

Exporters' reaction to positive foreign demand shocks

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Abstract

I use the quasi-natural experiment of the 2018 African swine fever (ASF) outbreak in China to analyze swine exporters' reaction to a foreign market's positive demand shock. I use the universe of Spanish firms' export transactions to China and other countries and compare the performance of swine and other exporters before and after the ASF. The ASF almost tripled Spanish swine exporters' sales to China. The increase in exports to China positively impacted export revenue and survival in other foreign markets. This positive impact was especially intense for small swine exporters.

KEYWORDS

China, exporting firms, positive demand shock, Spain, swine

JEL CLASSIFICATION

F10, F14

1 | INTRODUCTION

There is a debate on whether a positive demand shock in a market increases, decreases, or has no effect on a firm's sales in other markets. The standard model of international trade with heterogeneous firms, Melitz (2003), assumes that markets are independent and, therefore, predicts that a positive demand shock in a market does not affect sales in other markets. However, the findings of the empirical literature are inconsistent with this prediction. Some scholars show that an increase in foreign sales raises a firm's domestic sales (Berman et al., 2015; Erbahar, 2020). Contrarily, other scholars conclude that a decrease in domestic sales leads firms to increase their

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foreign sales (Almunia et al., 2021; Blum et al., 2013). These conflicting results indicate that the debate is far from being settled. Furthermore, there is scant evidence on the impact of a demand shock in a foreign market on an exporter's sales in other foreign markets.

This paper uses a quasi-natural experiment to identify how an unanticipated and large positive demand shock in a foreign market, namely, the 2018 African swine fever (ASF) outbreak in China, changed exporters' sales in the affected market and in other foreign markets. To arrest the spread of the ASF, the Chinese government ordered, first, the slaughtering of hogs in infected farms and farms that were within 3 km. Second, it banned the shipment of hogs from infected provinces to other Chinese provinces (Delgado et al., 2021). These measures triggered an increase in demand for swine imports. The ASF outbreak in China affected swine products only and thus enables to employ a difference-in-differences strategy to evaluate how the ASF outbreak changed swine exporters' behavior relative to that of other exporters to China.

Using data on the universe of Spanish firms' export transactions with China and other countries, I document that the ASF significantly increased Spanish swine exporters' export revenue in China, relative to other Spanish exporters to China. This increase stemmed from a large rise in exported quantities and moderate price growth. The ASF also reduced swine exporters' hazard of ceasing to export to China.

I find that Spanish swine exporters to China increased their export revenue in third markets after the ASF, relative to other Spanish exporters to China. I also explore within-firm mechanisms linking foreign markets on the extensive margin. Albornoz et al. (2021) argued that firms face a fixed cost to develop and maintain a product, which is independent of the number of markets served by the firm. If export revenue rises in a market, then the probability of covering the product fixed costs will increase, whereas that of ceasing to export in the remaining destinations will decrease. Furthermore, the positive effect of the ASF would be noticeable for small exporters because they generate less export revenue to cover fixed costs than large exporters. In line with this argument, I find that the ASF significantly reduced the risk of ceasing to export to third markets for small swine exporters only.

Exporters could not determine when the ASF would be eradicated in China and the swine population would return to pre-ASF levels. In any case, it is very likely that swine exporters viewed the increase in demand as temporary. Therefore, this study analyzes how exporters reacted to a short-term increase in foreign demand. It is noteworthy that despite being viewed as a temporary event, the ASF outbreak triggered sizable changes in exporters' behavior in China and in other foreign markets.

This study contributes to the literature that analyzes the effect of foreign market demand shocks on exporters' behavior. Previous studies analyzed the interplay between domestic market demand shock and foreign market sales, and between foreign market demand shock and domestic sales (Almunia et al., 2021; Berman et al., 2015; Blum et al., 2013; Erbahar, 2020; Vannoorenberghe, 2012). I contribute to the literature by analyzing how foreign market demand shock affects other foreign market sales.¹ I reveal that an unanticipated and large positive demand shock in a foreign market increases export revenue in other foreign markets and reduces the risk of exiting them.

This paper is structured as follows. Section 2 describes the ASF outbreak in China, its impact on China's swine imports, and the evolution of Spanish swine exports to China. Section 3 introduces the difference-in-differences regression equation and presents the results on the impact of ASF on Spanish swine exporters' behavior in China and in other foreign markets. Lastly, Section 4 concludes.

2 | AFRICAN SWINE FEVER OUTBREAK IN CHINA AND RESPONSE OF SPANISH EXPORTERS

The ASF is a highly contagious and deadly viral disease that affects domestic and wild pigs. The first ASF outbreak in China was reported on August 1, 2018, on a pig farm in Shenyang (Ma et al., 2020). The virus spread from this city in the northern province of Liaoning to the rest of the country. Two facts explain the spread of the virus across China (Delgado et al., 2021). First, lorries transporting live hogs coincided in slaughterhouses. Since trucks were not confined when they arrived at the slaughterhouse, the virus could spread easily from one lorry to another, bringing the virus back to the farm when the truck returned to get new hogs. Second, trucks carrying live hogs had to stop many times for safety inspections in their trip to the slaughterhouse. The virus could spread from one lorry to another while waiting to be inspected.

The culling of hogs began shortly after the first ASF case was reported (Delgado et al., 2021). However, according to data reported by Huang et al. (2021), the pig population began to decrease only from November 2018 onward, 3 months after the first ASF case was reported. The decline in the pig population was especially intense in January and February 2019. According to the Chinese Ministry of Agriculture and Rural Affairs, during the first ASF year the hog population declined by 41%; by November 2020, China had already recovered 80% of the hog population (Delgado et al., 2021). In any case, China notified 27 ASF outbreaks to the World Organization of Animal Health in 2020, indicating that the ASF outbreak had not been completely eradicated.²

In 2017, the year before the ASF outbreak, China had the largest stock of pigs in the world, that is, at 442 million heads, which was significantly higher than those of the next countries in the ranking: the United States (73 million), Brazil (41 million), and Spain (30 million).³ The reduced pig population due to the ASF triggered a raise in the price of pork. According to the Chinese Ministry of Agriculture and Rural Affairs the wholesale price of pork rose by 236%, from a minimum of 15.6 RMB/kg on May 21, 2018, to a maximum of 52.4 RMB/kg on November 1, 2019. By the end of 2020, the price of pork remained high relative to the pre-ASF period, that is, at 32.9 RMB/kg.⁴

The ASF also caused a substantial increase in the swine product import. Panel A of Figure 1 reports China's monthly imports of swine products (hereafter, swine) between January 2017 and December 2020. Table A1 in the Appendix identifies all products included in the Combined Nomenclature (CN) classification that are related to swine. A 12-month moving average of imports is calculated to avoid the noise introduced by the monthly data. For example, the value corresponding to January 2017 is the sum of the value of imports in that month and the previous 11 months. The value of imports in August 2018 is set to 100, during which the first ASF case was reported in China. China's swine imports were decreasing from the pre-ASF period to March 2019. However, between that month and December 2020, swine imports increased by more than three times. The figure indicates that the ASF provoked a change in China's trend of swine imports from 2019 onward. As explained before, the delayed response of imports to the ASF outbreak is explained by the fact that the population of pigs did not begin to decline until November 2018 onward, and the culling became especially intense in January and February 2019. Contrarily, imports of other products were rising before the ASF, but began to fall since the beginning of 2019.

Panel B of Figure 1 shows the evolution of Spanish export of swine and other products to China between 2017 and 2020. 93% of swine exported from Spain to China are white pigs' meat and offal. These are homogeneous products whose price is set in weekly auctions.⁵ Similar to panel A, a moving 12-month value of exports is calculated and the value of exports in August 2018 is set to 100. Spain's pre-ASF swine exports to China were decreasing but multiplied by six after the ASF.

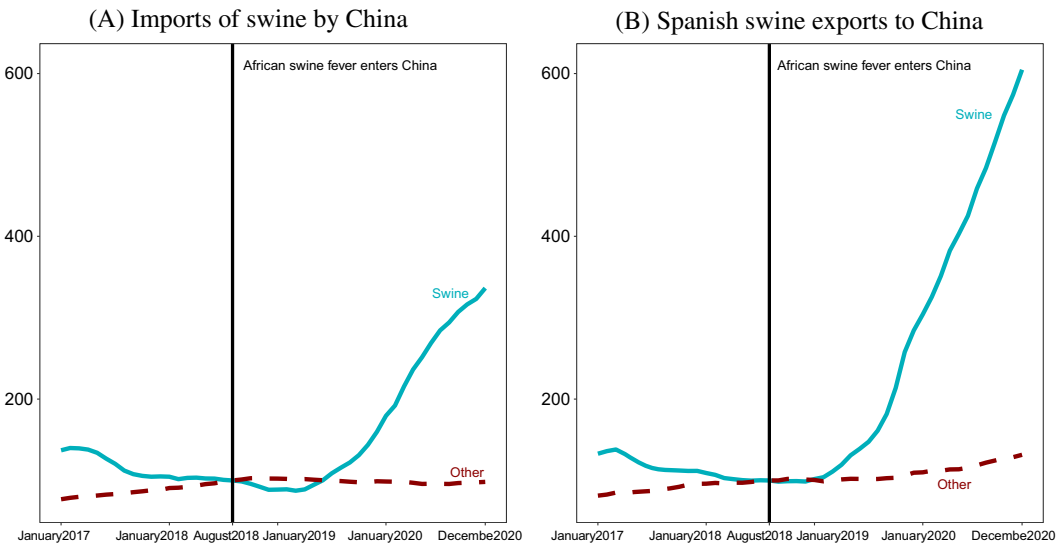


FIGURE 1 Trade in swine before and after the ASF, 2017–2020 August 2018 = 100. (a) Imports of swine by China; (b) Spanish swine exports to China. *Source:* Author's own elaboration based on Comtrade, China Customs, and Spanish Customs. *Note:* The value of trade for each month is the sum of the value of trade for that month and the previous 11 months. Swine covers all the CN four- and six-digit products included in Table A1. CN eight-digit products are not included, because Comtrade and China Customs do not provide data with this level of disaggregation. [Colour figure can be viewed at wileyonlinelibrary.com]

The increase in Spain's swine exports to China was much larger than in China's swine imports. As in panel A, Spain's swine exports to China began to grow from 2019 onward, that is, a few months after the first reported ASF outbreak. Contrary to swine, other exports were mildly increasing before the ASF, stagnated between August 2018 and March 2019, and moderately increased again afterward.

Spain was China's top swine supplier in 2020, accounting for 24% of China's total swine imports, followed by the United States (16%), Germany (12%), and Brazil (12%). China also became the top destination of Spain's swine exports in 2020, accounting for 47% of Spain's total swine exports, followed by France (9%), Japan (7%), and Italy (6%). Swine also became Spain's top exported product to China in 2020, accounting for 37% of its total exports to this country.

Table 1 presents the characteristics of Spanish swine exporters to China before the ASF and compare them with those of the rest of Spanish exporters to China. The baseline sample is composed by firms that exported every year to China during the period 2016–2020. A firm is a swine exporter if it exported to China any of the products included in Table A1 in all the pre-ASF years. The median share of swine products in a swine exporter's total export was 100% in the pre-ASF years. A firm is an exporter of other products if it exported to China in all the pre-ASF years but did not export any product included in Table A1. Data on Spanish exporters are collected from the Customs and Excise Department of the Spanish Tax Agency and include the universe of Spanish exporters of goods. The data set contains a firm identifier, export destination, the CN eight-digit classification, the value of exports, and exported quantities.⁶ The period 2016–2018 is defined as the pre-ASF period because the ASF did not translate into a demand shock until 2019 (panels A and B of Figure 1).

TABLE 1 Swine versus other exporters to China before the African swine fever.

	Swine exporters	Other exporters
Number of exporters to China	46	2,163
Average export revenue (million euros)	53	48
Average export revenue in China (million euros)	12	2
Average number of export destinations	24	29
Average number of exported products	19	20
Average number of exported products to China	7	4
Exports to China as a share of total exports (%)	25	17

Note: Average yearly values for the period 2016–2018. A swine exporter is a firm exporting a product included in Table A1 in all years between 2016 and 2020. Other exporters are firms that exported to China all the years between 2016 and 2020, but did not export any product included in Table A1.

The number of swine and other (nonswine) exporters to China before the ASF was 46 and 2,163, respectively.⁷ The small number of swine exporters is partly explained by the Chinese General Administration of Customs requirement for Spanish swine slaughterhouses, processing plants, cutting plants, and cold stores to export to China.⁸ The average yearly value of exports to all destinations by swine exporters to China during the pre-ASF period was 53 million euros, which was 10% larger than that for other exporters. The difference between swine and other exporters was much larger regarding the average export value to China: 12 million and 2 million euros, respectively. Swine exporters to China exported to less destinations than other exporters, but the number of exported products to all destinations was similar for swine and other exporters. However, swine exporters exported more products to China than other exporters.⁹ Finally, China already represented an important market for Spanish swine exporters before the ASF, accounting for a quarter of their total exports.¹⁰

The key identifying assumption of the difference-in-differences strategy is that other exporters provide an appropriate counterfactual of the trend that swine exports would have followed in China in the absence of the ASF outbreak. Figure 2 presents the evolution of exports to China of the median swine exporter, the median other exporter, and the median other food exporter before and after the ASF. I add this final category to control for the dissimilar effect that the Covid pandemic had on the demand for food and non-food products. The export trend before the ASF was very similar for all exporter categories. However, after the ASF outbreak there was a reduction in exports for other exporters and other food exporters, whereas there was a large increase for swine exporters. Exports to China by the median swine exporter slightly decreased between 2019 and 2020. In any case, the value of exports to China in 2020 was much larger than in the pre-ASF period. Figure 2 indicates that other exporters and other food exporters provide an appropriate counterfactual of the trend that swine exports would have followed in China in the absence of the ASF outbreak.

To further confirm the similarity in pre-trends, Table 2 presents the sales growth rate during the pre-ASF period, 2016–2018, for swine and other exporters in China and in other foreign markets. I test whether the pre-ASF average growth rate of sales for swine exporters is similar to the pre-ASF average growth rate of sales for other exporters. I cannot reject the null hypothesis that there is no significant difference in the average growth rate of sales between swine and other exporters in the two markets. This result confirms that the empirical results are not affected by differences in pre-trends between swine and other exporters.

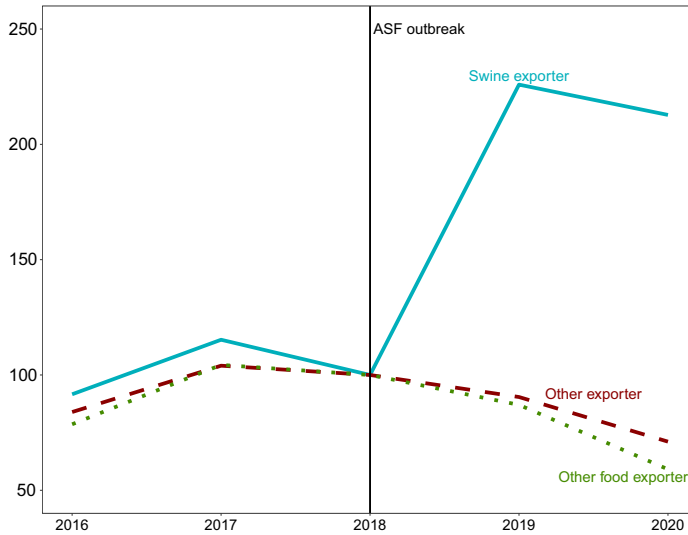


FIGURE 2 Exports to China of the median swine exporter, the median other exporter, and the median other food exporter, 2016–2020 (exports in 2018 = 100). *Note:* A swine exporter is a firm exporting a product included in Table A1 in all years between 2016 and 2020. Other exporters are firms that exported to China all the years between 2016 and 2020, but did not export any product included in Table A1. Other food exporters are other exporters that only export products covered in chapters 1 to 24 of the Harmonized Classification. [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 2 Common trends before African swine fever (export growth 2018–2016).

Market	Swine exporters			Other exporters			Difference		
	Mean	SD	Firms	Mean	SD	Firms	Diff	SE	<i>t</i> -value
China	4.47	15.66	46	4.27	33.93	2163	0.20	2.42	−0.08
Other foreign markets	0.84	2.43	43	0.82	8.01	2027	−0.02	0.41	−0.04

Note: A swine exporter is a firm exporting a product included in Table A1 in all years between 2016 and 2020. Other exporters are firms that exported to China all the years between 2016 and 2020, but did not export any product included in Table A1. Columns (2) and (5) report the growth rate in sales between 2018 and 2016; columns (3) and (6) the SD, and columns (4) and (7) the number of firms in each group and market. Column (8) reports the difference between the means, column (9) the SE of the means difference, and column (10) the *t*-value of the *t*-test.

3 | IMPACT OF THE AFRICAN SWINE FEVER ON THE BEHAVIOR OF SPANISH EXPORTERS TO CHINA

I divide this section into four parts. First, I present the specification used in the empirical analyses. Second, I analyze how the ASF outbreak affected the behavior of exporters in China. Third, I explore whether the positive demand shock in China altered the behavior of exporters in other foreign markets. I finish the section with some robustness analyses.

3.1 | Specification

I use the following specification to explore whether the ASF altered the behavior of Spanish swine exporters to China:

$$y_{ft} = \beta(\text{ShareSwine}_f * \text{PostASF}_t) + \gamma_f + \gamma_t + \epsilon_{ft}, \quad (1)$$

where y_{ft} is the dependent variable for firm f in year t . ShareSwine_f is the share of swine exports in firm f 's total exports to China before the ASF. It captures the extent to which an exporter was treated by the positive demand shock triggered by the ASF.¹¹ PostASF_t turns one if t is 2019 or 2020, γ_f and γ_t are firm and year fixed effects, respectively, and ϵ_{ft} is the disturbance term. The key variable is the difference-in-differences interaction $\text{ShareSwine}_f * \text{PostASF}_t$, which captures whether the dependent variable changed for swine exporters after the ASF. The construction of the interaction variable reflects the expectation of large change in the dependent variable after the ASF for firms whose swine products accounted for a large share in their exports to China before the ASF.

3.2 | Impact of the African swine fever on exporters' behavior in China

This subsection analyzes whether the ASF outbreak altered the behavior of swine exporters in China. Panel A of Table 3 shows that swine firms' exports significantly increased after the ASF, relative to other exporters to China.¹² The median swine exporter, whose swine exports represented 100% of its total exports to China before the ASF, multiplied its exports by almost three after the fever outbreak ($\exp(1.011)$). Panels B and C show whether the increase in export revenue was caused by an increase in quantity or price. I calculate export price as the ratio between export revenue and exported kilograms. 86% and 14% of the increase are attributed to a rise in quantities and prices, respectively. These figures demonstrate that Spanish swine exporters substantially increased the amount of swine exported to China to meet the demand generated by the ASF. However, this analysis is taken with caution, because revenues and quantities of different swine products are added at the firm level.

Next, I explore the effect of the ASF on the extensive margin of trade. I define a product as an eight-digit code included in the CN classification. I estimate Equation (1) with the number of exported products as the dependent variable and a Poisson model.¹³ Panel D shows that the number of products exported by swine exporters to China did not significantly increase after the ASF.¹⁴

TABLE 3 Impact of African swine fever on swine exporters' behavior in China.

Dependent variable	Post × Share swine	Observations
A. Revenue (log)	1.011* (0.156)	11,045
B. Quantity (log)	0.871* (0.165)	11,045
C. Price (log)	0.140 (0.090)	11,045
D. Number of exported products	0.073 (0.067)	11,045
E. Exit probability	-0.151* (0.043)	29,956

Notes: All estimations include firm and year fixed effects. Years included in the sample: 2016-2020. SEs clustered at the firm level are in parentheses. *, **, and *** denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Finally, panel E examines whether the swine exporters' probability of exiting the Chinese market decreased after the ASF. I estimate Equation (1) with a linear probability model with a dependent variable that turns 1 if the firm did not export to China in t . I broaden the sample to include any firm that exported to China, at least, one year during the pre-ASF period. Swine exporters reduced the probability of exiting the Chinese market after the ASF. For a median swine exporter, whose swine exports accounted for 100% of its total exports to China before the ASF, the probability of exiting the Chinese market decreased by 15 percentage points after the ASF.

3.3 | Impact of the African swine fever on exporters' behavior in other foreign markets

This section analyzes whether the ASF outbreak in China altered the behavior of Spanish swine exporters in other non-Chinese foreign markets. Accordingly, I add-up the value and quantity of exports and the number of exported products in non-Chinese destinations of the Spanish exporters to China. I select the firms that exported every year to China and other non-Chinese markets during the period 2016–2020.

Panel A of Table 4 shows that the ASF positively impacted the export revenue in other foreign markets of Spanish swine exporters to China, relative to other exporters to China. A median swine exporter, whose swine exports represented 100% of its total exports to China before the ASF, increased its value of exports to other foreign markets by 19%. The increase in export revenue was lower than that in China, where exports increased by almost 200%. Panels B and C show that the increase in export revenue can be attributed more to a raise in quantity than price; however, none of the coefficients are statistically significant. Panel D shows that the ASF reduced the number of products exported to third markets.

I also analyze whether the probability of exiting other foreign markets is correlated with the ASF in China. I extend the sample to include all firms that exported to China and another foreign market at least 1 year during the pre-ASF period. Column 1 of Table 5 shows that the difference-in-differences interaction coefficient is negative but statistically insignificant. Therefore, we find that the ASF outbreak in China had no significant effect on the risk of exiting other foreign markets.

Albornoz et al. (2021) argued that the probability of exporting to two different destinations can be correlated if the fixed cost of developing and maintaining a product is independent of the

TABLE 4 African swine fever impact on other foreign markets.

Dependent variable	Post \times Share swine	Observations
A. Revenue (log)	0.174** (0.079)	10,350
B. Quantity (log)	0.110 (0.089)	10,350
C. Price (log)	0.064 (0.052)	10,350
D. Number of exported products	-0.158* (0.055)	10,350

Notes: All regressions include firm and year fixed effects. Years included in the sample: 2016–2020. SEs clustered at the firm level are in parentheses. *, **, and *** denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 5 African swine fever impact on the probability of ceasing to export to other foreign markets.

	(1)	(2)
Post × Share swine	-0.021 (0.017)	-0.012 (0.021)
Post × Share swine × Small exporter		-0.045** (0.021)
Observations	37,044	37,044

Notes: The dependent variable is the probability that a firm ceases to export to a non-Chinese market. All regressions include firm and year fixed effects. Years included in the sample: 2016–2020. SEs clustered at the firm level are in parentheses. *, **, and *** denote statistical significance at the 1%, 5%, and 10% levels, respectively.

number of markets served by the firm. If export revenue rises in a market, then the probability of covering the product fixed costs will increase, whereas that of ceasing to export in the remaining destinations will decrease. They also predict that the effect of a rise in export revenue should benefit small exporters because they generate less export revenue to cover fixed costs than large firms. Column 2 of Table 5 tests this hypothesis. As predicted by Albornoz et al. (2021), it shows that the ASF significantly reduced the risk of ceasing an export activity in other foreign markets for small swine exporters only.

3.4 | Robustness analyses

In this subsection, I perform some additional analyses to test the robustness of my baseline results. First, a key assumption of the difference-in-differences analysis is that the difference in outcome between the treated and the nontreated group after the treatment is only explained by the treatment. If there is another variable that changes at the same time as the treatment and only affects the treated group, the difference in outcome between the treated and non-treated group could also be explained by this variable. The post-ASF period includes the year 2020. The pandemic provoked by Covid-19 led to changes in demand that were not evenly distributed across industries. For example, world exports of agricultural products, which includes food and live animals, rose by 1% in 2020, whereas manufacturing exports declined by 5% (World Trade Organization, 2021). Therefore, it might be the case that the positive effect of the ASF outbreak on the revenue of Spanish swine exporters to China is capturing the relative increase in demand for food during Covid-19.

To control for the effect that Covid-19 may have on results, I re-estimated all specifications using a sample that only included exports of live animals and animal products, vegetable products, animal or vegetable fats and oils, prepared foodstuff, beverages, and tobacco (food exporters, for short).¹⁵ Column 1 of Table 6 presents the results. The ASF outbreak increased the export revenue of swine exporters, relative to other food exporters, in China. The increase was explained by a raise in the quantity exported. There were no changes in the number of exported products. Exporters of swine to China reduced the risk of ceasing to export relative to other food exporters to China. As reported in Panel B, the revenue of swine exporters to China also increased in other foreign markets, relative to other food exporters to China. The increase in revenue was explained by a raise in prices rather than quantities. Swine exporters reduced the number of exported products relative to other food exporters. In the new sample, the probability of exiting other foreign markets decreased.

Second, I estimated the difference-in-differences interaction term excluding 2020 from the sample. Column 2 of Table 6 reports the estimates. The impact of the ASF on swine exporters'

TABLE 6 Robustness analyses.

Dependent variable	Independent variable: Post × Share swine						Monthly data
	Agriculture (1)	2020 excluded (2)	Enhanced firm sample (3)	Non-Chinese destinations (4)	ASF-free destinations (5)	Top-30 destinations (6)	
Panel A. Exports to China							
A.1 Revenue (log)	1.005* (0.167)	0.733* (0.188)	1.189* (0.191)				0.793* (0.112)
A.2 Quantity (log)	0.843* (0.175)	0.470** (0.189)	1.060* (0.194)				0.547* (0.110)
A.3 Price (log)	0.162*** (0.088)	0.262* (0.082)	0.129*** (0.071)				0.245* (0.077)
A.4 Number of products	0.046 (0.067)	0.000 (0.067)	0.223* (0.075)				
A.5 Exit probability	-0.125* (0.046)	-0.136* (0.045)					
Panel B. Exports to other foreign markets							
B.1 Revenue (log)	0.137*** (0.080)	0.283* (0.107)	0.158** (0.081)	0.211** (0.095)	0.215*** (0.128)	0.179** (0.085)	0.169** (0.083)
B.2 Quantity (log)	0.053 (0.089)	0.277** (0.137)	0.130 (0.094)			0.147 (0.089)	0.077 (0.094)
B.3 Price (log)	0.084*** (0.051)	0.006 (0.070)	0.028 (0.040)			0.033*** (0.021)	0.083 (0.038)
B.4 Number of products	-0.169* (0.052)	-0.145* (0.055)	-0.127* (0.036)			-0.137* (0.049)	
B.5 Exit probability	-0.045* (0.017)	0.024 (0.024)				-0.037* (0.011)	

Notes: All estimations, except column 6, include firm and year fixed effects. Estimations in column 6 include firm × destination and destination × year fixed effects. Years included in the sample: 2016–2020, except for column 2, which excludes data from 2020. SEs clustered at the firm level are in parentheses. *, **, and *** denote statistical significance at the 1%, 5%, and 10% levels, respectively.

revenue in China is positive and statistically significant. The rest of Panel A's estimates are also in line with those obtained with the whole sample. The ASF also had a positive and significant impact on the export revenue of Spanish swine exporters in other foreign markets. The remaining estimates reported in Panel B are in line with those obtained with the whole sample.

Third, the main estimation sample includes firms that exported in all the pre-ASF and post-ASF years. This may bias the results since I am selecting firms that survived during the whole period of analysis and, therefore, are likely to be "better" than the average exporter.¹⁶ Column 3 of Table 6 presents the estimates for a sample of firms that exported to China at least in one of the pre-ASF years (2016, 2017, or 2018) and one of the post-ASF years (2019 or 2020).¹⁷ Panel A presents the results for the impact of the ASF on exports to China. The impact of the ASF on export revenue, quantity, and price is similar to that reported in the baseline analysis, although now the impact of the ASF on prices is statistically significant. Contrary to the results in the baseline analysis, the ASF leads to an increase in the number of exported products. Panel B reports the estimates on the impact of the ASF on third markets. In line with the baseline results, I find that the ASF led to a significant increase in export revenue, with a higher impact on quantities than on prices (although neither impact was significant) and a reduction in the scope of exported products.

Fourth, I showed that increased export revenue from China raised swine exporters' revenue in other foreign markets. However, there may be other explanations for the correlation between sales in China and sales in other foreign markets. For example, Spanish exporters could increase their exports to destinations that were served by Chinese swine exporters before the ASF. To test this hypothesis, I exclude from the sample the destinations where imports from China represented 1% or more of total swine imports in the pre-ASF period. Column 4 of Table 6 shows that Spanish exporters also increased their exports to destinations that were not served by Chinese swine exporters before the ASF. Another explanation is that the ASF in China coincided in time with ASF episodes in other countries. To contrast this hypothesis, I removed from the sample all countries that reported an ASF outbreak in 2019 or 2020.¹⁸ Column 5 of Table 6 shows that export revenue also increased in countries that experienced no ASF outbreaks.

Fifth, to keep the analysis simple, and following Alborno et al. (2021), the baseline analysis collapses all the non-China foreign destinations into an "other foreign destinations" category. I test whether results are robust to using destination-specific data. I estimate the following specification:

$$y_{fjt} = \beta(\text{ShareSwine}_f * \text{PostASF}_t) + \gamma_{fj} + \gamma_{jt} + \epsilon_{fjt}, \quad (2)$$

where y_{fjm} is the dependent variable for firm f in destination j in year t . The new regression equation substitutes the firm and year fixed effects by firm \times destination and destination \times year fixed effects. I narrowed the sample to the top-30 destinations of Spanish swine exporters before the ASF outbreak, which accounted for 95% of total swine exports during the pre-ASF period (2016–2018).

Column 6 of Table 6 reports the estimates. The point estimate of the impact of the ASF on export revenue in other foreign markets is qualitatively similar to that reported in the baseline analysis. The increase in exported quantities was larger than in prices but only the latter coefficient was statistically significant. In line with previous results, there is a significant reduction in the number of exported products and a decrease in the probability of exiting a foreign market.¹⁹

Sixth, all the estimations are performed using yearly data. However, the Customs database provides data on a monthly basis. I re-estimated the impact of the ASF on exporters' export revenue,

quantity, and price in China and third markets using monthly data and setting the beginning of the ASF period in August 2018. I estimated the following specification:

$$y_{fjm} = \beta(\text{ShareSwine}_f * \text{PostASF}_{tm}) + \gamma_f + \gamma_t + \gamma_m + \epsilon_{fjm}, \quad (3)$$

where y_{fjm} is the dependent variable for firm f in year t and month m . PostASF turns one if the year and month combination corresponds to August 2018 or later. The regression equation incorporates an additional month fixed effect, γ_m , to control for the seasonality of exports.

Column 7 of Table 6 reports the results. The ASF significantly increased the export revenue of Spanish swine exporters in China. As in the baseline analysis, I find that the ASF had a larger effect on quantities than prices. Panel B shows that the ASF had a significant positive effect on Spanish swine exporters' revenue in other foreign markets. As opposed to the baseline results, the increase in export quantities was similar to export prices. However, none of the coefficients was significant.

4 | CONCLUSION

This paper shows that Spanish swine exporters reacted to the unanticipated positive demand shock from China by heavily increasing their exports to that market. Moreover, the increase in exports to China caused a raise in export revenue in other foreign markets.

I find evidence for the existence of within-firm mechanisms linking export markets on the extensive margin. The ASF reduced small exporters' risk of ceasing to export to third markets. This result is consistent with the existence of product-level fixed costs that are independent of the number of markets served by a firm.

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DATA AVAILABILITY STATEMENT

I cannot share the firm-level data used in the article since it is not publicly available. However, I would be happy to share my code for the data analysis so that anyone with access to the data can replicate the results.

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ENDNOTES

- ¹ This paper follows Aranguren et al. (2021) who analyzed the correlation between export revenue changes in a firm's top market and the export revenue in its remainder foreign markets.
- ² Information on the notified ASF outbreaks is available at: <http://www.oie.int>.
- ³ Data comes from the Food and Agriculture Organization, available at: <http://www.fao.org/faostat/en/data>.
- ⁴ <http://www.thepigsite.com/news/2020/12/chinese-pork-prices-rise-a-little-despite-herd-recovery>
- ⁵ Less than 4% of Spanish swine exports to China corresponded to "ibérico pig" products (e.g., jamón ibérico) that enable a large degree of differentiation.
- ⁶ A firm is an exporter if it exports at least 1,500 euros of a given product in a given market per year.
- ⁷ There were 691 Spanish firms that exported swine products in all the pre-ASF years: 2016, 2017, and 2018. 124 of these firms exported, at least, once to China during this period and 46 of them exported every year. Among the 124 swine exporters to China, 2 firms only exported to China and 122 exported to China and other destinations. There were 567 swine exporters that did not export to China during the pre-ASF period.
- ⁸ Firms should abide by the requisites established by the protocol signed by the Spanish and Chinese governments on November 7, 2007. Spanish establishments were inspected by Chinese authorities before 2018. However, in a new protocol signed in November 2018, Chinese authorities delegated the inspection and certification processes to the Spanish Ministry of Agriculture, Fishery and Feeding.
- ⁹ Exporters of swine to China also exported other products to this country. However, the average share of these products in a swine firm's total exports to China was low, that is, at 1.9%.
- ¹⁰ As explained in more detail later, matching Customs with the SABI database, I could identify the activity of some swine exporters. Only 6% of swine exporters were wholesalers and they represented 0.41% of all swine exports to China during the 2016–2020 period.
- ¹¹ I also defined two alternative indicator variables. The first turned one if swine products represented 90% or more of a firm's exports to China before the ASF. The second turned one if the firm exported any of the products listed in Table A1. Main conclusions were not altered.
- ¹² I cluster SEs at the firm level.
- ¹³ I use the Stata command `ppmlhdfc` developed by Correia et al. (2020).
- ¹⁴ The authorization to export to China covers all swine products (The list of products is available at <https://www.mscbs.gob.es/profesionales/saludPublica/sanidadExterior/docs/ChinaProcedEspecificoPorcino22062020.pdf>). When computing the number of products, I also include any non-swine products exported by a swine exporter.
- ¹⁵ These products are covered in chapters 1–24 of the Harmonized Classification.
- ¹⁶ Gutiérrez-Chacón and Martín-Machuca (2019) showed that Spanish firms exporting regularly for 4 years or more are larger and have higher labor productivity than those that do not.
- ¹⁷ I do not present data on the probability to exit a foreign market, since these analyses already included firms that had exported to China at least 1 year during the pre-ASF period.
- ¹⁸ Fifty-three countries reported, at least, an ASF case during the period 2019–2020. These countries are Belgium, Benin, Bulgaria, Burkina Faso, Cambodia, Cape Verde, Central African Republic, Chad, China, Dem. Rep. of Congo, Rep. of Congo, Côte d'Ivoire, Estonia, Germany, Ghana, Greece, Guinea-Bissau, Hong Kong, Hungary, India, Indonesia, Italy, Kenya, Dem. People's Rep. of Korea, Rep. of Korea, Lao PDR, Latvia, Lithuania, Madagascar, Moldova, Mongolia, Mozambique, Myanmar, Namibia, Nigeria, Papua New Guinea, Philippines, Poland, Romania, Russian Federation, Senegal, Serbia, Sierra Leone, Slovakia, South Africa, Tanzania, Timor-Leste, Togo, Uganda, Ukraine, Vietnam, Zambia, and Zimbabwe. This data is obtained from the World Organization for Animal Health. Available at: <https://wahis.oie.int>.
- ¹⁹ As in the baseline analysis, in all robustness estimations the probability of exiting other foreign markets after the ASF decreased more for small firms than for large ones.

REFERENCES

- Albornoz, F., Brambilla, I., & Ornellas, E. (2021). *Firm export responses to tariff hikes* (Centre for Economic Performance Working Paper No. 1683).
- Almunia, M., Antràs, P., Lopez-Rodriguez, D., & Morales, E. (2021). Venting out: Exports during a domestic slump. *American Economic Review*, 111(11), 3611–3662.

- Aranguren, M. J., Lucio, J. D., Mínguez, R., Minondo, A., & Requena, F. (2021). Export markets: Substitutes, complements, or independent? *Applied Economics Letters*, 28(3), 165–169.
- Berman, N., Berthou, A., & Héricourt, J. (2015). Export dynamics and sales at home. *Journal of International Economics*, 96(2), 298–310.
- Blum, B. S., Claro, S., & Horstmann, I. J. (2013). Occasional and perennial exporters. *Journal of International Economics*, 90(1), 65–74.
- Correia, S., Guimarães, P., & Zylkin, T. (2020). Fast Poisson estimation with high-dimensional fixed effects. *The Stata Journal*, 20(1), 95–115.
- Delgado, M. S., Ma, M., & Wang, H. H. (2021). *Exploring spatial price relationships: The case of African Swine Fever in China* (Working Paper No. 29141). National Bureau of Economic Research.
- Erbahar, A. (2020). Two worlds apart? Export demand shocks and domestic sales. *Review of World Economics*, 156(2), 313–342.
- Gutiérrez-Chacón, E., & Martín-Machuca, C. (2019). *Exporting Spanish firms*. Stylized facts and trends. Documento Ocasional 1903 del Banco de España.
- Huang, Y., Li, J., Zhang, J., & Jin, Z. (2021). Dynamical analysis of the spread of African swine fever with the live pig price in China. *Mathematical Biosciences and Engineering*, 18(6), 8123–8148.
- Ma, J., Chen, H., Gao, X., Xiao, J., & Wang, H. (2020). African swine fever emerging in China: Distribution characteristics and high-risk areas. *Preventive Veterinary Medicine*, 175, 104861.
- Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, 71(6), 1695–1725.
- Vannoorenberghe, G. (2012). Firm-level volatility and exports. *Journal of International Economics*, 86(1), 57–67.
- World Trade Organization. (2021). *World Trade statistical review 2021*. World Trade Organization.

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APPENDIX

TABLE A1 Swine products.

CN Code	Description
0103	Live swine
0203	Meat of swine, fresh, chilled or frozen
020630	Edible offal of swine, fresh or chilled
020641	Edible offal of swine, frozen livers
020649	Edible offal of swine, frozen others
0209	Pig fat, free of lean meat, and poultry fat, not rendered or otherwise extracted, fresh, chilled, frozen, salted, in brine, dried or smoked
021011	Meat of swine hams, shoulders and cuts thereof, with bone in salted, in brine, dried or smoked
021012	Meat of swine bellies (streaky) and cuts thereof in salted, in brine, dried or smoked
021019	Other meat of swine in salted, in brine, dried or smoked
02109941	Edible flours and meals of meat or meat offal-Livers of domestic swine
02109949	Edible flours and meals of meat or meat offal-Others of domestic swine
0502	Pigs', hogs' or boars' bristles and hair; badger hair and other brush making hair; waste of such bristles or hair
0504	Guts, bladders and stomachs of animals (other than fish), whole and pieces thereof, fresh, chilled, frozen, salted, in brine, dried or smoked
0506	Bones
1501	Pig fat (including lard) and poultry fat
160241	Other prepared or preserved meat, meat offal or blood. Hams and cuts thereof of swine
160242	Other prepared or preserved meat, meat offal or blood. Shoulders and cuts thereof of swine
160249	Other prepared or preserved meat, meat offal or blood. Other, including mixtures of swine
16029051	Preparations of blood containing meat or meat offal of domestic swine
41033000	Raw hides and skins of swine
41063100	Tanned or crust hides and skins of swine in the wet state (including wet-blue)
41063200	Tanned or crust hides and skins of swine in the dry state (crust)
41132000	Leather further prepared after tanning or crusting of swine