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Research article

Military presence and economic growth. The case of the COVID-19 pandemic in Spain

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Abstract: The evolving security paradigm has led to an increased domestic deployment of armed forces in Western nations to aid civilian authorities in managing crises. While this trend is prominent, its socioeconomic consequences, particularly on local economies, are not well understood. This study exploited a natural experiment—the COVID-19 pandemic—and granular provincial data to investigate the relationship between military presence and local economic activity. The analysis revealed a statistically significant positive effect, which intensified markedly during the pandemic. These findings highlight the significant role that military institutions can play as economic actors during periods of civil unrest.

Keywords: growth; GDP; economic development; Military; Covid-19

JEL Codes: O10, O4, H56, H84

1. Introduction

The effects of defence spending on economic growth have been widely analysed in the literature, both theoretically and empirically (Dunne et al., 2005), and continue to attract academic attention. Results are inconclusive, and many of the traditional empirical studies find that military spending is

not a significant factor in explaining economic growth (D'Agostino et al., 2017). The usual explanation is that defence spending is not productive, unlike investment in infrastructure, research and development, or education, and does not directly affect output (Korkmaz, 2015). A complementary strand of literature focuses on the local-level effects of military activities, demonstrating that military presence significantly influences the socioeconomic conditions of surrounding communities (e.g., Hoffman et al., 1996; Paloyo et al., 2010; Fortuna et al., 2022). This paper is more related to the latter branch of literature. We aim to evaluate the effect of military presence on the province's economic activity and growth in Spain.

The geographic distribution of military units and personnel usually responds to geopolitical reasons. Like any organisation, the armed forces (AFs) adapt to environmental changes to fulfil their objectives and missions. The international landscape is undergoing profound and widespread changes. The Russian war of aggression against Ukraine, the rise of China, technological advancements, and climate change have reshaped the tasks and priorities of traditional armies (Gilli et al., 2022). Counter-insurgency, counterterrorism, cyber defence, capacity-building, security-sector reform, as well as peacekeeping, humanitarian operations, and public health emergencies are considered part of the extended AFs missions. Interestingly, contrary to tradition, the new missions have been developed within national territories (Ratchev & Tagarev, 2018). The demand for military personnel to perform domestic tasks will also impact the AFs' capacity, organisation, and labour division, and is likely to accelerate reorganisation plans to enhance operational readiness in response to new challenges (Wilén, 2021). Many of these operational and personnel consequences emerge in the longer term, but they can have real-time implications (Kalkman, 2020).

Accordingly, the widespread use of the military for domestic crisis response could alter how societies prepare for future disasters, for instance, by fuelling greater military investment, making it more likely that the AFs would be used in these circumstances (Erickson et al., 2022). The effect on the local economy associated with military employment, base maintenance, and base operations (Andersson et al., 2007; Hooker & Knetter, 2001) could then be increased. Therefore, the creation or restructuring of a defence installation may be of interest to regional planners, and an assessment of its effects becomes relevant not only from an academic point of view but also from a policymaking perspective.

The objective of this paper is to make a contribution to this subject by analysing the influence of military units on the local economy during the COVID-19 outbreak in Spain. COVID-19 was a very severe pandemic, not only in terms of health and humanity but also as a global challenge for the world economy. The World Bank estimated a 3.4% contraction in global gross domestic product in 2020, with many countries experiencing economic recessions.[1] In Spain, the economic contraction was even larger, at 9.9%.[2]

For this study, the COVID-19 pandemic can be considered a natural experiment. In particular, we investigate whether the military presence affects the provincial economy and how this relationship is influenced by adverse circumstances, such as the COVID-19 outbreak. The period of analysis spans from 2015 to 2022. Results indicate that the presence of military facilities and the size of the military units have a positive impact on economic activity. Furthermore, we observe a "counter-cyclical" effect

[1] https://www.worldbank.org/en/news/press-release/2022/01/11/global-recovery-economics-debt-commodity-inequality.

[2] https://ine.es/dyngs/INEbase/operacion.htm?c=Estadistica_C&cid=1254736177057&menu=resultados&idp=1254735576581.

during the COVID-19 pandemic, such that provinces more affected by the crisis show a larger effect. We believe this paper is the first to uncover this differential effect.

The structure of the paper is as follows: Section 2 provides background to the analysis. Section 3 describes the data and empirical strategy. General results on the effect of military presence on the local economy are presented in Section 4, and the differential effects during times of crisis are included in Section 5. Finally, section 6 concludes.

2. Background

2.1. Military units and economic activity

The relationship between the activity of military bases and the economic situation of their surrounding areas has received increased attention, particularly since the end of the Cold War, when base realignments occurred in several countries. The evidence for the U.S. suggests a positive impact. For example, Nickelsburg (2020) analysed how military base closures affected the level of employment in the post-Cold War era. Hoffmann et al. (1996) demonstrated that California's economy is sensitive to defence cuts, and Soden et al. (2004) concluded that the Palo del Norte Region's military installations have a positive impact on the regional economy. Hill Thanner and Segal (2008) analysed the effect of closing an army post in the local community and showed a reduction in population and a negative impact on local businesses, but little relationship with employment. In the case of Germany, Paloyo et al. (2010) showed that base realignment and closure have had only a marginal impact on the local communities where the bases were located. Dahlberg et al. (2023) documented reductions in employment in Sweden following military base closures. Asteris et al. (2018) used the input-output methodology to highlight the importance of the Portsmouth Naval Base to the local economy. Finally, Fortuna et al. (2022) demonstrated a small regional effect on GDP but a greater local effect on the Terceira Island, Azores, and Portugal.

In the case of Spain, although several papers have analysed the economic impact of defence expenditures, only a few focused on the economic effects of military units. Lunar Bravo (2021) examined the economic impact of Spanish army military units on provincial economic activity and population in 2018, revealing significant differences across provinces. Callado-Muñoz and Utrero-González (2019) investigated the contribution of a fresh new military facility, the Military University Centre in Zaragoza, to regional economic activity, by analysing economic and knowledge effects. They showed that both direct and knowledge effects have a significant impact. The effects of military presence on provincial economic growth during domestic disaster response have not yet been analysed. This paper aims to fill this gap.

2.2. COVID-19, the military, and economic activity

The COVID-19 global outbreak led to a lockdown, halted everyday life, required staying within social bubbles, and encouraged practising physical distancing. These measures had a significant impact on the economy, particularly in sectors such as transportation, hospitality, and the broader business sector. Although the health crisis was pervasive, its economic consequences varied significantly across countries, depending on each country's economic structure (Camacho & Gadea, 2021). In addition,

Barrot et al. (2021) showed that industry workforce affection was also affected by the degree of exposure to government measures aimed at containing the virus's spread.

One of the most common policy measures governments employed to address the COVID-19 crisis was the domestic deployment of armed forces (Hidalgo, 2021). As military resources were activated to assist overwhelmed civilian authorities (Gibson-Fall, 2021), the COVID-19 crisis was rapidly militarised, with political leaders worldwide adopting and embracing the metaphor of war in their speeches to emphasise the gravity of the situation and legitimise their far-reaching decisions (Kalkman, 2020). Therefore, the coronavirus pandemic stands as a fundamental event in global civil–military relations. The tasks assigned to AFs varied across the countries analysed. Gibson-Fall (2021) described three different degrees of military participation in the COVID-19 response. The first type of response was minimal military-targeted technical assistance to support the civilian response. The second type of military collaboration was to complement the public health system's capacity. The third one was based on military leadership to plan and coordinate emergency hospitals, contact-tracing, surveillance, border controls, quarantine, and lockdown enforcement. Gad et al. (2021) analysed the associations between military and civil institutions in the national response measures adopted by six European countries during the early phase of the COVID-19 outbreak. They concluded that Spain (along with Italy) showed the highest levels of civil–military cooperation. These papers also reveal potential difficulties in civil–military relations. These may evolve towards closer collaboration under civilian supervision, increasing the domestic military presence and thereby improving the AFs' legitimacy. In this vein, Sirko et al. (2019) showed that citizens had a positive perception of military links with local communities. However, it is also acknowledged that these new military support roles may undermine the military's capacity to perform traditional core tasks in the long run and suggest the need to redefine AF missions. No analysis of the potential economic impact of increased military domestic deployment in the event of a crisis has been identified in previous literature. This is precisely one of the objectives of this paper.

2.3. Spanish case

The Spanish case is interesting because it is one of the fastest escalations in COVID-19 positive tests and deaths in the whole world. The Spanish government invoked the constitutional device of the "state of alarm" to impose strict limitations on civil liberties and centralise power in the Spanish executive. The military began to patrol the streets, and the central government seized power from autonomous regional and local authorities to impose a unified strategy (Amat et al., 2025). At the same time, a military declaration was issued in support of the national response, and military capabilities were allocated to assist the national health system and other public systems. The BALMIS military operation involved setting up field hospitals, delivering protective equipment, providing support in organisation and logistics, conducting air repatriations, managing border controls, and implementing mobile military testing.[3] Accordingly, the military had to modify its activities to protect its core military capability; however, as it increased its presence in national territory, it reduced external military missions. Therefore, the defence sector could be considered one of the most active sectors in the national economy during the pandemic.

[3] See https://www.defensa.gob.es/Galerias/gabinete/red/2020/07/p-8-13-red-374-balmis.pdf and http://atlasnacional.ign.es/wane/Defensa.

3. Data and empirical strategy

The analysis is carried out at the province level, which is the administrative unit below the regional level (52 units in Spain). We have data on the military units established in each of these provinces, along with the number of personnel assigned to them. The estimating equation is as follows:

$$EcoAct_{it} = \beta_1 GDP_{it-1} + \beta_2 Population_{it} + \beta_3 Business_{it} + \beta_4 ICT_{it} + \beta_5 Infraestructure_{it} + \beta_6 Education_{it} + \beta_7 Military_{it} + \nu_i + \mu_t + \varepsilon_{it} \quad (1)$$

The economic activity indicator of province i and time t, $EcoAct_{it}$, will be measured alternatively by the per capita level of GDP or GDP growth. As usual in the empirical growth literature, the log transformation is applied. The variable Military_{it} is our variable of interest. We include three alternative indicators of the presence of AFs in province i and time t: the number of military units, the number of military personnel, and the average unit size (the number of personnel per unit), at the provincial level. The estimation includes the traditional variables commonly found in the economic growth literature, such as population, business activity, information and communication technology (ICT), infrastructure, and education. In addition, the previous year's GDP per capita is introduced (see Barro (1991), among others). Population_{it} is proxied by the log of provincial population. As a measure of business activity, the number of active companies is used, $Business_{it}$. The ICT_{it} is approximated by the level of fibre coverage in each province. The number of total kilometres of roads, both national and regional or provincial, represents the level of infrastructure, $Infraestructure_{it}$. Finally, $Education_{it}$ measures the percentage of the population enrolled in higher education studies by province. We include province fixed effects (ν_i) to capture unobservable time-invariant fixed effects and year-fixed effects (μ_t) to control for aggregate fluctuations in GDP over time. ε_{it} is the error term. To control for the possibility that the error terms might be correlated, we estimate the model's standard errors clustered by province, which are robust to both heteroskedasticity and within-province serial correlation.

This baseline model (equation 1) will be expanded to analyse the differential effect of military presence, taking advantage of the natural experiment provided by COVID-19. In particular, we take into account the length of the pandemic and its effect on the province's economy.[4] To do that, we estimate the effect of military presence by comparing changes in outcomes during the pandemic across provinces more (or less) affected by COVID-19. In this vein, we will be able to separate the general effect of the military presence on the economy from its differential effect, first, on the years of the pandemic, and second, depending on the degree of economic impact in each province.

Data corresponding to the military units was obtained from the Ministry of Defence (MoD) Orders[5], which define the basic organisations of the Army (ET), the Navy (A), and the Air Force (EA), and from the Spanish National Atlas. Data on AF personnel were sourced from the MoD's statistical yearbook. Data on socioeconomic characteristics were obtained from the National Institute of Statistics (INE), namely the number of businesses, population, and GDP. The ICT, education, and infrastructure data were retrieved from the Ministry of Economic Affairs and Digital Transformation, the Ministry

[4] According to WHO (World Health Organisation) the Global pandemic ended in April 2023. Therefore, 2020, 2021 and 2022 are considered *pandemic years*. https://news.un.org/en/story/2023/05/1136367.

[5] Specifically, 2015 Ministry Orders 1265, 1642, and 1629, and 2018 Ministry Order 1362.

of Science, Innovation, and Universities, and the Ministry of Transport, Mobility, and Urban Agenda, respectively. All data in the study were collected at the provincial level for the period 2015–2022. Table 1 shows the descriptive statistics of the variables used in the analysis.

Table 1. Descriptive statistics.

Variable	Full sample	Pre-COVID	COVID
GDPpc (thousands of euros)	22.223	22.325	22.017
	(4.583)	(4.707)	(4.332)
GDP growth (in percentage terms)	0.014	0.025	−0.005***
	(0.049)	(0.024)	(0.069)
Population (number of inhabitants)	904267	898154	916493
	(1169086)	(1154853)	(1200717)
Business (per capita)	0.066	0.066	0.067
	(0.008)	(0.008)	(0.008)
ICT (per capita)	0.676	0.589	0.820***
	(0.207)	(0.200)	(0.119)
Infrastructure (per capita)	0.008	0.008	0.008
	(0.008)	(0.008)	(0.008)
Education (in percentage terms)	0.019	0.019	0.019
	(0.026)	(0.025)	(0.026)
Military units (number)	6.952	5.850	8.788**
	(11.556)	(9.228)	(14.485)
Military personnel (number)	1205.260	1130.515	1329.833
	(2697.270)	(2539.833)	(2945.326)
Unit size (personnel per unit)	158.827	174.759	132.273***
	(184.371)	(220.634)	(92.387)
Observations	416	260	156

Note: Mean and standard deviation in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$ indicate significant differences between the prepandemic and the pandemic years.

The geographical distribution of military units, personnel, and unit size, together with the incidence of COVID-19 per capita, is shown in Figures 1, 2, and 3, respectively.

As can be seen, COVID-19 incidence was concentrated in the centre-north area of Spain, including Madrid, and was less severe in the east, south, and northeast. In the case of military presence, the three alternative indicators are distributed differently. The presence of the AF was greater in Madrid, the centre of Spain, Sevilla and Cadiz in the south, Valencia and Murcia in the southeast, A Coruña in the northwest, and Zaragoza in the northeast, but also in the Canary Island and the North-African autonomous cities of Ceuta and Melilla, and it seems to be related to the political and geographical characteristics of Spain and the traditional threats: strong presence in the capital, along the coast, close to Africa, France, and in Spanish African cities; see Figures 1 and 2.

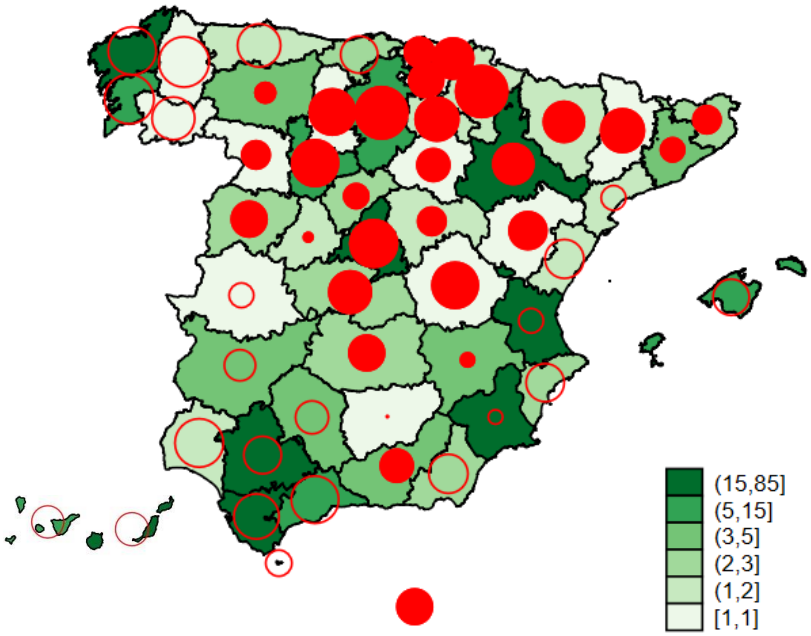

Figure 1. Distribution of military units per province and COVID-19 per capita incidence. Note: Shadow colours represent the number of military units in each province. Circles stand for COVID-19 incidence per capita. Circles stand for provinces below the median, and solid circles stand for provinces above the median. The size of the circles represents the distance from the median.

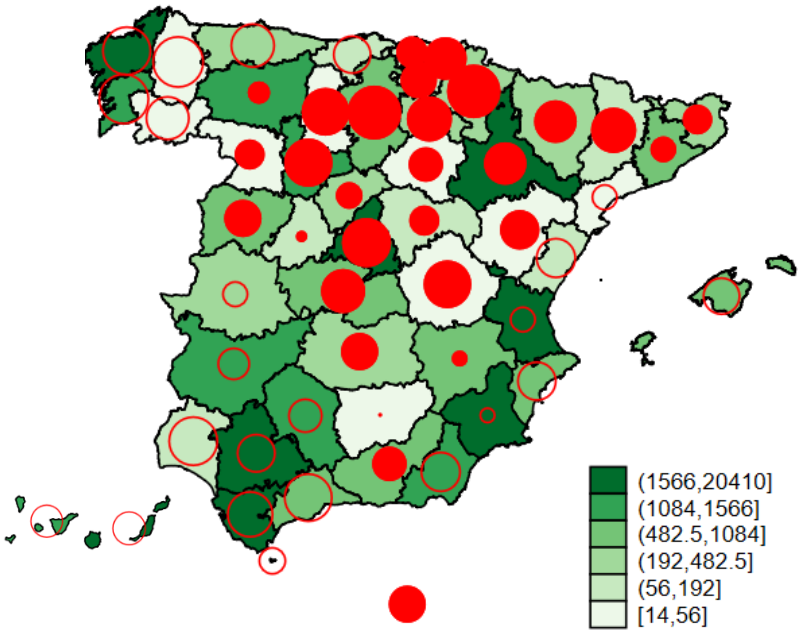

Figure 2. Distribution of military personnel by province and COVID-19 incidence per capita. Legend: Shadow colours represent the number of military personnel in each province. Circles stand for COVID-19 per capita incidence. Circles stand for provinces below the median, and solid circles for provinces above the median. The size of the circle represents the distance from the median.

When considering the unit size (see Figure 3), the distribution seems more "balanced", with more provinces gaining importance in terms of sizable units. This is important because although the Ministry of Defence has a plan to centralise acquisitions to improve efficiency,[6] larger military units can be considered "cost centres" and have more budget independence, allowing them to decide on certain daily acquisitions and investments. All in all, marked differences emerge between provinces with minimal military presence, a second group with regular military presence, and those with a more heavily militarised presence. These differences make it more relevant to analyse whether there are additional economic effects along with the protective and security mission.

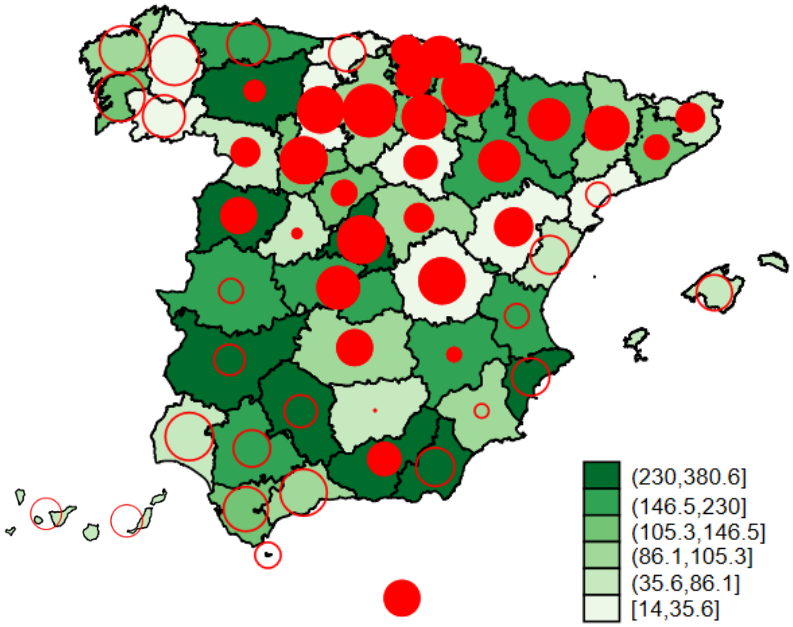

Figure 3. Distribution of unit size per province. Legend: Shadow colours represent average military unit size in each province. Circles stand for COVID-19 per capita incidence. Circles for provinces below the median, and solid circles for provinces above the median. The circle's size represents the distance from the median.

In addition to the geographical distribution, we use wavelet coherence analysis to obtain a preliminary picture of the relationship between military presence and economic activity. This analysis takes into account the nonlinear behaviour and coherence characteristics across both time and frequency domains (see Torrence and Webster, 1998; and Torrence and Compo, 1998 for methodological details).

Wavelet coherence is a measure of local correlation between two time series. We analyse how our two main variables of interest, military presence and GDP, have altered or not their coherence structure over time.[7] Based on the wavelet coherence plots, we define the coherence intensity between the two series over a given period using a heat map that ranges from blue (low coherence) to red (high coherence). The coloured bar at the end of each figure indicates the coherence intensity.

[6] https://www.defensa.gob.es/defensa/contratacionpublica/.

[7] This methodology has been applied by Dimitriou et.al. (2025) to the relationship between defence expenditure and economic growth.

To detect changes in coherence behaviour over time, we focus on colour changes. Due to our time span, our analysis focuses on the short-run (0−2-year cycle). The results of the coherence analysis for the province's average of military presence variables and economic growth indicators are shown in Figure 4.

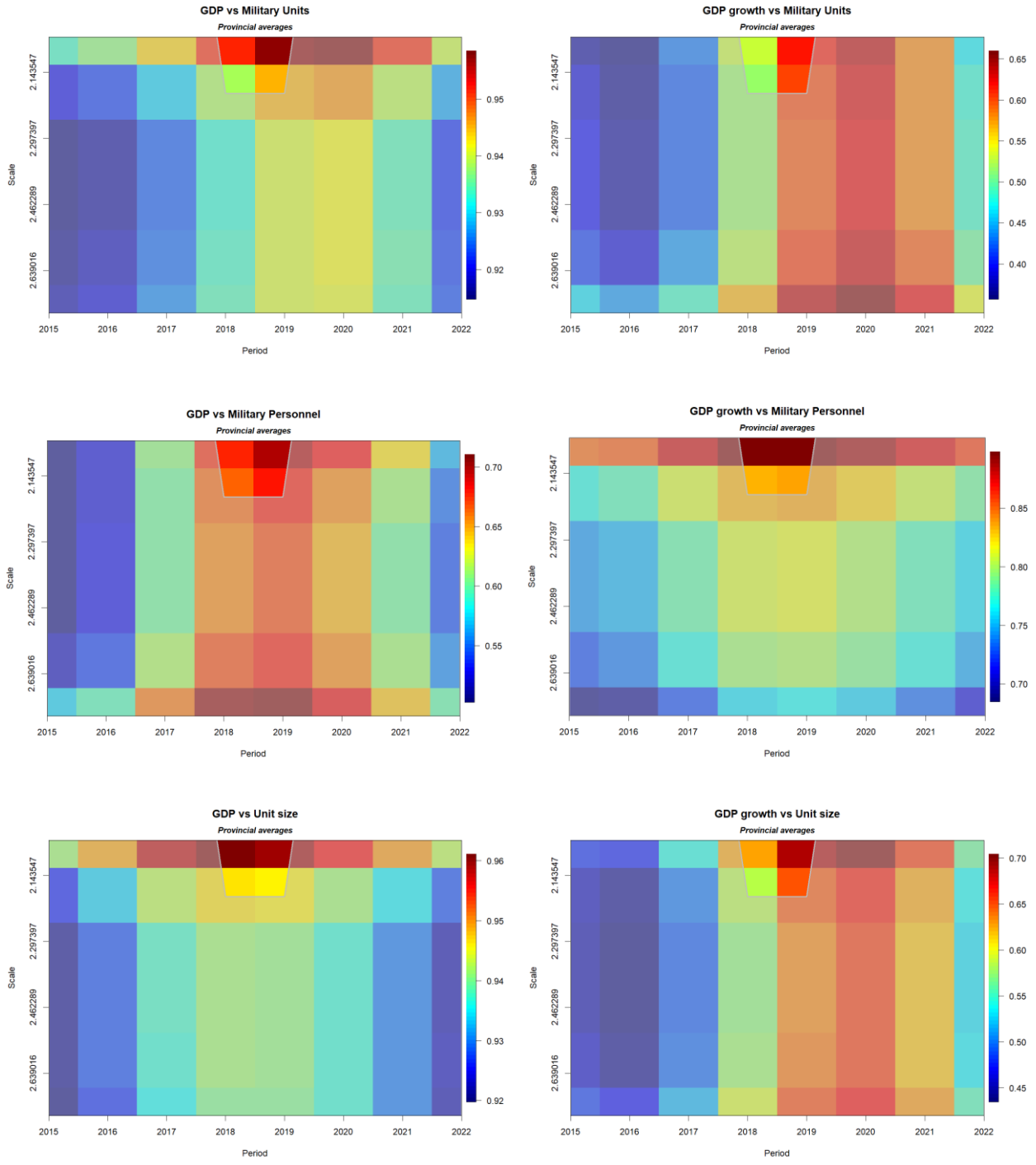

Figure 4. Wavelet coherence between military presence and economic activity. Provincial averages. Wavelet coherence plots measuring coherence intensity between two series over a given period using a heat map that ranges from blue (low coherence) to red (high coherence). The coloured bar at the end of each figure indicates the coherence intensity.

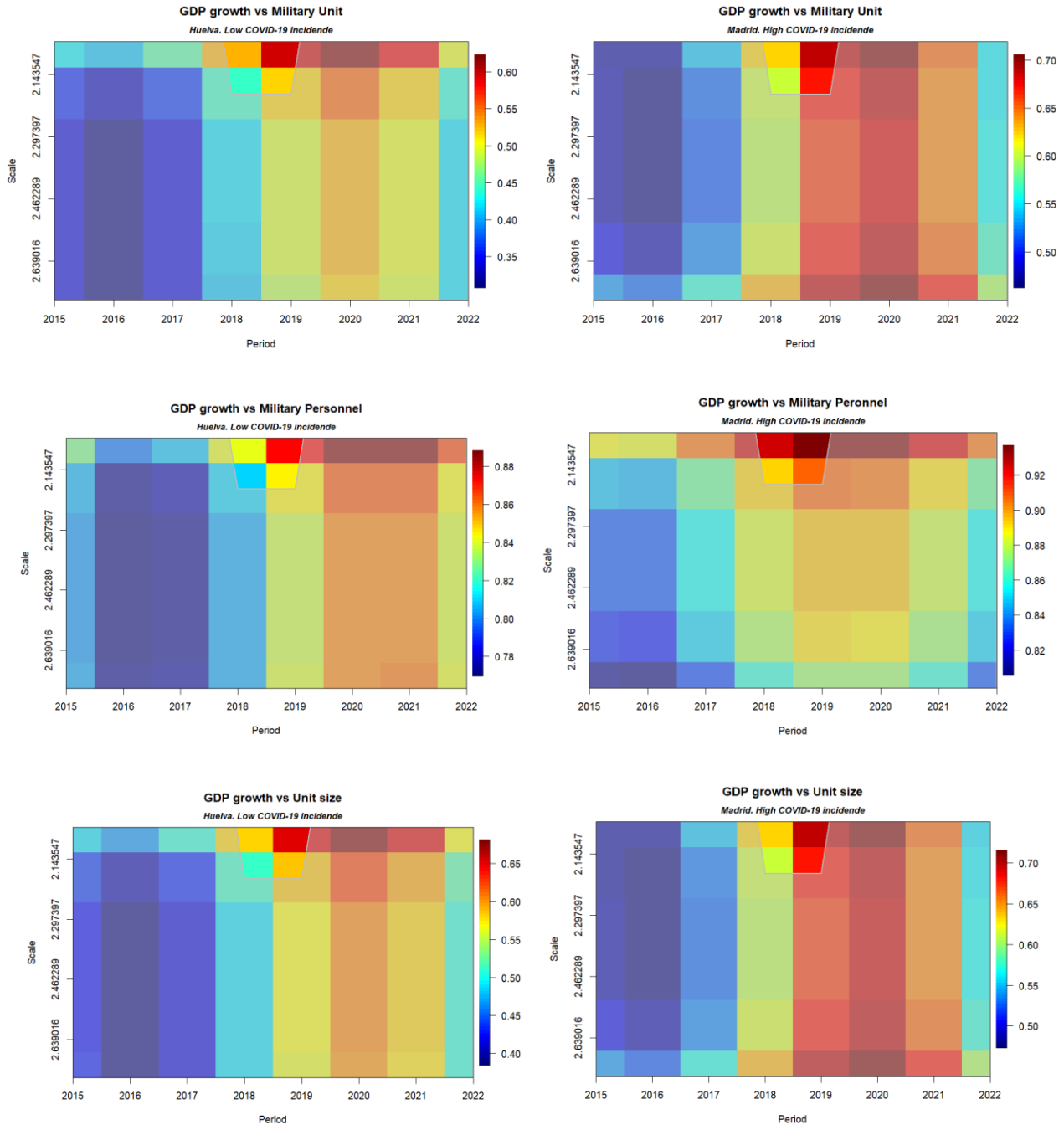

Figure 5. Wavelet coherence between military presence and GDP growth by COVID-19 incidence. Wavelet coherence plots measuring coherence intensity between two series over a given period using a heat map that ranges from blue (low coherence) to red (high coherence). The coloured bar at the end of each figure indicates the coherence intensity.

Regarding GDP level, colder colours (blue and light yellow) seem to prevail for military units and unit size. A small red area with coherence near 0.96 is found for the short run and for the years 2017–2021. This is different for military personnel. A significant red region is observed across all time spans for 2018–2020, suggesting higher coherence with GDP (close to 0.7). With respect to GDP growth, the coherence with the military presence variables appears to differ. In this case, military

personnel show colder colours, and only a red high-coherence area is found at the short run, especially during 2017–2021. On the contrary, military units and unit size present a clear red area and high coherence behaviour, with GDP growth around 2020, the COVID-19 year.

Figure 5 shows the relationship between military presence and GDP growth in two representative provinces, controlling for COVID-19 incidence: Madrid, with high incidence, and Huelva, with low incidence. Regarding military units, colder colours (blue and light yellow) seem to dominate in Huelva (low COVID-19 incidence), whereas the opposite is observed in Madrid (high COVID-19 incidence), with greater coherence (close to 0.7), especially in 2019–2021. A similar pattern can be observed for military unit size, with greater coherence during 2019–2021 in Madrid than in Huelva. The relationship between military personnel and GDP growth is a bit different. Colder colours dominate the first years of the period, with a lower coherence in Huelva. However, during 2020–2021, the red area seems very similar.

Altogether, this evidence shows that military presence is associated with economic activity, and this relationship appears stronger during the pandemic years. Spectral analysis provides useful information on the nonlinear behaviour of our series and their coherence characteristics, but does not allow the introduction of control variables. Therefore, a formal regression analysis is welcome to obtain additional insights.

4. Military presence and economic activity

As explained above, Equation (1) has been estimated using two different measures: the level of GDP per capita and the annual growth rate of GDP. Table 2 presents the results, with GDP per capita as the dependent variable. Three different models have been estimated. The first two columns display the results for the variables of military units and military personnel presented separately. The third column includes the results with the average size of the military unit.

Table 2. Military presence and economic growth. Gross domestic product in levels.

	(1)	(2)	(3)
GDPpc $_{(t-1)}$	0.536***	0.534***	0.533***
	(0.055)	(0.055)	(0.054)
Population $_t$	−0.135	−0.149	−0.165
	(0.152)	(0.156)	(0.156)
Business $_t$	−1.027	−1.015	−0.929
	(1.194)	(1.214)	(1.200)
ICT $_t$	0.001	−0.001	0.003
	(0.019)	(0.018)	(0.019)
Infrastructure $_t$	21.68*	21.54*	20.47*
	(11.02)	(11.20)	(11.59)
Education $_t$	−0.898	−0.696	−0.737
	(2.527)	(2.488)	(2.561)
Military units $_t$	−0.295		
	(0.250)		
Military personnel $_t$		−0.418	

Continued on next page

	(1)	(2)	(3)
		(3.657)	
Unit size $_{t}$			0.015*
			(0.008)
Constant	3.172	3.360	3.564*
	(2.052)	(2.100)	(2.094)
N	416	416	416

Note: Results of the regressions of GDP level on the defence presence variable and control variables. In columns (1), (2), and (3), defence presence is measured by the number of military units per 1000 inhabitants, the number of military personnel per capita, and unit size, respectively. The t-statistics reported in parentheses are based on standard errors clustered at the province level. ***, **, and * denote significance at levels 1%, 5%, and 10%, respectively.

Table 3. Military presence and economic growth. Gross domestic product growth.

	(1)	(2)	(3)
GDPpc $_{(t-1)}$	−0.455***	−0.454***	−0.457***
	(0.055)	(0.054)	(0.054)
Population $_{t}$	−0.020	−0.043	−0.052
	(0.170)	(0.174)	(0.174)
Business $_{t}$	−1.219	−1.156	−1.096
	(1.212)	(1.230)	(1.219)
ICT $_{t}$	0.013	0.010	0.016
	(0.020)	(0.020)	(0.020)
Infrastructure $_{t}$	27.150**	26.490**	25.650*
	(12.510)	(12.600)	(13.130)
Education $_{t}$	−1.584	−1.365	−1.467
	(2.547)	(2.502)	(2.617)
Military units $_{t}$	−0.241		
	(0.237)		
Military personnel $_{t}$		−2.851	
		(4.029)	
Unit size $_{t}$			0.018**
			(0.008)
Constant	1.595	1.908	2.020
	(2.303)	(2.349)	(2.350)
N	416	416	416

Note: Results of the regressions of the GDP rate of growth on the defence presence variable and control variables. In columns (1), (2), and (3), defence presence is measured by the number of military units per 1000 inhabitants, the number of military personnel per capita, and unit size, respectively. The t-statistics reported in parentheses are based on province-level clustered standard errors. ***, **, and * denote significance at levels 1%, 5%, and 10%, respectively.

Regarding the control variables, the previous year's GDP shows a positive, significant association with the current GDP. Infrastructure is also positive and significant. The remaining variables are not

significant. Regarding the variables of interest, the coefficients of the first two measures of military presence, number of units, and personnel are not significant. On the contrary, the average unit size is positively related to economic activity, as measured by GDP.

Table 3 presents the results with the GDP growth as the dependent variable. As expected, the previous year's GDP shows a negative and significant coefficient. This result aligns with previous evidence in economic growth equations that incorporate military investments (Utrero-González et al., 2019). The remaining control variables are not significant, except for the ICT variable, which has a positive and significant impact on provincial economic growth. Regarding the results for the variables of interest, the evidence is similar to that found in the GDP level estimation (Table 2). The number of military units and the number of military personnel do not show a significant relationship. However, the effect of average unit size is positive and significant.

In summary, whether measured by GDP or GDP growth, the average size of military units shows a positive relationship with the territory's economic activity. This evidence suggests that the economic association is linked to activities developed by the military presence rather than to the presence itself. As explained above, larger units have larger budgets and have more autonomy to decide. This result aligns with previous evidence indicating a negative effect of reducing military presence in local communities (Hoffmann et al., 1996; Soden et al., 2004; Hill Thanner & Segal, 2008). It also contrasts with the very marginal impact on the local community reported by Paloyo et al. (2010) and the small regional effect on GDP shown by Fortuna et al. (2022). Therefore, our results seem to underscore the importance of public administration presence in the territory, specifically sizable military establishments. From an economic policy perspective, this emphasises the importance of considering these effects, alongside national defence, when determining the geographical distribution of these facilities. We now turn to the analysis of the potential distinctive effect of military presence in a crisis and economic contraction situation, where the role of public activity may be more decisive.

5. Military presence and economic growth in the COVID-19 crisis

As outlined above, to disentangle the possible differential effect of military presence, we will include COVID-19 in the baseline model as an indicator variable that takes a value of 1 from the beginning of the pandemic and 0 otherwise. This variable tries to capture the differences before and after the pandemic. In addition, we introduce an interaction term between the COVID-19 indicator and the military variables. This enables us to estimate the distinctive effect of these variables on economic activity; that is, whether having a greater military presence can have a differential effect on the economy in times of crisis. Table 4 presents the results.[8]

Regarding the control variables, the results are similar to the basic specification. Examining the variables of interest, neither the number of units nor the number of personnel is significant. The average size of the military unit has a positive and significant coefficient. The COVID-19 indicator is not significant. Further, the interaction terms are not significant either, suggesting that the military presence does not differentially affect the province's GDP growth during the pandemic.[9]

[8] For exposition purposes, results are presented for the GDP growth. Results for the GDP level are similar and available on request.

[9] The analysis has also been made with the incidence of COVID-19 as a crisis indicator, and the results are the same.

Table 4. Military presence and economic growth during the COVID-19 crisis.

	(1)	(2)	(3)
GDPpc $_{(t-1)}$	−0.454***	−0.452***	−0.454***
	(0.055)	(0.054)	(0.055)
Population $_t$	−0.034	−0.042	−0.042
	(0.179)	(0.173)	(0.173)
Business $_t$	−1.115	−1.562	−1.086
	(1.260)	(1.349)	(1.223)
ICT $_t$	0.011	0.015	0.016
	(0.020)	(0.020)	(0.020)
Infrastructure $_t$	26.140*	28.800**	26.130**
	(13.120)	(12.640)	(12.992)
Education $_t$	−1.459	−1.838	−1.666
	(2.570)	(2.649)	(2.526)
COVID-19 $_t$	0.001	0.001	−0.001
	(0.007)	(0.008)	(0.009)
Mil. units $_t$	−0.285		
	(0.270)		
Mil. units × COVID-19 $_t$	−0.054		
	(0.065)		
Mil. personnel $_t$		−28.620	
		(22.510)	
Mil. personnel × COVID-19 $_t$		4.445	
		(3.747)	
Unit size $_t$			0.017*
			(0.010)
Unit size × COVID-19 $_t$			−0.009
			(0.043)
Constant	1.781	1.927	1.888
	(2.409)	(2.314)	(2.339)
N	416	416	416

Note: Results of the regressions of the GDP rate of growth on the defence presence variable and control variables. In columns (1), (2), and (3), defence presence is measured by the number of military units per 1000 inhabitants, the number of military personnel per capita, and unit size, respectively. COVID-19 is a dummy variable that takes the value 1 from the beginning of the pandemic, and zero otherwise. Mil. units × COVID-19, mil. personnel × COVID-19, and unit size × COVID-19 are the interactions of each variable with COVID-19. The t-statistics reported in parentheses are based on standard errors clustered at the province level. ***, **, and * denote significance at levels 1%, 5%, and 10%, respectively.

As shown in Figures 1, 2, and 3, COVID-19 incidence in Spain was not uniform across provinces. Moreover, as suggested by Camacho & Gadea (2021), the economic consequences can vary significantly depending on the relevance of the most affected sectors (transport, hospitality, and business in general) to the economy's structure. For example, the hospitality industry is more prominent on the Mediterranean Coast and in the Balearic and Canary Islands than in the inner provinces of Spain, except Madrid. However, the COVID-19 dummy control variable does not account

for this variance. To provide additional insights, we include an indicator that captures the economic impact of COVID-19. In particular, we use Spain's ERTE program.[10] This program was designed as a key labour market policy that allowed companies to temporarily suspend employees or reduce their working hours, rather than making them redundant. The government provided extensive social protection to affected workers and offered financial incentives to companies to maintain employment. The ERTE program was a massive intervention in the Spanish labour market. From March 2020 onwards, a total of 4.4 million employment relationships were protected under these schemes, with hospitality (19% of all ERTEs) and retail trade (almost 12%) being the main sectors. At its peak, it protected 3.5 million workers simultaneously, meaning roughly one in five employed people in Spain was covered by an ERTE.[11] The ERTE variable is defined as the per capita number of employees protected by the ERTE scheme by province and year. Table 5 presents the results.

In this case, contrary to the pandemic dummy variable, the ERTE coefficient is negative and significant. The higher the relative importance of the pandemic's effects on the labour market, the lower the economic growth. Military units continue to be insignificant. The military personnel coefficient is significant but negative. The interaction coefficient of personnel with the ERTE variable, however, is positive and significant. Therefore, in provinces with a higher number of ERTE, the adverse effect is less severe with a higher number of military personnel. In summary, the presence of military personnel appears to mitigate the overall negative impact of the COVID-19 pandemic. As in previous estimations, the effect of the average size of the military facility on economic growth is positive and significant (column 3). The interaction term is also positive and significant, indicating that the general positive effect of military unit size is even more substantial in provinces that were more economically affected by the pandemic. These results support the view that the presence of military forces is differentially associated with a territory's economic activity during a crisis. Having more personnel and a larger average unit size implies a positive relationship with economic activity for provinces with a higher incidence of the pandemic in the labour market.

Table 5. Military presence and economic growth. COVID-19 and ERTEs.

	(1)	(2)	(3)
$GDPpc_{2019}$	−0.461***	−0.458***	−0.471***
	(0.055)	(0.053)	(0.054)
Population $_t$	0.0511	0.00952	−0.00962
	(0.186)	(0.189)	(0.200)
Business $_t$	−0.382	−0.446	−0.299
	(1.058)	(1.050)	(1.081)
ICT $_t$	−0.001	−0.004	0.009
	(0.021)	(0.020)	(0.021)
Infrastructure $_t$	26.660**	25.290*	23.300
	(12.900)	(12.830)	(14.650)
Education $_t$	0.726	0.770	1.083

Continued on next page

[10] The program was established by Royal Decree-Law 8/2020 of March 17 and was extended and adapted through subsequent agreements and decrees over nearly two years.

[11] https://revista.seg-social.es/-/proteccion-erte.

	(1)	(2)	(3)
	(1.947)	(1.890)	(2.090)
COVID-19 $_t$	0.001	0.005	−0.001
	(0.007)	(0.008)	(0.006)
ERTE $_t$	−0.237***	−0.249***	−0.274***
	(0.053)	(0.051)	(0.049)
Mil. units $_t$	−0.035		
	(0.203)		
Mil. units × ERTE $_t$	0.0221		
	(0.286)		
Mil. personnel $_t$		−11.060**	
		(5.468)	
Mil. personnel × ERTE $_t$		11.940**	
		(5.654)	
Unit size $_t$			0.0263***
			(0.008)
Unit size × ERTE $_t$			0.466***
			(0.147)
Constant	0.588	1.163	1.428
	(2.513)	(2.544)	(2.715)
N	416	416	416

Note: Results of the regressions of the GDP growth rate on the defence presence variable and control variables. In columns (1), (2), and (3), defence presence is measured by the number of military units per 1000 inhabitants, the number of military personnel per capita, and unit size, respectively. COVID-19 is a dummy that takes the value 1 from the beginning of the pandemic, and zero otherwise. ERTE stands for the number of COVID-19 ERTE per capita in each province. Mil. units × ERTE, mil. personnel × ERTE, and unit size × ERTE are the multiplications of each variable by ERTE. The t-statistics reported in parentheses are based on standard errors clustered at the province level. ***, **, and * denote significance at levels 1%, 5%, and 10%, respectively.

These results can be explained, at least, from two perspectives: first, as part of the public sector relevance in each province. Defence activity is part of government spending and, as such, was less affected by the pandemic crisis. Provinces with a higher military presence in the territory would have had less impact from the reduction in economic activity since government spending and public employment were maintained. This reasoning supports the positive differential results for the number of personnel and the size of military units in provinces with a higher number of employees protected by the ERTE scheme. Second, as stated above, the AFs were among the most active sectors of the economy during the pandemic. Our results indicate that the increase in activities and operations of the AFs developed by its personnel across the national territory had a positive effect on GDP growth, with a greater effect in provinces with a higher incidence of COVID-19 in the labour market. Although the interventions of the AFs could have, in some cases, extended beyond their own provinces, this additional activity would also have had a significant impact in their home province due to fiscal adscription. In summary, our evidence suggests that a more significant military presence in a given area positively affects economic outcomes, not only in normal times but, most importantly, in critical situations such as the COVID-19 pandemic, therefore acting as a "counter-cyclical" measure in the more affected territories, mostly derived from its increasing domestic functions. Again, these results

reinforce the importance of public administration presence in the territory, specifically military establishments, during a crisis. The importance of considering these relationships, in addition to national defence, when determining the geographical distribution of these facilities becomes even stronger in the case of a global health crisis. Economic policy decision-making should take into account these differential associations of local public investments when considering the restructuring of facilities' location and distribution.

6. Conclusions

This work analysed the relationship between the presence of military units and AF personnel and economic activity and growth, as well as the differential effect during the COVID-19 pandemic. The analysis was carried out for Spain at the provincial level. Results show that the size of the military unit has a positive relationship with economic activity, both at the level of GDP and its growth during the analysed period. When the impact of COVID-19 is taken into account, this positive effect is even greater the more severely a province is affected. This result aligns with previous evidence suggesting a negative effect of a reduction in military presence in local communities (Hoffmann et al., 1996; Soden et al., 2004; Hill Thanner & Segal, 2008).

Our study has several limitations. First, the fixed effect panel data allowed us to eliminate confounders caused by time-constant heterogeneity, which is a prerequisite for identifying the causal effect between military presence and economic activity. However, we have not ruled out potential endogeneity of geographic province features and military presence, so the evidence found does not have a complete causal interpretation. Additionally, there may be other time-varying factors that could influence the results. For example, firms' private investments could not be considered due to data availability reasons. Future research should tackle these concerns and analyse other institutional contexts. In any case, our estimates, which control for a comprehensive set of provincial features, bring new evidence on the linkages of domestic military presence and economic activity.

AFs are known for adapting to new situations, as evidenced by recent reorganisation and restructuring efforts. Knowing the impact of military forces on their local geographic area, once new missions are incorporated, is important for making decisions about future military reorganisations, especially considering that promoting economic development is part of any government's strategy. Provided AFs continue to support civil institutions, especially in critical situations such as the COVID-19 pandemic, understanding the potential economic benefits of these new military operations becomes more relevant for government officials and provincial administrators.

Our findings are extremely timely. The debate within NATO and European Union members about the need to increase defence spending, as well as the United Nations' (UN) concern about the potential effects this increase may have on the Sustainable Development Goals (SDGs) and a peaceful future, underscores the relevance of the evidence presented. Our evidence of a positive association between military presence and economic activity, as well as its effects during crisis times, suggests that, as long as military investment includes extended domestic missions to cooperate in national emergencies, the main concerns raised by the UN report could be mitigated. For instance, the positive association of the military and local economic growth can have a positive impact on SDG 1, No Poverty, and SDG 8, Decent Work and Economic Growth. The differential effects observed during times of crisis could positively influence the cases of SDG 3, Good Health and Well-being, and SDG 4, Quality Education (by improving preparedness for pandemics and public health crises). Finally, the institutional impact

in local areas resulting from the presence of military facilities would improve SDG 16, which focuses on Peace, Justice, and Strong Institutions.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

Author contributions

Authors have contributed equally to the development of this article, participating at all stages of the research process.

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Conflict of interest

All authors declare no conflicts of interest in this paper.

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