

ANALYTICAL ARTICLES

Economic Bulletin

2/2020

BANCO DE **ESPAÑA**
Eurosistema

THE HETEROGENEOUS ECONOMIC IMPACT
OF COVID-19 AMONG EURO AREA REGIONS
AND COUNTRIES

Elvira Prades Illanes and Patrocinio Tello Casas

ABSTRACT

The global spread of COVID-19 and, above all, the social distancing measures adopted to contain the health crisis have resulted in a significant standstill in economic activity in most economies. The economic impact on different countries' or regions' economies may vary significantly depending on their respective productive structures and will also be influenced by the cross-sectoral customer-supplier relationships in the domestic and international supply chains. This article investigates how the impact of the shock triggered by COVID-19 may vary depending on these two characteristics: differences in the productive structure and cross-sectoral connections. First, the impact of two different scenarios envisaged for Spain on the value added of its different regions (*Comunidades Autónomas*) is quantified. Then, those same scenarios are used to estimate the impact of an identical shock on the largest euro area countries (Germany, France, Italy and Spain). The findings confirm that the effects of the restrictions imposed on economic activity in Spain to contain the pandemic vary according to the region on account of the different productive structures and cross-sectoral relationships. Broadly speaking, it appears that the estimated impact is significantly higher in the regions most exposed to the sectors related to accommodation and food service activities, such as the island regions. The impact would also be high in other regions, which tend to be those where the manufacturing of vehicles is of particular importance, due not only to the closure of production plants, but also to the spillover effect on other sectors. By applying to the main euro area economies the same degree of sectoral shutdowns as that observed in the Spanish economy, the impact on Germany, France and, to a lesser extent, Italy is comparatively smaller than in Spain. The differences in productive structure and cross-sectoral connections render the Spanish economy relatively more vulnerable to a common shock such as the current pandemic due to its greater reliance on those sectors particularly stricken by the social distancing measures.

Keywords: common shocks, lockdown, COVID-19, input-output relationships, EUREGIO, regional analysis.

JEL classification: E01, E32, F14, F15, H72.

THE HETEROGENEOUS ECONOMIC IMPACT OF COVID-19 AMONG EURO AREA REGIONS AND COUNTRIES

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Introduction

The rapid global spread of COVID-19 and, above all, the lockdown and social distancing measures adopted by the authorities in different countries to contain the disease have brought a significant portion of activity to a sudden halt in several countries, triggering a drop in output unprecedented in recent times. Despite its global nature, this common shock is having a heterogeneous impact on different countries, mirroring the differences in the severity and duration of the restrictions on activity and on people's mobility, and in the structural characteristics of each economy.

Indeed, the lockdown has a varying impact on different sectors of activity. Specifically, it is particularly damaging to those sectors in which interaction with the end-consumer plays an important role, such as tourism-related sectors. Likewise, those sectors that are more integrated with global value chains, such as car manufacturing, have also been hard hit by the disruptions to the various links in the supply chain. The sectors being affected in different ways foretells significant disparities in the aggregate impact of the shock triggered by COVID-19 among countries and among a country's regions. The regional element is relevant to Spain because its regions' productive structures differ significantly. Furthermore, the pandemic has hit some regions harder than others, resulting in a somewhat asymmetrical easing of the lockdown measures.

Input-output tables provide a suitable analytical framework for quantifying the spillover effects of a total or partial suspension of activity in a specific sector on the other sectors and on the economy as a whole. Specifically, the EUREGIO database, which contains data on customer-supplier relationships for 249 EU regions and 14 sectors of activity, serves to quantify the varying impact of the same losses of activity on different sectors and regions of the four largest EU economies (Germany, Italy, France and Spain).

The findings confirm that there has been a marked reduction in activity in all Spanish regions as a result of the measures associated with the declaration of the state of alert due to COVID-19, above all in those in which tourism-related sectors are of particular importance. Lastly, it appears that, given the same lockdown scenarios in terms of severity and duration, activity in Spain would fall relatively more than in other euro area countries and, furthermore, there would also be greater disparity in the impact among regions.

Methodology and database

As in other countries, the impact of the measures adopted in Spain to curb the spread of the pandemic differs according to sector of activity. Initially, Royal Decree 463/2020 of 14 March 2020, declaring the entry into force of the state of alert, ordered the closure of accommodation and food, entertainment and restaurant services, in addition to non-essential sales-related activities. Subsequently, Royal Decree-Law 10/2020 of 29 March 2020 extended the scope of the closure to include all non-essential activities (not just sales activities) between 30 March and 9 April. Based on provisional estimates made by the Banco de España, the declaration of the state of alert brought around 30% of activity in Spain to a standstill (this would approach 70% during the suspension of non-essential activities). Subsequent to 9 April, and up to the publication of this article, the state of alert has been extended four times, to 7 June; however, the last two extensions have been accompanied by an easing, at different speeds across the country depending on region, of the restrictions.

Preliminary estimates of the National Accounts for 2020 Q1 point to GDP dropping by 5.2% quarter-on-quarter. Given that the lockdown has impacted differently each sector's level of activity, the differences in the regions' sectoral structures are crucial to calculating the loss of value added (VA) in each region. Data at the regional level on the period in which the measures adopted were in force and, above all, on the labour market are scant at present, yet they are sufficient to confirm that the lockdown is having a particularly severe impact on some sectors and regions.¹

The methodology used in this article to calculate the effects of the social distancing measures on the economy, at the national and regional level, first requires an estimation of the loss of activity associated with the periods in which the aforementioned Royal Decree and Royal Decree-Law are in force. Specifically, for the 64 sectors of activity for which VA data are available at the national level, assumptions were made on the direct loss of activity in Spain as a whole in each week of lockdown, distinguishing between a week of severe (the fortnight Royal Decree-Law 10/2020 was in force) and moderate (the remaining period) closure.

The estimate at this level of disaggregation was based chiefly on the interpretation of the aforementioned Royal Decree and Royal Decree-Law, supplemented with information at the firm level from the Banco de España's Central Balance Sheet Data

1 Specifically, the notable drop in social security registrations throughout the second half of March, following the declaration of the state of alert, and, to a lesser extent, in April, was particularly sharp in the accommodation and food, restaurant, entertainment and construction activities. The geographical breakdown of this statistic points to the sharpest fall taking place in the Balearic Islands and the smallest in the Basque Country. See Box 1 in Banco de España (2020), *La evolución del empleo y del paro en el primer trimestre de 2020, según la Encuesta de Población Activa*. Furthermore, employees subject to layoffs or short-time work arrangements (ERTE by its Spanish acronym) and the self-employed who have ceased activities also account for a particularly high proportion of employment in the accommodation and food, restaurant and entertainment sectors.

Table 1

WEEKLY SHUTDOWN OF ACTIVITY SCENARIOS BY SECTOR OF ACTIVITY

Each week in which the state of alert is in force (moderate closure) would give rise to a direct suspension of activity of 17% in Spain, rising to 42% during the weeks of suspension of non-essential activities (severe closure). The spillover effects generated by the input-output relationships would increase those percentages to 28% and 71%, respectively. The services sector, in particular hotels and restaurants, is the hardest hit.

	VA	Moderate closure		Severe closure	
	%	Direct impact (%)	With spillover effect (%)	Direct impact (%)	With spillover effect (%)
Agriculture	2.7	0	-13	0	-41
Mining, quarrying and energy supply	2.8	0	-19	0	-60
Food, beverages and tobacco	2.3	0	-19	-52	-84
Textiles and leather	0.6	0	-4	-52	-64
Coke, refined petroleum, nuclear fuel and chemicals etc.	2.8	0	-10	-52	-84
Electrical, optical and transport equipment	2.2	-72	-82	-87	-100
Other manufacturing	6.2	0	-14	-50	-100
Construction	9.9	0	-5	-100	-100
Distribution	10.7	-49	-64	-49	-95
Hotels and restaurants	7.2	-100	-102	-100	-100
Transport, storage and communications	7.3	-37	-60	-48	-100
Financial intermediation	4.9	0	-14	-28	-73
Real estate, renting and business activities	17.9	-6	-23	-32	-77
Non-market services	22.5	1	-1	-6	-14
TOTAL	100	-17	-28	-42	-71

SOURCES: EUREGIO, Eurostat and own calculations.

Office together with the results from an ad hoc survey conducted on a set of firms from that sample.² Subsequently, the assumptions for the 64 sectors at the national level were grouped into the 14 sectors for which data are available at the regional level in the EUREGIO database, which is the database used in this article.³ Table 1 presents the results obtained,⁴ showing the direct and overall effect for each sector of activity. The overall effect is the sum of the direct effect plus the estimated spillover effect resulting from the indirect impact on the other sectors.⁵

As regards the lockdown's direct consequences, based on the assumptions made, drops in activity are especially steep in the services sector and, in particular, in three types of service. First, a 100% reduction in activity during each week of the

2 See Box 1 in *Reference macroeconomic scenarios for the Spanish economy after COVID-19*, Banco de España, Analytical Article, Economic Bulletin 2/2020.

3 The disaggregation into 14 and 64 sectors of activity coincides with NACE Rev.1 (2010) and NACE Rev.2 (2016), respectively. In order to map the sectors, it was necessary to make certain assumptions.

4 To simplify the exercise, an additional assumption was made, namely that in each sector activity is distributed evenly throughout the year.

5 This effect is calculated using the coefficients of the Leontief inverse matrix, which are estimated, at the regional level, on the basis of the EUREGIO database's input-output table, as detailed in Box 1.

state of alert is assumed in the case of hotels and restaurants, in line with the mandatory closure of establishments of this kind. Second, in the distribution sector a reduction in activity of around 50% is assumed, since non-essential product distribution, which ceased to operate normally in accordance with Royal Decree 463/2020, accounts for this percentage of the total.⁶ Lastly, a reduction of 60% is estimated in the transportation sector due to the transportation of passengers and non-essential goods coming practically to a standstill.⁷ This results, considering the transportation, storage and communications sector as a whole, in a 37% decline in activity.

As for other market services, it is assumed that there is no direct loss of activity during the state of alert, except for the fortnight from 31 March to 13 April, where the cessation of activity was extended to include sectors not deemed to be direct providers of essential services. This gives rise to a 28% drop in the VA of other market services as a whole. Lastly, a 10% increase in public sector activity, included in the non-market services sector, is assumed, anticipating the expected growth in general government expenditure, particularly on healthcare, in 2020.

As regards the activities within the manufacturing sector, the full closure of motor vehicle production plants was assumed. The other manufacturing activities do not experience direct drops in their activity during the lockdown, except for the period when non-essential services were suspended (during which around 50% of this output was affected).⁸ Construction is considered to have continued to function normally throughout the state of alert (except between 30 March and 9 April, when activity was halted). Lastly, due to their essential nature the primary and energy sectors' levels of direct activity remain unchanged.

The indirect effects in an ordinary week of the state of alert amount to approximately 15% of the VA for most sectors, although this percentage is somewhat higher for the energy, food and, above all, transportation sectors (see Table 1). The drop is significantly sharper for some sectors in the period in which non-essential activities were suspended. This is particularly the case for the energy sector, due to the spillover effect of the cessation of activities in some sectors whose output is heavily reliant on energy.⁹

6 According to the Central Balance Sheet Data Office, wholesale and retail trade activities for staple goods, such as food, tobacco, beverages, medicinal products and medical devices, and press account for 51% of the overall wholesale and retail trade sector.

7 The loss of 99% of passenger transport and of 49% of freight transport unrelated to the distribution of essential products is assumed. According to the Central Balance Sheet Data Office, freight transport accounts for approximately 80% of the total.

8 Essential product manufacturing is deemed to be: Manufacture of food; beverages; manufactured tobacco; coke and refined petroleum products; chemicals; basic pharmaceutical products and pharmaceutical preparations; computer, electronic and optical products; and electrical equipment.

9 Specifically, the decline due to indirect effects is approximately 20% and 60% in the periods of moderate and severe closure, respectively.

For the economy as a whole, the information presented in Table 1 confirms that the scale of the spillover effects is not insignificant. In an ordinary week of the state of alert, the Spanish economy's VA falls by 17% due to the direct effect of the lockdown. This decline rises to 28% when the spillover effects on other sectors are taken into account. During the period when non-essential activities ceased, the direct effect of the standstill is estimated to have affected 42% of the VA. This figure rises to almost 71% when the indirect effects are also taken into account.

Having estimated the decrease in activity during the state of alert (distinguishing furthermore between the moderate closure of an ordinary week and the severe closure of early April), it is possible to calculate the total impact on activity for Spain as a whole and for each region during the entire lockdown period assuming it lasts a specific amount of time. To do so, two somewhat ad hoc scenarios were defined: short lockdown (8 weeks) and long lockdown (12 weeks).¹⁰ Two clarifications must be made. First, these illustrative exercises do not purport to opine on the duration of the state of alert (which, in fact, at the date of publication of this article exceeded by far the shorter of the two durations considered). And second, characterising the two scenarios by their duration in weeks should be deemed to be a mere description of a more complex reality entailing a gradual return to normality. Indeed, at the cut-off date for this article,¹¹ several regions had already commenced the reactivation of some economic activities, while the stricter measures mentioned above remained in force in others. To simplify, the analysis presented in this article does not take into account the nascent normalisation process, which will differ among the regions. The findings are presented below.

The economic impact of the COVID-19 crisis on Spain's regions

In the context of measuring the impact of the COVID-19 crisis on Spain's individual regions, one particularly important difference lies in the diversity of their productive structures.¹² There are two reasons why this is the case. First, as has been noted, the social distancing measures implemented by authorities affect the different sectors of activity in contrasting ways, in some cases forcing them to close entirely. Second, cross-sectoral relationships within the business sector are shaped by productive specialisation, and these relationships play a central role in the propagation of shocks along the production chain. Chart 1.2 illustrates the differences between the regions' productive structures.

10 In both cases, the severe closure period (suspension of non-essential activities) is included. The total duration of the state of alert taken into consideration is consistent with the scenarios included in "*Reference macroeconomic scenarios for the Spanish economy after COVID-19*".

11 The cut-off date is 21 May 2020.

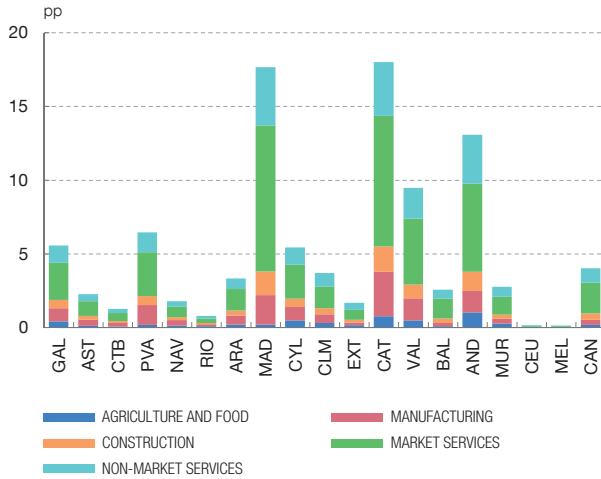
12 For a detailed description of the differences between the regions in this and other facets, see, for example, Artola et al. (2018).

Chart 1

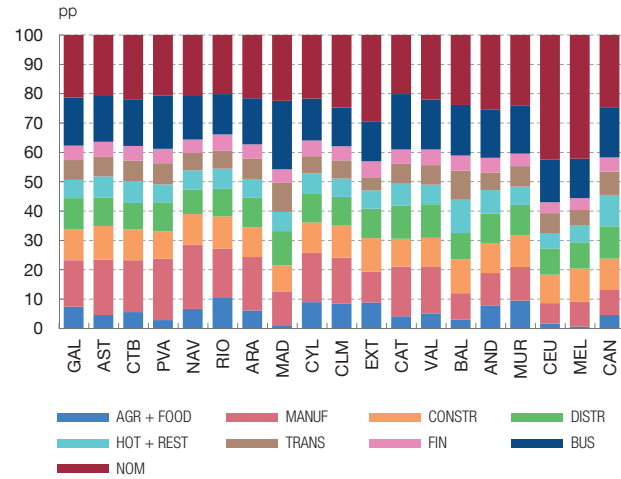
SECTORAL AND REGIONAL STRUCTURE OF THE SPANISH ECONOMY

Significant differences exist in the various regions' productive structures. While the weight of the tourism sector in the Canary Islands and the Balearic Islands exceeds the average, in Madrid there is a tendency towards the professional activities and transportation sectors. By contrast, in the regions in the north-east of the peninsula the manufacturing sector is of particular importance.

1 EACH REGION'S VA AS A % OF SPAIN'S VA



2 EACH SECTOR AS A % OF EACH REGION'S VA



SOURCE: EUREGIO 2018 input-output table.

N.B.: The data refer to 2010. The sectors are classified as AGR + FOOD: Agriculture and Food, beverages and tobacco; MANUF: Manufacturing sector (which includes: mining, quarrying and energy supply, textiles and leather, coke, refined petroleum, nuclear fuel and chemicals etc., electrical, optical and transport equipment and other manufacturing); CONSTR: Construction; DISTR: Distribution; HOT+REST: Hotels and restaurants; TRANS: Transport, storage and communication; FIN: Financial intermediation; BUS: Real estate, renting and business activities; and NOM: Non-market services.



Even so, it should be noted that the assumptions in relation to the direct full or partial closure of the various sectors are identical for all regions in both of the scenarios examined. In other words, a series of sectoral-regional shocks, common to all regions, are identified in terms of a percentage decrease (or increase) in VA in a given sector. However, how such closure affects each region's total VA will depend on each sector's weight in the region's productive structure and the interconnections between the sectors.¹³

Chart 2 plots the heterogeneous impact of the lockdown in the two scenarios defined, one of short duration and another of long duration (A and B, respectively), on the VA of the 17 regions and Ceuta and Melilla.¹⁴ Naturally, the longer period of lockdown will give rise to a deeper falloff in activity. However, the relative rankings

13 For example, a shock affecting tourism-related activities in the Canary Islands would have a greater impact on the total economy of the region than a shock of similar magnitude affecting tourism in the region of Madrid. According to estimates by Exceltur and the respective regional statistics institutes, while over 30% of the Canary Islands' GDP depends directly or indirectly on tourism, in Madrid it is less than 7% (see <https://www.exceltur.org/impactur/#>).

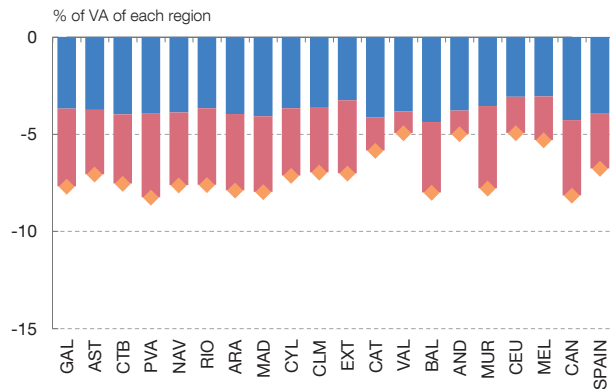
14 External spillover effects are not factored into this initial exercise, i.e. activity levels in the rest of the world are assumed to remain unchanged.

Chart 2

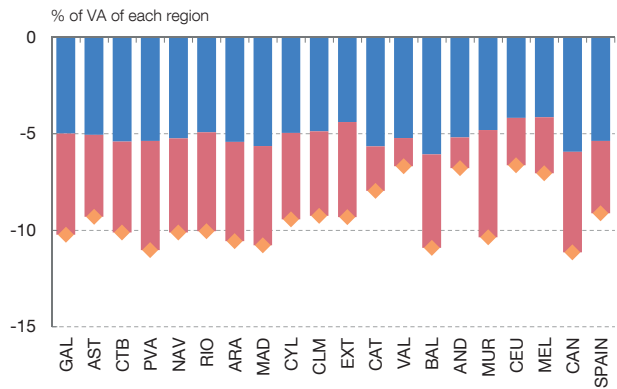
THE IMPACT OF THE COVID-19 CRISIS ON THE REGIONS' VA: A SUPPLY-SIDE APPROACH

The measures associated with the lockdown period are having a heterogeneous impact on the sectors of activity. In line with their different productive structures, the restrictions on activity are having a heterogeneous impact on the Spanish regions' value added. Specifically, the VA of the regions that are more dependent on the tourism sector and those in which motor vehicle manufacturing and the transportation sector are more important has been impacted to a greater extent.

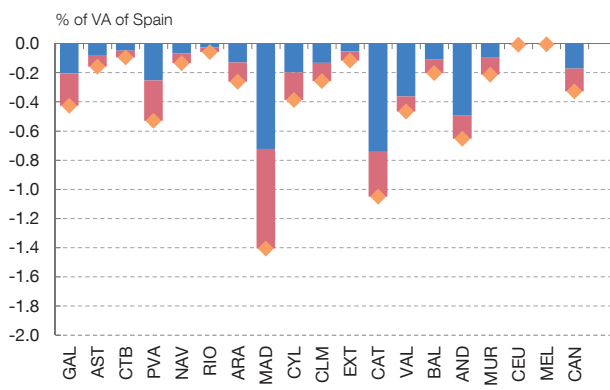
1 IMPACT OF COVID-19 ON THE ANNUAL VA BY REGION: SCENARIO A



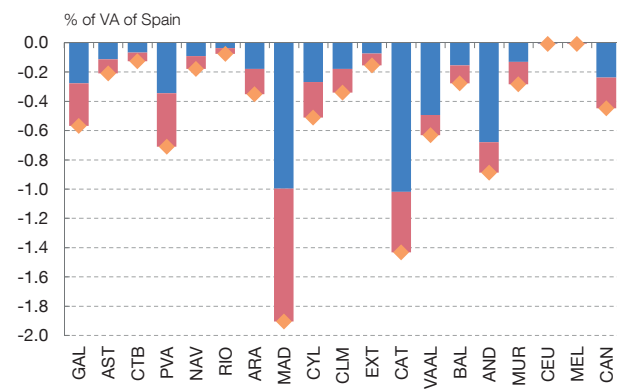
2 IMPACT OF COVID-19 ON THE ANNUAL VA BY REGION: SCENARIO B



3 IMPACT OF COVID-19 ON THE ANNUAL VA BY REGION: SCENARIO A



4 IMPACT OF COVID-19 ON THE ANNUAL VA BY REGION: SCENARIO B



■ DIRECT IMPACT ■ SPILLOVER EFFECT ◆ TOTAL EFFECT

SOURCES: EUREGIO 2018 input-output table and own calculations.



of the regions are similar in both scenarios. Specifically, the Canary Islands, the Balearic Islands, the Basque Country and Madrid would record the sharpest declines in activity in both scenarios A and B, while Catalonia, the region of Valencia and Andalusia would be the least affected.¹⁵ The extent of the annual decrease in regional VA would fluctuate between approximately -5% and -8% in scenario A and

15 In the case of Catalonia, and to a lesser degree Andalusia, while the regional VA and sectoral distribution in the EUREGIO database mirror the official National Statistics Institute data relatively faithfully, it seems that both cross-border trade relationships and those with other Spanish regions are underestimated. This would explain the scant indirect effect on regional VA of activity closures in other sectors.

between -6.5% and -11% in scenario B. A precise identification of the sectors responsible for these differences is difficult. However, broadly speaking, the estimates indicate that those regions where tourism, vehicle manufacturing and transport services have a greater weight in the productive structure would record the sharpest falloff in activity, in terms of regional VA, during the state of alert, irrespective of its duration.

The direct impact is particularly large for the Balearic Islands and Canary Islands, owing to the complete closure of the tourism industry, and to a lesser degree Madrid, due to the transport services and distribution sectors carrying more weight. The indirect or spillover effect, which reflects the propagation of the shock throughout the production chains, magnifies the shock's direct impact via cross-sectoral relationships. This effect is particularly marked in regions where car manufacturing carries greater weight.

Taken on aggregate, the decline in regional VA prompted by the lockdown is expected to cause an annual falloff in the VA of the total Spanish economy of -6.8 pp in scenario A and -9.1 pp in scenario B (see Charts 2.1 and 2.2).¹⁶ Madrid (owing to its weight in total VA and the impact of the shock) and Catalonia and Andalusia (owing to their weight in total VA) are the regions primarily responsible for the drop in Spain's total VA (see Charts 2.3 and 2.4).

There are several reasons why these results are subject to considerable uncertainty. In particular, the assumptions regarding the percentage of activity affected in each sector are, in some cases, estimated with relative imprecision. Further, the assumption that the percentage of activity directly lost in a given sector will be identical across all regions may be questionable. Finally, particular caution is required when interpreting the results of the analysis due to the database employed being in its infancy.¹⁷ That said, the results do illustrate how a common shock, such as COVID-19, can have a heterogeneous impact on Spain's regions.

The economic impact of a common shock in Germany, France, Italy and Spain

The pandemic stands as a unique shock in recent economic history, since it has been global and symmetric in origin. Accordingly, other countries aside from Spain have also implemented social distancing measures. The measures do differ among the countries in terms of their severity and duration, but all have entailed the full or partial closure of major activity segments.

¹⁶ These results are comparable with those found for Spain as a whole using the 2016 input-output table in the analytical article *"Reference macroeconomic scenarios for the Spanish economy after COVID-19"*.

¹⁷ As described in the Annex, there seems to be some evidence that the cross-sectoral effects, and therefore total effects, in EUREGIO are skewed to the downside (for Catalonia in particular).

The methodology used in the previous section also serves to approximate how a common shock may affect the main euro area countries differently, based on their productive structures and their businesses' cross-sectoral relationships. To this end, the decline in VA was estimated for Germany, France and Italy based on the lockdown scenarios established in the above section for Spain.¹⁸ However, in addition to the two channels considered above - the direct impact caused by the closure of a sector and the spillover effect on other sectors of the same country -, a third aspect is also examined: the international spillover effect on the other three countries.

The availability of an input-output table with regional detail and compiled using a standard methodology for each of the EU economies, the EUREGIO, ensures comparable results between the countries. Thus, following the same procedure as described for Spain, the Leontief inverse matrix is calculated for Germany, Italy and France using the EUREGIO database. Subsequently, this matrix is employed to quantify the impact of a homogeneous shock - the lockdown in Spain - on activity for the ensemble of these countries and their regions at the NUTS 2 level.

Table 2 shows the weekly decrease in activity for each of the 14 sectors during a week of moderate or severe suspension of activity.¹⁹ In both scenarios, the percentage of activity affected during the lockdown, as it was defined in the previous section, is higher in Spain and Italy than in Germany and France. The scale of the spillover effects on total activity is large in all four countries. The total impact on each country's value added is shaped by its productive structure and the cross-sectoral relationships outlined in the input-output table.

Chart 3 plots the total estimated decline in VA for these countries in the two previous lockdown scenarios (short duration, A, and long duration, B), factoring in the direct impact and spillover effects of the falloff in activity in both domestic and foreign sectors.

The results show that the effect of the lockdown, which was calibrated for the Spanish economy, is set to be more adverse for Spain's economy than for Germany, France and, to a lesser degree, Italy (see Chart 3.1). Thus, annual VA in Spain would decline by around 7 pp in scenario A (short) and 9.5 pp in scenario B (long). This represents a steeper decrease than expected for Germany (-6.2 pp and -8.3 pp, respectively) and France (-5.9 pp and -7.9 pp, respectively), and similar, albeit still somewhat more negative, to that projected for Italy (-6.7 pp and -9.1 pp, respectively). First, these differences reflect the countries' varying percentages of total activity directly affected by the common lockdown, with Spain accounting for the largest

18 Note that these sector shutdown scenarios are calibrated for Spain and may be less suitable for other countries.

19 As in Table 1, the spillover effects only include the effects of domestic sectors and do not include those arising from a decrease in activity in the other three countries' sectors. Further, as in Spain, VA is broken down into 64 sectors of activity based on NACE Rev. 1 (2010).

Table 2

WEEKLY SHUTDOWN OF ACTIVITY SCENARIOS BY SECTOR OF ACTIVITY IN SELECTED ECONOMIES

A lockdown of similar characteristics to that of Spain would affect significant portions of activity in the largest euro area countries. The percentage of activity affected by the partial or total closure of certain sectors would be higher in Italy and Spain than in Germany and France, mirroring their different productive structures and input-output relationships.

	Germany				France				Italy				Spain			
	Moderate closure		Severe closure		Moderate closure		Severe closure		Moderate closure		Severe closure		Moderate closure		Severe closure	
	Direct (%)	With spillover (%)	Direct (%)	With spillover (%)	Direct (%)	With spillover (%)	Direct (%)	With spillover (%)	Direct (%)	With spillover (%)	Direct (%)	With spillover (%)	Direct (%)	With spillover (%)	Direct (%)	With spillover (%)
Agriculture	0	-5	0	-31	0	-8	0	-37	0	-14	0	-41	0	-13	0	-41
Mining, quarrying and energy supply	0	-11	0	-32	0	-10	0	-37	0	-18	0	-52	0	-19	0	-60
Food, beverages and tobacco	0	-5	-52	-64	0	-10	-52	-74	0	-20	-52	-86	0	-19	-52	-84
Textiles and leather	0	-1	-52	-56	0	-5	-52	-71	0	-5	-52	-76	0	-4	-52	-64
Coke, refined petroleum, nuclear fuel and chemicals etc.	0	-8	-52	-73	0	-10	-52	-82	0	-11	-52	-86	0	-10	-52	-84
Electrical, optical and transport equipment	-67	-80	-84	-100	-67	-80	-85	-100	-52	-64	-77	-100	-72	-82	-87	-100
Other manufacturing	0	-10	-51	-85	0	-14	-47	-100	0	-10	-51	-95	0	-14	-50	-100
Construction	0	-4	-100	-116	0	-2	-100	-100	0	-7	-100	-100	0	-5	-100	-100
Distribution	-49	-62	-49	-86	-49	-64	-49	-91	-49	-67	-49	-96	-49	-64	-49	-95
Hotels and restaurants	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100
Transport, storage and communications	-36	-63	-47	-97	-36	-56	-46	-89	-40	-64	-49	-100	-37	-60	-48	-100
Financial intermediation	0	-11	-28	-68	0	-17	-28	-79	0	-17	-28	-78	0	-14	-28	-73
Real estate, renting and business activities	-3	-18	-30	-74	-3	-18	-30	-72	-4	-24	-31	-77	-6	-23	-32	-77
Non-market services	3	1	-5	-13	3	1	-7	-12	2	0	-5	-11	1	-1	-6	-14
TOTAL	-13	-24	-37	-66	-12	-22	-35	-63	-14	-27	-38	-70	-17	-28	-42	-71

SOURCES: EUREGIO, Eurostat and own calculations.

percentage and France the smallest (see Table 2).²⁰ Second, the spillover effects on each sector of activity, stemming from the direct (partial or total) closure of other domestic sectors, differ between the countries as a result of their input-output relationships. These effects are particularly large in Italy. Finally, the spillover effects stemming from the other three countries included in the analysis are relatively minor in Spain in comparison with those projected for the other economies. These effects are somewhat more robust in France and, above all, Germany, which is more firmly integrated with global value chains, than in Italy and Spain (see Chart 3.1). Not

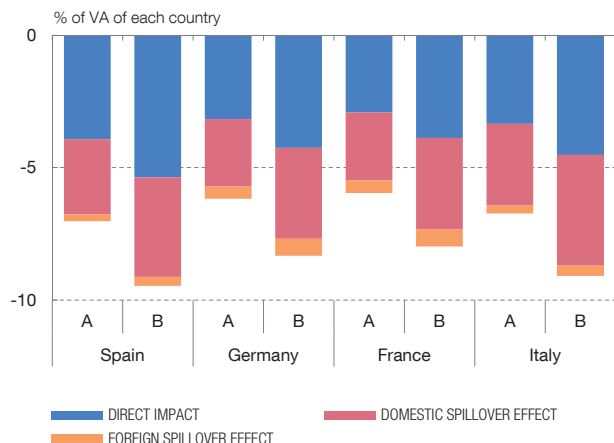
20 According to the OECD, the percentage of activity affected by the full or partial shutdown of certain sectors will be very similar in Germany and Spain, and smaller in France and Italy. The average proportion of activity affected by the lockdown across the four countries is set to stand at 27% (<https://www.oecd.org/newsroom/oecd-updates-g20-summit-on-outlook-for-global-economy.htm>).

Chart 3

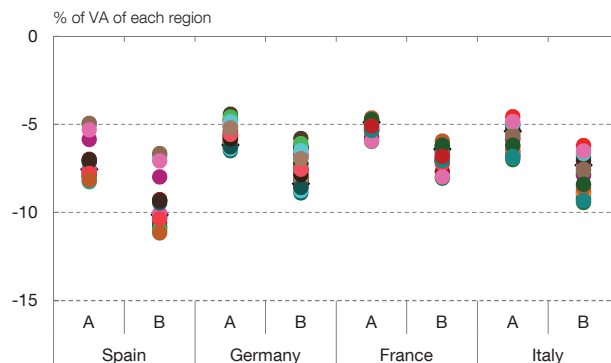
THE EFFECT OF THE COVID-19 LOCKDOWN ON EURO AREA COUNTRIES

COVID-19 is a common shock that is having a heterogeneous impact on the four largest economies of the euro area. Differences in productive structure and input-output relationships, both domestic and international, help to explain the contrasting effects on these economies. In the two lockdown scenarios established for Spain, A (short) and B (long), the VA of Germany and France would decline less than that of Italy and Spain. This heterogeneous impact at the aggregate level is also evident at the regional level, with Spain showing the greatest regional disparity and France the least.

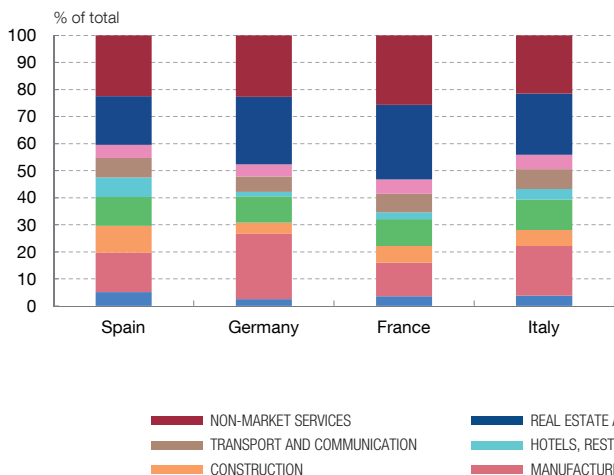
1 IMPACT OF COVID-19 ON ANNUAL VA BY COUNTRY



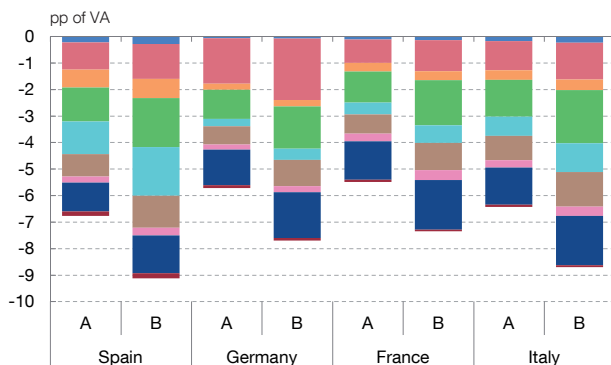
2 IMPACT OF COVID-19 ON ANNUAL VA BY COUNTRY AND REGIONAL DISPERSION



3 VA DISTRIBUTION BY SECTOR OF ACTIVITY



4 CONTRIBUTIONS TO THE DECLINE OF ANNUAL VA BY SECTOR OF ACTIVITY



SOURCES: EUREGIO 2018 input-output table and own calculations.



included here are the spillover effects arising from the suspension of activity in other countries. Given the global nature of the shock, this suggests that the pandemic's ultimate impact on the four main euro area countries could be significantly greater than estimated in this article.

Lastly, some disparity is observed among the four countries in terms of the outlined lockdown's impact at the regional level. Even so, the estimates indicate a more

diverse impact across the regions of Spain and a less diverse impact for the regions of France (see Chart 3.2). This disparity is heightened in the longer lockdown scenario.

In short, the analyses based on EUREGIO, the global input-output database with regional detail, illustrate that a common shock can affect the VA of each economy in different ways, depending on productive specialisation and cross-sectoral interconnections both within the country and with the rest of the world. Specifically, the differences in terms of productive structure and input-output relationships render the Spanish economy somewhat more vulnerable to shocks such as the current pandemic, due to its greater reliance on the sectors hardest hit by social distancing measures.

27.5.2020.

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THE EUREGIO DATABASE: A GLOBAL INPUT-OUTPUT TABLE WITH REGIONAL DETAIL

The EUREGIO database is a global input-output table with regional detail developed by the Tinbergen Institute in Amsterdam. It has been available for use since late 2018. Specifically, the EUREGIO combines data on productive structures and trade relations from the World Input-Output Database (WIOD, 2013 version) with a detailed breakdown for 249 EU regions (NUTS 2 level). The database also includes information for 16 non-EU countries and a block comprising the rest of the world. The data, in nominal terms and in euro, are available for the 2000-2010 period. The results set out in this article are based on the regional input-output table for 2010 (the most recent). In terms of the sectoral breakdown, which is essential for assessing the impact had by the COVID-19 lockdown, EUREGIO provides details for 14 sectors of activity: (1) Agriculture; (2) Mining, quarrying and energy supply; (3) Food, beverages and tobacco; (4) Textiles and leather; (5) Coke, refined petroleum, nuclear fuel and chemicals etc.; (6) Electrical, optical and transport equipment; (7) Other manufacturing; (8) Construction; (9) Distribution; (10) Hotels and restaurants; (11) Transport,

storage and communications; (12) Financial intermediation; (13) Real estate, renting and business activities; and (14) Non-market services. A more detailed analysis of the specifications and construction of the EUREGIO can be found in Los et al. (2018).¹

EUREGIO corresponds relatively accurately to certain characteristics of the Spanish economy that are relevant to our analysis. First, in terms of VA, the various regions are similarly representative in the EUREGIO and in official INE statistics (see Chart 1). Likewise, the sector of activity structure is highly analogous in both sets of statistics (see Chart 2). Conversely, for some regions trade flows with other regions of Spain and the rest of the world are underestimated in EUREGIO, distorting the spillover effects from the direct falloff in sectoral activity (whether in another region or the rest of the world). This is particularly true for Catalonia, where the input-output tables formulated by the *Institut d'Estadística de Catalunya* suggest that the region's trade flows are larger than reported by EUREGIO.²

REPRESENTATIVENESS OF THE EUREGIO DATABASE

The EUREGIO database, the first global input-output table with EU-wide regional detail, approximates very accurately to the information prepared by the official national sources for Spain's regions. The weight of the different regions in Spain's VA is practically identical to the information provided by the INE (see Chart 1), as is the data on productive specialisation at the national level (see Chart 2).

Chart 1
VALUE ADDED BY REGION IN 2010

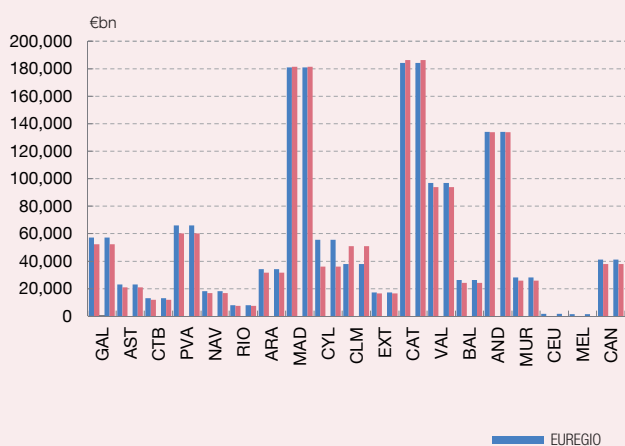
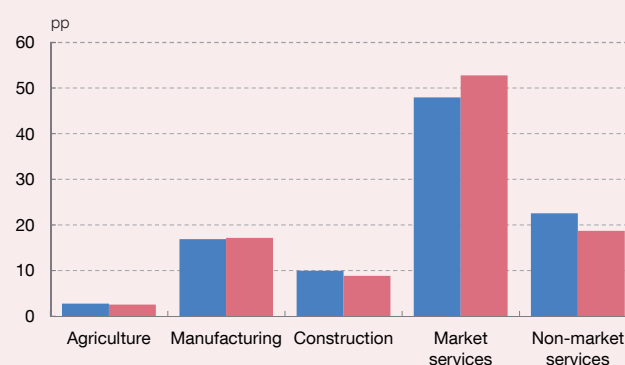


Chart 2
VALUE ADDED BY SECTOR OF ACTIVITY (2010)



SOURCES: EUREGIO 2018 input-output table and INE.

1 In particular, the usual limitations of the input-output framework apply.
 2 The comparison of both sets of statistics indicates that Catalonia's trade flows, both with other regions and with the rest of the world, are underestimated by a magnitude equal to approximately 5% of Catalonia's VA.

THE EUREGIO DATABASE: A GLOBAL INPUT-OUTPUT TABLE WITH REGIONAL DETAIL (cont'd)

The EUREGIO serves to calculate the Leontief inverse matrix for each sector and region combination.³ Each element of this matrix (h_{ij}^a) indicates the impact in euro had on the sector of activity j (e.g. energy) by a change of one euro in the production of sector i (e.g. vehicle manufacturing) in region a . Therefore, h_{ij}^a includes both the direct and spillover effects arising from the change in the production of i on other sectors (e.g. k , hotels and restaurants), which in turn require inputs from sector j .

By way of example, Chart 3 shows the coefficients of the Leontief inverse matrix for the Basque Country. Each node represents total requirements at the sector-region level. A greater node density indicates the greater reliance of a specific sector (shown on the vertical axis) in the Basque Country on inputs from the sectors shown in the horizontal axis. The sectors supplying the inputs may be located in the same region, another region of Spain, another region of Europe, or in the rest of the world. The

density of the nodes indicates strong interconnections between sectors irrespective of location. This is especially true within the same sector.

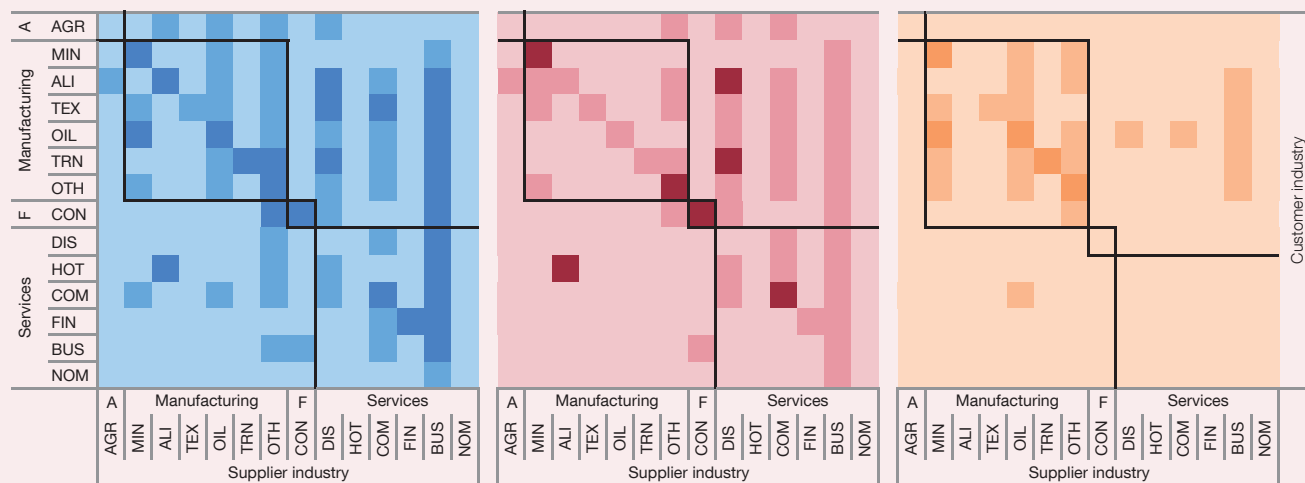
EUREGIO can be used to calculate the Leontief inverse matrix based on the origin of the inputs, whether this be the same region, another region of Spain or another country. Chart 4 shows the coefficients of the regional Leontief inverse matrix based on inputs from other regions of Spain, i.e. reflecting the reliance of suppliers, at sectoral level, on other regions of Spain. Similarly, Chart 5 sets out the same coefficients with the rest of the world, approximating to the reliance of sectors of activity in the Basque Country on imports from the rest of the world. As expected, the productive sectors are more reliant on inputs from other regions of Spain than from the rest of the world, which presages significant spillover effects on other regions as a result of activity coming to a standstill in certain sectors of the Basque Country.

A sector of activity requires inputs from other sectors in order to produce. Charts 3, 4 and 5 below summarise the cross-sectoral relationships for 14 sectors of activity in the Basque Country. A darker colour node indicates greater interdependence between sectors. Chart 3 shows the dependence of a sector in the Basque Country (vertical axis) on other sectors (horizontal axis) irrespective of their region of origin; Chart 4 shows the dependence on inputs from other regions; and, lastly, Chart 5 shows the dependence on imported inputs. The charts show that cross-sectoral links are particularly intense with other regions of Spain and imported inputs are concentrated mainly in the manufacturing sector.

Chart 3
INTENSITY OF USE OF INPUTS IN THE BASQUE COUNTRY

Chart 4
INTENSITY OF USE OF INPUTS FROM OTHER REGIONS IN THE BASQUE COUNTRY

Chart 5
INTENSITY OF USE OF IMPORTED INPUTS IN THE BASQUE COUNTRY



SOURCES: EUREGIO 2018 input-output table and own calculations.

3 A more detailed analysis of the Leontief matrix and associated coefficients, as well as the potential uses of the EUREGIO database, can be found in Prades-Illanes and Tello-Casas (2020).