration.[6]

The standard deviation of the construction production and aggregate business cycles was utilised to study the volatility. We evaluated the degree of synchronisation between these variables by calculating Spearman correlation coefficients, contemporaneous, with leads and lags. We choose to compute Spearman's rank correlation because it has the advantage of not being sensitive to the possible asymmetry of the distribution of the variables or to the presence of outliers, thus not requiring the data to be normally distributed.

Spearman's rank correlation coefficients indicate the strength of association between two variables, with values ranging from -1 to +1. Strong positive correlation values indicate the procyclical behaviour between the two cycles. On the other hand, negative correlation values indicate counter-cyclical behaviour. Alternatively, correlation values close to zero are indicative of acyclical behaviour (Sørensen & Whitta-Jacobsen, 2010).

More specifically, we computed the contemporaneous bivariate correlations and the lagged and forward two-year correlations of the construction GVA cycle for the Portuguese business cycles (as measured by GDP). Among those five correlations, we chose the highest figure (maximum correlation). Hence, we defined corr (y_{t+i}, x_t) as the correlation between the construction production cycle (y_{t+i}), with $-2 \leq i \leq 2$, and the business cycle (x_t). If the maximum correlation obtained is i = 0, the cycles are contemporaneously correlated; a negative i value means that the construction production cycle leads the aggregate business cycle by i years; a positive value for i means that the construction production cycle lags the aggregate business cycle by i years.

The whole period (1960–2019) was considered and, to obtain a more detailed analysis, we divided the total sample into four identical sub-periods: (1) 1960–1974; (2) 1975–1989; (3) 1990–2004; and (4) 2005–2019. Some of the relevant historical milestones for the Portuguese economy that occurred in these sub-periods include: (1) the time before the April 25th Revolution (sub-period 1960–1974); (2) the opening of the economy to the outside world that follows the April revolution and the process of preparing for Portugal's entrance into the EEC in 1986 (sub-period 1975–1989); (3) the inception in

[5]For the HP filter, we set $\lambda = 6.25$ which is the customary value for annual data (Ravn & Uhlig, 2002). The results obtained from the application of HP filter are available upon request.

[6]To obtain the cycles, we worked with the natural logarithm of both variables because changes in the logarithm approximate its percentage changes.

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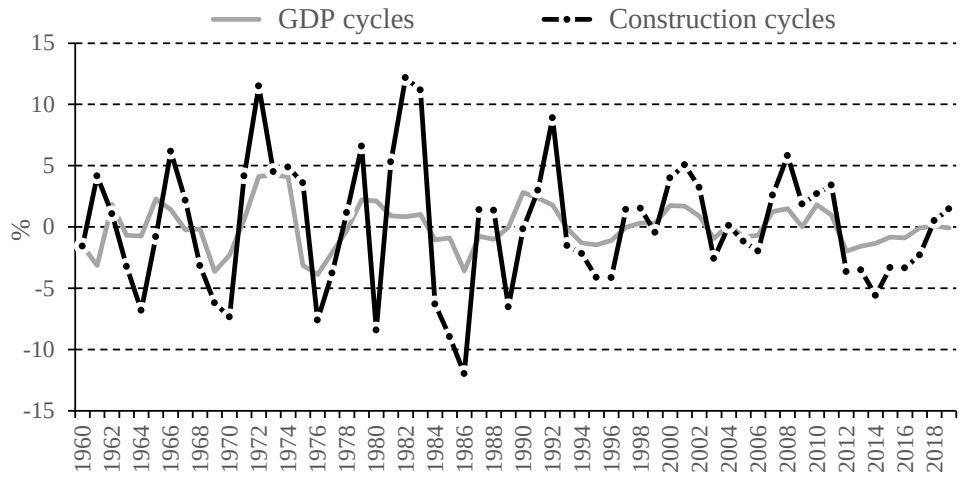
Economic Monetary Union in 1999 and the euro circulation in 2002 (sub-period 1990–2004); (4) Portugal being struck by the financial and economic crisis in 2008, the sovereign debt crisis in 2011 and the presence of the Troika from 2011–2014 (sub-period 2005–2019).

Empirical Results

In general, visual inspection of the graphs of the cyclical GDP components and construction production (Figure 7) reveals a positive relationship between the two variables in the 1960–2019 period. This result indicates that the Portuguese construction industry exhibits a procyclical behaviour. Concerning the construction output cycles, the most positive point (i.e., the highest peak, marking the transition from a good to bad phase) was in 1982, while the most negative point (i.e., the lowest valley marking a transition from a bad phase to good phase) was in 1986, coinciding with Portugal's entry into the EEC. Notable, the oscillations of the construction production tend to have greater amplitudes (ranging from -12% to 12%) than of the Portuguese GDP (ranging from -4% to 4%), demonstrating that the construction sector is more volatile than the aggregate economy and is consistent with previous studies. We also observed lower dispersion in theses amplitude ranges after the 1990s.

Figure 7. *Cycles of Construction and Business Cycles, BK filtered, 1960-2019(%)*



Source: authors' calculations.

In fact, the standard deviation results reveals (Table 1) that the construction activity cycles exhibit much higher volatility than the national level for the entime time period and the four sub-periods analysed. Concerning the entire time period (i.e., 1960–2019), the relative standard deviation (standard deviation of construction cycles relative to standard deviation of GDP cycles) is 2.8, corresponding to amplitude fluctuations three times greater than for the GDP. The results across periods show that the cyclical volatility of construction output is about two-fold greater than that of the national output in the 1960–1974 sub-period and almost four-fold greater in 1975–1989. A significant

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reduction in cyclical volatility was detected after the 1990s, both for the construction and aggregate economies, especially in 2005–2019 sub-period. This data suggests that construction activity became more stabilised after the 1990s. However, it should be noted that the relative standard deviation remained high (near 3).

Table 1. *Standard deviation of the GDP and the construction cycles (%)*

	Whole period	**Sub-periods**			
	1960–2019	**1960–1974**	**1975–1989**	**1990–2004**	**2005–2019**
GDP cycles	**1.84**	2.56	1.92	1.37	1.15
Construction cycles	**5.17**	5.42	7.58	3.61	3.30

Source: authors' calculations.

At first glance, the data presented in Figure 7 indicate that the construction GVA displays a procyclical behaviour, meaning that as economic activity increases, this sector also improves and vice-versa. However, the graphical representation does not quantify the degree of association between the cycles of the two variables or identify the possible existence of leads or lags. Therefore, we calculated the correlation coefficients for the entire period and the four sub-periods (Table 2).

Table 2. *Correlation coefficients, whole sample and by sub-periods*

	-2	**-1**	**0**	**1**	**2**
1960–2019	-0.09	0.30**	**0.65*****	0.49***	0.11
(1) 1960–1974	-0.15	0.48*	**0.68*****	0.49*	-0.19
(2) 1975–1989	-0.10	0.19	**0.48***	0.24	0.22
(3) 1990–2004	-0.25	0.10	**0.79*****	0.58**	0.26
(4) 2005–2019	0.23	0.41	**0.93*****	0.70***	0.30

Source: authors' calculations.
Note: *, ** and *** indicates statistical significance at the 10%, 5% and 1% level.

Overall, the results support a procyclical behaviour of the construction production for all the periods analysed. We did not detect annual leads or lags with the Portuguese business cycle. All the correlation coefficients are statistically significant, indicating strong or very strong degrees of association. Additionally, after the 1990s, the degree of association between the two cycles experienced a considerable increase, with the highest value being attained in the 2005–2019 last sub-period (0.9). Since the 2005–2019 sub-period is plagued by Portuguese economic crises starting in 2008, this almost perfect association between the construction and business cycles demonstrates that the construction sector reacts to crises in a manner similar to the overall economy. This observation may be related to the challenge of obtaining credit for construction-related activity under difficult financial circumstances.

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Concluding Remarks

The succint characterisation of some indicators provided in this study for Portugal demonstrate relevant dynamics for the Portuguese construction sector after the 1990s, namely: (1) the number of enterprises had a systematic increase until 2007, suffering its greatest fall between 2008 and 2014, followed by a positive evolution; (2) the sector is mainly composed by SMEs and microenterprises; the average size decreased sharply until 2004 (from 10 to four workers), remaining relatively constant until 2019; (3) employment was gradually increased until the 2008 crisis, decreased sharply during the crisis period; and then recovered and improved in parallel with the aggregate economic recuperation.

Another conclusion refers to the importance the construction sector has had on the national economy. The share of GDP throughout the period analysed (1960–2019) demonstrates that the construction sector greatly influences the Portuguese economy, consistently accounting for greater than 4% of the GDP. Its contribution to the national economy was significant even during the crisis periods in the 2008–2014 period. Notably, there has been a progressive loss of importance over time, which was more accentuated after 2008.

From the analysis of the cyclical volatility of construction output in the last six decades (1960–2019), we observed larger amplitude fluctuations than in the national business cycle for the whole period and the four sub-periods considered. The calculation of correlations, leads and lags, both for the whole period and the four sub-periods, demonstrated that construction output had a procyclical behaviour, exhibiting a substantial degree of association with the national business cycles. Therefore, the positive and negative shocks that hit the Portuguese economy also pushed the construction sector in the same direction.

Overall, these results prove that, although construction output exhibits much greater instability, there was a strong association between cyclical fluctuations of construction and aggregate activities, in the past. For example, after the 2008 Great Recession, the behaviour suggests a similar reaction of the construction sector and overall economy in times of economic crisis. In this context, a question that naturally emerges is how the recent COVID-19 pandemic affects construction activity.

The Portuguese economy has been highly constrained by the COVID-19 pandemic. Indeed, official 2020 estimates indicate a 7.6% drop in activity, above the 6.8% estimated for the euro area (Bank of Portugal, 2021). As the sanitary crisis due to COVID-19 has substantially decreased the purchasing power and investments, thus, considering its procyclicality, the construction sector is expected to experience a negative reaction. However, the GVA of the construction sector increased by 3.2%, and its share in the total GVA remained almost unchanged at about 4%. These figures point to an exceptionally resilient construction sector, a feature opposite to what was observed in previous recessions.

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According to the Bank of Portugal (2021), the dynamism of construction activity is due to the flow of new projects, primarily residential real estate and major infrastructure works, as long as containment measures do not suspend construction works and there is a sustained international demand in the residential component. The European Commission (2020) emphasises the positive impact of government policies as financial instruments for urban rehabilitation and revitalisation (the IFFRU 2020 programme) to explain this favourable evolution of construction sector demand. For example, initiatives launched by the government (such as the National Investment Programme 2030) concerning investment projects in the areas of energy, infrastructure and the environment, thus stimulating construction activity.

Notwithstanding these positive signs, the Portuguese construction sector currently continues struggling with issues such as the small size of most enterprises, the lack of skilled workers in some areas (bricklayers, electricians), the low salaries as compared to other countries, a complex tax system and limited liquidity (European Commission, 2020) that constrain its expansion. Thus, at the moment, we only have a partial view of the impact of the COVID-19 pandemic on the construction sector. The full extent of this crisis remains to be seen since it is still characterised by great uncertainty.

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Appendix

Table A.1. *Descriptive statistics, 1960–2019, millions of euros.*

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Aggregate production	60	30562.40	176192.70	109451.31	47401.27
Construction production	60	2076.90	12282.70	7567.71	2709.65

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