

# Unlocking Innovation: Government Support and Innovation Performance of Micro Firms, the case of Poland

**Barbara Liberda, Krzysztof Szczygielski, Jacek Lewkowicz**

University of Warsaw, Poland

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# Research questions & contribution

***What micro-firm's characteristics are linked with spending on R&D?***

***Is government support received by micro-firms related to spending on R&D?***

- We provide a detailed analysis of the innovation performance of Polish micro-firms, which has been largely unexplored, particularly in the Central and Eastern European context
- By identifying the significant role of government support and other firm-level factors in fostering R&D activities, our research offers valuable insights for policymakers on the basis of a broad and detailed dataset

# Related literature – innovations in micro-firms

- Research and development (R&D) expenditure is a critical determinant of innovation for micro-firms, enhancing internal knowledge and productivity (Acs & Audretsch, 1988; Wallsten, 2000; Stam & Wennberg, 2009; Farè, 2022)
  - micro-firms invest more in R&D per employee than larger firms, leading to higher innovation success (Baumann & Kritikos, 2016; Audretsch et al., 2020)
- Innovation activity is influenced by human-related factors such as leadership, human capital, and pay-incentives. Employment levels within micro-firms also play a crucial role (Salimi & Della Torre, 2022; Tajeddini et al., 2020; Baumann & Kritikos, 2016)
- Firms enhance productivity through investments in hardware (tangibles) and software (intangibles), with varying outcomes depending on the industry (Henard & Dacin, 2010; Gurbaxani & Mendelson, 1992; Gong et al., 2021). The choice of accounting systems reflects firm characteristics that may influence innovation activities (Ruiz & Collazzo, 2021)

# Related literature – innovation policy

- Government policies can address insufficient firm capabilities and weak innovation system linkages (Szczygielski et al., 2017)
- Micro-firms face information asymmetry in capital markets and need favorable tax policies (Holtz-Eakin, 2000). They significantly contribute to technological progress (Brown & Mason, 2014)
- Policies include tax exemptions, grants, technology parks, and public funding in venture-capital sectors (Lundström & Stevenson, 2005; Ratinho et al., 2020; Brown & Mason, 2014)
- Effectiveness of these policies is unclear, with criticisms that grants can crowd out private R&D spending (Ratinho et al., 2020; Brown & Mason, 2014; Wallsten, 2000). Policy re-orientation may be beneficial (Brown & Mason, 2014)

# Data

- Extensive survey of micro-enterprises conducted yearly by Statistics Poland on the representative sample drawn from 2 million micro-firms with up to 9 employees operating in Poland
- Seven repeated waves of ca. 60 thousand micro-firms surveyed annually in the period 2015-2021
- Range of firms' characteristics and the two-digit industry division codes of NACE
- Model regressions executed by Statistics Poland on the survey firm-level data on microenterprises of 420 123 observations for 2015-2021, with truncation of the top 0.001 values for each variable to eliminate evident outlier observations
  - statistical confidentiality

# Logit model

- Our dependent variable ( $RD_i$ ) is binary and takes the value of 1 if the company has incurred R&D expenditures or 0 otherwise
- The baseline set of our independent variables includes
  - accounting type (*accounting*) in a firm (level 1 for companies relying on account books [base level], 2 for those keeping a tax ledger, 3 for those with revenue records, and 4 in case of the absence of separate records)
  - expenditures on computer software ( $exp\_software_i$ )
  - expenditures on new fixed assets, improvements to existing assets, and expenditures on the purchase of used fixed assets ( $exp\_tangible_i$ )
  - employment level including co-owners and partners ( $staff_i$ )
  - public funds as a share of financing sources for expenditures on tangible assets ( $public\_funds_i$ )
  - average wage per employee ( $wage_i$ )
  - effective tax rate as a ratio of income tax to gross profit ( $etr_i$ )

$$P(Y = 1|x_1, \dots, x_k) = \frac{\exp(\beta_0 + \beta_1 x_1 + \dots + \beta_n x_n)}{1 + \exp(\beta_0 + \beta_1 x_1 + \dots + \beta_n x_n)}$$

# Descriptive statistics

Table 1. Descriptive statistics

Variable	min.	1st.qu	median	mean	3rd.qu	q.90%	st. dev.
<i>exp_software*</i>	0	0	0	0.07	0	0	0.9660
<i>exp_tangible*</i>	0	0	0	14.1	0	7.4	222.0755
<i>staff</i>	0	1	1	1.8	2	4	1.6025
<i>public_funds</i>	0	0	0	0.45	0	0	6.1316
<i>wage*</i>	0	0	0	10.9	25.9	33.6	21.0141
<i>etr</i>	-1	0	0.073	0.099	0.154	0.190	0.1502
<i>ind_upstr</i>	1.1	1.3	1.7	1.8	2.2	2.4	0.5464

Source: own elaboration. \* Values in thousands PLN, in real terms adjusted with CPI, expressed in 2021 prices.

# Descriptive statistics

Table 2. Descriptive statistics cont.

variable		% of micro-firms in the dataset
<i>RD</i>		
	no	99.4%
	yes	0.6%
<i>etr</i>		
	low	43.9%
	mid	10.7%
<i>accounting</i>		
1	accounting books	10.1%
2	tax book of income and expenses	67.5%
3	revenue records	18.6%
4	tax card	3.7%

Source: own elaboration.



# Baseline results

	(1)	(2)
accounting_2	-0.3672*** (0.0846)	-0.4246*** (0.0844)
accounting_3	-0.9305*** (0.1953)	-0.932*** (0.1933)
accounting_4	0.2212 (0.4725)	0.2292 (0.474)
exp_software	0.065*** (0.0089)	0.065*** (0.0089)
exp_tangible	0.0000** (0.0000)	0.0000** (0.0000)
staff	0.0752*** (0.0157)	0.0721*** (0.0159)
public_funds	0.0232*** (0.0063)	0.0236*** (0.0062)
wage	-0.0012 (0.0012)	-0.0011 (0.0012)
etr	0.7553*** (0.1842)	
etr_low		-0.2546*** (0.0761)
etr_mid		-0.2413** (0.1399)
year dummies	yes	yes
PKD dummies	yes	yes
cons	-4.8683*** (0.2985)	-4.6346*** (0.3002)
observations	420 123	420 123

# Results

- Baseline specifications
  - positive impact of expenditure on computer software, spending on new fixed assets, the level of employment, the share of public funds in financing investment in assets, and the level of the effective tax rate
  - negative influence of tax ledger or simple revenue records as accounting types and a low or medium effective tax rate
- Robustness checks
  - dummies for low-/high-technology or knowledge-intensive sectors
  - Pavitt-Castellacci taxonomy
  - upstreamness index

# Key messages

- Interplay between firm characteristics, industry-specific factors, and the influence of public funding on R&D activities
  - unique data from Poland's largest micro-enterprise survey
- Positive impact of public funds on R&D expenditures and the role of effective tax rate
- Expenditures on computer software, new fixed assets, and employment levels positively linked with R&D expenditures
- Open avenues for exploring long-term impacts of innovation policies on micro-enterprises using granular data

Thank you  
for your attention!