

# Financially distressed firms: exit, recovery and productivity

Fernando Alexandre<sup>1</sup>, Nuno Azevedo<sup>3</sup>, Pedro Bação<sup>2</sup>, Gilberto Loureiro<sup>1</sup>, Miguel Portela<sup>1</sup> & Emma Szhao<sup>3</sup>

<sup>1</sup>Universidade do Minho; <sup>2</sup>Universidade de Coimbra; <sup>3</sup>Banco de Portugal

Data Science - Bridging Fundamental Research and Industry  
Universidade do Minho  
March 28<sup>th</sup>, 2019

Project: “It’s All About Productivity: contributions to the understanding of the sluggish performance of the Portuguese economy”, funded by FCT (*PTDC/EGE-ECO/29822/2017*)

# Motivation

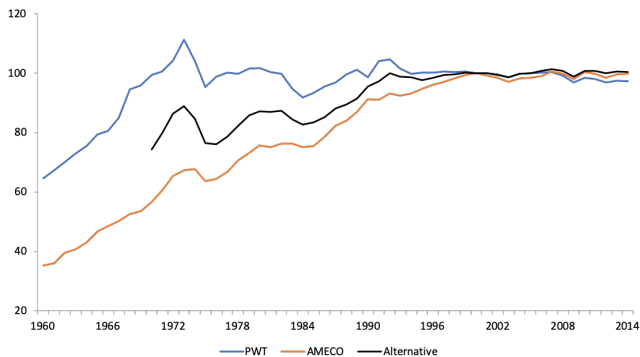


Figure 1: Total Factor Productivity in Portugal (base, 2000 = 100)

- The Portuguese crisis was a debt crisis.
- Firms were highly indebted, very dependent on banks funding and banks had very low capital ratios.
- In 2012, at the height of the crisis, financially distressed firms (FDF) represented 11% of total value-added, 17% of total employment and 25% of total firms' debt.
- In this paper we address the following questions:
  - What were the determinants of the status of FDF?
  - What was the role of productivity in the survival and exit of FDF?
  - Have banks contributed to a better allocation of resources?
  - How did the share of FDF in the banks' balance sheet affect the efficiency in the allocation of resources?

Financially distressed firms (FDF):

Interest coverage ratio =  $\frac{EBIT}{Interest\ Expenses} < 1$  for at least 3 years and firms must be at least 10 years old

⇒ BPLIM: The Microdata Research Laboratory of *Banco de Portugal*

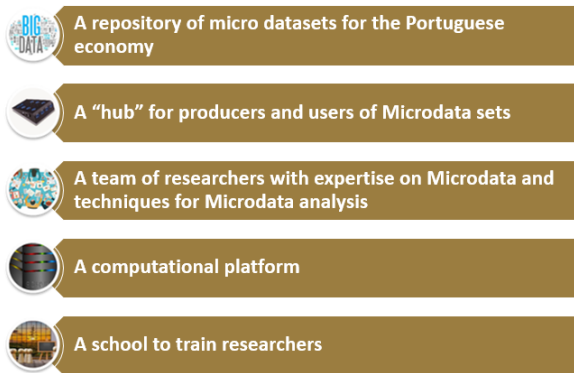


Figure 2: What is BPLIM?

⇒ Anonymized data: firm, worker & bank level

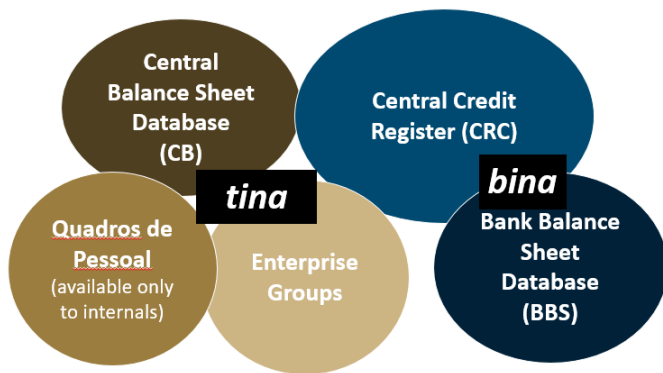


Figure 3: Available datasets

**Central Balance Sheet Database (Central de Balanços):** is an economic and financial database on Portuguese non-financial corporations. Annual accounting data available from 2006 onwards. It is based on information on the annual accounts of corporations reported under *Informação Empresarial Simplificada* (Simplified Corporate Information).



**Central Credit Responsibility (CCR):** has data on the indebtedness of borrowers (including collective persons, individual entrepreneurs and private persons) as reported by credit-granting institutions. Data is collected monthly (available between 1980 and 2019). All credit obligations are included, regardless if the credit is in good standing or in situations of non-compliance.

**Quadros de Pessoal – QP (“Personnel Records”)**: is a yearly matched employer–employee dataset gathered by the Portuguese Ministry of Employment. Each year, more than 2.5 million workers and 200,000 companies are covered. Data from 1986 to 2017 is available. Data are available on each establishment (location, economic activity, and employment), the firm with which it is affiliated (location, economic activity, employment, sales, and legal framework), and each and every one of its workers (gender, age, education, skill, occupation, tenure, earnings).

# FDF in the Portuguese economy

Table 1: Descriptive statistics – frontier vs. laggards, 2006–2017

	Full Economy			Frontier			Laggards		
	Mean	Median	s.d.	Mean	Median	s.d.	Mean	Median	s.d.
Labour productivity	11.54	8.76	13.52	38.79	28.81	26.99	8.51	8.09	5.53
Employee	19.07	6.00	154.40	32.88	8.00	147.58	17.53	6.00	155.04
Capital (real)	0.30	0.05	0.72	0.77	0.20	1.21	0.24	0.04	0.61
Turnover	1.07	0.30	2.07	3.05	1.44	3.42	0.85	0.26	1.72
Profitability	-0.002	0.03	0.30	0.12	0.09	0.17	-0.02	0.03	0.30
Leverage	0.33	0.23	0.48	0.23	0.17	0.26	0.33	0.24	0.49
Age	16.78	14.00	13.53	18.12	15.00	14.50	16.63	14.00	13.40

Notes: the number of observations for the full economy, frontier and laggards is 989863, 98980 and 890883, respectively.

# FDF in the Portuguese economy

Table 2: Descriptive statistics – Non-FDF vs. FDF

	Non-FDF			FDF		
	Mean	Median	s.d.	Mean	Median	s.d.
Labour productivity	11.93	9.04	13.59	6.60	5.43	11.51
Employee	18.48	6.00	146.10	26.44	7.00	234.60
Capital (real)	0.28	0.05	0.68	0.54	0.08	1.05
Turnover	1.07	0.30	2.06	1.11	0.26	2.24
Profitability	0.01	0.04	0.28	-0.18	-0.08	0.38
Leverage	0.31	0.22	0.44	0.56	0.41	0.75
Age	16.19	13.00	13.27	24.21	20.00	14.52

Notes: the number of observations for the Non-FDF and FDF is 916829 and 73034, respectively.

# FDF in the Portuguese economy

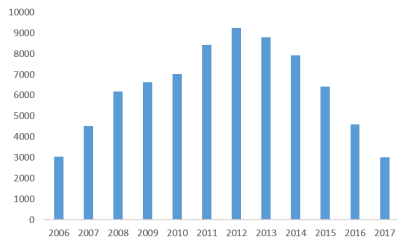


Figure 4: Number of FDF, 2006 – 2017

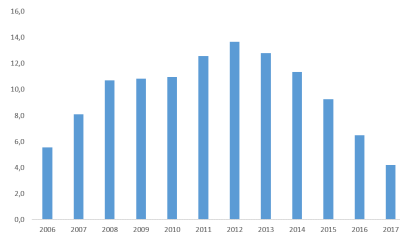


Figure 5: Share of FDF in total firms, 2006 – 2017 (%)

# FDF in the Portuguese economy

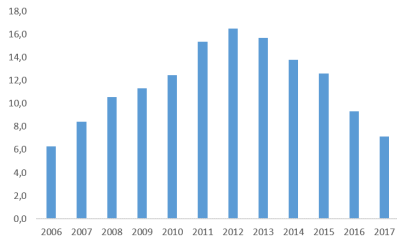


Figure 6: Share of FDF in total employment, 2006 – 2017 (%)

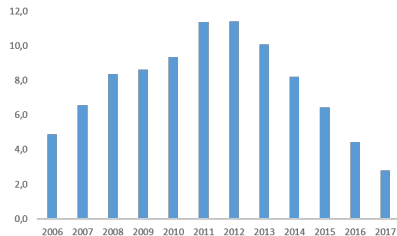


Figure 7: Share of FDF in total value-added, 2006 – 2017 (%)

# FDF in the Portuguese economy

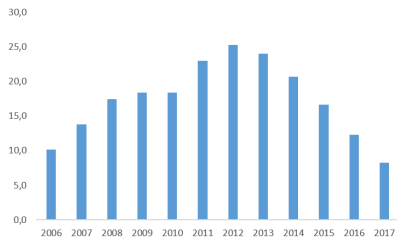


Figure 8: Share of FDF in total debt, 2006 – 2017 (%)

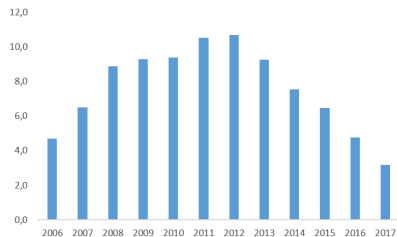


Figure 9: Share of FDF in total exports, 2006 – 2017 (%)

# FDF in the Portuguese economy

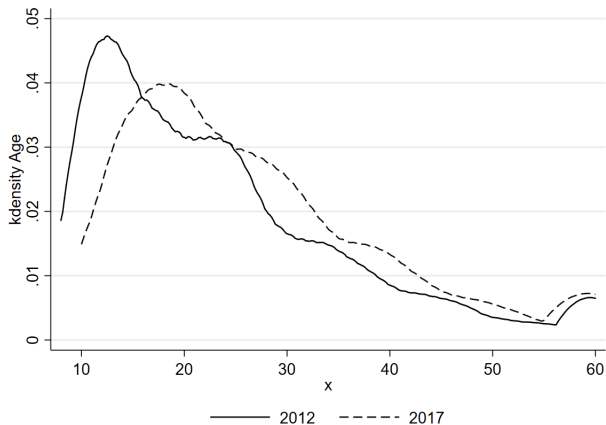


Figure 10: Age distribution for FDF, 2012 & 2017



Table 3: FDF transition to recovery and exit (%)

Year ( $t$ )	FDF ( $t + 1$ )	Recovery ( $t + 1$ )	Exit ( $t + 1$ )
2008	83.4	8.0	8.6
2009	80.8	11.6	7.6
2010	84.8	8.0	7.2
2011	85.4	7.4	7.2
2012	84.2	9.8	5.9
2013	81.5	13.3	5.2
2014	77.7	17.6	4.7
2015	79.3	16.2	4.4
2016	77.1	16.1	6.8

# FDF and productivity in the Portuguese economy

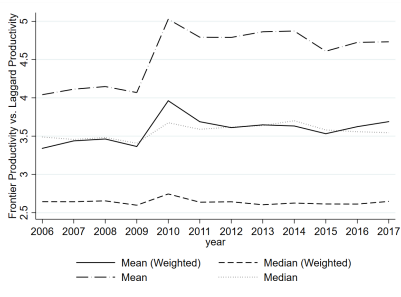


Figure 11: Ratio of productivity: frontier vs. laggard firms, 2006 – 2017

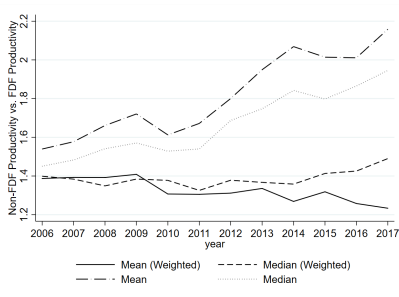


Figure 12: Ratio of productivity: non-FDF vs. FDF, 2006 – 2017

# FDF and productivity in the Portuguese economy

Table 4: Average yearly transition probabilities between productivity deciles: total firms (2006 to 2017)

		year $t + 1$										
		D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	Exit
year $t$	D1	75.98	12.73	2.50	1.06	0.55	0.28	0.13	0.08	0.02	0.01	6.67
		81.86	10.52	0.91	0.34	0.10	0.05	0.05	0.05	0.00	0.00	6.13
	D2	17.09	58.06	14.56	3.22	1.12	0.48	0.24	0.10	0.03	0.01	5.11
		19.08	65.18	9.66	1.12	0.27	0.25	0.09	0.04	0.02	0.00	4.30
	D3	1.97	21.26	52.95	14.85	3.10	1.07	0.41	0.12	0.05	0.01	4.21
		1.86	26.01	57.40	8.79	1.03	0.29	0.19	0.00	0.03	0.00	4.39
	D4	0.58	3.17	22.15	51.71	14.72	2.89	0.86	0.26	0.09	0.01	3.56
		0.63	3.43	29.87	51.67	8.89	1.22	0.28	0.15	0.03	0.00	3.83
	D5	0.25	0.82	3.33	22.05	52.56	14.58	2.38	0.58	0.14	0.03	3.30
		0.40	0.99	4.23	29.27	52.21	7.55	0.89	0.27	0.03	0.03	4.13
	D6	0.10	0.29	0.80	2.98	21.33	55.67	13.89	1.75	0.28	0.05	2.85
		0.18	0.46	1.15	4.00	29.29	53.04	6.98	0.74	0.11	0.00	4.04
	D7	0.07	0.11	0.24	0.66	2.55	19.57	60.59	12.49	0.94	0.10	2.68
		0.10	0.26	0.51	1.26	3.98	25.89	57.67	5.90	0.28	0.09	4.05
	D8	0.02	0.05	0.10	0.16	0.46	1.74	17.02	67.30	10.38	0.36	2.41
		0.04	0.13	0.17	0.44	1.01	2.91	23.47	63.06	4.86	0.25	3.67
	D9	0.01	0.02	0.03	0.04	0.09	0.25	0.95	13.46	76.62	6.39	2.15
		0.03	0.00	0.07	0.07	0.17	0.40	1.59	17.48	73.24	3.56	3.40
	D10	0.00	0.00	0.00	0.01	0.02	0.03	0.08	0.36	7.98	89.48	2.02
		0.00	0.00	0.00	0.01	0.01	0.04	0.08	0.49	10.20	85.96	3.19

Note: within each decile the second row stands for FDF firms.

# FDF and productivity in the Portuguese economy

Table 5: Transition probabilities between productivity deciles for FDF firms, from 2011 to 2012

		year 2012										
		D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	Exit
year 2011	D1	396	66	2	3	1		1				34
		78.73	13.12	0.40	0.60	0.20		0.20				6.76
	D2	121	471	60	5	2	1					36
		17.39	67.67	8.62	0.72	0.29	0.14					5.17
	D3	18	180	442	79	9	5	1				35
		2.34	23.41	57.48	10.27	1.17	0.65	0.13				4.55
	D4	3	12	245	381	77	12	6	2			31
		0.39	1.56	31.86	49.54	10.01	1.56	.78	.26			4.03
	D5	6	11	34	234	390	55	6		2		46
		0.77	1.40	4.34	29.85	49.74	7.02	0.77		.26		5.87
D6	2	4	9	35	225	357	61	5			24	
	0.28	0.55	1.25	4.85	31.16	49.45	8.45	0.69			3.32	
D7		2	5	9	24	197	407	42	4		24	
		0.28	.7	1.26	3.36	27.59	57.00	5.88	0.56		3.36	
D8		2		2	9	15	173	432	29		24	
		0.29		0.29	1.31	2.18	25.18	62.88	4.22	0.15	3.49	
D9	1					1	13	157	530		20	
	0.13					0.13	1.75	21.13	71.33	2.83	2.69	
D10				1		1		6	108	790	16	
				0.11		0.11		0.65	11.71	85.68	1.74	

Notes: Within each decile the first row stands for the number of FDF firms, while the second row stands for % FDF firms in that decile.

Table 6: Shares in FDF in 2011

Variable	Share D10 (%)	Share D10 → D10 (%)
Value-added	16.4	10.9
Employment	10.9	8.2
Exports	13.3	10.2
Debt	15.3	9.8
Interest	15.0	9.2
	Mean	Median
Age	28.9	23.0

# Empirical analysis: Logit model

Table 7: Logit (FE)

	2006 – 2017	2008 – 2013	2014 – 2017
Productivity	-0.042*** (0.001)	-0.035*** (0.002)	-0.040*** (0.004)
Export (dummy)	-0.015 (0.032)	0.035 (0.052)	-0.199 (0.131)
Leverage	0.237*** (0.024)	0.484*** (0.049)	0.245** (0.101)
Profitability	-0.069*** (0.001)	-0.085*** (0.001)	-0.069*** (0.003)
Cash holding	-1.607*** (0.091)	-1.083*** (0.157)	-2.399*** (0.398)
Overdue (dummy)	0.410*** (0.023)	0.276*** (0.037)	0.337*** (0.100)
Bank concentration	-0.868*** (0.044)	-1.025*** (0.081)	-1.118*** (0.211)
Observations	150252	64544	18491

Notes: standard errors in parenthesis. Significance levels: \*, 10%; \*\*, 5%; \*\*\*, 1%.

Table 8: Multinomial Logit, Recovery

	2006–2017	2008–2013	2014–2017
Productivity	0.014*** (0.001)	0.012*** (0.001)	0.023*** (0.001)
Firm age	-0.009*** (0.000)	-0.009*** (0.001)	0.004*** (0.001)
Export (dummy)	0.031* (0.017)	0.092*** (0.022)	-0.026 (0.037)
Leverage	-0.067*** (0.013)	-0.069*** (0.019)	-0.019 (0.020)
Profitability	0.028*** (0.000)	0.026*** (0.001)	0.026*** (0.001)
Overdue (dummy)	-0.424*** (0.015)	-0.364*** (0.019)	-0.314*** (0.029)
Bank concentration	0.179*** (0.023)	0.225*** (0.030)	0.417*** (0.048)
Observations	147465	84206	33467

Notes: standard errors in parenthesis. Significance levels: \*, 10%; \*\*, 5%; \*\*\*, 1%.

Table 9: Multinomial Logit, Exit

	2006–2017	2008–2013	2014–2017
Productivity	-0.022*** (0.002)	-0.037*** (0.002)	0.005 (0.003)
Firm age	0.008*** (0.001)	0.011*** (0.001)	0.008*** (0.002)
Export (dummy)	-0.060 (0.048)	-0.039 (0.060)	-0.114 (0.082)
Leverage	0.051*** (0.019)	0.114*** (0.027)	-0.006 (0.030)
Profitability	-0.006*** (0.000)	-0.008*** (0.000)	-0.003*** (0.000)
Overdue (dummy)	1.560*** (0.034)	1.706*** (0.043)	1.351*** (0.059)
Bank concentration	0.626*** (0.063)	0.808*** (0.080)	0.364*** (0.108)
Observations	147465	84206	33467

Notes: standard errors in parenthesis. Significance levels: \*, 10%; \*\*, 5%; \*\*\*, 1%.



Table 10: Competing Risks

	Recover: 2011	Exit: 2011
Productivity	0.006** (0.003)	-0.012*** (0.002)
Firm age	0.011*** (0.002)	-0.020*** (0.002)
Export (dummy)	0.075 (0.130)	-0.002 (0.063)
Leverage	-0.092 (0.061)	-0.135*** (0.024)
Profitability	0.034*** (0.004)	-0.002*** (0.000)
Overdue (dummy)	-1.084*** (0.121)	0.715*** (0.054)
Bank concentration	0.382** (0.192)	-0.589*** (0.088)
Observations	3205	3205

Notes: standard errors in parenthesis. Significance levels: \*, 10%; \*\*, 5%; \*\*\*, 1%.

$$\text{Std.Dev.Productivity}_{ijt} = \beta_0 + \beta_1 \Delta \text{Productivity}_{ijt} + \beta_2 \text{ShareZombie}_{ijt} + \beta X_{ij,t-s} + \eta_i + \gamma_t + \varepsilon_{ijt}$$

Table 11: Bank level data (2006 – 2017) – Productivity dispersion

	Model (1)	Model(2)	Model (3)
$\Delta$ Productivity	0.357*** (0.065)	0.357*** (0.065)	0.357*** (0.065)
Share Zombie	4.257*** (1.424)	4.252*** (1.422)	4.202*** (1.421)
Loan Ratio Zombie		0.034*** (0.008)	
Loan Ratio Exit			1.378*** (0.355)
Observations	12439	12439	12439

Notes: standard errors in parenthesis. Significance levels: \*, 10%; \*\*, 5%; \*\*\*, 1%.

Table 12: Bank level data (2008 – 2013) – Productivity dispersion

	Model (1)	Model(2)	Model (3)
$\Delta$ Productivity	0.367*** (0.075)	0.367*** (0.075)	0.367*** (0.075)
Share Zombie	3.769* (2.119)	3.824* (2.115)	3.765* (2.120)
Loan Ratio Zombie		0.029*** (0.007)	
Loan Ratio Exit			0.906*** (0.317)
Observations	4817	4817	4817

Notes: standard errors in parenthesis. Significance levels: \*, 10%; \*\*, 5%; \*\*\*, 1%.

Table 13: Bank level data (2014 – 2017) – Productivity dispersion

	Model (1)	Model(2)	Model (3)
$\Delta$ Productivity	0.707*** (0.122)	0.707*** (0.122)	0.705*** (0.122)
Share Zombie	7.126** (2.992)	7.048** (3.000)	6.899** (2.952)
Loan Ratio Zombie		0.120*** (0.039)	
Loan Ratio Exit			2.013*** (0.495)
Observations	2230	2230	2230

Notes: standard errors in parenthesis. Significance levels: \*, 10%; \*\*, 5%; \*\*\*, 1%.

- Higher productivity:
  - reduces the likelihood of being FDF.
  - being FDF, increases the probability of recovery and decreases the probability of exit.
  - accelerates the recovery and delays the exit of FDF.
- Higher leverage and lower profitability.
  - increases the likelihood of being FDF.
  - being FDF, reduces the likelihood of recovery and increases the likelihood of exit.

- The probability of being FDF is inversely related with the concentration of bank loans.
- Firms with less bank concentration are more likely remain in FDF state.
- The higher the share of FDF and the share of credit given to FDF the worse the credit bank allocation.
- The higher the share of credit given to FDF firms that exit the worse the credit bank allocation.