



RISING ENERGY PRICES AND PRODUCTIVITY: SHORT-RUN PAIN, LONG-TERM GAIN?

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Soaring energy prices have raised concerns on the risks energy price shocks pose for firms' performance...

“Energy prices have become unsustainable for firms (...) the most exposed are those having gas and electricity at the center of production: metal, glass, cement, and paper.”

Il Post, Italy

“Nine out of 10 small businesses say rising energy costs over the past 12 months have forced them to change the way they operate (...) modifying processes or even stopping production to cope”

Accountants Daily, Australia

... and for the green transition

“Increasing energy savings and efficiency and scaling up renewables are expected to alleviate the pressure on energy prices, while boosting the green transition in the EU.”

European Commission



Motivation

A **trade-off** between **short-** and **long-term** policy objectives when facing energy price increases?

Short-term

To preserve their economic performance and industrial jobs, it may be temporarily necessary to **shield firms from energy price shocks**.

vs

Long-term

To reduce dependence on fossil fuels, a **strong price signal providing the right incentives for firms** to invest in energy saving technologies is needed.

How to **navigate a potential trade-off**? It is first necessary to understand:

The **impact of energy price shocks on firms' performance** over short and medium term.

and

The **conditions under which the impacts** of energy price increases on firms **materialise**.



Our paper

What we do

We investigate the potential impact of **energy price shocks** on **firm productivity**.

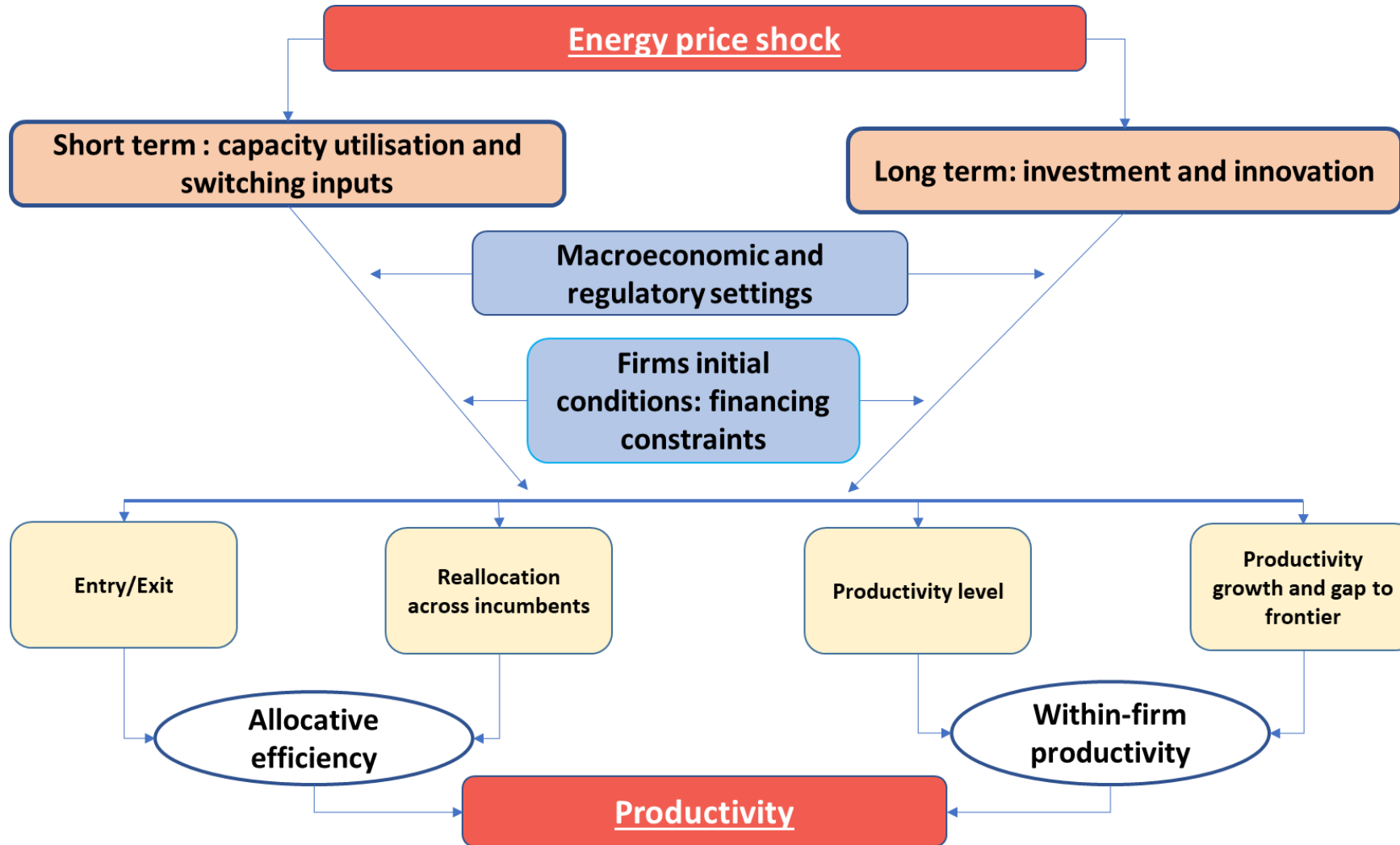
How we do it

Empirical analysis on a **panel of firms**, located in **21 countries** for the period **1995-2020**:

- Focusing on heterogeneity across countries, sectors and firm characteristics;
- Distinguishing between short- and medium-term impacts;
- Understanding the channels behind impacts.



Analytical framework: from energy prices to productivity





Data

1

Firm-level data

- **Orbis database:** Financial information for both listed and unlisted firms in manufacturing and construction sectors and located in 21 countries.
- **Productivity measures:** Multi-factor productivity (MFP) a la Wooldridge (2009), value added based production function, and Labor productivity (LP), computed as value added over number of employees.

Details

2

Energy prices

- **Price indices** constructed as averages of country- and fuel-specific prices weighted by country- and sector-level fuel consumption (Sato et al., 2019):

$$\ln(\text{EnPrice}_{s,c,t}) = \sum_f w_{f,s,c} \ln(\text{Price}_{f,c,t})$$

- Price “shocks”: annual change larger than 10% (1 SD) [mild shock] or larger than 15% (1.5 SD) [severe shock].

Details

3

Macro and policy variables

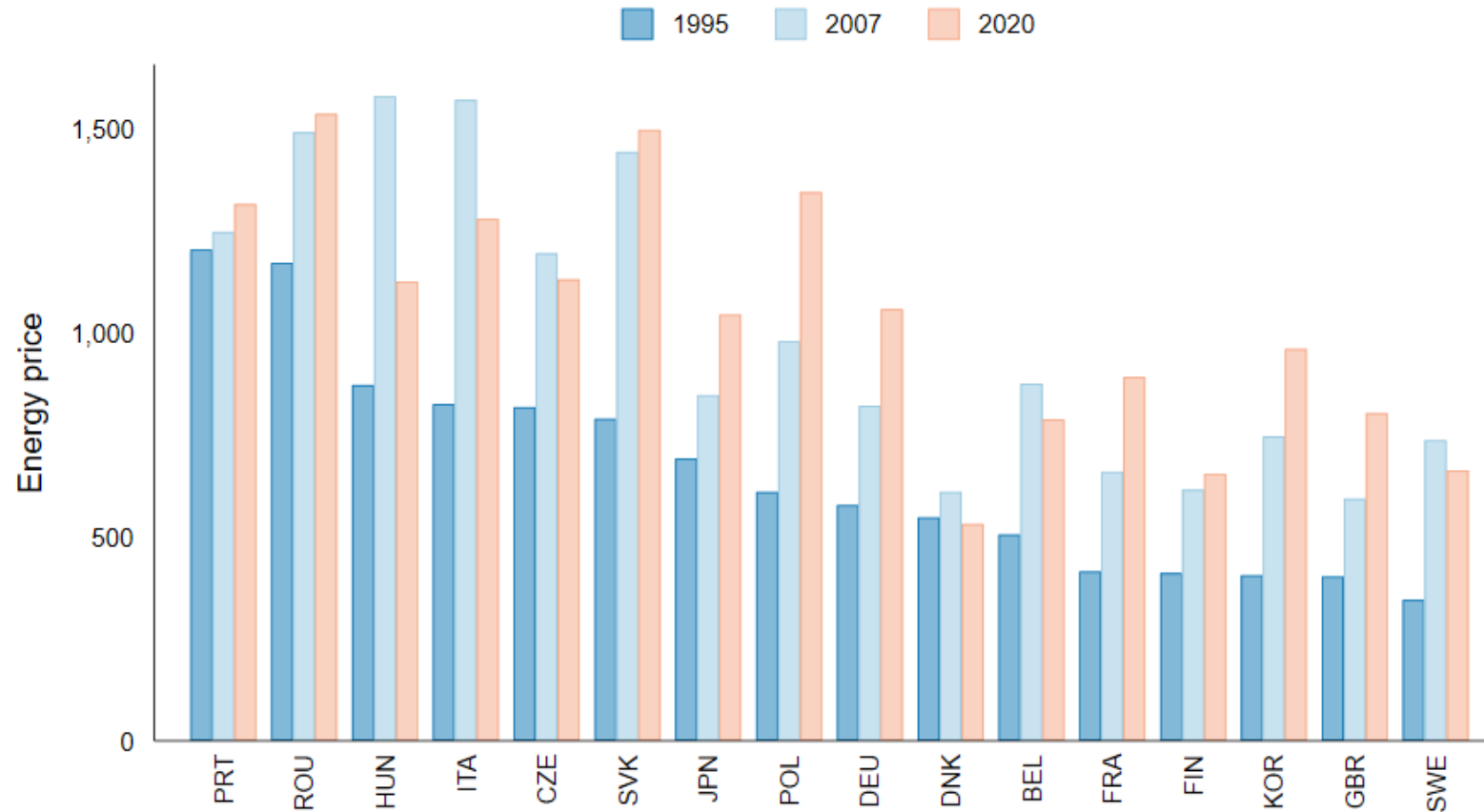
- *Country level:* Environmental Policy Stringency (EPS) indicator from the OECD, Economic Policy Uncertainty, Financial Development, Output Gap.
- *Sector level:* External Finance Dependence, Energy Intensity.

Details



Data (cont'd)

Energy prices varied markedly across countries





Methodology (1): static analysis

“Static” panel fixed effects model:

$$Productivity_{i,c,s,t} = \beta_0 + \beta_1 \underbrace{EnPrices_{cs,t-1}}_{(Exposure_{ics} * EnPrices_{cs,t-1})} + \beta_2 X_{ics,t-1} + \delta_i + \underbrace{\delta_{ct} + \delta_{st}}_{\delta_{cst}} + \varepsilon_{icst}$$

Approach a la Rajan-Zingales (1998)

- $Productivity_{icst}$: log level of MFP or LP.
- $Enprices_{cs,t-1}$: lagged log level of energy prices.
- X_{ics} : set of firm level controls, including firms' size classes, age, leverage ratio, profitability + lagged capital to assets ratio when depvar is LP.
- δ_i : firm fixed effects, which subsume country by sector FE.
- δ_{ct}, δ_{st} stand for country by time and sector by time fixed effects, respectively.



Static analysis: Energy prices and productivity are inversely related

Dependent Variable: (Log) Productivity Level						
<i>Productivity measure</i>	(1) MFP	(2) LP	(3) MFP	(4) LP	(5) MFP	(6) LP
Lag Energy Prices	-0.075*** (-2.6)	-0.104*** (-3.5)				
Lag Energy Prices * Small Firm			-0.043*** (-7.9)	-0.053*** (-9.4)		
Lag Energy Prices * Low Mark-up Firm					-0.161*** (-17.7)	-0.144*** (-19.4)
Observations	6,606,830	6,606,830	6,606,382	6,606,382	6,606,382	6,606,382
R-squared	0.829	0.802	0.835	0.809	0.835	0.809
Firm Level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country by Sector FE	Subsumed	Subsumed	Subsumed	Subsumed	Subsumed	Subsumed
Country by Year FE	Yes	Yes	Subsumed	Subsumed	Subsumed	Subsumed
Sector by Year FE	Yes	Yes	Subsumed	Subsumed	Subsumed	Subsumed
Country by Sector by Year FE	No	No	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: T-statistics in parentheses; standard errors clustered at the firm and country-sector-year level. Significance Level: *10%, **5%, ***1%.



Methodology (2): dynamic analysis

Short-term analysis: Catch-up model of productivity growth

$$\Delta Productivity_{i,c,s,t} = \beta_0 + \beta_1 Priceshock_{c,s,t-1} + \beta_2 GapToFrontier_{i,c,s,t-1} + \beta_3 \mathbf{X}_{i,c,s,t-1} + \delta_{cs} + \delta_{ct} + \delta_{st} + \varepsilon_{icst}$$

Medium-term analysis: Local projection estimator (Jordà, 2005)

$$Productivity_{i,c,s,t+k} - Productivity_{i,c,s,t-1} = \beta_1 GapToFrontier_{i,c,s,t-1} + \beta_2 Priceshock_{c,s,t-1} + \sum_{h=1}^k \varphi_h Priceshock_{c,s,t+h} + \sum_{h=1}^2 \varphi_h Priceshock_{c,s,t-h} + \beta_4 \mathbf{X}_{i,c,s,t-1} + \delta_{cs} + \delta_{ct} + \delta_{st} + \varepsilon_{icst}$$

where $k = \{0, \dots, 4\}$ and:

- $\Delta Productivity_{icst}$: MFP or LP growth (i.e. log difference).
- $GapToFrontier_{i,c,s,t-1}$: distance from the productivity frontier.
- $Priceshock_{c,s,t-1}$: lagged shock to energy prices.
- $\mathbf{X}_{i,c,s}$: set of firm level controls, including firms' size classes, age, leverage ratio, profitability + lagged capital to assets ratio when depvar is LP.
- $\delta_{cs}, \delta_{ct}, \delta_{st}$ stand for country by sector, country by time and sector by time fixed effects, respectively.



Short-term pain?

Yes, relatively sharp price increases lower productivity

Dependent Variable: MFP growth				
	(1)	(2)	(3)	(4)
<i>Size of the price shock</i>	Mild	Severe	Mild	Severe
Energy Price Shock	-0.003 (-0.9)	-0.011*** (-3.0)		
Price Increase Shock			-0.008* (-1.8)	-0.010** (-2.0)
Price Decrease Shock			-0.004 (-0.5)	0.014** (2.0)
Lag MFP Gap To Frontier	0.306*** (89.8)	0.306*** (89.8)	0.306*** (89.8)	0.306*** (89.8)
Observations	6,188,824	6,188,824	6,188,824	6,188,824
R-squared	0.239	0.239	0.239	0.239
Controls	Yes	Yes	Yes	Yes
Country by Sector FE	Yes	Yes	Yes	Yes
Country by Year FE	Yes	Yes	Yes	Yes
Sector by Year FE	Yes	Yes	Yes	Yes
Firm FE	No	No	No	No

Note: T-statistics in parentheses; standard errors clustered at the firm and country-sector-year level.
Significance Level: *10%, **5%, ***1%.



Short-term pain?

The capacity utilisation channel

Dependent Variable: Capacity Utilisation				
	(1)	(2)	(3)	(4)
<i>Size of the price shock</i>	Mild	Severe	Mild	Severe
Energy Price Shock	-0.359** (-2.5)	-0.580*** (-2.9)		
Price Increase Shock			-0.585*** (-3.0)	-0.637** (-2.2)
Price Decrease Shock			0.007 (0.0)	0.486* (1.8)
Observations	6,536,522	6,536,522	6,536,522	6,536,522
R-squared	0.629	0.629	0.629	0.629
Controls	Yes	Yes	Yes	Yes
Country by Sector FE	Subsumed	Subsumed	Subsumed	Subsumed
Country by Year FE	Yes	Yes	Yes	Yes
Sector by Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes

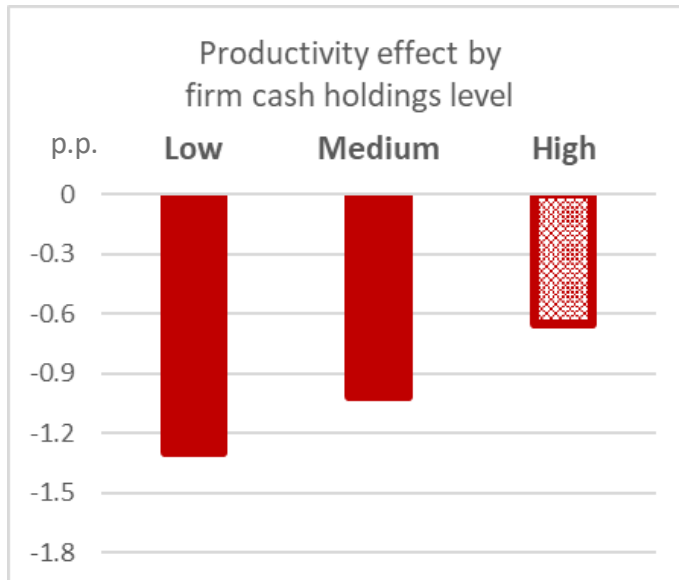
Note: T-statistics in parentheses; standard errors clustered at the firm and country-sector-year level. Significance Level: *10%, **5%, ***1%. Capacity utilisation is proxied by the ratio of revenues over lagged fixed assets.



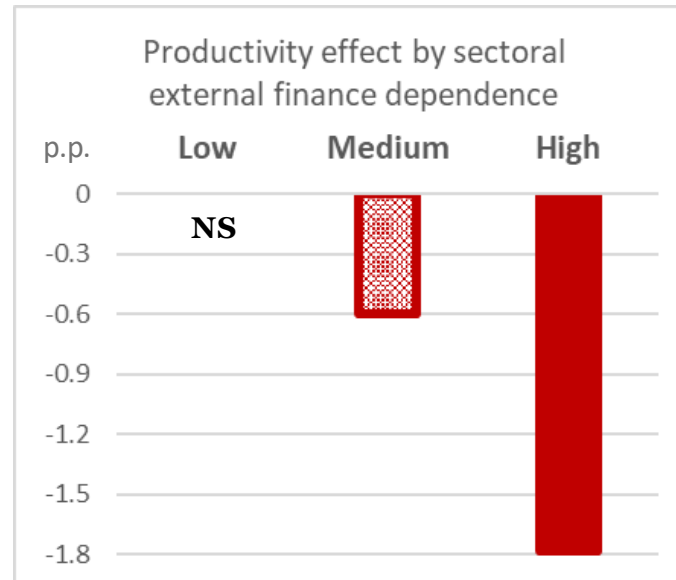
Short-term pain?

The role of financial and macroeconomic conditions

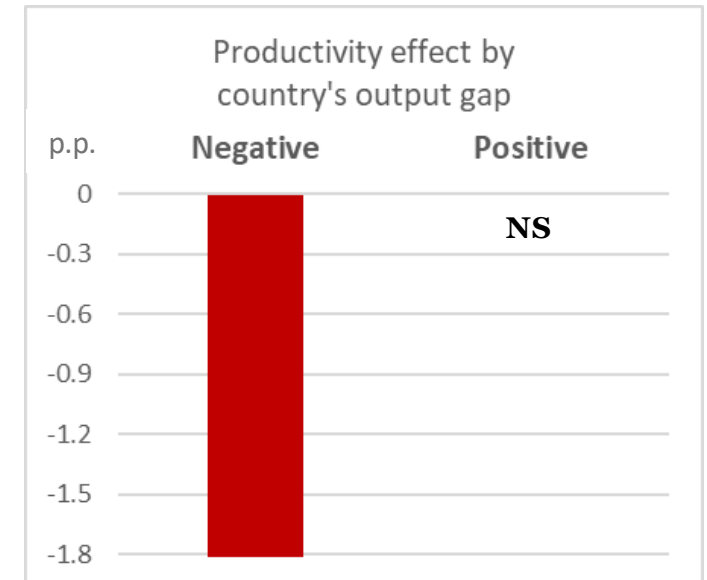
Larger cash buffers help cushioning energy price shocks



Firms in external finance dependent sectors are more exposed



The economic momentum matters: effect tends to vanish when output is above potential



Note: A bar with a solid fill indicates results that are statistically significant at the 5% level, while a pattern fill indicates results significant at the 10% level and “NS” results that are not statistically significant. Low, medium and high stand respectively for 10th, 50th and 90th percentile of the distribution of the interaction variable of interest.



Robustness checks

Productivity

- Findings are qualitatively and quantitatively unchanged when using LP in place of MFP.

Energy prices

- Use of an alternative year to fix fuel consumption shares.
- Use of time varying fuel consumption shares.
- Use of alternative thresholds (in a similar ballpark) to define the shocks.

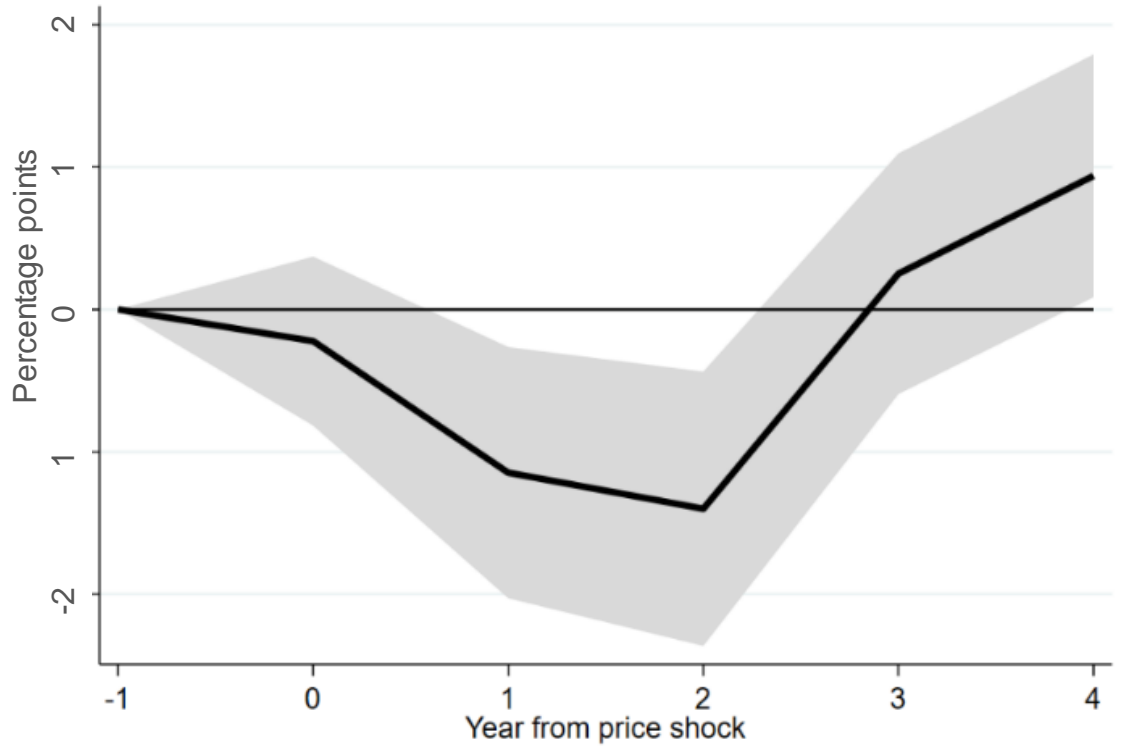
Sample

- Restrict the sample to a subset of firms displaying a longer panel.
- Variations in the period covered by the analysis (e.g. exclusion of GFC, starting the sample at the year fixing the shares...).
- Variations in countries and sectors included.

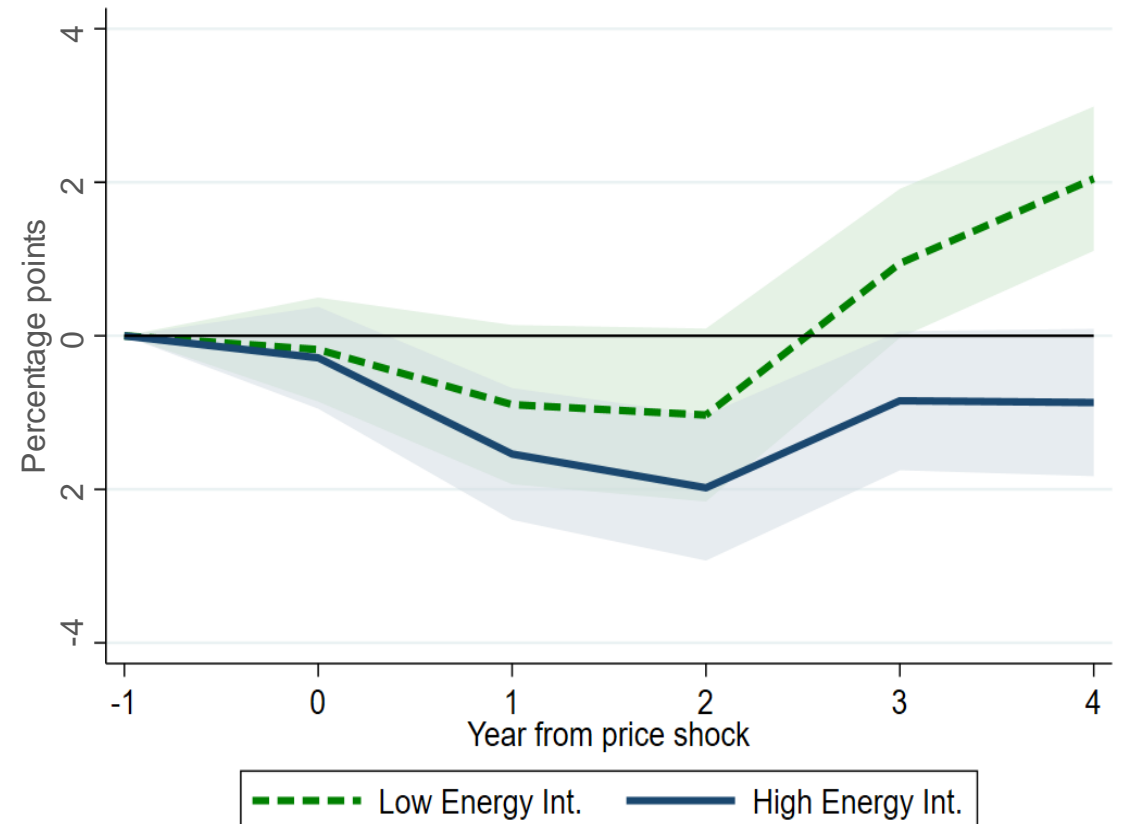


Long-term gains? Yes, but only under certain conditions

Response over time of MFP growth to a mild (1-standard deviation) price shock



Response of MFP growth to a mild price shock: results by energy intensity

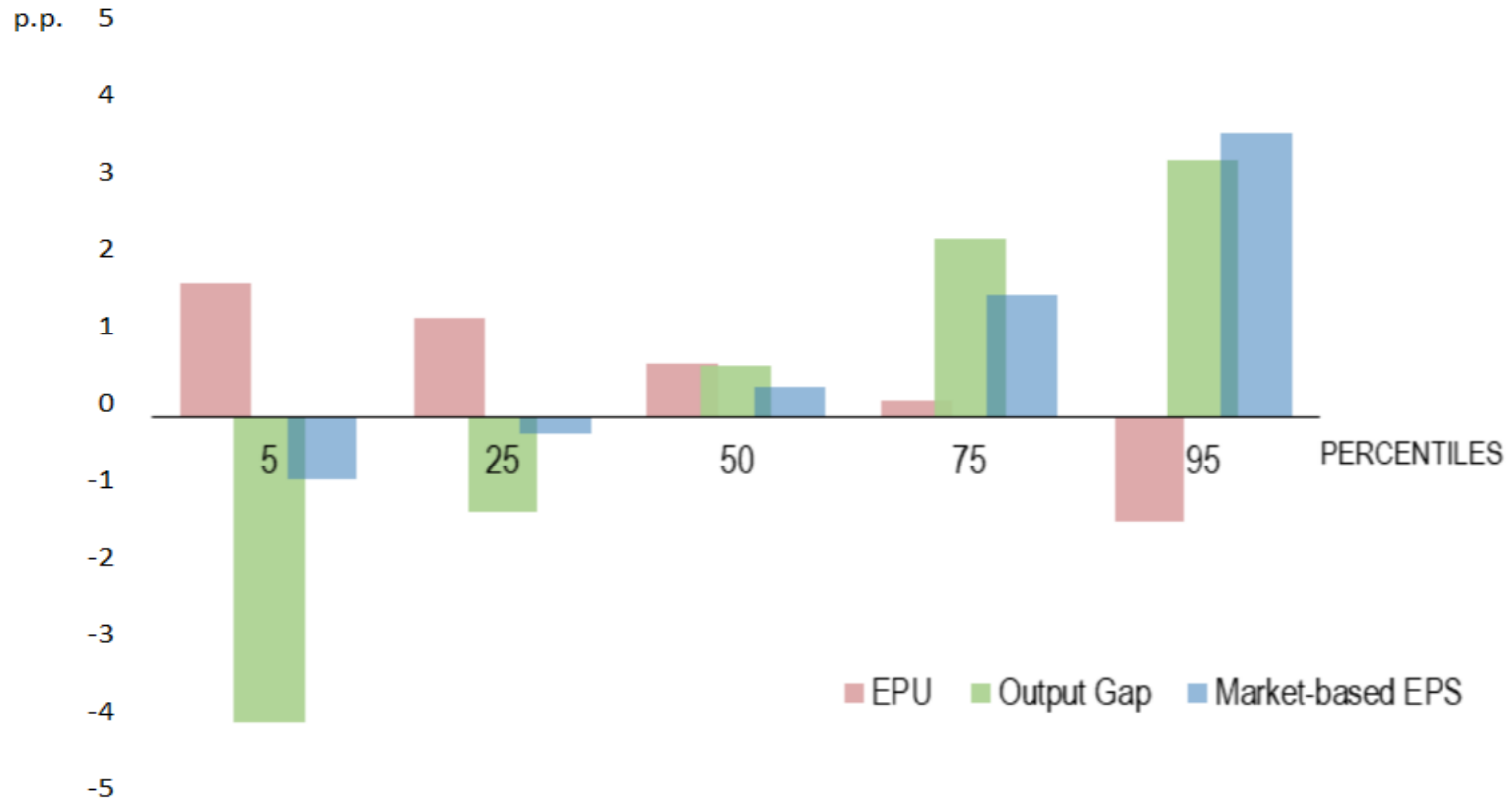


The effect of severe price shocks remains negative also in the medium run.



Long-term gains: an investment tale?

Effect of energy price shocks on productivity growth for different levels of existing EPS, EPU and Output Gap (horizon=4)

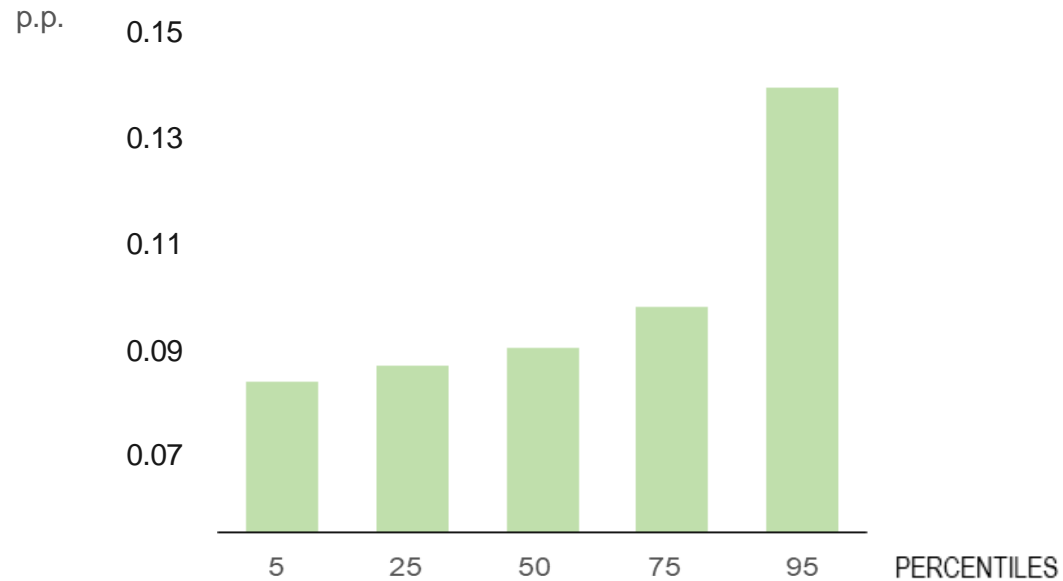




Long-term gains: an investment tale? (cont'd)

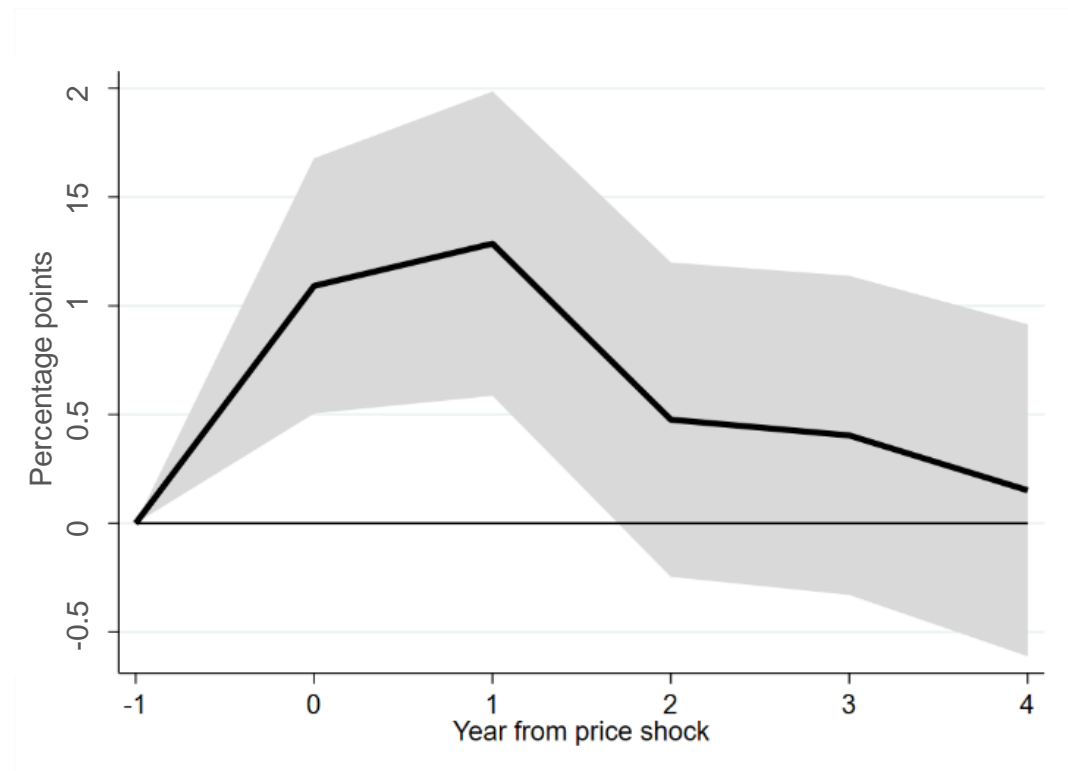
The role of pre-shock investment

Effect of energy price shocks on productivity growth 4 years after the shock, by pre-shock investment



Post-shock investment patterns

Response over time of investment to a mild (1-standard deviation) price shock





Policy implications

Governments wishing to ***preserve firm performance*** and avoid the risks of productivity stagnation while ***promoting the green transition*** could consider the following:

Maintain well-defined price signals on fossil fuel energy, especially in expansionary periods of the business cycle when the cost of adjustment is lower.

Facilitate firms' access to finance, reduce policy uncertainty and strengthen environmental policy to support firms' investments in energy efficiency.

Support small and financially constrained firms when faced with severe price shocks to offset potential scars to the corporate sector.

Thank you!

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ANNEX



Firm-level data

- **Orbis** data: large cross-country panel firm-level dataset, including both listed and unlisted firms.
- Firms operating in manufacturing and construction sectors and located in 21 countries:
 - BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, JPN, KOR, POL, PRT, ROU, SVK, SVN, SWE.
- To ensure firms' comparability across countries and sectors, the data are prepared as in Gal (2013) and Kalemli-Ozcan et al. (2015).
 - Noteworthy, very small firms (< 3 employees) were excluded to avoid data quality concerns.
- Productivity measures:
 - Multi-factor productivity (MFP) a la Wooldridge (2009), value added based production function.
 - Labor productivity (LP), computed as value added over number of employees.



Energy prices

- Available for all manufacturing and construction sectors across all the 21 countries in the analysis, from 1995 to 2020.
- Price indices constructed as averages of country- and fuel-specific prices weighted by country- and sector-level fuel consumption (Sato et al., 2019):

$$\ln(EnPrice_{s,c,t}) = \sum_f w_{f,s,c} \ln(Price_{f,c,t})$$

- The share of fuel consumption is kept constant in 2005 (IEA World Energy Balances).
- Prices for four fuel types: oil, coal, gas, and electricity (IEA Energy End-Use Prices database).
- Include taxes, a major part of the variation in coal, electricity and oil prices across countries (Sato et al., 2019).
- Price shock: annual change larger than 10% (1 SD) [mild shock] or larger than 15% (1.5 SD) [severe shock].
 - Categorical variable taking values 1 (positive shock), -1 (negative shock), and 0 (no shock); *or*
 - Two separate categorical 0-1 variables for each type of shock.



Environmental policy, country-level macroeconomic variables and sectoral characteristics

- Environmental policy: OECD's Environmental Policy Stringency indicators (Botta and Koźluk, 2014; Kruse et al., 2022).
- Economic policy uncertainty: average at the country-year level the monthly indicator developed by Baker et al. (2015).
- Financial development: multidimensional index of financial development based on IMF data (Svirydzenka, 2016).
- Economic momentum: output gap (OECD statistics).
- Sectoral energy intensity: energy input intensity based on OECD input-output tables.
- External finance dependence: indicator by Demmou et al. (2019) using Compustat.



Static analysis: Interactions by energy intensity, size and age

Dependent Variable: MFP levels or MFP growth			
	(1)	(2)	(3)
Dependent Variable: MFP	Levels	Levels	Levels
Lag Energy Prices	-0.054*	-0.061**	-0.096***
	(-1.7)	(-2.1)	(-3.3)
Lag Energy Prices * Energy Intensity	-0.812**		
	(-2.0)		
Mature Firm * Lag Energy Prices		0.005*	
		(1.9)	
Old Firm * Lag Energy Prices		-0.017***	
		(-3.7)	
Small Firm * Lag Energy Prices			0.024***
			(8.9)
Medium Small Firm * Lag Energy Prices			0.038***
			(9.2)
Medium Firm * Lag Energy Prices			0.054***
			(9.1)
Medium Large Firm * Lag Energy Prices			0.059***
			(7.4)
Large Firm * Lag Energy Prices			0.032***
			(2.9)
Observations	6,606,830	6,606,830	6,606,830
R-squared	0.829	0.829	0.829
Firm Level Controls (Size, Age, ROA, Leverage)	Yes	Yes	Yes
Country by Sector FE	Subsumed	Subsumed	Subsumed
Country by Year FE	Yes	Yes	Yes
Sector by Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Note: T-statistics in parentheses; standard errors clustered at the firm and country-sector-year level. Significance Level: *10%, **5%, ***1%.

BACK



Static analysis: Alternative assumptions on fuel shares

Dependent Variable: MFP levels or MFP growth								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Dependent Variable: MFP</i>	Levels	Levels	Levels	Levels	Growth	Growth	Growth	Growth
<i>Prices baseline year</i>	1995	2015	No base	2010	1995	2015	No base	2010
<i>Sample</i>	Full	Full	Full	Post-GFC	Full	Full	Full	Post-GFC
Lag Energy Prices	-0.062** (-2.3)	-0.143*** (-4.8)	-0.000* (-1.8)	-0.210*** (-5.6)	-0.024+ (-1.6)	-0.054*** (-4.0)	-0.000*** (-5.4)	-0.039** (-2.4)
Lag MFP Gap To Frontier					0.302*** (86.1)	0.303*** (90.3)	0.367*** (32.5)	0.302*** (76.0)
Observations	5,812,929	6,832,857	4,811,004	3,836,331	5,487,231	6,473,933	4,506,023	3,667,655
R-squared	0.843	0.827	0.844	0.858	0.243	0.238	0.271	0.210
Firm Level Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country by Sector FE	No	No	No	No	Yes	Yes	Yes	Yes
Country by Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector by Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	No	No	No	No

Note: T-statistics in parentheses; standard errors clustered at the firm and country-sector-year level. Significance Level: + 15%, *10%, **5%, ***1%.



Growth model: Energy prices and productivity are inversely related

Dependent Variable: Productivity Growth						
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Productivity measure</i>	MFP	LP	MFP	LP	MFP	LP
Lag Energy Prices	-0.025** (-2.1)	-0.041*** (-3.4)	-0.057*** (-2.6)	-0.086*** (-3.7)		
Lag MFP Gap To Frontier * Lag Energy Prices					-0.036*** (-6.0)	-0.034*** (-5.1)
Lag MFP Gap To Frontier	0.305*** (90.3)	0.332*** (100.4)	0.677*** (137.1)	0.713*** (157.3)	0.542*** (13.6)	0.5554*** (12.8)
Observations	6,250,876	6,261,423	6,240,272	6,248,141	6,250,498	6,261,049
R-squared	0.239	0.262	0.487	0.506	0.250	0.272
Firm Level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country by Sector FE	Yes	Yes	Subsumed	Subsumed	Subsumed	Subsumed
Country by Year FE	Yes	Yes	Yes	Yes	Subsumed	Subsumed
Sector by Year FE	Yes	Yes	Yes	Yes	Subsumed	Subsumed
Country by Sector by Year FE	No	No	No	No	Yes	Yes
Firm FE	No	No	Yes	Yes	No	No

Note: T-statistics in parentheses; standard errors clustered at the firm and country-sector-year level. Significance Level: *10%, **5%, ***1%.



Short-term pain?

The role of financial and macroeconomic conditions

Dependent Variable: Multifactor productivity (MFP) growth								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Interaction variable	Cash		ExtFinDep		FinDev		Output Gap	
Size of the price shock	Mild	Severe	Mild	Severe	Mild	Severe	Mild	Severe
Energy Price Shock	-0.006	-0.014***	-0.005	-0.012***	-0.053*	-0.081**	-0.007	-0.019***
	(-1.5)	(-3.5)	(-1.3)	(-3.2)	(-1.7)	(-2.2)	(-1.2)	(-3.5)
Energy Price Shock * Interaction var.	0.018***	0.019**	-0.021***	-0.020***	0.070*	0.094**	0.008	0.016**
	(2.9)	(2.3)	(-4.2)	(-3.3)	(1.7)	(2.0)	(1.0)	(2.3)
Interaction var.	0.028**	0.028**						
	(2.2)	(2.2)						
Lag MFP Gap To Frontier	0.306***	0.306***	0.309***	0.309***	0.314***	0.314***	0.306***	0.306***
	(90.2)	(90.1)	(89.5)	(89.5)	(87.9)	(87.9)	(88.9)	(88.8)
Observations	6,006,285	6,006,285	6,055,639	6,055,639	5,473,178	5,473,178	6,157,021	6,157,021
R-squared	0.240	0.240	0.241	0.241	0.247	0.247	0.218	0.219
Firm Level Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Energy Price Levels Before Shock	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country by Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country by Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector by Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	No	No	No	No	No	No	No

Note: T-statistics in parentheses; standard errors clustered at the firm and country-sector-year level.

Significance Level: *10%, **5%, ***1%.



Between-firm effects: sharp price decreases hamper productivity-enhancing labor reallocation

$$\Delta \text{Log} L_{icst} = \beta_0 + \beta_1 \text{MFP}_{ics,(t-1)} + \beta_2 \left(\text{MFP}_{ics,(t-1)} * \text{EnPriceShocks}_{cs,(t-1)} \right) + \beta_3 \mathbf{X}_{ics,(t-1)} + \delta_{cst} + \epsilon_{icst}$$

Dependent Variable: Employment Growth				
	(1)	(2)	(3)	(4)
Size of the price shock	Mild	Severe	Mild	Severe
Lag MFP Levels	0.075*** (10.2)	0.072*** (9.9)	0.078*** (10.5)	0.073*** (9.9)
Lag MFP Levels * Energy Price Shock	0.003** (2.1)	0.007*** (3.0)		
Lag MFP Levels * Price Increase Shock			0.000 (0.2)	0.006* (1.8)
Lag MFP Levels * Price Decrease Shock			-0.009*** (-4.9)	-0.010*** (-3.5)
Observations	6,540,777	6,540,777	6,540,777	6,540,777
R-squared	0.068	0.068	0.068	0.068
Controls	Yes	Yes	Yes	Yes
Country by Sector by Year FE	Yes	Yes	Yes	Yes
Firm FE	No	No	No	No

Note: T-statistics in parentheses; standard errors clustered at the firm and country-sector-year level.
Significance Level: *10%, **5%, ***1%.



Long-term gains?

Full table – baseline specification

Dependent Variable: Multifactor productivity growth ($MFP_{i,t+k} - MFP_{i,t-1}$)									
Moderate shock									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	t + 0	t + 1	t + 2	t + 3	t + 4	t + 1	t + 2	t + 3	t + 4
Energy Price Shock	-0.002	-0.011**	-0.014**	0.003	0.009*	-0.010*	-0.008	0.009*	0.014***
	(-0.6)	(-2.1)	(-2.4)	(0.5)	(1.8)	(-1.9)	(-1.4)	(1.9)	(2.9)
Lag Gap To Frontier	0.291***	0.341***	0.376***	0.403***	0.423***	0.341***	0.376***	0.404***	0.423***
	(110.0)	(122.6)	(129.4)	(137.6)	(139.7)	(122.6)	(129.0)	(137.1)	(139.3)
Lag Energy Price	-0.036***	-0.070***	-0.048***	-0.033*	-0.012	-0.062***	-0.016	0.014	0.024
	(-3.6)	(-4.9)	(-3.0)	(-2.0)	(-0.7)	(-4.3)	(-1.0)	(0.8)	(1.2)
Observations	2,111,883	2,111,883	2,111,883	2,111,883	2,111,883	2,111,883	2,111,883	2,111,883	2,111,883
R-squared	0.212	0.239	0.258	0.284	0.268	0.239	0.258	0.283	0.268
Severe shock									
Energy Price Shock	-0.003	-0.005	-0.016***	-0.016***	-0.022***	-0.003	-0.010**	-0.008*	-0.012**
	(-0.9)	(-1.1)	(-3.4)	(-3.4)	(-4.5)	(-0.8)	(-2.3)	(-1.7)	(-2.5)
Lag Gap To Frontier	0.291***	0.341***	0.376***	0.404***	0.423***	0.341***	0.376***	0.404***	0.423***
	(110.0)	(122.6)	(129.0)	(137.3)	(139.5)	(122.6)	(129.0)	(137.2)	(139.3)
Lag Energy Price	-0.036***	-0.062***	-0.030*	-0.023	-0.023	-0.057***	-0.016	0.004	0.010
	(-3.5)	(-4.3)	(-1.8)	(-1.2)	(-1.2)	(-4.0)	(-1.0)	(0.2)	(0.5)
Observations	2,111,883	2,111,883	2,111,883	2,111,883	2,111,883	2,111,883	2,111,883	2,111,883	2,111,883
R-squared	0.212	0.239	0.258	0.284	0.268	0.239	0.258	0.283	0.268
Firm Level Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Leads of price shock	No	Yes	Yes	Yes	Yes	No	No	No	No
Country by Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country by Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector by Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: T-statistics in parentheses; standard errors clustered at the firm and country-sector-year level.
Significance Level: *10%, **5%, ***1%.



Long-term gains?

Full table – results by energy intensity

Dependent Variable: Multifactor productivity growth ($MFP_{i,t+k} - MFP_{i,t-1}$)					
	(1)	(2)	(3)	(4)	(5)
	t + 0	t + 1	t + 2	t + 3	t + 4
Energy Price Shock	-0.002	-0.009	-0.010+	0.009+	0.020***
	(-0.4)	(-1.4)	(-1.5)	(1.6)	(3.6)
Energy Price Shock x	-0.001	-0.006	-0.010*	-0.018***	-0.029***
Energy Intensive	(-0.3)	(-1.3)	(-1.7)	(-3.3)	(-5.4)
Lag Gap To Frontier	0.291***	0.341***	0.376***	0.403***	0.423***
	(110.0)	(122.6)	(129.4)	(137.6)	(139.7)
Lag Energy Price	-0.036***	-0.071***	-0.049***	-0.035**	-0.016
	(-3.6)	(-5.0)	(-3.1)	(-2.1)	(-0.9)
Observations	2,111,883	2,111,883	2,111,883	2,111,883	2,111,883
R-squared	0.212	0.239	0.258	0.284	0.268
Effect for Energy Int	-0.00286	-0.0154	-0.0198	-0.00845	-0.00869
P-value	0.477	0.00305	0.000574	0.125	0.136
Firm Level Controls	Yes	Yes	Yes	Yes	Yes
Leads of price shock	No	Yes	Yes	Yes	Yes
Country by Sector FE	Yes	Yes	Yes	Yes	Yes
Country by Year FE	Yes	Yes	Yes	Yes	Yes
Sector by Year FE	Yes	Yes	Yes	Yes	Yes

Note: T-statistics in parentheses; standard errors clustered at the firm and country-sector-year level.
Significance Level: *10%, **5%, ***1%.



Long-term gains?

Full table – results by EPS levels

Dependent Variable: Multifactor productivity growth ($MFP_{i,t+k} - MFP_{i,t-1}$)					
	(1)	(2)	(3)	(4)	(5)
	t + 0	t + 1	t + 2	t + 3	t + 4
<i>EPS_{ct-1}</i>					
Energy Price Shock x	-0.001	-0.004	0.006+	0.003	0.005
Interaction variable	(-0.4)	(-1.1)	(1.5)	(0.7)	(1.0)
Energy Price Shock	0.012	0.013	-0.019	-0.002	-0.011
	(1.6)	(1.3)	(-1.6)	(-0.2)	(-0.8)
Observations	1,978,444	1,978,444	1,978,444	1,978,444	1,978,444
R-squared	0.206	0.223	0.237	0.246	0.231
<i>MarketEPS_{ct-1}</i>					
Energy Price Shock x	0.002	0.005	0.014**	0.002	0.018**
Interaction variable	(0.4)	(0.7)	(2.0)	(0.3)	(2.3)
Energy Price Shock	0.006	-0.005	-0.022**	0.003	-0.023*
	(0.8)	(-0.5)	(-2.1)	(0.3)	(-1.9)
Observations	1,978,444	1,978,444	1,978,444	1,978,444	1,978,444
R-squared	0.206	0.223	0.237	0.246	0.231
<i>NonMarketEPS_{ct-1}</i>					
Energy Price Shock x	0.001	-0.003	0.001	0.003	0.001
Interaction variable	(0.7)	(-1.4)	(0.3)	(1.0)	(0.3)
Energy Price Shock	0.004	0.014	-0.005	-0.005	-0.001
	(0.6)	(1.6)	(-0.5)	(-0.4)	(-0.1)
Observations	1,978,444	1,978,444	1,978,444	1,978,444	1,978,444
R-squared	0.206	0.223	0.237	0.246	0.231

Note: T-statistics in parentheses; standard errors clustered at the firm and country-sector-year level.

Significance Level: *10%, **5%, ***1%.



Long-term gains?

Full table – results by macroeconomic conditions

Dependent Variable: Multifactor productivity growth ($MFP_{i,t+k} - MFP_{i,t-1}$)					
	(1)	(2)	(3)	(4)	(5)
	t + 0	t + 1	t + 2	t + 3	t + 4
EPU (t-1)					
Energy Price Shock x	-0.000**	-0.000**	-0.000	-0.000	-0.000**
Interaction variable	(-2.6)	(-2.3)	(-0.5)	(-1.3)	(-2.2)
Energy Price Shock	0.017***	0.019**	-0.001	0.017	0.031**
	(2.7)	(2.1)	(-0.1)	(1.3)	(2.4)
Observations	1,643,002	1,643,002	1,643,002	1,643,002	1,643,002
R-squared	0.211	0.226	0.238	0.246	0.230
Output Gap (t-1)					
Energy Price Shock x	0.001	0.007***	0.009***	0.009***	0.007***
Interaction variable	(1.1)	(3.3)	(3.5)	(4.3)	(3.5)
Energy Price Shock	-0.002	-0.007	-0.009	0.008	0.014**
	(-0.4)	(-1.1)	(-1.3)	(1.4)	(2.5)
Observations	2,109,788	2,109,788	2,109,788	2,109,788	2,109,788
R-squared	0.212	0.238	0.258	0.270	0.258

Note: T-statistics in parentheses; standard errors clustered at the firm and country-sector-year level.
Significance Level: *10%, **5%, ***1%.



Long-term gains?

Full table – results wrt investment

Dependent Variable: Capital investment ratio growth ($Investment_{i,t+k} - Investment_{i,t-1}$)					
	(1)	(2)	(3)	(4)	(5)
	t + 0	t + 1	t + 2	t + 3	t + 4
$Priceshock_{c,s,t-1}$	0.011***	0.013***	0.005	0.004	0.002
	(3.1)	(3.0)	(1.1)	(0.9)	(0.3)
$Investment_{i,cs,t-2}$	-0.029***	-0.035***	-0.029***	-0.026***	-0.026***
	(-15.9)	(-17.9)	(-14.4)	(-12.6)	(-11.3)
$EnPrices_{c,s,t-1}$	0.024**	0.031**	0.062***	0.069***	0.031**
	(2.6)	(2.4)	(4.7)	(5.1)	(2.2)
Observations	1,356,796	1,355,195	1,353,074	1,350,074	1,344,946
R-squared	0.011	0.014	0.016	0.019	0.023
Firm Level Controls	Yes	Yes	Yes	Yes	Yes
Leads of price shock	Yes	Yes	Yes	Yes	Yes
Country by Sector FE	Yes	Yes	Yes	Yes	Yes
Country by Year FE	Yes	Yes	Yes	Yes	Yes
Sector by Year FE	Yes	Yes	Yes	Yes	Yes

Note: T-statistics in parentheses; standard errors clustered at the firm and country-sector-year level.
Significance Level: *10%, **5%, ***1%.