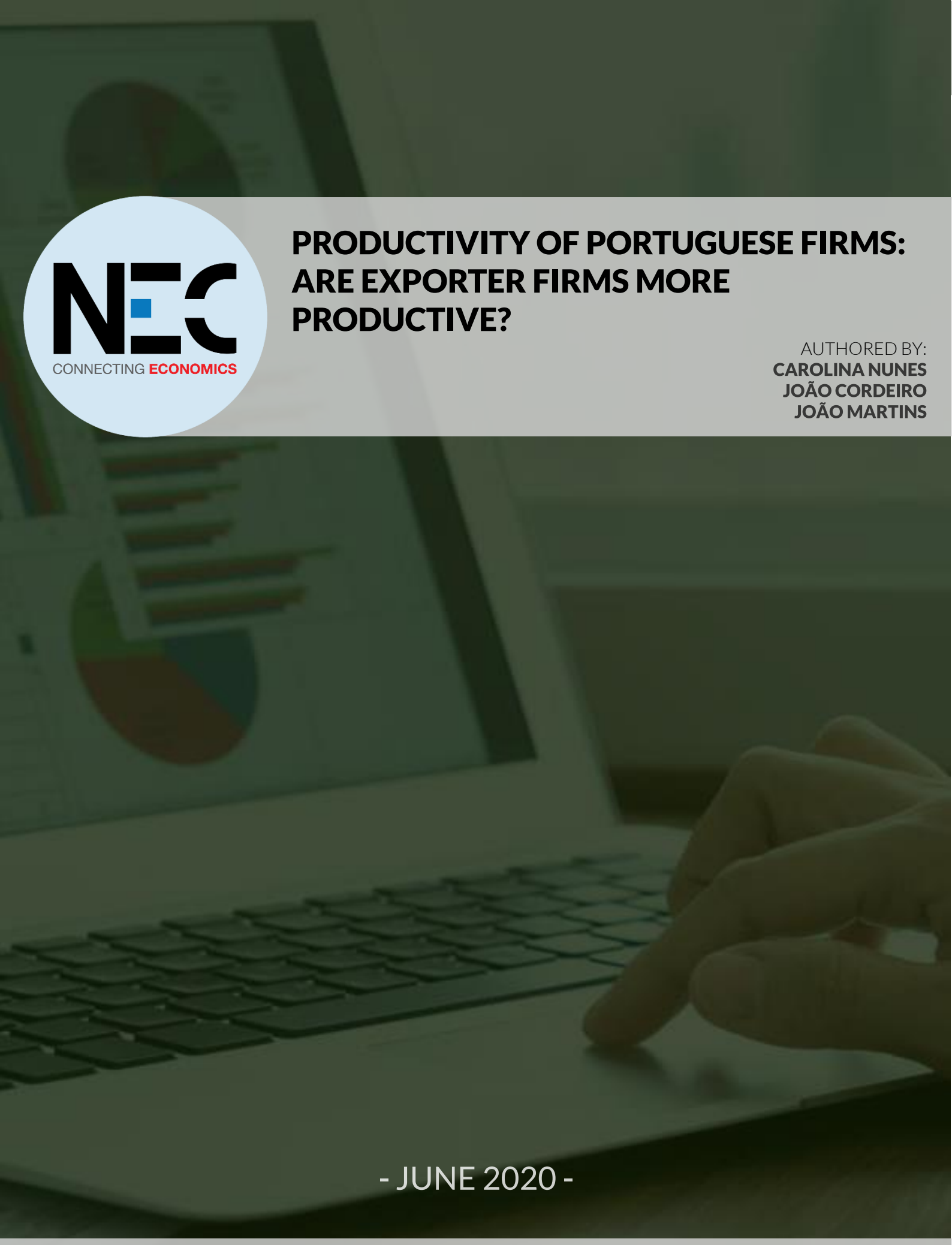

PRODUCTIVITY OF PORTUGUESE FIRMS: ARE EXPORTER FIRMS MORE PRODUCTIVE?

AUTHORED BY:
CAROLINA NUNES
JOÃO CORDEIRO
JOÃO MARTINS

CONNECTING ECONOMICS

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e-mail: novaeconomicsclub@novasbe.pt
website: www.novaeconomicsclub.pt

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Authors: *Carolina Nunes*, *João Cordeiro*, *João Martins*
Partner: *GPEARI – Gabinete de Planeamento, Estratégia, Avaliação e Relações Internacionais do Ministério das Finanças*
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PRODUCTIVITY OF PORTUGUESE FIRMS: ARE EXPORTER FIRMS MORE PRODUCTIVE?

Carolina Nunes

Nova Economics Club

Nova School of Business and Economics

carolina24nunes@hotmail.com

João Cordeiro

Nova Economics Club

Nova School of Business and Economics

jmpcordeiro@novasbe.pt

João Martins

Nova Economics Club

Nova School of Business and Economics

joao.martins@novasbe.pt

Abstract: In this project, we analyse labour productivity and its determinants at the firm-level. We use a dataset composed by virtually all Portuguese firms for the period 2010-2018. By utilizing a vast array of productivity determinants as well as a comprehensive dataset, we try to reach a better assessment of the relative contribution of each factor towards a firm's labour productivity. We found that exporter status has significant and positive contribute for labour productivity, in agreement with previous literature. Furthermore, we also found a negative association between big firms and labour productivity. As for R&D, we found a positive yet inconclusive contribute for labour productivity, given it was not statistically significant. These two findings contradict previous literature, a reason for which we think they should be given a closer look in future research.

Keywords: Productivity; Portuguese Firms; International Trade

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1. Introduction

The slowdown in aggregate productivity growth among developed economies is a known fact largely studied at the macroeconomic level. However, increasing scientific attention has been given to the underlying dynamics at the micro scale, and specifically at the firm-level. Some factors that have been pointed out to be contributing to the slowdown are the possibility of higher entry barriers, decreasing competition, slower technological diffusion leading to technological divergence at the firm-level and rising resource misallocation to less productive sectors and firms.[1]

In the case of Portugal, the productivity slowdown is even more worrying, with the country experiencing a stagnation in labour productivity levels, diverging from most countries of the Eurozone and other member-states of the European Union, which show slower yet positive growth rates[2]. This trend of productivity growth slowdown and divergence for the Portuguese economy at the aggregate level comes from the 1990s.[3] A recent study by the Bank of Portugal (2019) confirms this stagnation of labour productivity at the firm-level in the recent decade (2008-2017) for at least two thirds of the Portuguese economy (as measured by share of real GVA). There are several reasons that might explain the lack of productivity gains for the Portuguese economy. The period prior to the financial crisis was characterized by increasing levels of indebtedness both for firms and households, driven by cheap credit originated by the financial and monetary integration that was applied, more often than not, towards non-tradable sectors, less productive due to lower levels of competition[4]. This generated a series of consecutive macroeconomic imbalances, which ultimately led to the Portuguese sovereign debt crisis in 2011[3]. That experience made the generality of policy makers to see exporting and its stimulation as a way out of the unsustainable imbalances and high levels of indebtedness. Other reasons specific to the functioning of the Portuguese national markets usually pointed out are low level of qualifications of the labour force, labour market segmentation and product market regulations, poor governance in some firms and limited investment in Research and Development (henceforth R&D)[4].

Labour productivity is the most used single input measure of productivity, consisting in the ratio between value added and the number of workers or worked hours. Despite being

[1] See Andrews *et. al*. (2016) and Pinheiro-Alves (2017)
[2] Bank of Portugal (2019)
[3] Pinheiro-Alves (2017)
[4] National Productivity Board (2019)

a single input measure, it does not capture the efficiency associated with labour exclusively. It is also affected by the intensity of other factors of production such as physical or human capital. An advantage of this measure is that it is closely connected with improvements in income and living standards, which are the ultimate goals of increasing productivity[4]. Other advantages are its easiness of computation and interpretation. For all these reasons, labour productivity will be the measure of productivity to which we will adhere in this project.

In this study, we aim to look for the determinants of labour productivity of Portuguese firms. We do so by analysing micro data at the firm-level. We also take a special look at the exporter sector as defined by the Bank of Portugal, trying to characterize it and finding how it contrasts with the non-exporter sector in terms of productivity as well as its determinants. By analysing a vast array of these determining factors of labour productivity, with a dataset composed by virtually all Portuguese firms in the period from 2010-2018, we want to better assess the relative contribution of each of the specified factors towards a firm's labour productivity.

This study is organized as follows. Section 2 provides a literature review on the determinants of productivity of firms and the effect of exports on the productive capacity. Section 3 introduces the data used and presents several descriptive statistics, distinguishing between total, exporter and non-exporter firms. Section 4 explains the methodology used and the models selected. Section 5 presents the results obtained using an OLS specification and using a Fixed Effects specification. Finally, section 6 concludes and introduces some ideas for future research.

2. Literature Review

The first report of the National Productivity Board (2019), through a non-exhaustive literature review, highlights the qualification of workers, the human capital of entrepreneurs and managers, innovation and R&D as positive factors contributing to productivity, while difficulties in access to finance and high levels of indebtedness weight negatively on productivity, since they are hindering factors on a firm's capacity to invest.

Machado (2019), using firm data for the period 2006-2015, presents evidence that exporters have a higher labour productivity than non-exporters. Furthermore, the evidence presented seems to confirm the self-selection hypothesis, in which firms that become exporters already present higher levels of productivity prior to exporting than non-exporting firms. Thus, this author defends further incentives to higher productivity

and higher relative levels of investment from the policy-making side in order to increase the number of exporting firms, since both these factors weight positively in making a firm likelier to export.

Gonçalves and Martins (2016) gather some evidence on the determining factors of productivity for the Portuguese manufacturing sector, using data for the period 2010-2014 at the firm-level. Although they use TFP as a measure of productivity, they divide the factors determining productivity in four categories: internal firm characteristics (dimension and age), trade (export status), financial constraints (debt-to-equity ratio) and R&D and innovation, and Human capital (training expenses, innovation, and wages). For the manufacturing sector, the age of the firm has a negative effect on productivity, with firms losing productivity as they get older. The dimension of the firm (small, medium or big) has a positive effect on productivity, which increases with the dimension of the firm. This result is consistent with the study conducted by Bank of Portugal (2019), which when analysing firm data for the period 2008-2017, finds a clear and positive relationship of labour productivity with the size of the firm for a larger array of sectors besides manufacturing. In what regards the exporter status, as defined by the Bank of Portugal, Gonçalves and Martins (2016) find a positive effect on productivity growth, in line with several different explanations for the link between exports and productivity. Training expenses as a share of personnel global costs was found to have a positive effect on productivity. Innovation as proxied by the existence of Fix Intangible Assets, also has a positive effect on TFP growth. Finally, these authors also find that the annual average gross wages growth rate impacts positively the growth of TFP. On the financial constraints, they find that the debt-to-equity ratio decreases the growth of TFP.

Branco *et. al.* (2018) also gather some evidence on the determining factors of productivity for the Portuguese services sector, using data for the period 2010-2016 at the firm-level. They also use the TFP as a measure of productivity. These authors found a positive correlation between TFP growth and financial health, innovation, and wage premium. On the other hand, they found non-linear relationships between TFP growth and capital intensity, training, and age.

3. Data

3.1 Database Description

The data used in this project consists of a firm-level panel dataset constructed with information from *Informação Empresarial Simplificada* (IES) provided to us by GPEARI (Ministério das Finanças). We have decided to use this data due to the large amount of firm level data existent nowadays, which allows to have a good idea of firm-behaviour across time. This dataset consists on a broad collection of accounting and financial data, and other descriptive data and firm-specific characteristics, such as district, size, number of workers and industry of each firm that is annually self-reported by the firms. The period considered goes from 2010 to 2018 and we have performed some data cleaning, namely by removing firms reporting zero total workers and zero euros of turnover. Firms with negative age and non-defined CAE were also dropped, as these are most likely errors in the reporting. For the remaining firms, we have also substituted the missing values in the number of R&D workers and export values by zero.

Table 1 displays the number of firms in our dataset per year and the number of companies that fulfil the Exporter Status criteria defined by the Bank of Portugal:

1. At least 50% of annual turnover is from exports of goods and services; or
2. At least 10% of annual turnover due to exports and its value above 150.000€.

Table 1 – Total number of firms and exporter firms

YEAR	NR OF FIRMS	NR OF EXPORTERS	EXPORTERS SHARE
2010	281,203	1,692	0.60%
2011	285,038	1,766	0.62%
2012	279,625	2,107	0.75%
2013	278,684	2,268	0.81%
2014	281,281	2,318	0.82%
2015	283,835	2,302	0.81%
2016	297,869	2,474	0.83%
2017	305,695	2,533	0.83%
2018	311,196	2,508	0.81%

In Table 1, we see that up to 2013, the proportion of firms that fulfil the exporter status criteria increased but has stabilized since then. We also see that, except for 2015 and 2018, the number of exporters always increased during this period, whereas the total number of firms only decreased in 2012 and 2013.

The total number of firms sums up to 2,604,426 observations over the 9 years being considered. We can understand that the number of firms fell from 2010 to 2013, most likely in the aftermath of the financial crisis. From 2014 until 2018, the number of firms has been increasing, a result that is in line with the slow recovery of the Portuguese economy following the crisis. This trend, however, is not verified in terms of the number of exporters, which has been increasing over the analysed time period.

In order to have a sense of how firms are distributed across the different years, we can understand that almost 40% of the firms in the dataset are associated with a low number of observations (3 or less observations) while 29.1% of the firms have information for the full period.

Table 2 – Distribution of the number of observations per firm

OBS PER INDIVIDUAL	FREQ.	PERCENT	CUM.
1	75,633	14.99	14.99
2	68,653	13.60	28.59
3	55,486	10.99	39.58
4	43,251	8.57	48.15
5	34,543	6.84	55.00
6	30,298	6.00	61.00
7	23,973	4.75	65.75
8	26,092	5.17	70.92
9	146,775	29.08	100.00

It is also possible to conclude that the most common patterns are for firms observed in continuous periods. This can help us to conclude that the majority of firms were active for a continuous period of time. The most common pattern in the sample is for firms to have information for all the time periods. As such, there is a small proportion of firms that only have information for middle periods or that enter and exit the market several times.

Table 3 – Top 10 observations patterns

PATERN	FREQ.	PERCENT	CUM.
111111111	146,775	29.08	29.08
000000001	29,549	5.85	34.94
000000011	23,580	4.67	39.61
110000000	23,178	4.59	44.20
100000000	21,976	4.35	48.55
000000111	20,586	4.08	52.63
111000000	19,761	3.92	56.55
000001111	18,212	3.61	60.16
000011111	15,600	3.09	63.25

3.2 Firm Size and Sector

An important aspect to determine firm's performance and export status is its size. In this case, firm size was denoted according to the number of employees of each firm, using the definition established by the Portuguese Statistics Institute, INE (*Instituto Nacional de Estatística*). As such, firms were divided in Micro firms (less than 10 employees), Small firms (between 10 and 50 employees), Medium firms (between 50 and 250 employees) and Big firms (more than 250 employees). From this analysis we can understand that this dataset is comprised mostly of Micro firms. The group of Micro firms is the one that concentrates the highest number of observations for exporting firms, followed by the group of Small sized firms. However, it is the Big size firms' group that concentrates the highest proportion of exporting firms' observations compared with the total number of observations.

Table 4 – Number of firms per size category

SIZE	EXPORTER	NON-EXPORTER	TOTAL	% OF EXPORTERS
BIG	933	8,055	8,988	10.4%
MEDIUM	4,394	44,941	49,335	8.9%
SMALL	6,969	317,013	324,882	2.1%
MICRO	7,672	2,213,549	2,221,221	0.3%
TOTAL	19,968	2,584,458	2,604,426	0.8%

In table 15 on the Appendix it is also possible to analyse the division in the total number of firms, exporters and non-exporters sector-wise using the Portuguese classification of economic activities. CAE is a 5-digit code that identifies sector of operation of each company and reflects its economic activity. For this purpose, the statistics were computed with the classification CAE rev 3 at two-digit classification. The most striking and expected conclusion is that the sectors that have more exporting firms are from Division 25 (Manufacture of metal products, except machinery and equipment) and Division 46 (Wholesale trade except motor vehicles and motorcycles).

3.3 Firm Productivity

As mentioned before, the goal of this project is to analyse the impact of exporting on the productivity of firms. There are two main ideas that can support this relation between productivity and exports. The first is that only more productive firms will export and sell abroad, due to its advantages in production. The second is the idea that firms can increase their productivity levels after they become exporters, since the higher competition levels forces them to improve production. In any of the cases, a productivity proxy must be defined.

In this case, the productivity proxy used was the Gross Value Added per worker of the firms. Hence, the analysis will be done based on the average productivity of each employee. We can start by comparing the mean productivity levels of the total firms, the exporters and the non-exporters. It is clear that the exporter firms show a higher mean productivity (51503.75), especially when compared with non-exporters (21251.9).

Table 5 – Summary statistics of Productivity

VARIABLE	CATEGORY	OBS	MEAN	STD.DEV.	MIN	MAX
PRODUCTIVITY	Total	2,603,376	21470.54	312016.6	-1.75e+08	1.21e+08
	Exporter	18,816	51503.75	440998	-3237554	3.53e+07
	Non-Exporter	2,584,560	21251.9	310870.9	-1.75e+08	1.21e+08

In terms of variation over time, we can see that the mean productivity levels suffered a major fall between 2010 and 2012, results we can associate with the financial crisis that hit the whole European Union and Portugal in a severe way. After 2012, the productivity levels have been on the rise, with the mean productivity in 2018 surpassing the productivity levels of 2010.

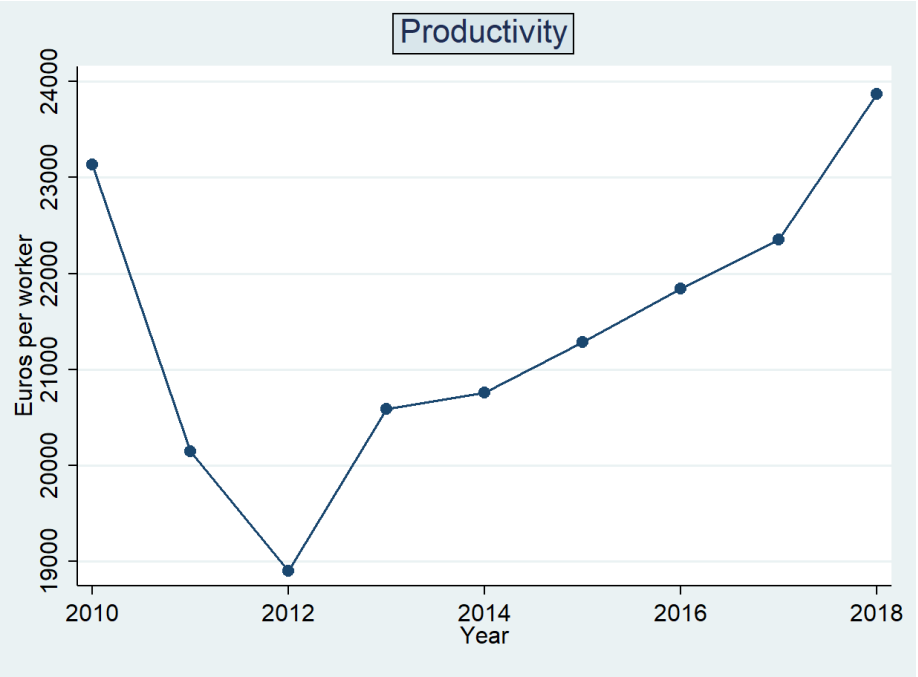

Figure 1 – Mean Productivity between 2010 and 2018

3.4 Firm Investment

Investment and capital per worker are commonly identified in the literature as two of the determinants to decide whether a firm becomes an exporter or not, as shown by Alvarez and López (2008). It is also known that investment can increase the productivity of the firms and hence allow them to export later on. As it is such an important determinant, we have decided to use some proxies in this study.

A firm's rate of investment was considered to be the variation in the sum of tangible and intangible assets across time. By analysing the variation over time, we can understand whether firms have increased or decreased their long-term productive assets. Another measure of investment done by firms is typically done in the form of Research and Development (R&D) activities, as firms want to create new products and processes or improve the existing ones. We can expect such activities to increase firm's productivity growth. In this case, R&D expenses of firms are not mandatory information to divulge, so we don't have access to that specific variable. To proxy such investments, we have analysed instead the number of R&D workers in firms and the share of R&D workers as a proportion of total workers, denominated R&D investment.

As we can see from the table below, exporting firms tend to have, on average, higher investment rates than non-exporting firms. Capital per worker also tends to be higher for exporting firms than for the total and the non-exporting ones. In what regards R&D

workers, the values show a high concentration level around zero. The R&D proportion of employees is really low for most firms. Nevertheless, we can see that the number of R&D workers as well as it's proportion in terms of total workers is, on average, higher for exporting firms than for non-exporting ones. While an exporting firm has a mean of 1.28% employees dedicated to R&D, a non-exporting one has a mean of only 0.28%.

Table 6 – Summary statistics of Investment variables

VARIABLE	CATEGORY	OBS	MEAN	STD.DEV.	MIN	MAX
INVESTMENT	Total	2,188,366	9.953002	2.331391	-4.60517	23.7378
	Exporter	18,705	12.47088	2.629502	-4.60517	22.00325
	Non-Exporter	2,169,661	9.931295	2.316789	-4.60517	23.7378
CAPITAL PER WORKER	Total	2,604,410	40523.75	1258404	-.01	4.97e+08
	Exporter	19,968	49120.77	287940.6	0	2.68e+07
	Non-Exporter	2,584,442	40457.33	1263002	-.01	4.97e+08
R&D WORKERS	Total	2,604,410	.0490967	2.214446	0	1439
	Exporter	19,968	1.317057	8.764173	0	284
	Non-Exporter	2,584,442	.0393002	2.082238	0	1439
R&D INVESTMENT	Total	2,603,360	.0028509	.0487584	0	1
	Exporter	19,968	.0127603	.0752039	0	1
	Non-Exporter	2,583,392	.0027743	.04849	0	1

3.5 Other Firm Dynamics

To have an even better description of the differences between exporters and non-exporters, summary statistics of other relevant variables of the dataset were computed. We can conclude that exporter firms have on average a higher number of total workers. Exporter firms also appear to have higher turnover and gross value-added levels than non-exporters and have more years of existence on average. In fact, exporters have on average 19 years old while non-exporters only have 13 years old. We can suspect that these differences arise since firms that are in the market for longer time periods can improve production with learning-by-doing and take advantage of stronger market positions to sell their products abroad.

Table 7 – Summary statistics of other firm variables

VARIABLE	CATEGORY	OBS	MEAN	STD.DEV.	MIN	MAX
TOTAL WORKERS	Total	2,603,360	9.50862	104.3025	1	25614
	Exporter	19,968	66.75641	248.8125	1	8863
	Non-Exporter	2,583,392	9.06613	102.2696	1	25614
TURNOVER	Total	2,604,410	1123281	2.52e+07	.01	9.63e+09
	Exporter	19,968	1.62e+07	1.83e+08	7.5	9.63e+09
	Non-Exporter	2,584,442	1007053	1.95e+07	.01	7.13e+09
GVA	Total	2,604,410	260379.4	4746930	-5.25e+08	1.28e+09
	Exporter	19,968	2915608	1.99e+07	-4.03e+07	6.84e+08
	Non-Exporter	2,584,442	239864.5	4427831	-5.25e+08	1.28e+09
AGE	Total	2,552,013	13.30142	13.17159	0	515
	Exporter	19,776	19.30512	16.30087	0	260
	Non-Exporter	2,532,237	13.25453	13.13343	0	515

4. Methodology

The goal of this project is to estimate the effect of exporting on the productivity of Portuguese firms. To do so, 3 different specifications regarding exports where used: the exporting status, the value of exports for firms that satisfy the criteria to be considered an exporter mentioned above and the value of exports for all the firms the dataset.

In the first specification, we follow the previous literature to check whether there is an effect of being an exporter on productivity for the Portuguese firms during the 2010-2018 period. The methodology used is Ordinary Least Squares (OLS) with Robust Standard Errors. For the estimation, we use the following equation:

$$Productivity_{it} = \alpha + \beta \times Exporter_{it} + \gamma \times Controls_{it} + \varepsilon_{it}$$

where Productivity represents the labour productivity of firm *i* in year *t*, measured by the gross value added divided by the total number of workers. Exporter is a dummy variable taking value 1 if the firm fulfil the Bank of Portugal's criteria to have an exporter status in each year. *Controls* is a vector of different variables that were used in different specifications to account for firm observable effects that can impact productivity apart from the exporter status. The variables used include: 1) Firm size, using the criteria defined by the Portuguese Statistics Unit – INE and leaving Micro firms as a reference group; 2)

Sector, using a two digit dummy for the economic classification of each firm; 3) Year dummies to control for unobserved time effects, such as inflation; 4) Other variables that can affect the productivity levels of firms, described in the table below.

Table 8 – Description of control variables

VARIABLE	DESCRIPTION
COSTS PER WORKER	Total labour costs divided by the number of total workers.
INVESTMENT RATE	Variation (logarithm) in the sum of tangible and intangible assets across years.
CAPITAL PER WORKER	Total capital (tangible plus intangible assets) divided by the number of total workers.
LIQUIDITY RATIO	Current assets divided by current liabilities.
SOLVENCY RATIO	Total equity divided by total liabilities.
CAPITAL WEIGHT	Total capital (tangible plus intangible assets) divided by total assets.
TURNOVER	Firm turnover.
R&D INVESTMENT	Number of R&D workers divided by the number of total workers.
TRAINING COSTS	Total training costs divided by the total labour costs.
AGE	Firm years of existence since creation.

As mentioned before, we are interested in understanding whether the value of the exports and not only the exporting status has an impact on the productivity of firms. Hence, in the second specification, we used the following equation:

$$Productivity_{it} = \alpha + \beta \times Exports_{it} + \gamma \times Controls_{it} + \varepsilon_{it}$$

where all the variables have the same definition except that Exports is the value of the exports for the firms with exporting status equal to 1 of each firm *i* in year *t*. The controls used where the same as the ones described above.

Finally, we were interested in testing whether the value of the exports has any effect on the productivity of firms for all the firms present in the dataset, regardless of whether they fulfilled the exporting status or not. The estimated equation is:

$$Productivity_{it} = \alpha + \beta_1 \times Exports_{it} + \beta_2 \times Exports^2{}_{it} + \gamma \times Controls_{it} + \varepsilon_{it}$$

In this specification, we have decided to include also the level of exports squared, in order to check for possible scale effects, as the gains from exporting may follow a concave shape, decreasing after a certain level of total exports.

Several regressions were tested using different sets of controls. The results we present in the section below include a baseline regression with only the variable of interest as independent variable and other four regressions with different sets of controls. We have used this specific set of controls given the data available for this experiment and following the previous literature findings described above.

Apart from the use of OLS, all the previous equations were also estimated using the Fixed Effects model with clustered standard errors at the firm level in order to account for all observable and non-observable time-invariant characteristics of the firms that can create productivity differences. This methodology was used because there are several non-observable aspects, such as the quality of the workforce or the management quality, that can be controlled for using fixed effects. It is also important to note that the Fixed Effects model was chosen over the Random Effects one since there is the possibility of correlation between the explanatory variables used and the error term, mainly due to omitted variables not accounted for.

5. Results

5.1 Ordinary Least Squares

As mentioned in the previous section, we used three different specifications to analyse how productivity varies within each firm given the exporting status and the absolute amount of exports. In this section, we will assess the results of these different specifications considering the models estimated with Ordinary Least Squares (OLS) using Robust Standard Errors. Later on, in section 5.2, it is possible to find the results and a more in-depth interpretation using a Fixed Effects methodology instead.

5.1.1 Effects on Productivity of Exporter Status

We start by using an OLS model to check if there was an effect of being an exporter on productivity for the Portuguese firms between 2010 and 2018.

Table 9 presents the results of regressing productivity (proxied by GVA per worker) on an Exporter dummy and several control variables. Note that the Exporter dummy is the unique variable used in the baseline model.

Table 9 - OLS with Exporter Status

VARIABLES	(1) Baseline	(2) Eq. 9.2	(3) Eq. 9.3	(4) Eq. 9.4	(5) Eq. 9.5
Exporter Status (=1)	24,490***	20,489**	999.0	23,135**	3,831**
	(3,006)	(10,113)	(2,115)	(10,542)	(1,805)
Costs per worker		-1.445	1.844***	-1.581	1.712***
		(2.656)	(0.316)	(2.722)	(0.294)
Investment Rate		4,789	-467.6	5,011	-1,320
		(4,014)	(1,326)	(4,262)	(1,342)
Capital per worker		0.148***	0.161***	0.146***	0.157***
		(0.0188)	(0.0337)	(0.0190)	(0.0337)
Liquidity Ratio		0.000152	0.00432***	0.000189	0.00655***
		(0.000615)	(0.00161)	(0.000606)	(0.00214)
Solvency Ratio		-0.000730	0.0732	-0.00105	0.0945
		(0.000913)	(0.0770)	(0.000963)	(0.0800)
Capital weight		-64,120**	-36,707***	-66,330**	-37,504***
		(28,639)	(4,169)	(28,951)	(4,207)
Firm Size = Big		-4,357	-61,950**	-8,306	-58,586**
		(6,892)	(24,415)	(6,240)	(23,914)
Firm Size = Small		440.7	-5,176	2,195	-3,941
		(3,618)	(4,254)	(4,558)	(4,059)
Firm Size = Medium		-1,567	-15,835*	117.1	-12,671
		(6,334)	(8,231)	(6,963)	(7,843)
Turnover			0.000456**		0.000453**
			(0.000189)		(0.000188)
R&D Investment			-11,761***		-10,272***
			(3,853)		(3,611)
Training costs			32,062***		26,572***
			(7,131)		(7,507)
Age			-67.05		-39.23
			(49.11)		(53.45)
Constant	21,283***	4,313	8,171	33,147	-70,898*
	(193.5)	(7,132)	(14,065)	(66,739)	(41,999)
Sector Controls	No	No	No	Yes	Yes
Year Controls	No	No	No	Yes	Yes
Observations	2,603,376	2,140,825	386,432	2,140,825	386,432
R-squared	0.000	0.373	0.328	0.377	0.345

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

From these estimates, one can see that there is a positive and significant effect on productivity caused by being an exporter, confirming previous literature findings. The Exporter dummy is significant even when controlling for sector and year dummies. Despite this significance, there is a notorious decline on the magnitude of the coefficient when more controls are added, especially in equations 9.3 and 9.5, in which the coefficients are much smaller in comparison with the remaining ones. Furthermore, surprisingly, only equation 9.3 did not show any significance in terms of the coefficient of interest.

It is also possible to identify some other interesting results, namely in terms of the significance of R&D investment, training costs per worker and capital per worker. Results for these latter two variables confirm previous literature and our intuition that higher training costs as well as cost and capital per worker lead to higher productivity. Following the same intuition, costs per worker is also significant and positive in equations 9.3 and 9.5. Variables such as the liquidity ratio and turnover also seem to affect positively productivity. However, despite their significance, their effect is quite modest.

On the other hand, variables like capital weight (as a percentage of total assets), R&D investment and a "big" size (more than 250 employees) exhibit significant and negative large coefficients, contradicting previous studies. Despite these opposite results, it is important to mention that some of these positive effects previously found were sector specific, with disparity in results possibly arising from sector individual characteristics.

5.1.2 Effects on Productivity of Exports for Firms with Exporter Status

In this section we assess the results obtained using as variable of interest the total level of exports for firms that fulfil the exporter status. As such, the variable we are interested in analysing was modified: for firms with exporter status equal to one, the variable takes the value of the total exports while for firms with exporter status equal to zero, the variable takes value zero. Our goal here, as mentioned before, is trying to understand how the absolute value of exports of firms considered to be exporters affects productivity. We included the exact same control variables as in the previous section, but we used the variable Exports, representing the total value of the exports for exporting firms, instead of the dummy variable for being an Exporter.

Looking at the results on Table 10, one can easily see that despite significant, the Exports variable has a small magnitude, with its sign even being negative in equations 10.3 and 10.5. Regarding the remaining variables, the obtained coefficients are quite similar to ones on Table 9, without any sizable discrepancy. Furthermore, the estimates also yielded the same results both in terms of impact and significance. Note also that even when comparing the R^2 obtained in Table 9 with the ones on Table 10, the disparity is almost minimal. Thus, we can conclude from these results that the most meaningful factor that affects a firm's productivity is whether it exports or not, with its absolute amount being almost negligible, despite significant.

Table 10 – OLS with Total Exports

VARIABLES	(1) Baseline	(2) Eq. 10.2	(3) Eq. 10.3	(4) Eq. 10.4	(5) Eq. 10.5
Exports	0.00128**	0.00122**	-0.000612**	0.00123**	-0.000595**
	(0.000508)	(0.000527)	(0.000287)	(0.000528)	(0.000284)
Costs per Worker		-1.460	1.846***	-1.596	1.715***
		(2.654)	(0.317)	(2.720)	(0.294)
Investment		4,772	-519.3	4,994	-1,349
		(4,035)	(1,320)	(4,282)	(1,342)
Capital per Worker		0.148***	0.161***	0.146***	0.157***
		(0.0188)	(0.0337)	(0.0190)	(0.0337)
Liquidity Ratio		0.000151	0.00432***	0.000189	0.00646***
		(0.000614)	(0.00161)	(0.000605)	(0.00212)
Solvency Ratio		-0.000736	0.0730	-0.00105	0.0925
		(0.000913)	(0.0768)	(0.000963)	(0.0788)
Capital Weight		-64,207**	-36,334***	-66,405**	-37,322***
		(28,785)	(4,327)	(29,080)	(4,330)
Firm Size=Big		-19,711**	-63,958**	-23,572**	-60,501**
		(9,961)	(25,463)	(9,539)	(24,974)
Firm Size=Small		848.2	-5,228	2,622	-4,028
		(3,715)	(4,292)	(4,648)	(4,094)
Firm Size=Medium		-526.4	-16,546*	1,314	-13,325
		(6,935)	(8,578)	(7,572)	(8,170)
Turnover			0.000557**		0.000551**
			(0.000236)		(0.000234)
R&D Investment			-10,984***		-9,307***
			(3,857)		(3,578)
Training Cost			31,941***		26,477***
			(7,139)		(7,506)
Age			-65.76		-39.27
			(48.93)		(53.32)
Constant	21,378***	4,753	8,517	34,100	-76,180*
	(192.9)	(7,054)	(13,987)	(66,640)	(44,186)
Sector Controls	No	No	No	Yes	Yes
Year Controls	No	No	No	Yes	Yes
Observations	2,603,360	2,140,819	386,432	2,140,819	386,432
R-squared	0.001	0.374	0.329	0.378	0.345

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.1.3 Effects on Productivity of Exports

Finally, in this last specification, we analyse the Exports variable as our main variable of interest, considering all firms (including those that do not fulfil the exporter status), as well as the squared level of exports in order to verify if there are any kind of scale effects on the amount of exports.

Table 11 - OLS with Exports and Exports Squared

VARIABLES	(1) Baseline	(2) Eq. 11.2	(3) Eq. 11.3	(4) Eq. 11.4	(5) Eq. 11.5
Exports	0.00439***	0.00436***	-0.000258	0.00439***	-0.000249
	(0.00141)	(0.00152)	(0.000309)	(0.00152)	(0.000311)
Exports Squared	-1.41e-12***	-1.41e-12***	-1.73e-13**	-1.42e-12***	-1.69e-13*
	(4.57e-13)	(4.91e-13)	(8.53e-14)	(4.92e-13)	(8.90e-14)
Costs per Worker		-1.473	1.844***	-1.609	1.713***
		(2.654)	(0.317)	(2.720)	(0.294)
Investment		4,691	-548.3	4,920	-1,374
		(4,031)	(1,320)	(4,277)	(1,342)
Capital per Worker		0.148***	0.161***	0.146***	0.157***
		(0.0188)	(0.0337)	(0.0190)	(0.0337)
Liquidity Ratio		0.000151	0.00432***	0.000189	0.00641***
		(0.000612)	(0.00161)	(0.000604)	(0.00212)
Solvency Ratio		-0.000740	0.0727	-0.00106	0.0914
		(0.000912)	(0.0768)	(0.000963)	(0.0783)
Capital Weight		-63,768**	-36,169***	-66,007**	-37,184***
		(28,759)	(4,339)	(29,055)	(4,342)
Firm Size=Big		-39,281***	-66,226***	-43,228***	-62,713**
		(14,469)	(25,673)	(14,233)	(25,210)
Firm Size=Small		925.2	-5,169	2,780	-3,947
		(3,716)	(4,289)	(4,652)	(4,089)
Firm Size=Medium		-2,386	-16,716*	-443.8	-13,447*
		(6,936)	(8,580)	(7,557)	(8,170)
Turnover			0.000553**		0.000548**
			(0.000234)		(0.000232)
R&D Investment			-11,490***		-9,747***
			(3,885)		(3,600)
Training Costs			31,897***		26,401***
			(7,140)		(7,505)
Age			-67.03		-40.21
			(48.96)		(53.34)
Constant	21,244***	5,537	8,786	36,649	-75,432*
	(199.5)	(7,060)	(13,981)	(66,658)	(44,068)
Sector Controls	No	No	No	Yes	Yes
Year Controls	No	No	No	Yes	Yes
Observations	2,603,360	2,140,819	386,432	2,140,819	386,432
R-squared	0.002	0.375	0.329	0.379	0.345

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11 shows de obtained results for the OLS approach. From these results, we can see that the variable Exports is significant at a 1% significance level in the baseline equation as well as in equations 11.2 and 11.4. In terms of the squared variable, its significance and its negative sign are a common factor in all equations presented above. However, even though "Exports Squared" has indeed statistical significance, its effects are quite minimal. Concerning the remaining variables, the signs of the coefficients we got in this section are extremely similar to the ones obtained in the previous two sections.

5.2 Fixed Effects

As previously mentioned, we also applied Fixed Effects models in the exact same regressions used before to verify if the results would change using a different methodology. Moreover, we added clustered standard errors at a firm level, allowing for observable and unobservable individual time-invariant characteristics that might be causing discrepancies in terms of productivity between firms.

5.2.1 Effects on Productivity of Exporter Status

Table 12 presents the results of our main specification analysing the effect of fulfilling the exporter status using Fixed Effects instead. At a first glance, we can easily observe some differences when comparing with the results shown in Table 9. The Exporter dummy is not significant in equations 12.3 and 12.5, demonstrating significance and a positive sign on the remaining equations, as expected. These two equations show some similarities in terms of estimates and significance, with the only difference being on the significance at 1% level of the age variable in equation 12.3. One interesting result is the significance of the costs per worker variable, that seems to affect positively productivity at a 1% significance level in each one of the regressions where it was included. This variable is quite important since it can also be seen as a proxy for schooling, according to Gonçalves and Martins (2016), as well as a measure for workers' efficiency as pointed out by Gehringer *et. al* (2013).

In equations 12.2 and 12.4, we can also denote the significance of capital per worker, liquidity ratio, solvency ratio and capital weight, that show relatively similar results to the OLS estimates. Nevertheless, there are some differences, namely in the solvency ratio that is now significant. Regarding the investment rate, contrary to the results on Table 9, it is now significant at 1% in equations 12.3 and 12.5, affecting positively productivity, as demonstrated by previous literature. Denote also the positive estimates obtained for R&D Investment and training costs that confirm previous findings and our intuition. However, since there is no statistical significance, we cannot conclude anything. Finally, the dummy variable for "big" firms is now significant in equation 12.2, where its sign is actually positive, confirming the finding that bigger firms are indeed more productive.

Table 12 – Fixed Effects with Exporter Status

VARIABLES	(1) Baseline	(2) Eq. 12.2	(3) Eq. 12.3	(4) Eq. 12.4	(5) Eq. 12.5
Exporter Status (=1)	6,335**	6,616**	1,267	6,631**	1,376
	(3,025)	(2,736)	(1,717)	(2,740)	(1,719)
Costs per Worker		1.191***	1.123***	1.188***	1.117***
		(0.170)	(0.182)	(0.172)	(0.182)
Investment Rate		-174.5	2,561*	-245.0	2,377*
		(713.9)	(1,406)	(719.0)	(1,441)
Capital per Worker		0.178***	0.00383	0.178***	0.00380
		(0.0640)	(0.0822)	(0.0640)	(0.0822)
Liquidity Ratio		0.000694***	0.000192	0.000694***	0.00137
		(8.93e-05)	(0.00132)	(8.94e-05)	(0.00143)
Solvency Ratio		-0.000935***	-0.0139	-0.000944***	-0.00268
		(0.000144)	(0.0191)	(0.000141)	(0.0182)
Capital Weight		-24,976***	-11,059	-24,640***	-10,522
		(5,166)	(9,544)	(5,197)	(9,586)
Firm Size=Big		23,206*	-41,822**	22,440	-42,594**
		(14,081)	(20,492)	(14,125)	(20,297)
Firm Size=Small		2,276	-5,828	2,018	-6,281
		(2,415)	(3,871)	(2,417)	(3,842)
Firm Size=Medium		11,244	-18,110*	10,677	-18,871*
		(7,384)	(10,663)	(7,427)	(10,542)
Turnover			0.000940*		0.000934*
			(0.000531)		(0.000530)
R&D Investment			3,824		3,898
			(2,423)		(2,481)
Training Costs			12,220		12,181
			(8,593)		(8,603)
Age			430.5**		170.0
			(177.2)		(164.6)
Constant	21,422***	6,755	-20,433	108,381	128,857
	(23.20)	(5,552)	(14,177)	(87,454)	(94,151)
Sector Controls	No	No	No	Yes	Yes
Year Controls	No	No	No	Yes	Yes
Observations	2,603,360	2,140,819	386,432	2,140,819	386,432
R-squared	0.000	0.392	0.007	0.392	0.007

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.2.2 Effects on Productivity of Exports for Firms with Exporter Status

In this section, similarly to what was stated about the results on Table 10, the difference between using a dummy for exporter or a variable for the value of exports within firms with exporting status relies mainly on the magnitude of the coefficients. In Table 13, the Exports coefficient is not significant in any of the equations, while other variables exhibit extremely similar results to the ones on the previous section, where we used the Exporter Status dummy (Table 12). Thus, we have statistical evidence to believe that the inclusion of the Exports variable is not significant.

Table 13 – Fixed Effect with Total Exports

VARIABLES	(1) Baseline	(2) Eq. 13.2	(3) Eq. 13.3	(4) Eq. 13.4	(5) Eq. 13.5
Exports	0.00167	0.00162	-0.000224	0.00162	-0.000222
	(0.00152)	(0.00150)	(0.000288)	(0.00150)	(0.000286)
Costs per Worker		1.187***	1.124***	1.183***	1.119***
		(0.173)	(0.182)	(0.176)	(0.182)
Investment		-178.0	2,558*	-251.1	2,376*
		(713.1)	(1,406)	(717.8)	(1,441)
Capital per Worker		0.178***	0.00383	0.178***	0.00379
		(0.0640)	(0.0822)	(0.0640)	(0.0822)
Liquidity Ratio		0.000694***	0.000191	0.000694***	0.00137
		(8.92e-05)	(0.00132)	(8.94e-05)	(0.00144)
Solvency Ratio		-0.000935***	-0.0140	-0.000944***	-0.00280
		(0.000144)	(0.0192)	(0.000141)	(0.0182)
Capital Weight		-24,933***	-11,093	-24,596***	-10,562
		(5,167)	(9,545)	(5,197)	(9,587)
Firm Size=Big		23,419	-41,767**	22,641	-42,522**
		(14,374)	(20,557)	(14,419)	(20,358)
Firm Size=Small		2,336	-5,816	2,073	-6,263
		(2,402)	(3,877)	(2,406)	(3,849)
Firm Size=Medium		11,454	-18,165*	10,877	-18,913*
		(7,391)	(10,695)	(7,437)	(10,574)
Turnover			0.000964*		0.000959*
			(0.000551)		(0.000550)
R&D Investment			3,747		3,823
			(2,426)		(2,487)
Training Costs			12,199		12,161
			(8,595)		(8,605)
Age			430.7**		171.1
			(176.6)		(164.2)
Constant	21,349***	6,735	-20,400	108,457	128,395
	(111.1)	(5,551)	(14,172)	(87,454)	(93,927)
Sector Controls	No	No	No	Yes	Yes
Year Controls	No	No	No	Yes	Yes
Observations	2,603,360	2,140,819	386,432	2,140,819	386,432
R-squared	0.001	0.393	0.007	0.393	0.007

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.2.3 Effects on Productivity of Exports

Finally, we applied Fixed Effects using as our variable of interest the absolute level of exports for as well as its squared, in order to access if there is sort of scale effect. In comparison with the OLS results presented in Table 11, our exports variables are no longer significant, raising some doubts concerning the usage of the exports variables. In terms of

the remaining variables, once again, the results obtained in this section are rather similar to ones obtained in previously when we applied OLS with robust standard errors. Lastly, we would like to stress what is a common factor to these three different approaches, a relatively small R^2. In table 12, 13 and 14, the variability in productivity that our covariates seem to explain is quite small. Therefore, we have statistical evidence to believe that productivity is properly explained by much more variables than just the ones we used in this project.

Table 14 – Fixed Effects with Exports and Exports Squared

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Baseline	Eq. 14.2	Eq. 14.3	Eq. 14.4	Eq. 14.5
Exports	0.00281	0.00273	-5.09e-05	0.00273	-4.90e-05
	(0.00198)	(0.00196)	(0.000202)	(0.00196)	(0.000201)
Exports Squared	-4.80e-13	-4.66e-13	-9.61e-14	-4.66e-13	-9.58e-14
	(3.15e-13)	(3.13e-13)	(1.40e-13)	(3.13e-13)	(1.40e-13)
Costs per Worker		1.187***	1.124***	1.183***	1.119***
		(0.175)	(0.182)	(0.178)	(0.182)
Investment		-183.6	2,554*	-257.1	2,372*
		(713.0)	(1,407)	(717.6)	(1,441)
Capital per Worker		0.178***	0.00383	0.178***	0.00380
		(0.0640)	(0.0822)	(0.0640)	(0.0822)
Liquidity Ratio		0.000694***	0.000192	0.000694***	0.00137
		(8.92e-05)	(0.00132)	(8.94e-05)	(0.00144)
Solvency Ratio		-0.000935***	-0.0140	-0.000944***	-0.00279
		(0.000144)	(0.0192)	(0.000141)	(0.0182)
Capital Weight		-24,906***	-11,079	-24,574***	-10,548
		(5,168)	(9,546)	(5,198)	(9,588)
Firm Size=Big		23,018	-42,232**	22,250	-42,986**
		(14,602)	(20,602)	(14,643)	(20,409)
Firm Size=Small		2,341	-5,821	2,080	-6,268
		(2,400)	(3,876)	(2,403)	(3,848)
Firm Size=Medium		11,437	-18,207*	10,865	-18,955*
		(7,396)	(10,693)	(7,442)	(10,572)
Turnover			0.000970*		0.000964*
			(0.000555)		(0.000554)
R&D Investment			3,784		3,861
			(2,425)		(2,485)
Training Costs			12,206		12,168
			(8,595)		(8,605)
Age			428.8**		169.2
			(176.6)		(164.3)
Constant	21,300***	6,732	-20,374	108,445	128,185
	(124.9)	(5,553)	(14,171)	(87,407)	(93,800)
Sector Controls	No	No	No	Yes	Yes
Year Controls	No	No	No	Yes	Yes
Observations	2,603,360	2,140,819	386,432	2,140,819	386,432
R-squared	0.001	0.393	0.007	0.393	0.007

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

6. Conclusion

This project followed previous literature, especially concerning the Portuguese economy and its firms' behaviour. As recent studies demonstrate, the lack of productivity gains for the Portuguese economy may be explained by the increasing levels of indebtedness both for firms and households prior to the crisis. During this period, exporting was seen as a lifesaving buoy due to the imbalances and the weakness of the Portuguese domestic market. Hence, the exporting status of a firm may have enhanced discrepancies in terms of productivity in Portugal.

In this study, we followed this intuition by looking at the determinants of productivity for Portuguese firms. Using three different specifications as well as two different methodologies, OLS and Fixed Effects, we found a positive and significant correlation between being an exporter and productivity. As our data shows, exporting firms have a higher productivity in comparison with firms that do not export. However, when we looked for any effect caused by its absolute values, we did not find any reliable nor substantial relationship, especially when we applied Fixed Effects. In what concerns other variables, we also found some interesting results that go along with previous findings, namely in terms of the significance of capital per worker and costs per worker. Furthermore, when we used Fixed Effects, we found positive effects, albeit non-significant, on productivity in terms of R&D investment and training costs. Finally, some of the Fixed Effects results contradicted previous literature: "big" firm size showed significance in the three different specifications, but its sign was negative, contradicting the theory that bigger firms tend to be more productive. As previously mentioned, some of these effects are sector specific, thus differences may be arising from not looking at each sector individually. In our view, this disparity may as well come from the inclusion of a large and unconventional set of control variables. Furthermore, the lack of, for instance, regional controls might as well be contributing to this discrepancy. This reasoning is also supported by the small R^2 values obtained when using both OLS and FE, meaning that there are still other relevant variables missing in the equation.

There is still an undoubtedly important path to be analysed in terms of finding what is causing this global slowdown. It is a topic that has been puzzling economists that have dedicated years of research into the topic. Portugal had a quite different and specific performance over these last years, especially due to the crisis that indeed did not make things easier, affecting how productive firms are and increasing divergence among them, but also due to specific characteristics of the Portuguese economy coming prior to the

crisis. Although our project comes up with some different results when compared to previous literature, we think that it brings plurality to the research of productivity of Portuguese firms. These differences might be due to the larger choice of controls on our behalf as well as the coverage of virtually all sectors of the Portuguese economy, which is not so commonly found on previous literature. There are still methodological differences that should be considered, such as the usage of labour productivity.

We found that the exporter status contributes significantly to higher levels of labour productivity, but the volume of exports *per se* does not (even when considering non-linearity) neither in the case of all firms nor in the case of it being considered only for exporters. In terms of policy implications, and from a labour productivity perspective, this might recommend that incentives should be channelled to help non-exporters becoming exporters, instead of incentivising higher volumes of exports for firms already with exporter status.

For future research these differences should be targeted more specifically. A sector breakdown approach could be considered, as well as the removal of some sectors, such as the public sector, health, and education, which might not be as relevant for this analysis. Other possible options could be a more in-depth analysis of intra-sectorial dynamics, which are pointed out to be relevant for the productivity slowdown in the literature.

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Appendix

Table 15 – Number of firms per sector

CAE (2 digits)	Exporter	Non-Exporter	Total
1	65,535	262	65,797
2	11,501	24	11,525
3	3,865	62	3,927
6	3	0	3
7	46	6	52
8	5,032	124	5,156
9	102	2	104
10	42,082	364	42,446
11	6,221	229	6,450
12	25	5	30
13	14,590	477	15,067
14	33,038	1,024	34,062
15	16,122	346	16,468
16	19,273	505	19,778
17	2,960	66	3,026
18	14,605	82	14,687
19	65	13	78
20	4,494	147	4,641
21	710	87	797
22	6,845	467	7,312
23	17,429	719	18,148
24	1,889	127	2,016
25	50,722	1,440	52,162
26	1,425	194	1,619
27	3,621	300	3,921
28	8,346	800	9,146
29	3,073	252	3,325
30	1,184	79	1,263
31	17,240	677	17,917
32	10,414	235	10,649
33	15,791	224	16,015
35	2,323	5	2,328
36	1,022	4	1,026
37	370	0	370
38	5,305	68	5,373
39	85	0	85
41	139,630	436	140,066
42	15,803	89	15,892
43	112,766	455	113,221
45	109,975	304	110,279
46	236,259	4,068	240,327
47	367,311	733	368,044
49	120,869	778	121,647

50	1,461	12	1,473
51	446	35	481
52	14,089	201	14,290
53	2,767	3	2,770
55	34,395	105	34,500
56	217,751	44	217,795
58	9,698	110	9,808
59	8,555	78	8,633
60	2,100	4	2,104
61	3,784	24	3,808
62	37,034	635	37,669
63	3,735	51	3,786
64	5,614	27	5,641
65	184	0	184
66	29,556	28	29,584
68	89,271	101	89,372
69	82,873	105	82,978
70	57,471	399	57,870
71	54,322	447	54,769
72	2,243	67	2,310
73	20,304	80	20,384
74	30,610	319	30,929
75	7,883	1	7,884
77	10,757	45	10,802
78	3,566	28	3,594
79	12,272	101	12,373
80	2,646	27	2,673
81	18,911	20	18,931
82	40,104	249	40,353
84	485	0	485
85	38,235	38	38,273
86	134,210	84	134,294
87	7,496	0	7,496
88	6,353	0	6,353
90	9,009	71	9,080
91	648	1	649
92	1,360	0	1,360
93	24,524	87	24,611
94	3,596	1	3,597
95	6,875	33	6,908
96	57,278	28	57,306
97	3	0	3
98	2	0	2
Total	2,584,442	19,968	2,604,410

CONNECTING ECONOMICS

GPEARI Gabinete de Planeamento, Estratégia, Avaliação e Relações Internacionais MINISTÉRIO DAS FINANÇAS · Office for Economic Policy and International Affairs MINISTRY OF FINANCE