

# Corporate Expenditures on Environmental Protection

Stefanie Haller and  
Liam Murphy  
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# Environmental Expenditures Motivation

- International commitments to reduce Greenhouse gas emissions
- Manufacturing contributed 23%\* of Irish CO<sub>2</sub> emissions in 2007 (excluding Transport)
- Firms may invest in environmental protection because of regulation or in order to give themselves a 'green' image
- Social returns to pollution abatement investment are large

\* Source: EPA, SEI

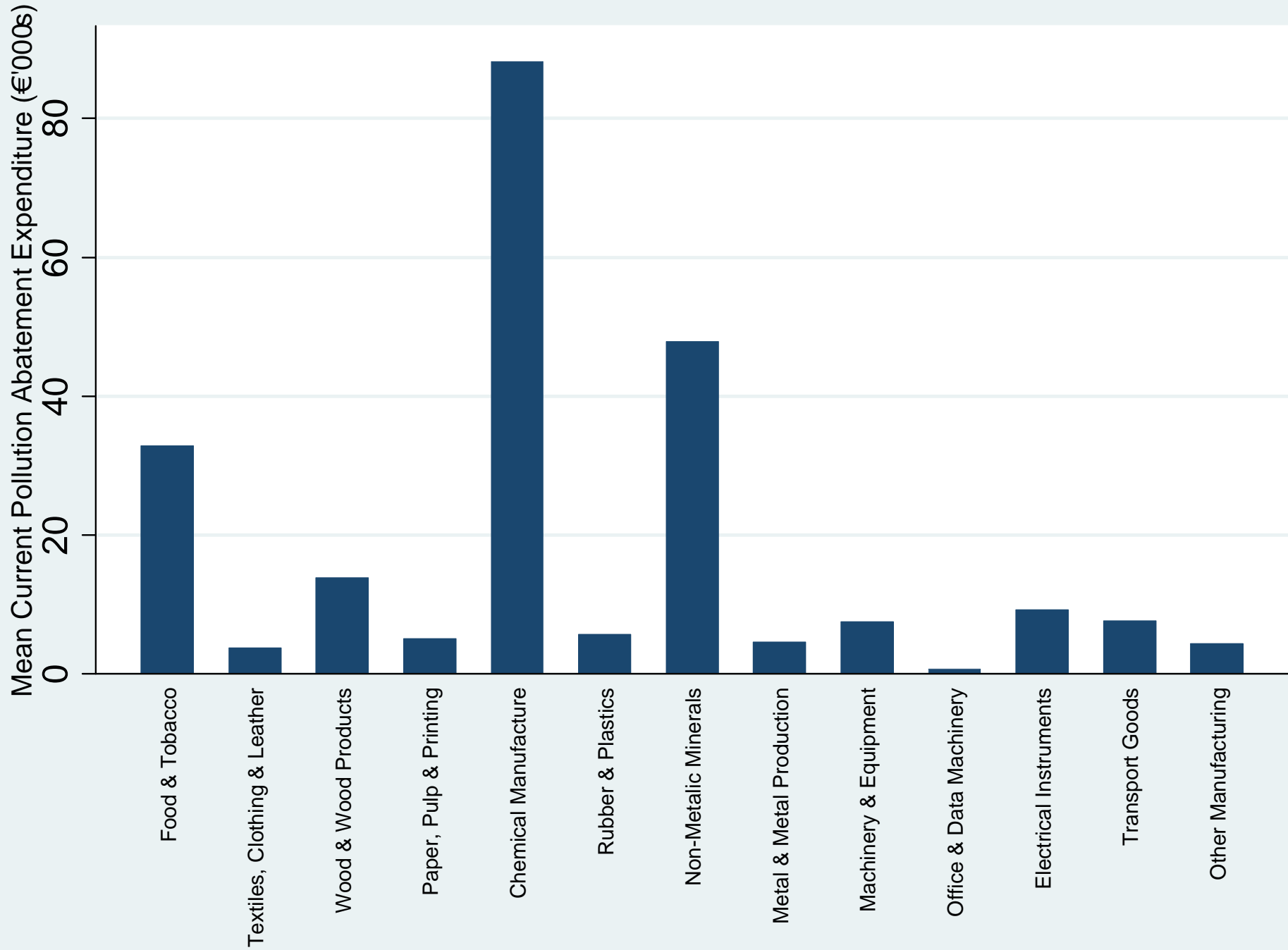
# Two Questions

- Which factors influence a manufacturing firm's decision to commit resources towards environmental expenditure?
- Given that a firm has environmental expenditures – which factors determine the level of these expenditures?

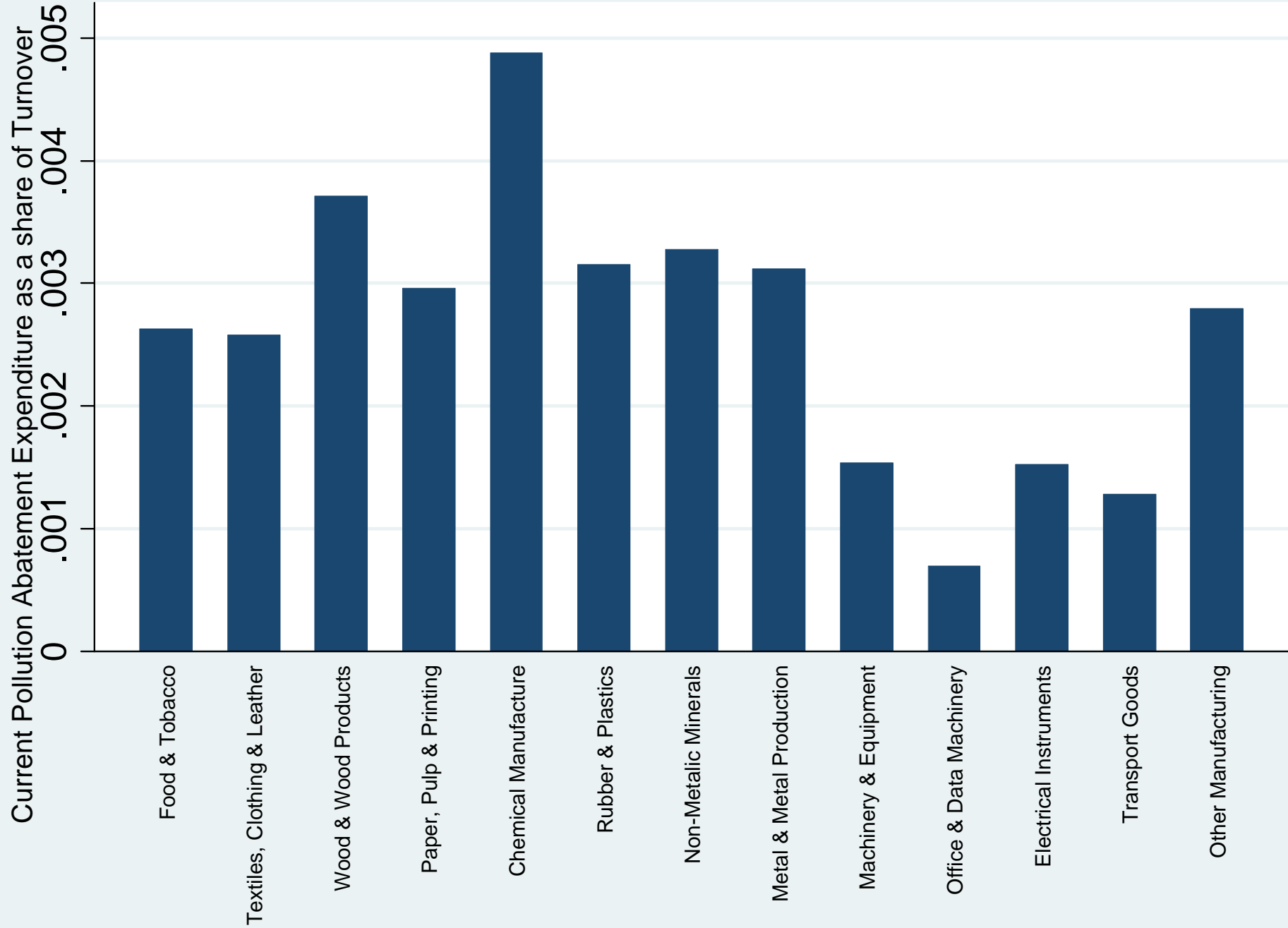
# Dataset

- Irish Census of Industrial Production (CIP)  
Nace Rev. 1.1. Sectors 15-37 for 2006/7 - 9658 observations
- Questions on environmental expenditure and capital expenditure on pollution abatement only asked of firms with 20 or more persons engaged (F forms)
- Only fully completed entries included
- 2622 Observations – 2023 Censored (i.e. current environmental expenditure was 0)
- 10.3% of firms in CIP, 25.6% of employment, 35.3% of gross value added in 2007\*

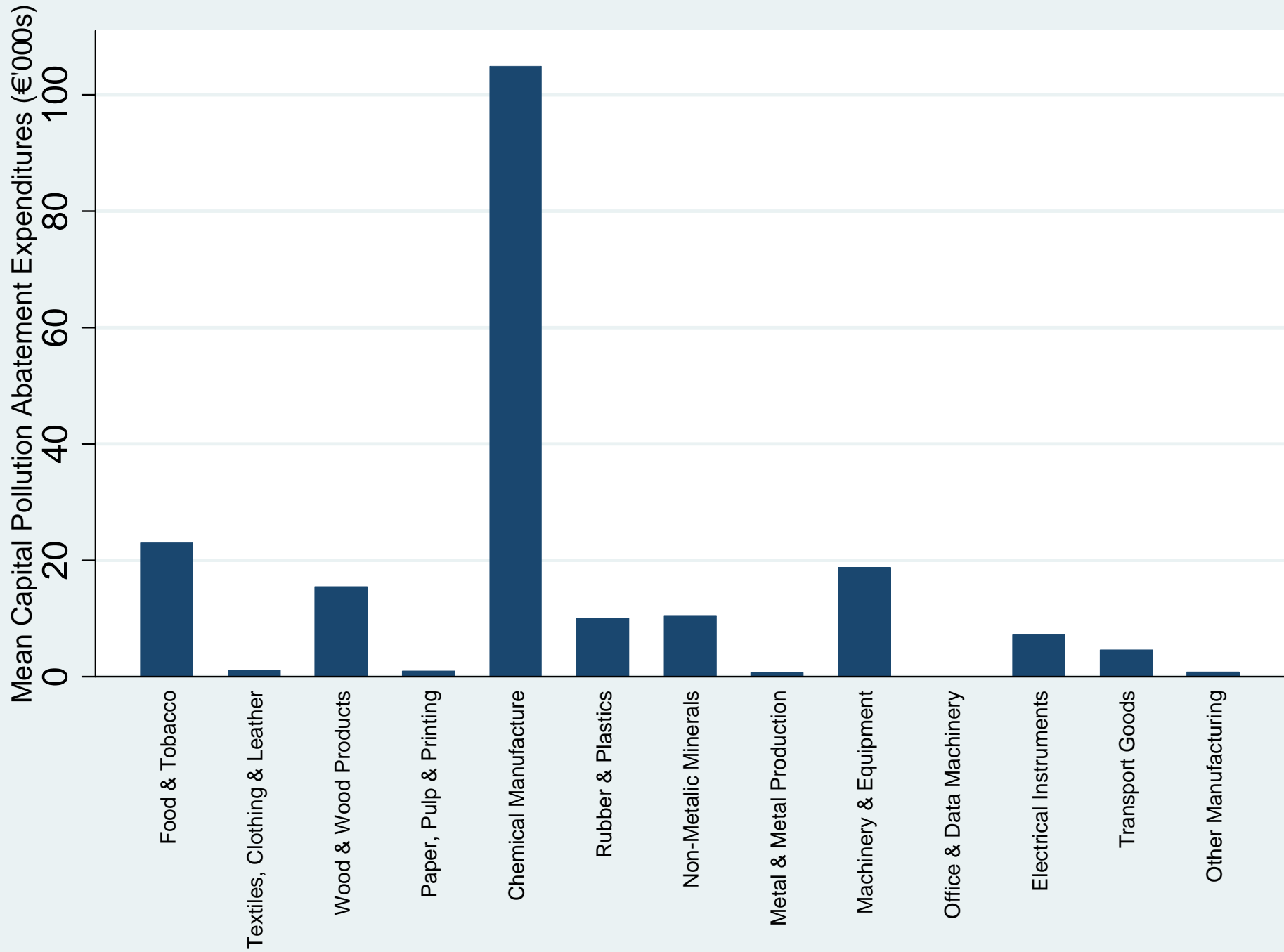
\* *Source: own calculations from CIP*



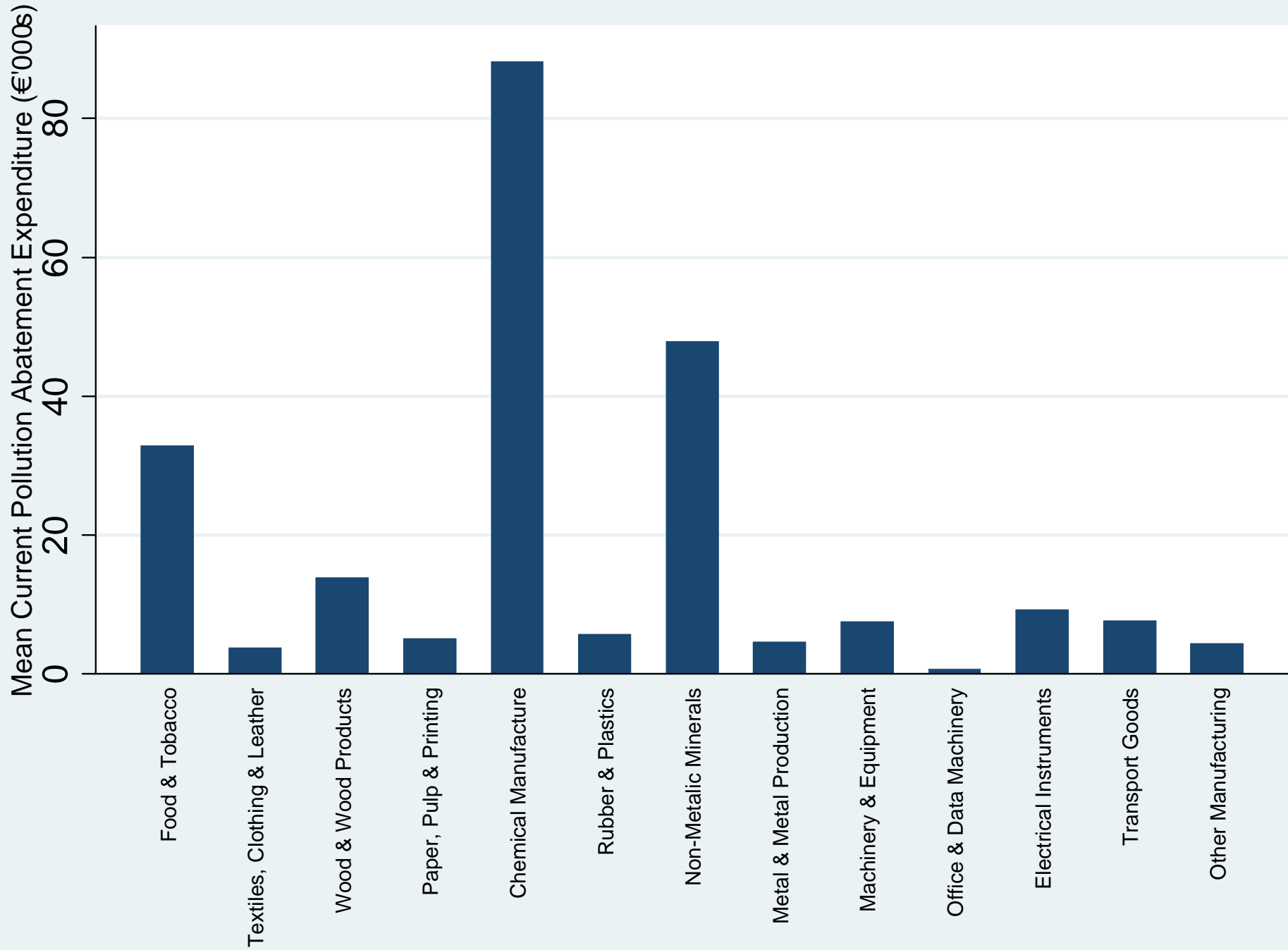
*Current Pollution Abatement Expenditures by Sector*



*Current Pollution Abatement Expenditure Share by Sector*



Capital Pollution Abatement Expenditures by Sector



*Current Pollution Abatement Expenditures by Sector*

# Methodology

## Heckman selection model

- First stage: probit model on determinants of firm's decision to spend
- Second stage: determinants of how much firms spend given that they spend

# Explanatory Variables

- *Size* –  $\log(\text{number of Persons engaged})$
- *Age* –  $\log(\text{age})$
- *Foreign* – Foreign ownership dummy variable
- *Export* – Exporter dummy variable
- *Einten* – Energy intensity = fuel use/turnover
- *ETS* – Member of EU emissions trading scheme
- Control Variables – Year, NACE sector and Region

# ETS

- Variable not Included in CIP
- Form Proxy for ETS – Based on Sectors in ETS and Emissions Threshold
- Ireland's ETS Threshold Based Mix of Various Inputs and Outputs
- Adopt UK Threshold – 10,000 t Carbon per Annum
- All firms with carbon output from fuel in excess of UK threshold record value of 1

<b>M o d e l</b>	<b>S e l e c t i o n</b>	<b>R e g r e s s i o n</b>
<b>D e p e n d a n t V a r i a b l e</b>	<b>E n v i r o n s p</b>	<b>L o g ( E n v i r o n )</b>
<b>L o g ( S i z e )</b>	<b>0.140*** (0.039)</b>	<b>0.698*** (0.074)</b>
<b>L o g ( A g e )</b>	<b>0.061** (0.035)</b>	<b>0.003 (0.075)</b>
<b>F o r e i g n</b>	<b>-0.009 (0.091)</b>	<b>0.303** (0.150)</b>
<b>E x p o r t</b>	<b>0.582*** (0.089)</b>	<b>0.028 (0.214)</b>
<b>E i n t e n</b>	<b>0.026* (0.016)</b>	<b>0.015 (0.021)</b>
<b>E T S</b>	<b>0.321** (0.164)</b>	
<b>Y e a r 2 0 0 7</b>	<b>-0.148*** (0.038)</b>	<b>0.200** (0.085)</b>
<b>C o n s t a n t</b>	<b>-1.907*** (0.220)</b>	<b>1.491** (0.742)</b>

## **Results – Explanatory Variables**

Base region and industry – Food and tobacco firm located in Dublin

<b>Model</b>	<b>Selection</b>	<b>Regression</b>
<b>Omitted Industry - Food and Tobacco</b>		
<b>Textiles ,Clothing &amp; Leather</b>	<b>-0.387* (0.228)</b>	-0.497 (0.439)
<b>Wood</b>	0.259 (0.165)	-0.059 (0.262)
<b>Paper and Pulp</b>	-0.155 (0.141)	-0.586 (0.261)
<b>Chemical</b>	0.085 (0.144)	<b>0.430* (0.261)</b>
<b>Rubber and Plastic</b>	-0.197 (0.149)	-0.435 (0.304)
<b>Non-Metallic</b>	-0.049 (0.174)	0.052 (0.269)
<b>Metal</b>	<b>-0.281** (0.142)</b>	-0.086 (0.269)
<b>Machinery</b>	<b>-0.292** (0.149)</b>	<b>-0.627** (0.271)</b>
<b>Office Equipment</b>	<b>-0.592* (0.344)</b>	-1.981 (0.498)
<b>Electrical &amp; Optical Equipment</b>	-0.186 (0.136)	<b>-0.883*** (0.223)</b>
<b>Transport Equipment</b>	0.247 (0.217)	<b>-1.772*** (0.307)</b>
<b>Other</b>	0.145 (0.116)	0.084 (0.203)
<b>Omitted Region - Dublin</b>		
<b>Border</b>	0.058 (0.120)	-0.242 (0.214)
<b>Midlands</b>	0.194 (0.145)	<b>-0.565** (0.247)</b>
<b>West</b>	0.099 (0.138)	-0.284 (0.265)
<b>Mideast</b>	<b>0.244** (0.121)</b>	-0.189 (0.212)
<b>Midwest</b>	0.128 (0.138)	0.050 (0.263)
<b>Southeast</b>	-0.034 (0.124)	0.288 (0.233)
<b>Southwest</b>	0.145 (0.116)	0.084 (0.203)

## **Results – Sector/Region Variables**

# Results

- Size, Age, Export, Energy Intensity and Year significant in selection model
- Size, Management Quality and Year significant in Regression Model
- No strong trends in control variables –  
Nace29: Machinery is only variable significant in both models

# Robustness Checks

- Adjust Threshold on ETS Variable
- Potential biases due to firms completing the incorrect survey forms
- Different Regional Variables

# Ongoing Work

- Add water charges to model on the assumption that water abatement is also included in pollution abatement figures
- Change ETS variable to a dummy variable for IPPC licences
- Further investigation of determinants of capital pollution abatement expenditures

# Conclusions

- Firm size, age, export status and energy intensity have a positive impact on a firm's decision to invest in environmental protection
- Larger and foreign-owned firms spend more on environmental protection and there is a positive time trend
- Firms for whom environmental concerns are most costly in terms of production and image do most to address them