

*Employee training and firm performance  
Evidence from ESF grant applications*

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# Outline

- 1 Introduction
- 2 Programme description (FIG)
- 3 Methodology & Data
- 4 DID effects
- 5 Conclusions

# Motivation & Research Questions

- 'Future of work' - lifelong learning - Artificial intelligence
- Potential of public programmes
  - Which features work best? Supply- vs demand-focus, targeted vs non-targeted, ...
  - EU Structural Funds (ESF+, 101 billion; PT 9%)
- Returns to training - private (workers, firms), public, social
  - Multiple potential outcomes, incl employment and international trade

Does (employee) training pay-off? Are (subsidised) training programmes effective? How to run programmes and select applications? Potential insights for PRR

# Preview & Contributions 1/2

- Quasi-experimental variation in training from €320m programme in Portugal, 2008-2014
  - Grants for firms to train their employees in context of technological or organisational changes
  - Variable co-payment rates; demand-led, flexible content
  - Targeted approach (focus on particular firms and workers)
- Analysis of rich matched (employer-employee-administrative) data over long period (2007-2017)
- DID and RD approaches, based on comparison of successful and unsuccessful bids (and their scores)
- Research published in Labour Economics, 72, 102056, 2021

# Preview & Contributions 2/2

- Significant positive effects on take up and different measures of firm performance (added value, sales, employment, profits)
  - Effects can take three or more years to emerge
  - No positive effects on firm-level wages (possibly due to composition)
  - Positive cost-benefit relationship
- First quasi-experimental evidence on firm-level returns to employee training
  - Insights on designing and evaluating (employee) training programmes

# Theoretical remarks

## Theory dimensions

- Firm-specific vs general training
- Competitive vs monopsonistic labour market

## Sources for underprovision of training:

- Positive externalities (worker mobility)
- Credit constraints
- Lack of evidence of training effects/managerial practices
- Imperfect competition in training markets

Equity dimensions, eg potential lower training returns for low-schooling workers

# Literature

- Returns to training:
  - ALMPs (unemployed, jobseekers): ...
  - Take up: Schwerdt et al (JPubEc 2012), Abramovsky et al (JLabEc 2011), Leuven & Oosterbeek (JLabEc 2004)
  - Productivity: Konings & Vanormelingen (REStat 2015), Almeida & Carneiro (LabEc 2009)
  - Wages: Brunello et al (LabEc 2012), Leuven & Oosterbeek (JAE 2008)
  - Employment, Profitability, International trade: ?
- EU structural funds: Becker et al (AJE:EP 2013), ...
- Management practices: Bloom & van Reenen (QJE 2007), ...
- RDD: Abdulkadiroglu et al (Ectrice 2014), ...

# 'Training for Innovation and Management' (FIG) 1/4

Programme launched in Portugal in 2008, with ESF support

Goals - and application scoring criteria:

- Increasing workers' skills and employability, in the context of technological and organisational changes in their firms (assessment weight: 40%)
- Focus on smaller firms (20%), low-skill workers/certification (10%), promotions and work life balance (15%), new technologies (10%), and equality of opportunities (namely gender; 5%)
- Fostering innovation and higher value-added tradable goods and services; incentivising and empowering firms in training provision



## 'Training for Innovation and Management' (FIG) 2/4

Subsidy (30% to 80%) of total training costs (depending on training type, firm size and region)

- Demand-led: firms subsidised, not training providers
- Indirect costs (salaries) potentially included
- Flexible training formats allowed
- Could be used to meet labour-law *quantity* requirement (35 hours)

Applications accepted depending on their score and funding available

- Minimum score between 50% (quality threshold) and 65% (funding)
- Funding provided could be adjusted (if request above ESF parameters)

# 'Training for Innovation and Management' (FIG) 3/4

Effective funding thresholds (marks out of 100), applicants and funding

Call	Regions			Number of Applicants	Public Funding
	North & Centre & Alentejo	Algarve	Lisbon		
2008:1	50	50	50	1,788	22.9
2008:2	60	50	60	2,203	39.0
2009	62.5	52.5	55	1,736	36.7
2010	65	60	50	2,812	38.7
2011	52.5	50	50	3,852	34.8

# 'Training for Innovation and Management' (FIG) 4/4

190m euros (ESF and national funds) committed in 5 calls (2008-11), separately in 3 regions (15 competitions)

- 12,391 applicants assessed, 6,202 approved, 5,552 funded
- Average public funding of 28k euros per approved firm (+ 20k of private funds)
- Average funding of 3,810 hours of training for 130 workers (29 hours/worker) over 12 months (max: 24)

Similar programmes in many other EU MS:

- GR: New Innovative Entrepreneurship; PL: Professional qualifications and counselling for enterprises; ML: Training Aid Framework

# Data sets

*FIG/POPH* (PT ESF management agency)

- All bids (firms), including scores and funding

*QP* (*Quadros de Pessoal*, Ministry of Employment, Stats PT)

- Matched employer-employee panel data, 2007-2017

*SCIE* (Accounting data, Stats PT)

- All firms, 2007-2017

*CI* (International trade, Stats PT)

- Matched product-country-month-firm panel data, 2007-2017

Merged data set, 2007-2017

- Firm-year panel data (selected and rejected applicants)
- Ongoing research: worker-level analysis (employment, firm mobility, wages, training, gender differences, ...)

## Firm characteristics means, 2008:2 competition, by outcome

	Rejected (n=1,263)	Approved (n=1,001)
Sales	18.5	44.6
Workers	209.6	280.7
Equity	10.7	10.6
Domestic private equity share	75.5	85.8
Foreign equity share	7.1	11
Year of firm birth	1984.2	1986.6
Manufacturing industry (C)	26.9	43
Construction (F)	10.9	11.4
Retail, car repair (G)	15.1	21
Transports, storage (H)	4.7	4.6
Consulting (M)	7.3	3.8
Health, social support (Q)	13.8	2.2
North region	53.8	46.2
Centre	27.5	29.7
Lisbon	15.4	17.6
Application score (centered)	-11.9	6.5

## Exports and workers means, 2008, by outcome

	Rejected (n=1,263)	Approved (n=1,001)
Exports (n=402; n=510)	9.2	18.4
Products exported	28.1	29.4
Countries exported to	8.2	10.3
Product-countries exported to	54.8	58.8
Female	44.6	35.9
Age	38.3	38.3
Tenure	7.4	8.1
Non-permanent jobs share	33.3	32.3
Secondary diploma share	20.7	21.8
University diploma share	19.4	15.6
Monthly salary	876	933
Hourly salary	5.7	5.9
Application score (centered)	-11.9	6.5

# FIG applications means, 2009-10, by outcome

	Rejected (n=1,263)	Approved (n=1,001)
Total funding requested, 2009	76,620	115,921
Funding attributed, 2009	0	43,773
ESF paid, 2009	0	18,166
National public funds paid, 2009	0	6,578
Private funds, 2009	0	18,962
Total funding requested, 2010	5,030	4,585
Funding attributed, 2010	0	23,231
ESF paid, 2010	0	10,206
National public funds paid, 2010	0	3,479
Private funds, 2010	0	9,515
Workers under training - application, 2009 and 2010	179	188.2
Worker under training - approved, 2009 and 2010	0	162.3
Total hours of training - application, 2009 and 2010	5,577	5,618
Total hours of training - approved, 2009 and 2010	0	4,818
Application score (centered)	-11.9	6.5

## Actual training means, 2010-11, by application outcome

	Rejected (n=1,263)	Approved (n=1,001)
Training firms share, 2010	69.2	76.9
Workers under training share, 2010	43.8	52.7
Average hours of training per worker, 2010	21.4	31.2
Average hours of external training per worker, 2010	17.1	24.9
Training firms share, 2011	67.5	72.1
Workers under training share, 2011	42.1	47
Average hours of training per worker, 2011	21.3	22.7
Average hours of external training per worker, 2011	17.5	15.8
Application score (centered)	-11.9	6.5



# Methodology: Application-Score Regression Discontinuity

Using (centered) application scores (and resulting funding decisions, if score  $\geq$  threshold) to identify impact of training

Assumptions (RD as a local randomized experiment):

- Probability of treatment discontinuous at threshold (jumps from 0)
- Forcing variable (application score) continuous around threshold
- Outcome continuous function of forcing variable around threshold
- No discontinuities at threshold (other than treatment)

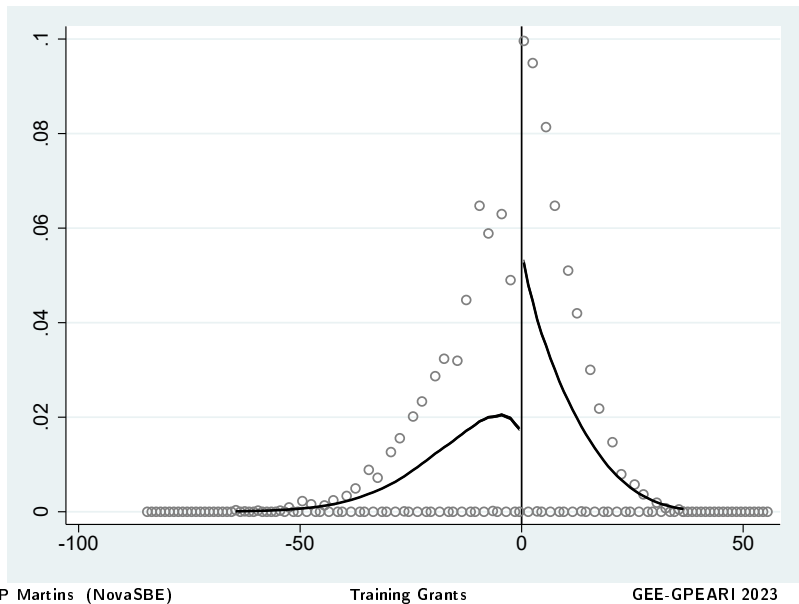
Complementary approach based on DID

# Regression discontinuity: specification and variables

$$\Delta Y_{it} = \alpha + \beta D_i + S(\tilde{Z}_i) + \epsilon_{it} \quad (1)$$

- $\Delta Y_{it}$ : change in (log) outcome between  $t$  (2009-17) and year before bid (2007-10)
  - Firm performance measures, incl gross value added, sales, employment, salaries, etc
- $D_i = I(\tilde{Z}_i \geq 0)$ : intention-to-treat dummy
- $S(\tilde{Z}_i)$ : polynomial function of the (centered) forcing variable (score) of firm  $i$
- Fuzzy version: actual treatment instrument by assignment (ITT) dummy
- SEs clustered at application score

## McCrary tests



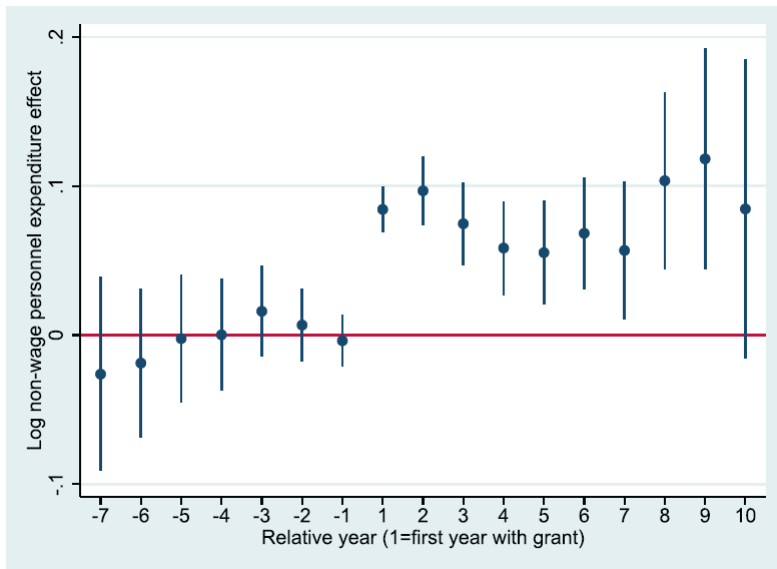
# DID model: specification and variables

$$Y_{it} = \sum_{j=1}^{14} \delta_j I(t = j) + \sum_{j=1}^{14} \beta_j FIG_i * I(t = j) + \alpha_i + \epsilon_{it} \quad (2)$$

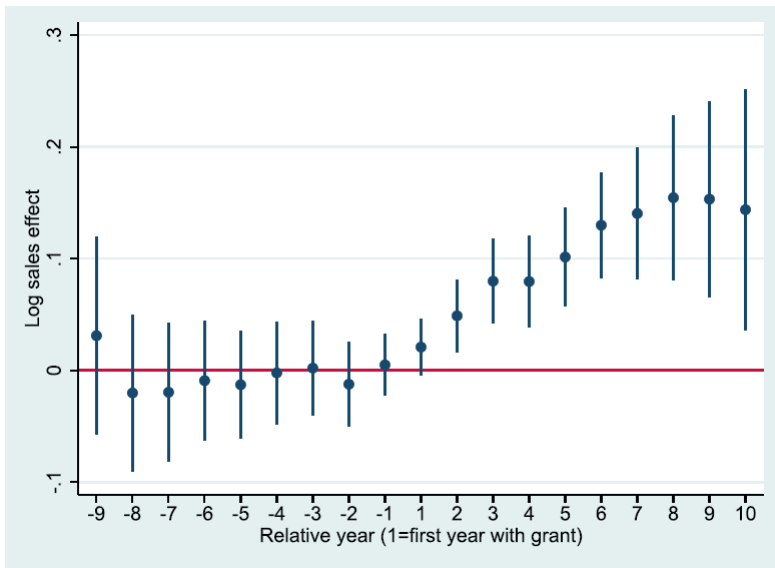
- $Y_{it}$ : (log) outcome of firm  $i$  in (calendar) year  $t$
- $FIG_i$ : treatment dummy
- Up to 4 (10) periods before (after) bid
- $\alpha_i$ : firm fixed effects
- SEs clustered at the firm level

Large positive effects on training (50%-80%) when using 2010 call in DID specification

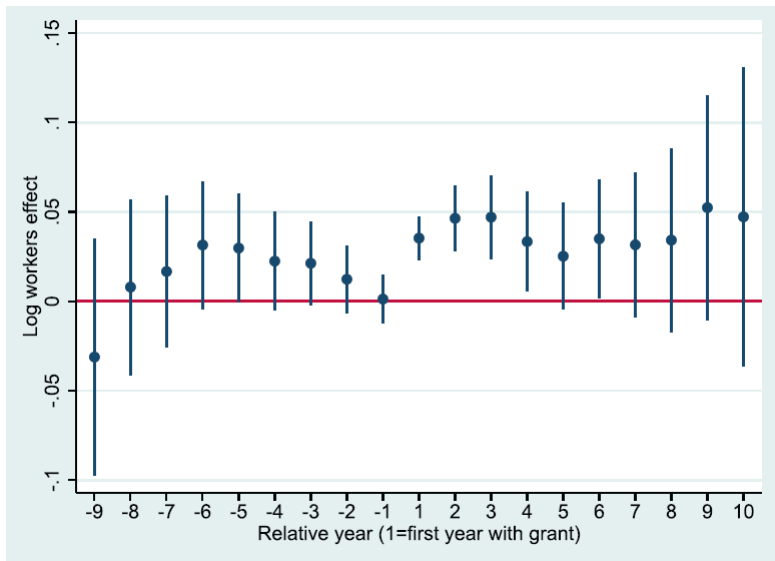
## DID: Non Wage Personnel



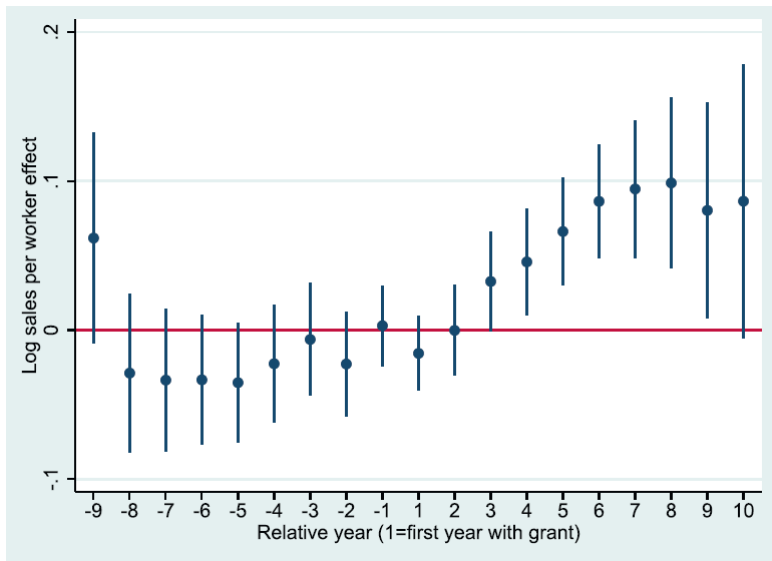
## DID: Log Sales



## DID: Log Employment

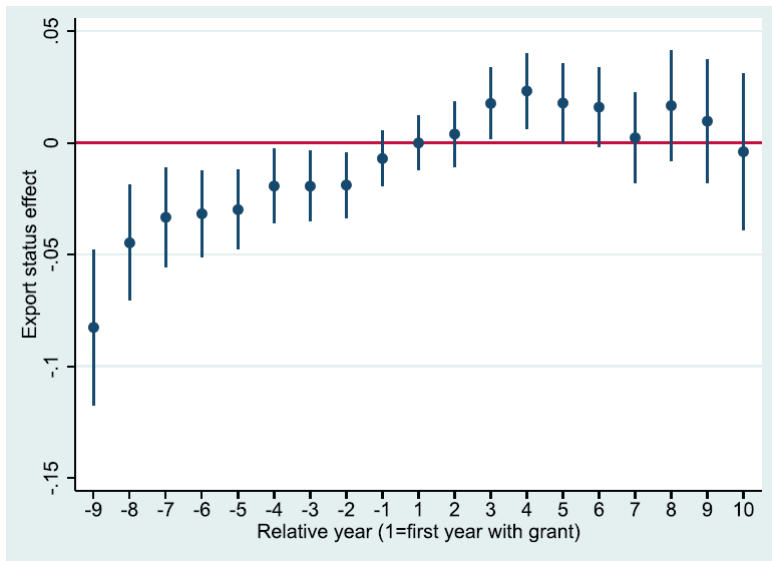


## DID: Log Sales per worker





## DID: Export status



# Conclusions

- Large positive effects of (flexible, demand-oriented, targeted) training grants on firm performance:
  - Increases in value added, sales and employment of around 10% after three years
  - Positive cost-benefit relationship
- Average wages fall, most likely due to composition effects [future research: worker-level]
- Explanations: returns uncertainty, credit constraints, interaction effects
- AS-RD: promising template for evaluations of (EU) programmes