THE ECONOMIC MULTIPLIER OF THE FCC-EE PROCUREMENT: PRELIMINARY RESULTS

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FCCIS WP4

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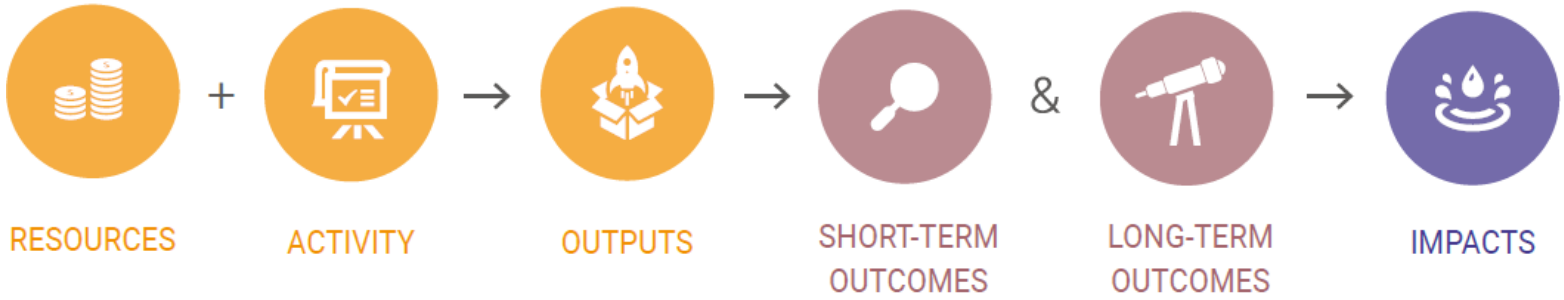
From HEP to industry: logic of the procurement impact pathway



RESOURCES	ACTIVITY	OUTPUTS	SHORT-TERM OUTCOMES	LONG-TERM OUTCOMES	IMPACTS
• Money • Skills • Dedicated staff	Procurement relationships between the firm and the research infrastructure	• N of orders processed • N of products delivered • N of services delivered	• Acquisition of know-how • Product and process innovation • Entered new markets • Acquisition of new clients • Improved firm's reputation		• Increased turnover • Increased profit • Increased employment • New business units

*The graph on the top is from the RI-PATHS Guidebook for Socio-economic Impact Assessment of Research Infrastructures (2020). Deliverable D5.4 https://ri-paths.eu/deliverable/
See also Florio (2019), Investing in Science Social Cost-Benefit Analysis of Research Infrastructures, MIT Press.

The concept of Procurement Economic Multiplier (PEM)

$$PEM = \frac{Incremental\ suppliers'\ \boldsymbol{profit}\ generated\ by\ CERN\ Procurement}{Value\ of\ CERN\ procurement\ contracts}$$

Where **profit is given by incremental revenues net of incremental costs** generated by the procurement contract

- Revenues include:
  - revenues from sales to other customers (non-CERN)
  - costs savings (e.g., more efficient production processes)
- Costs include:
  - additional costs to meet the CERN requirements
  - potential missed opportunities caused by the commitment with CERN
  - potential losses caused by the contract with CERN

PEM: evidence from previous studies

Organisation	Method	PEM	Source
		Average value	
CERN	Survey to suppliers	3	Schmied (1977)
CERN	Survey to suppliers	1.2	Schmied (1982)
CERN	Survey to suppliers	3	Bianchi-Streit et al. (1984)
European Space Agency	Survey to suppliers	3	Brendle et al. (1980), Bach et al. (1988)
European Space Agency	Survey	1.5 – 1.6	Schmied (1982)
European Space Agency	Survey	4.5	Danish Agency for Science (2008)
NASA Space Programmes	Input–Output model	2.1	Bezdek and Wendling (1992)
Italian National Institute of Nuclear Physics	Input–Output model	2 – 2.7	Salina (2006)
John Innes Centre, UK	Input–Output model	3	Webb, D and White, R. (2009)
Italian Space Agency	Econometric regressions model	3	Florio et al., (2021)

PEM ≅ 3

1 CHF spent by CERN in a (high-tech) contract generates 3 CHF of additional profit to suppliers on average

Our study

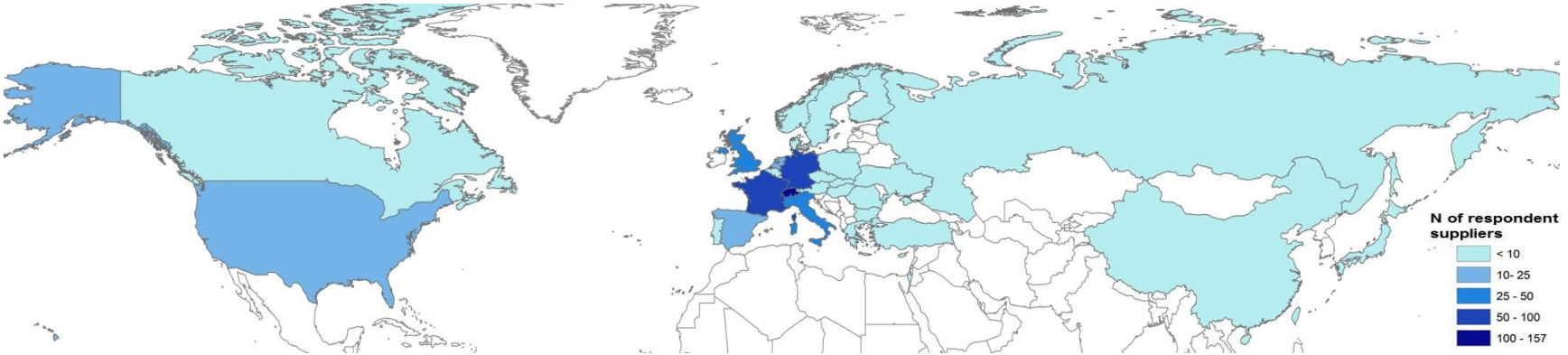
- We wanted to recompute the PEM for more recent CERN procurement data (LHC and HL-LHC)
- Analysis of balance sheet data of suppliers (more objective evidence) triangulated with survey data
- Use the PEM to forecast the socio-economic spillovers of FCC-ee procurement

Source: Author based on Florio (2019; Table 5.1; p. 138). Investing in science: Social cost-benefit analysis of research infrastructures. MIT Press.
The result for the Italian Space Agency (ASI) is from Florio et al., (2021) available at https://www.asi.it/wp-content/uploads/2022/01/Report_ASI-UNIMI.pdf

The procurement activity of CERN (HL-) LHC

Population
4,204 suppliers from 47 countries
33,414 orders
4,318 Million CHF of expenditure

Analysed sample
669 (**15%**) suppliers from 31 countries
8,247 (**25%**) orders
757 (**27%**) Million CHF of expenditure



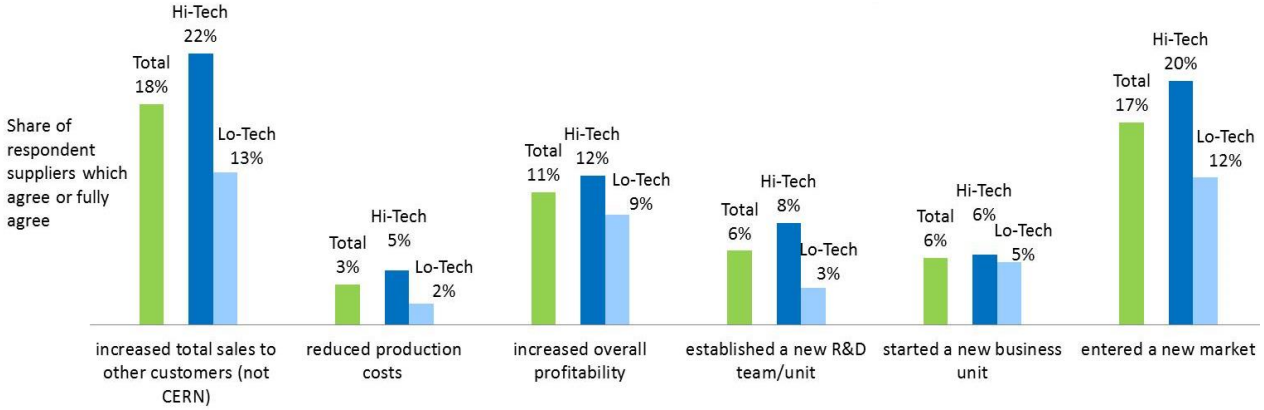
Period 1995 – 2015; Orders > 10.000 CHF

Source: Castelnovo, P., Florio, M., Forte, S., Rossi, L., Sirtori, E. (2018); Florio F., Giffoni, F., Giunta, A., Sirtori, E. (2018)

Impact of procurement activity of CERN (HL-) LHC: evidence from a survey

What was the **innovation level of products and services** supplied to CERN? (tick at most 2 options)

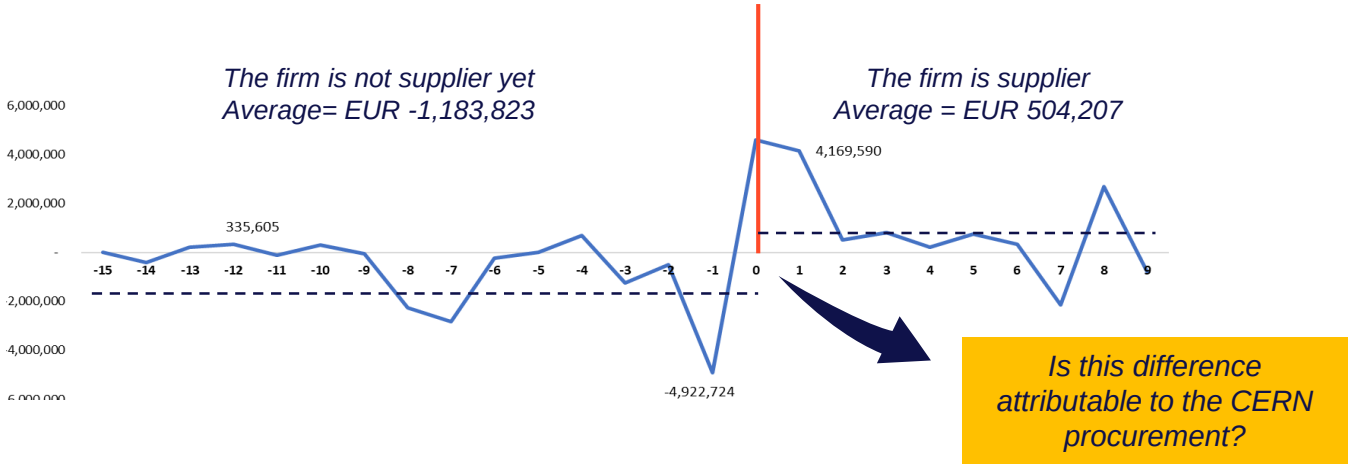
Economic performance. Because of the work with CERN, we …



Source: Florio F., Giffoni, F., Giunta, A., Sirtori, E. (2018) - Number of survey respondents: 669

Impact of procurement activity of CERN (HL-) LHC: analysis of balance sheets data

Average profit* per firm (yearly changes – EUR) wrt the year of the 1st order received by CERN



The challenge to calculate the CERN Procurement Economic Multiplier is to isolate the CERN impact from all other factors that can influence the suppliers' profit (firm's characteristics, firm strategic investment decisions, macroeconomic conditions, etc.)

Profit is defined as EBIT = Earnings before interests and taxes

Estimation of the PEM with an econometric analysis

$$EBIT_{i,t} = \beta_o + \gamma \text{CERN procurement} + \beta_1 Size_{i,t} + \beta_2 \overline{Macro}_t + \beta_3 \bar{Z}_i + \varepsilon_{i,t}$$

Suppliers' profit

Impact of CERN on suppliers' profit

Where:
i is the *i-th* individual, t is the time
EBIT is the suppliers' Earnings before interests and taxes (our proxy of profit)
CERN procurement is a binary variable equal to 1 after receiving the first CERN order and to zero before
Size is the supplier's size (small, medium, large, very large)
Macro is a vector that groups macroeconomic variables (GDP variation, inflation, etc.)

Z is a vector that contains other suppliers' characteristics (total assets, geographical location, etc.)

Estimation of the PEM: results of the regression model

	(4) ΔEBIT
CERN	5999.5** (2365.0)
size_very_large	295.0 (455.9)
size_large	1440.6 (1099.6)
size_medium	77.91 (431.2)
Macroeconomic controls	Yes
Years	Yes
Years*country	Yes
Cons	−2531.8*** (359.4)
R^2	0.114
N	5812

Period 1995 – 2015;
Orders > 10.000 CHF

Dependent variable to be explained: EBIT variation over time

CERN procurement impact on EBIT (th EUR) (γ)

Effect of being a very large-sized supplier wrt be small $(\hat{\beta}_{1,1})$

Effect of being a large-sized supplier wrt be small $(\hat{\beta}_{1,2})$

Effect of being a medium-sized suppliers wrt be small $(\hat{\beta}_{1,3})$

Effects of macroeconomic conditions and time related conditions

Constant of the model $(\hat{\beta}_0)$

Source: Castelnovo, P., Florio, M., Forte, S., Rossi, L., Sirtori, E. (2018)

Estimation of the PEM by type of supplier

	HT (3) ΔEBIT	NHT (4) ΔEBIT
CERN	8631.3** (3766.0)	−2034.0 (2841.5)
ΔTotal Assets (bln)	23,722.3*** (4588.8)	98,216.5*** (5953.9)
Macro controls	Yes	Yes
Years	Yes	Yes
Years*country	Yes	Yes
Cons	-1695.0*** (156.7)	7511.4*** (1298.2)
R^2	0.581	0.511
N	3706	2106

FE regressions.
Standard errors clustered by country in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Castelnovo, P., Florio, M., Forte, S., Rossi, L., Sirtori, E. (2018)

The impact is higher for companies receiving high-tech orders

Impact of CERN procurement on high-tech suppliers' EBIT
It is statistically significant (i.e. different from zero at 5% level)

Impact of CERN procurement on low-tech suppliers' EBIT
It is not statistically significant: ***there is no CERN impact***

Incremental profit generated by CERN for high-tech suppliers (per supplier)

Total N of high-tech suppliers for which financial data from balance sheets were available

$$PEM = \frac{8{,}631\ th\ EUR * 222}{616\ M\ EUR} = \mathbf{3.11}$$

Value of CERN procurement high-tech contracts processed by the 222 high-tech suppliers

From the PEM to the FCC-ee industrial suppliers impact

Socio-economic benefit of FCC-ee for high-tech suppliers

Estimation of FCC-ee cost structure and time profile

Estimation of the share of high-tech procurement

Application of the procurement economic multiplier

Estimation of FCC-ee procurement socio-economic local / regional effects (beyond suppliers)

Main References

Castelnovo P., Florio M., Forte S., Rossi L. Sirtori, E. (2018). **The economic impact of technological procurement for large-scale research infrastructures: Evidence from the Large Hadron Collider at CERN**. Research Policy, 47(9), 1853-1867.

Estimation of the impacts on industrial suppliers from balance sheet data

Florio, M., Giffoni, F., Giunta, A., Sirtori, E. (2018). **"Big Science, Learning, and Innovation: Evidence From CERN Procurement."** Industrial and Corporate Change 27 (5): 915–936.

Analysis of survey data to investigate the impact mechanisms of procurement

CSIL - Centre for Industrial Studies (2018)

Qualitative case studies on a sample of supplier companies

Thank you for your attention