Quantifying the Cost of Oil Shocks: The Case of the Transportation Sector

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Abstract

I study the impact of oil shocks on key financial ratios of transportation firms over the past two decades, both during and outside periods of energy crisis. I investigate heterogeneous effects across transportation modes, shock signs, and firm sizes. I also discuss the trade-off between the cost related to oil shocks and the cost of financing the low-carbon transition. Using firm-level data, I show that exposure to oil shocks significantly influences real outcomes but in an asymmetric manner: following oil price increases, profit margins decline, labor share and debt increases, whereas oil price decreases generate no effects. I show that the transmission of oil price increases operates through rigidities on the labor side. These effects vanish in the medium term. Quantitatively, one-standard deviation higher weighted-oil price increase leads to a 8.2% decrease in profit margin. However, even if the magnitude is economically significant, I show that these effects are modest when compared with an investment option hedging against these shocks. I extend the analysis to the 2022 energy crisis and show that public support largely offset the adverse effect of price increases. All in all, I show that oil shock did not provide incentives to finance the low-carbon transition over 2000-2022. Finally, I assess the external validity over two major European countries. This paper has implications for financial stability and climate transition regardless of the origin of energy price shocks (climate risks, carbon taxation, geopolitical events). I also provide quantitative evidence on the financial challenge posed by the low-carbon transition.

JEL classification: G3; Q40; ; R40.

Keywords: oil shock, fuel, energy, profit margin, firm, climate risk, low-carbon, transition.

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Declaration of Generative AI and AI-Assisted Technologies in the Manuscript Preparation Process:

- During the preparation of this work, the author used GPT-4, Microsoft Copilot, and GPT-5.5 to improve (i) the quality and readability of the English writing and (ii) the structure of local projection code and graphical presentation of the local projection results. No AI tools were used in the design of the study, or the analysis of the data.
- After using these tools, the author carefully reviewed and edited all generated content as necessary and takes full responsibility for the content of the published article.

1 Introduction

Oil shocks have been a major concern for policymakers at least since 1973. And the recent succession of energy crises[1] offers a clear illustration of the still highly relevant issue. Aside geopolitical risk, climate change and climate change mitigation policies are expected to put upward pressure on prices (NGFS, 2024; Del Negro et al., 2023; Coenen et al., 2024), in particular on energy prices (Schnabel, 2022a,b), highlighting also concerns about energy prices and their repercussions.

When faced with shocks to input prices, firms seek to adjust their output. But frictions – such as low elasticity of substitution between inputs (Boehm et al. (2019)), wage rigidities (Babecký et al. (2010)) or dividend payment constraints (Waters (2018); Lintner (1956))– may hamper this adjustment, limiting firms' ability to absorb input price shocks and thus affecting their profitability, productivity or even survival. But to what extent do input price shocks –particularly shocks of fossil resources– affect firm outcomes? And through which channels do they materialize?

The goal of this paper is to tackle those questions and thus to analyze the impacts of oil shocks on firms at microeconomic level for a key industry that is (i) a major contributor to GHG emissions, (ii) an hard to decarbonize sector, (iii) a high source energy dependence, and (iv) a cornerstone of economic systems, enabling trade, and shaping spatial organization, namely the transportation sector.

Against this background, I study (i) the impact of oil shocks on key financial ratios of firms; and investigate heterogeneous effects across transportation modes, shock signs, and firm sizes. (ii) I analyze the transmission channels: to what extent do oil shocks affect firms' fuel expenditures? To what extent do shocks to fuel

[1] Notably the 2022–2023 Russia-Ukraine conflict and the 2026 conflict in Iran.

expenditures propagate within the firm? (iii) Ultimately, I analyze to what extent are there any real effects on the probability of default? (iv) As fluctuations in oil spot prices highlight the risks associated with the transition risk, I discuss the trade-off between the cost related to oil shocks and the cost of financing the transition to a low-carbon economy in period out of energy crisis. I also discuss the situation during times of energy crisis. Finally (v), I extend this analysis to two major European countries.

To carry out this work, I am relying on two complementary datasets based on firm-level balance sheets and income statements. First, the core analysis relies on a dataset for France that combines a high level of detail with a two-decade time span. Second, to demonstrate the external validity of the results, I complement this analysis with a second dataset covering Spanish and Italian firms over a shorter period. Although with a shorter temporal coverage, the availability of comparable firm-level financial data across multiple countries allows to assess the robustness and external validity of the first results. All in all, those data are also unique in terms of the scope of firms it covers, ranging from very small firms, that generally fall outside the scope of most studies, to the largest firms. In total, the two datasets contain more than 130,000 firm-year observations and over 23,000 firms.

Since the input costs paid by a firm, and, more generally, the dynamics of financial statement components are endogenous to the firm, I first need to address this endogeneity issue. To tackle this, I use a Bartik (shift-share) instrument. The "share" part of the instrument (i.e. the exposure) is the firm's dependence on fossil fuel. The "shift" part (i.e. shocks) are fluctuations in oil prices on the reference spot market in Europe. Because, following (Kilian (2009)), oil price fluctuations can

be attributed to three types of shocks: (i) oil supply shocks, (ii) oil-specific demand shocks, and (iii) global aggregate demand shocks that influence commodity markets as a whole; so I rely on oil-specific shocks defined either in the spirit of Stock and Watson (2002) and Delle Chiaie et al. (2022), or based on the data provided by Baumeister and Hamilton (2019). I then use this Bartik instrument to examine whether the impact of oil price shocks on firms' financial ratios varies with their degree of fossil fuel dependence.

With this setting, I first focus on the period outside energy crisis (2000-2019) and show that oil price shocks affect firm's profit margin, but the impacts exhibit several sources of heterogeneity: (i) the impact is asymmetrical, that is, by breaking down the shocks between price increases and price decreases. I show that a one-standard-deviation higher weighted-oil shock leads to a 8.2% decrease in the profit margin, while oil price decrease have no significant impact. This asymmetrical effect is economically and statistically significant. (ii) These results are driven by the freight road transport sector (in this sector, one-standard-deviation higher weighted-oil shock leads to a 9.8% decrease in the profit margin), no significant effect are reported for the air, rail or water transport sectors. All results are robust to controls for demand shocks.

However, even if the magnitude of these impacts estimated so far is economically significant, based on Belle-Larant et al. (2024) and Pisani-Ferry and Mahfouz (2023), I show that these impacts remain modest when compared with an investment option enabling to hedge against these shocks (without public support). In other words, I provide quantitative evidence that, outside periods of crisis, oil price shocks generate insufficient incentives to drive the low-carbon transition in the road freight sector.

Second, I break down the first results to analyze the transmission channels. I show that oil price rises increase firms' fuel expenditures. This rise in fuel expenditures is largely absorbed through a decrease of value added: 44% of the fuel costs increase is absorbed by the value added. This shock further propagates within the firms affecting the allocation of the value added: the wage bill is unaffected –as are average wages and employment– while the profit margin bears the burden of the adjustment, leading to an increase of the labor share. This adjustment in profit could affect the company's cash holdings: in fact, cash holdings are unaffected at the cost of increased debt. In the end, the impact is short term: (i) the three-year-horizon probability of default is unaffected, indeed (ii) by making local projections (Jordà and Taylor (2024)) I show that the financial impact materializes in the year of the shock but does not persist thereafter.

Third, so far, I have focused on periods outside energy crises. So I turn to the 2022 energy crisis. I show that public support measures implemented during the 2022 energy crisis were directed toward the firms most in need –namely, the most vulnerable firms, as documented in this paper –. And that, government aid mitigates –or even cancels out– the effect of price increases.

Finally, because the organization of an energy system is, at least partially, a matter of national strategy (Chancel, 2025), this article takes the issue of the external validity of the results seriously in order to draw lessons that apply beyond a single country. I thus rely on a database covering Spain and Italy, with less granular detail than the data for France, a shorter time frame, but much broader sectoral coverage. I show that the main lessons of this analysis remains: asymmetrical effect, magnitude of the effect, concentration of the impact on the road transport.

Related literature. A first contribution of this paper is part of a long-standing literature, starting at least in the 1970s and analyzing the impact of oil shocks on the economy (Hamilton (1983); Hooker (1996); Hamilton (1996); Lee and Ni (2002); Hamilton (2003); Kilian and Park (2009)). The early literature primarily adopted a macroeconomic perspective. Subsequently, the microeconomic literature has examined firms' responses to oil price shocks, or more generally energy shocks, often focusing on one specific margin of adjustment, such as (i) the pass-through of energy prices (Lafrogne-Joussier et al. (2023); Dedola et al. (2021); Cavallo et al. (2023); Fontagné et al. (2024)), competitiveness effects (Fontagné et al. (2024)), (ii) the employment or wage effects at sector or regional level (Keane and Prasad (1996); Davis et al. (1997)), (iii) investment effects (Chen et al. (2020)). A closely related paper is Aggarwal et al. (2012), which studies the impact of oil price changes on large listed firms in the transport sector, as captured by the S&P Transportation Industry Index. While the paper documents asymmetric effects of oil price shocks on transportation firms' returns, it focuses on stock market outcomes rather than on real firm-level outcomes (fuel expenditures, value added, wage, employment, profit margin, probability of default, liquidity risk, debt).

To the best of my knowledge, my paper is the first to provide a comprehensive assessment of the impact of an oil price shock on real firm-level outcomes of a given sector, and on a large range of firms, from very small firms which generally fall outside the scope of most corporate finance studies, to the largest firms, while papers often focus on the stock returns of large publicly listed firms. The present work highlights the direct effect on fuel costs, but also the consequences on key financial variables (value added, the value added sharing, profit margin, labor share, cash

holdings, indebtedness, probability of default), both in the short- and medium-term. It also documents several sources of heterogeneity in the effects of oil price shocks, depending on the sign, the mode of transport, and firm size. By jointly considering these dimensions of heterogeneity, the analysis provides a rich understanding of how such shocks affect firms. It also demonstrates the external validity of these findings across other major European countries. This information is of major interest for bankers and policymakers analyzing the ability of firms to absorb oil shocks for competitiveness or financial stability issues (bank stress-testing, macro-financial modeling, e.g. Dimitrov et al. (2024)).

A second contribution is related to the climate literature. As oil shocks mimic a carbon tax, the paper is related to the expanding empirical literature on climate transition risk. A rising corpus has focused on the macroeconomic implications of mitigation policies (e.g. Metcalf and Stock (2020); Berthold et al. (2023); Känzig (2023); Ciccarelli and Marotta (2024); Moessner (2025)). At microeconomic level, my paper is at the intersection between two literature: (i) the pricing of climate transition risk by investors and bankers (Capasso et al. (2020); Kleimeier and Viehs (2018); Jung et al. (2018); Delis et al. (2019); Safiullah et al. (2021); Ehlers et al. (2022)). (ii) And the literature on the trade-off between the cost of inaction and the cost of investing in the low-carbon transition (Stern (2006)). This trade-off is particularly relevant in the transport sector, where firms face immediate losses from oil price shocks while the investment needed to reduce fossil-fuel dependence remains substantial. Although higher energy prices during an energy crisis would, in principle, be expected to strengthen decarbonization incentives, I find that government emergency support substantially mitigated –or even cancels out–, the resulting

financial pressures on firms, thereby reducing incentives to decarbonize at that time.

Section (2) describes the identification strategy, Section (3) the data, Section (4) the empirical results, and Section (5) concludes.

2 Identification Strategy

2.1 The basic framework

On the basis of a simplified accounting identity, the value added of a firm f in year t, denoted $VA_{f,t}$, is defined as the firm's sales, $SA_{f,t}$, less the firm's operating expenses, here split between the fuel costs $FC_{f,t}$ and other costs, denoted $OC_{f,t}$:

$$VA_{f,t} \equiv SA_{f,t} - (FC_{f,t} + OC_{f,t}) \tag{1}$$

Dividing by the sales and taking the first difference leads to relate changes in fuel costs (per euro of sales) with changes in value added (per euro of sales).[2] Since value added can be broken down into the wage bill $W_{f,t}$ and profit $P_{f,t}$, it is possible to relate changes in the profit margin –described in standard textbooks (Zimmerman (2010)) and used by investors (e.g. Campbell (2016),Waters (2018))– with changes in the fuel costs per euro of sales.

$$\overbrace{\Delta(\text{Profit margin})_{f,t} + \Delta\left(\frac{W}{SA}\right)_{f,t}}^{\Delta\left(\frac{VA}{SA}\right)_{f,t}} + \Delta\left(\frac{OC}{SA}\right)_{f,t} \equiv -\Delta\left(\frac{FC}{SA}\right)_{f,t} \tag{2}$$

In a similar way to Chang et al. (2014) and Lé and Vinas (2024), the accounting identity (2) is used to set the equations (3a) and (3b).

[2] I use either "per euro of output" or "per euro of sales" throughout this paper.

$$\begin{cases} \Delta\left(\frac{VA}{SA}\right)_{f,t} = \alpha_{VA} + \gamma_{VA} \times \Delta\left(\frac{FC}{SA}\right)_{f,t} + \epsilon_{VA,f,t} & \text{(3a)} \\ \Delta\left(\frac{OC}{SA}\right)_{f,t} = \alpha_{OC} + \gamma_{OC} \times \Delta\left(\frac{FC}{SA}\right)_{f,t} + \epsilon_{OC,f,t} & \text{(3b)} \end{cases}$$

with:

$$\begin{cases} \alpha_{VA} + \alpha_{OC} = 0 & \text{(4a)} \\ \gamma_{VA} + \gamma_{OC} = -1 & \text{(4b)} \end{cases}$$

Decomposing the value added leads to equations (5a) to (5c):

$$\begin{cases} \Delta\left(\frac{W}{SA}\right)_{f,t} = \alpha_{W} + \gamma_{W} \times \Delta\left(\frac{FC}{SA}\right)_{f,t} + \epsilon_{W,f,t} & \text{(5a)} \\ \Delta\left(\text{Profit margin}\right)_{f,t} \equiv \Delta\left(\frac{P}{SA}\right)_{f,t} = \alpha_{P} + \gamma_{P} \times \Delta\left(\frac{FC}{SA}\right)_{f,t} + \epsilon_{P,f,t} & \text{(5b)} \\ \Delta\left(\frac{OC}{SA}\right)_{f,t} = \alpha_{OC} + \gamma_{OC} \times \Delta\left(\frac{FC}{SA}\right)_{f,t} + \epsilon_{OC,f,t} & \text{(5c)} \end{cases}$$

with:

$$\gamma_{VA} + \gamma_{OC} = \gamma_{W} + \gamma_{P} + \gamma_{OC} = -1 \quad \text{(6)}$$

Two points need to be made. First, scaling with sales has a number of advantages –e.g. it highlights usual financial ratio as profit margin–, but does not allow to know how the firm reacts by adjusting its sales. This is taken into account in the empirical analysis (Section (4)). Second, this framework is not causal. To solve this, I use a Bartik instrument built in the spirit of Dedola et al. (2021).

2.2 The Bartik instrument

To build the Bartik instrument, I first write the firm's dependence on fuel, defined as the sum of the cost related to each fuel inputs scaled by sales:

$$\Big(\frac{FC}{SA}\Big)_{f,t} \equiv \frac{\sum_c^C [p_{c,f,t} \times q_{c,f,t}]}{SA_{f,t}} \tag{7}$$

Where $p_{c,f,t}$ is the price and $q_{c,f,t}$ the quantity of fuel input c purchased by firm f at time t, and C is the set of inputs (diesel, gasoline, jet fuel etc.).

The change in the cost of fuel per euro of sales between $t-1$ and t is:

$$\Delta\Big(\frac{FC}{SA}\Big)_{f,t} = \overbrace{\sum_c^C \Big[\Big(\frac{p_{c,f,t-1} \times q_{c,f,t-1}}{SA_{f,t-1}}\Big) \times gr(p_{c,f,t})\Big]}^{\text{Direct impact of change in fuel price}} + \overbrace{\sum_c^C \Big[p_{c,f,t} \times \Delta\Big(\frac{q_{c,f,t}}{SA_{f,t}}\Big)\Big]}^{\text{Firm's adjustments to variation in fuel price}} \tag{8}$$

With $gr(.)$ the growth rate function.

On the right hand side of Equation (8), the first component (leftmost) is the direct impact of fuel price change, the second component (rightmost) is the firm's adjustments in input quantities and output prices and quantities.

The price change $gr(p_{c,f,t})$ can be seen as the sum of an idiosyncratic price shock (e.g. the bargaining power of the firm) and price shocks common to all firms. These common shocks are linked, at least partially, to shocks from the crude oil markets, because fossil fuels are derived from crude oil.

Based on this argument, the first component of the right-hand side of equation (8) is used to build a Bartik (shift-share) instrument $Z_{f,t}$ whose "shift" part is defined as shocks stemming from the oil market, namely price changes of the Western Europe

reference, i.e. the Brent crude oil. And the "share" part (the exposure) is the dependence of the firm on fuel, measured as its fuel costs per euro of sales before the shock. Following the convention in the literature (Goldsmith-Pinkham et al. (2020)), the firm's exposure to the shock is the first observed value in the dataset (t_0). Therefore, the Bartik instrument is:

$$Z_{f,t} = \left(\frac{FC}{SA}\right)_{f,t_0} \times gr\left(\text{Oil Price}\right)_t \tag{9}$$

In practice, the oil price growth rate, like any other growth rate mentioned in this paper, is calculated *à la* Davis and Haltiwanger (1992). So, based on Equations (5a) to (5c) and the Bartik instrument defined with Equation (9), I explain the impact of oil shocks on key financial ratios of firms using the following reduced-formed equation:

$$\Delta\left(\frac{\pi}{SA}\right)_{f,t} = \beta_1 \times Z_{f,t} + X_{f,t-1} + \alpha_f + \theta_{s,t} + \epsilon_{f,t} \tag{10}$$

I use the reduced-form equation because I am interested in the total impact of oil shocks on firms. Indeed the Bartik instrument could affect outcomes through multiple channels, not just through the fuel costs: e.g., the firm could adjust its production in response to the shock, affecting its reliance on outsourcing and external staff. However a two-stage least squares (2SLS) estimation is also reported in the robustness section of the paper, with $\Delta\left(\frac{FC}{SA}\right)_{f,t}$ as the endogenous variable.

In Equation (10), the variable $\Delta\left(\frac{\pi}{SA}\right)_{f,t}$ is the first difference (between $t-1$, the year before the oil price change, and t, the year of the oil price change) in the ratio of profit over sales, that is the change in profit margin. In the empirical analysis, I first

examine the impact on profit margin, but other financial variables from the income statement and balance sheet will also be taken into account, such as value added, wage bill, etc. The variable $Z_{f,t}$ is the Bartik instrument. The variables $X_{f,t-1}$ are a set of one-year lagged controls measured at firm level: (i) the share of cash holdings over total assets, to control for the firm's liquidity level, (ii) leverage, to control for the firm's indebtedness, and (iii) the logarithm of total assets, to control for the firm's size. All estimations are carried out with (iv) firm fixed effects α_f, to control for the firm's unobservable characteristics, and (v) industry-by-year fixed effects (3 digits), $\theta_{s,t}$, to control for yearly shocks at industry level, in particular demand shocks. All the standard errors are clustered at the firm level.

The empirical strategy tests whether firms' differential exposure (i.e. firms' differential dependence on fuel) to common shocks (i.e. price changes on the oil market) leads to differential changes in outcomes. The source of identification is the differences between firms in their dependence on fuel in the first observed year (Goldsmith-Pinkham et al. (2020)). The validity of this instrument is based on the assertion that neither the firms' initial dependence on fuel nor unobserved variables correlated with it directly predict the outcome of interest conditional on controls ((Baum-Snow and Ferreira, 2015, p.50)): this holds because the firm fixed effects capture any firm-specific factors that may have affected both the initial dependence and the current outcomes (Fontagné et al. (2024)).

In building this identification strategy, I choose to normalize variables by the firm's sales. There are several advantages to scaling the income statement variables by sales. First, it enables to compare firms of different sizes. Second, it makes it possible to directly highlight the dynamics of key variables of interest for investors

and firm managers, such as the profit margin (see Equations (2) and (5b)).[3] Third, it controls for the two channels of adjustment that the firm can rely on: price adjustment (the pass-through of input prices to customers) and quantity adjustment. The 2022 energy crisis is an illustration of both situations: see Lafrogne-Joussier et al. (2023) for the first case, and Reuters (2022) and Albert et al. (2022) for the second case. These channels of adjustment are not distinguished at this stage. And I cannot analyze the dynamics of output price and quantity separately. However, I can (i) break down the financial ratios to understand their dynamics by examining the dynamics of the numerator and denominator separately, and (ii) I can also discuss the cost pass-through (see Section 4).

2.3 Oil-specific shocks

Oil prices fluctuate for many different reasons. And the underlying source of these movements matters, because they have different macroeconomics effects (Kilian (2009)): oil price fluctuations reflect (i) oil supply shocks that are specific to the oil market, (ii) oil demand shocks that are specific to the oil market, or (iii) global demand shocks for all commodities (Kilian (2009)).

To take this point into account, and stay consistent with my framework, I distinguish shocks that are specific to the oil market from shocks that co-move with other commodities. To identify global commodity market movements, I extract the first principal component from a broad set of commodity prices. This factor summa-

[3] Another approach could be to scale by the number of employees, thus replacing value added per euro of sales in the left-hand side of Equation (3a) with labor productivity, and relating this to fuel costs per worker. However, this would make the approach more cumbersome, particularly by adding the term "sales per worker" in addition to labor productivity in Equation (2), and also adding an equation in the systems of equations.

rizes the common variation across commodities and can be interpreted as a global commodity cycle. This approach is in the spirit of Stock and Watson (2002) and Delle Chiaie et al. (2022). The second approach, presented in the robustness section (4.6.3), relies on oil supply shocks used in the literature, namely structural oil supply shocks identified by Baumeister and Hamilton (2019). Although alternative identification schemes exist in the literature (Kilian, 2009; Kilian and Murphy, 2014), I rely on the oil supply shocks estimated by Baumeister and Hamilton (2019), as they provide a directly usable series covering the period of interest, 2000-2022.[4] The main results are robust to the choice of oil shock series and remain largely unchanged across specifications.

More precisely, regarding the first approach: let $P_{i,t}^{X}$ denote the price of commodity i in category X at time t, where $X \in \{\text{fossil}, \text{food}, \text{metallic \& mineral}, \text{others}\}$. I construct the oil-specific shocks ε_t^{oil} as the residuals from a regression of Brent crude oil price changes, $gr\left(P_{Brent,t}^{oil}\right)$, on four factors: (i) a factor common to all commodities, noted $\mathcal{F}_t^{all}$, and (ii) three factors –respectively for the food category $\mathcal{F}_t^{food}$, for the metallic & mineral-based category $\mathcal{F}_t^{m}$, and for the remaining nonfossil series $\mathcal{F}_t^{oth}$– that are commodity specific and orthogonal to the common factor $\mathcal{F}_t^{all}$.

The factor common to all commodity prices, $\mathcal{F}_t^{all}$, is the first principal component over a basket of 98 series of commodity price changes composed of 10 fossil commodities, 38 food commodities, 31 metallic and mineral-based commodities, and 19 remaining commodities (cotton, rubber, paper pulp, tropical wood, wool etc.). The three commodity-specific factors are built by regressing each series on the common factor $\mathcal{F}_t^{all}$, taking the residual of those regressions $\epsilon_{i,t}^{food}$, $\epsilon_{i,t}^{m}$, $\epsilon_{i,t}^{oth}$ and extracting the

[4] Available here: https://sites.google.com/site/cjsbaumeister/datasets, accessed July 2026.

principal component on the residual of the food series (to get $\mathcal{F}_t^{food}$), metallic and mineral-based series (to get $\mathcal{F}_t^{m}$) and the other nonfossil series (to get $\mathcal{F}_t^{oth}$).

As shown in the empirical analysis, the findings remain largely unchanged when alternative definitions of oil-specific price shocks are employed.

3 Data

The analysis carried out in this paper relies on four sets of information: (i) tax statements of French firms, (iii) firm's default probability from the Banque de France, (iii) commodity prices at market level, and (iv) tax statements of Spanish and Italian firms.

The first set of information is a database gathering tax statements of non-financial firms, managed by the Banque de France (called FIBEN, *"Fichier Interbancaire des Entreprises"*). This database is one of the main inputs into the Banque de France's corporate credit risk assessment system. Data are available from 1990 to 2022. The reporting is carried out yearly at the legal entity level (unconsolidated accounts). An important feature of FIBEN is its coverage of small businesses.

The following restrictions are applied to the FIBEN database. First, only firms with a 12-month accounting period are retained. Second, the analysis focuses on the transport sector. Since freight activities can be more clearly identified in firms' industry classifications (NACE codes), I restrict the analysis to freight transport, including air, rail, road, and waterborne transport, both maritime and inland. Third, since balance sheet data are annual, the oil price used in the Bartik instrument is yearly averaged. Most balance sheet dates are in December, so the oil price is based

on the average price over the calendar year (that is, from January to December), and therefore I restrict the analysis to firms that end their fiscal year in December. Fourth, the number of individual firms in the database has increased over time, particularly in the first decade: it doubled in the 1990s. This is due to the ramp-up in the data collecting process during that first decade. I therefore focus on the period starting from 2000. The number of firms also increased markedly from 2019 onward due to a change in the data provider. To maintain a balanced sample across years, I restrict the analysis to the 4,000 firms with the highest turnover from 2019 onward. Fifth, as the 2020-2021 health crisis gave rise to public aid, notably the Job Retention Scheme, which affected the value-added allocation, I restrict the data to 2019, and therefore run the analysis over the period 2000-2019. Finally, the main variables of interest are trimmed at 99% (and 1% when relevant). All economic variables are deflated using the consumer price index provided by the French National Institute of Statistics and Economic Studies (INSEE).

This results in a set of 28,430 observations representing 3,264 firms (see the descriptive statistics in Table (1)). The average sales are €8.2 million (in 2000 euros) and the average number of employees is 61.2. Beyond these averages, there is considerable heterogeneity between firms: the first decile of sales is €1.0 million, while the last decile is 15 times higher at €15.1 million. The same applies to the number of employees.

An important feature of FIBEN is its coverage of small businesses. Contrary to most corporate finance studies that tend to cover large firms better than small firms because of data unavailability or access difficulties –for example, studies based on Compustat data are biased towards large firms, as mentioned in Chodorow-Reich

(2014, p.14)–, in Chodorow-Reich (2014), the median firm has sales of $500 million (in 2005 dollars) and 620 employees, compared to €3.2 million (in 2000 euros) and 32 employees in the dataset used here.

Fuel expenditures are proxied using the tax return items "purchases of raw materials and other supplies" and "changes in inventories", which, in the case of transportation service companies, are expected to closely reflect actual fuel spending.

A second piece of information is the firm's probability of default. This information is one of the output of the credit risk assessment of non-financial firms carried out by the Banque de France. The quality of this information is recognized by the External Credit Assessment Institution (ECAI) and In-House Credit Assessment System (ICAS) statuses of the Banque de France.[5] That information represents the estimation of firm's probability of bankruptcy[6] over a three-year horizon for each firm. The average value of the probability of default is 4.3%.

The third database used in the paper is on commodity prices. This is made available by the INSEE.[7] It provides over a hundred series in euros or foreign currencies (essentially dollars) over the period 1990-2023. These data cover fossil resources and their derivatives, such as naphtha and heating oil, as well as agricultural and food resources (corn, wheat, oilseeds, etc.), and metallic and mineral-based commodities

[5]As metionned, *"the Banque de France is a recognised External Credit Assessment Institution (ECAI) which means it complies with international credit risk assessment criteria: objectivity, independence, transparency and publication of the methodology used, extensive use by the banking profession, and verified and standardised performance criteria. In Europe, the Banque de France is one of the eight central banks whose credit rating system has been officially recognised by the Eurosystem as an In-House Credit Assessment System (ICAS)"*.See https://www.banque-france.fr/system/files/2025-01/Fiche-Cotation_EN.pdf. Accessed on January 12, 2026.

[6]Note that I equally use the terms "probability of bankruptcy" or "probability of default" all along the paper, but, to be precise, this is the probability of bankruptcy.

[7]Reference: INSEE, 2025, Raw materials price indices and international prices, INSEE, https://www.insee.fr/en/statistiques/series/105299226. Database version in February 2024 (data available until January 2024).).

(copper, nickel, aluminum, lead). This database does *not* provide firm-level data: it reports quoted spot market prices or price indexes on a monthly basis. As France is in the euro zone, I use the oil price in euros as the reference price for oil. As balance sheet data are annual, commodity series are averaged over the year before being merged with firm balance sheet data.

Lastly, the tax statements for Spain and Italy comes from the iBACH database. IBACH is a harmonized firm-level database of financial statements.This database is the result of a joint effort between European national central banks and the European Central Bank: within the framework of an ECCBSO working group (European Committee of Central Balance Sheet Data Offices),[8] experts collaborated to harmonize accounting definitions and make firm-level data from different European countries suitable for cross-country comparative analysis.

Here, this database is used for the external validity and described in the Online Appendix (see Section 8.1). In the external validity, I use a set 107,728 observations (43.5% from Spain, 56.5% from Italy) representing 20,287 firms. The iBACH database offers a larger sample size compared to French data, because the Spanish and Italian data provide a coverage that is closer to an exhaustive representation of the corporate sector respectively for Spain and Italy than the French data for France.[9] The reason being, in particular, that the motivation for data collection is not the same for all this countries.

While the iBACH database offers a larger sample size compared to French data, it also entails some limitations. First, the harmonization of accounting variables

[8] See https://www.eccbso.org/

[9] See Figure 8 in the Online Appendix for an illustration of employee coverage by country in iBACH. N.B. The coverage of French firms is higher when using FIBEN than when using iBACH, but it remains below the levels observed for Spain and Italy.

results in a lower level of detail in the financial statements. For example, with iBACH data, I approximate fuel costs by operating expenses, which arguably remain a suitable proxy for firms operating in the freight transportation sector. Second, the available time coverage is more limited with iBACH (starting from 2009), resulting in a shorter observation period.

4 Empirical Results

This paper aims to quantify the effects of oil price shocks on firms operating in the transportation services sector. To this end, I first assess the overall impact of oil shocks on a key financial ratio used by investors: the profit margin.

In practice, I implement the identification strategy described in Section (2): Equation (10) is estimated using the Bartik instrument, defined in Equation (9), as the main explanatory variable, with firms' profit margins as the outcome of interest. The results are reported in Table (2).

4.1 Average effect on the transportation services

As reported in column (1) of Table (2), the impact of weighted oil-price shocks[10] on the profit margin is negative and (weakly) significant.

Regarding the interpretation of the coefficient, column (1) shows that, in the transportation sector, a one-standard-deviation higher weighted-oil shock leads to a 2.7% decrease (=0.013×8.4%/4.1%) in the profit margin.

This first result is economically modest and reflects the behaviour of an average

[10]Weighted by the firm's dependence on fuel, see Section (2) for more details.

firm, whatever the shock sign, the firm size, or the transportation mode (air, rail, road, or water).

By dis-aggregating the analysis, I show the extent to which the magnitude of the effect differs depending on these characteristics.

4.2 Break down by shock sign

The result of the previous section presents the average effects regardless of whether the oil price has increased or decreased. However, asymmetric effects between oil price increases and decreases have been reported in the macroeconomic literature (Hamilton, 2003) or the microeconomic literature of cost-pass-through (Lafrogne-Joussier et al., 2023).

In column (2) of Table (2), I separate the shocks into price increases and price decreases to highlight potential asymmetries. The results show no significant effect of oil-price decreases. The average effect observed in the previous section stems from rising oil prices: in other words, the sector's overall sensitivity is driven by upward, not downward, movements in oil prices.

Regarding the interpretation of the coefficient, column (2) shows that a one-standard-deviation higher weighted-oil shock leads to a 8.2% decrease (=0.040 $\times$ 8.4%/4.1%) in the profit margin. This effect is economically and statistically significant.

However, the transport sector is far from homogeneous: it includes different modes of transport and firms of varying sizes, which may experience oil price shocks differently. The next section investigates these heterogeneous effects.

4.3 Break down by transportation mode

The freight transportation sector encompasses a wide range of transportation modes, including air, rail, road, and maritime transport. These modes differ substantially, particularly in terms of firm size. Road transport is characterized by smaller firms compared to other sectors, with an average of 59.6 employees, compared to 200.3 employees on average in other transport modes (see Table (1)). This discrepancy is not driven by any single mode –air, rail, and water transport firms– each report larger average firm sizes than those in road transport.

This heterogeneity motivates a decomposition. However, due to the small number of observations in certain sectors, where only a few firms operate, I choose to distinguish road freight (columns (4) and subsequent columns) from other transport modes (column (3)).

Column (4) presents the same regression as in column (2), but focuses specifically on the road transport sector. Road freight transport exhibits behavior consistent with the analysis conducted so far: the industry's margins are shrinking in the face of rising oil prices, but they remain unaffected by falling oil prices.

By contrast, the other transport mode (see column (3)) exhibits no significant impact when oil prices rise or fall.[11] More precisely, they exhibit a pattern opposite to that observed in road transport. The sign of the coefficients is consistent, for example, with hedging against rising oil prices, and conversely with increasing margins when prices fall. Some transport modes indeed have a long tradition of fuel price hedging, such as the airline industry with regard to the price of jet fuel (Mor-

[11] Or weakly significant but not robust.

rell and Swan, 2006). Even if the hedging is imperfect,[12] the airline industry has tools to limit the impact of jet fuel price increases. An option that is generally not available to road transport operators, who rely on retail fuel purchases: indeed, in road freight transport, access to wholesale fuel prices is relatively limited and often takes the form of negotiated bulk-purchase prices, for instance for carriers equipped with on-site fuel tanks.

Figure (1) illustrates the results for the road transport. It reports a binscatter plot of average changes in profit margins (y-axis) as a function of changes in the weighted oil shock (x-axis), after controlling for firm fixed effects. The figure indicates that positive weighted oil price shocks are associated with lower profit margins, while negative shocks do not seem to have any significant effect on profit margins, or at least the slope is less steep than for increases in oil prices.

Regarding the interpretation of the coefficient for the road transport, column (4) shows that a one-standard-deviation higher weighted-oil shock leads to a 9.8% decrease (=0.046×8.5%/4.0%) in the profit margin.

$$\frac{\Delta margin}{\overline{margin}} = \frac{\beta \times \sigma_Z}{\overline{margin}} = 9.8\% \quad \text{with } (\beta; \sigma_Z; \overline{margin}) = (0.046; 8.5\%; 4.0\%) \quad (11)$$

These results for the road transport sector are consistent with a demand for road transport fuel that is inelastic with respect to price. Indeed transportation companies operate vehicles that cannot run on alternative fuels: (i) the use of biofuels is limited by blending constraints, as they can only be incorporated into conventional

[12] See for example the relationship between Jet kerosene price and Crude oil price in https://www.mba.aero/wp-content/uploads/marginsinturbulencefinal.pdf Accessed on May, 28 2026.

fuels up to a few percentage points,[13] and (ii) the adoption of hybrid vehicles in the transportation sector remains very low. Road transport depends predominantly on fossil fuels: "*As of 1 January 2024, the heavy-duty vehicle fleet comprised 625,000 vehicles in circulation, including 305,800 trucks. Almost all heavy-duty vehicles (97.7%) were powered by diesel internal combustion engines*".[14] So, if firms can not switch to alternative fuel and if they have a limited ability to pass-through oil price increase,[15] their profit margin decrease in the face of oil price increase.

Finally the asymmetry of margin dynamics between oil price increases and decreases may stem from a difference in how prices at gas stations react to price increases and decreases in the crude oil spot market: since the papers of Bacon (1991) and Borenstein et al. (1997), at least, the literature has shown that price increases are passed on more quickly at gas stations than price decreases (the so-called "rockets and feathers" effect).

Using an more rudimentary shift-share definition, column (5) reveals both the asymmetry of the impact and the role of dependence in the adjustment of profit margins to oil price shocks. In this specification, the shift-share instrument is simplified: the main variable of interest is now the interaction between the (unweighted) oil shocks and a dummy set to one for firms with a large fuel dependence (top 25% largest dependence). As shown in column (5), when oil prices rise, firms that are more dependent on fuel are affected more than those that are less dependent. However, there is an asymmetry between price increases and decreases, such that when

[13] See https://www.ecologie.gouv.fr/politiques-publiques/biocarburants, accessed on May, 28 2026.

[14] Citation from: https://www.statistiques.developpement-durable.gouv.fr/625-000-poids-lourds-en-circulation-au-1er-janvier-2024. Accessed on 28 May 2026.

[15] The limited extent of price pass-through has been documented in the literature, particularly during "normal" periods, that is, outside episodes of energy crisis (Lafrogne-Joussier et al., 2023).

oil prices fall, this dependence has no significant effect.

Because the effects are driven by the road transport sector, the rest of the paper focuses on this mode of transport unless otherwise mentioned.

4.3.1 Profit loss outside energy crisis vs investment for the transition

Assessing the impact of oil price shocks within the framework adopted so far effectively corresponds to a partial equilibrium analysis. This amount to assuming, for example, that aggregate demand for transport services remains unaffected by the shock. Such an approximation is likely to be reasonable outside periods of energy crises, especially when the objective is to gauge the order of magnitude of the effects.

The magnitude of the impact estimated so fare is economically significant but it remains modest when compared with an investment option enabling to hedge against these shocks. Belle-Larant et al. (2024), building on Pisani-Ferry and Mahfouz (2023), computes the incremental net present cost of adopting a clean heavy-duty truck relative to a conventional one (diesel heavy-duty truck) in France, the latter being cheaper to purchase but more expensive to operate, leading to a green extra-cost between €45K-60K.[16] Under their assumptions regarding annual mileage, vehicle lifetime, and the discount rate,[17] and taking a trucking cost of approximately between €1 and 2 per kilometer,[18] this results in an annual loss (every year over the vehicle's lifetime) that exceeds the average industry margin: $\frac{\Delta margin}{\overline{margin}} \geq 100\%$.

Although the decision to invest in the low-carbon transition is a choice that goes

[16] See Table (3) of Belle-Larant et al. (2024).

[17] See the technical appendix of Belle-Larant et al. (2024) here: https://www.strategie-plan.gouv.fr/files/files/Publications/Rapport/fs-2024-na144-annexe-7octobre_final.pdf, accessed on 08 June 2026

[18] Cf. https://www.trans-road.com/en/freight-rates/cost-per-km-europe and https://innovia-transport.com/tarif-transport-routier-au-km , Accessed on 08 June 2026.

beyond a simple comparison of these two costs –the development of charging infrastructure matters, as well as the firm's financing capacity, or the firm's environmental positioning, to give some examples–, but this calculation of the trade-off between the costs and benefits of adopting a clean vehicle highlights the magnitude of the green investment (without public support) and underscores the fact that, at least outside of energy crises, oil shocks provide little incentive to invest in the transition to a low-carbon economy without public support.

These first findings open the way for extending the analysis. The analysis conducted so far has focused on a period outside any energy crisis periods. This work could be extended to energy crisis, for example to assess the impact of government support during an energy crisis. But first, I extend the analysis of sources of heterogeneity to other dimensions, with a focus on the road sector, as other modes of transport do not report significant impact in the analysis conducted so far.

4.4 Further Evidence on the Effects in the Road Transport Sector

4.4.1 Heterogeneous Effects by Firm Size

Past research has shown the heterogeneous behavior of firms in the face of a shock depending on their size. Indeed, firms of different size may have different behavior in the face of a shock for example due to different funding constraint, small firms being more constraint (Beck et al. (2008); Gertler and Gilchrist (1994)), or different cost pass-through levels (Devereux et al. (2017), Lafrogne-Joussier et al. (2023)[19]).

[19]In particular footnote 11 of Lafrogne-Joussier et al. (2023).

Overall carrying out a analysis by firm size is also informative because few (large) firms can shape the aggregate trade patterns of an industry (Bernard et al. (2007)). I thus break down the analysis by firm size and show the results in Table (3).

Column (1) in Table (3) reports the same result as in column (5) of Table (2). Column (2) breaks down this result by firm size. Firm size is defined through a yearly segmentation of the sales distribution in the spirit of Covas and Den Haan (2011), based on quartiles. The size used is the size before the shock.

The column (2) shows that the asymmetrical effect highlighted in column (1) persists when the analysis is broken down by firm size: (i) in the case of oil price decreases, the coefficients are not statistically significant (or not robust, see for example the robustness section (4.6.1)); (ii) by contrast, significant effects are observed for oil price increases, regardless of firm size.

More precisely, for oil price increase, the coefficients vary according to the size of the firm. They are decreasing with firm size, ranging from +0.055, for the bottom 25% smallest firms, to +0.035, for the top 25% largest firms. The significance is even declining for the largest companies. Therefore, the larger the company, the smaller the impact of rising oil prices.

So far, the analysis has focused on profit margins; what about other adjustment channels than profits, such as wages or employment?

4.4.2 Transmission channel analysis

Hereafter, I analyze and compare the different potential channels of adjustment through wages, employment, and profits. That is I wonder, first, (i) to what extent do oil shocks affect firms' fuel expenses in the road transport sector? (ii) To what

extent do shocks to fuel expenses propagate within the firm, for example to value added? And (iii) is the allocation of value added substantially changed? That is, to what extent do the wage bill and profit adjust? And (iv), ultimately, do these results lead to a deterioration in firms' financial health?

Since I found that only increases in oil prices have a significant impact on firms, the analysis is broken down between price increase and decrease, and I focus on pice increases (see Table (4)). However, for transparency, the results for price decreases are also reported.

In column (1) of Table (4) the dependent variable is the change in the fuel expenditures per euro of sales. As shown in column (1), the impact of oil price increases on fuel expenditures per euro of sales is significant and positive. Regarding the interpretation of the coefficient, column (1) shows that, in the road transportation sector, a one-standard-deviation higher weighted-oil shock leads to a 6.4% increase (=0.116×8.5%/15.3%) in fuel expenditures per euro of sales.

As the accounting identity is preserved (see Equation (2)), any increase in fuel expenditures per euro of sales is absorbed by the other components for an equivalent amount, namely: either by valued added per euro of sales or by other operating costs. Column (2) shows the effect of oil shocks on firms' value added. It highlights a significant decline in value added: 44% (=0.051/0.116) of the shock of fuel expenditures is absorbed by the valued added.

This relationship between the weighted oil shocks, fuel expenditures and the value added is illustrated with Figure (2). This Figure plots (i) the weighted average of oil price changes over time with (ii) the average changes in firms' fuel costs per euro of sales, and (iii) the average changes in firms' value added per euro of sales. The

changes in value added are presented with a "times-minus-one" transformation to be consistent with the (expected) negative relationship with the other two variables (see Equation (2) in Section (2)). Figure (2) clearly shows (i) a positive relationship between the weighted oil shocks and the change in firms' raw material costs, and (ii) a negative relationship between the weighted oil shocks and the change in firms' value added, as expected, and as shown in columns (1) and (2) of Table (4).

I further break down the value added between the dynamics of the numerator (the growth rate of value added, see column (3)) and the dynamics of the numerator (the growth rate of sales, see column (5)). The result of column (2) appears to be driven more by a decline in value added (see column (3)) than by an increase in sales (see column (4)). This is consistent with the literature on the absence of full cost pass-through outside of energy crisis periods (Lafrogne-Joussier et al., 2023).

If the value added per euro of output decrease, does this lead to change in the value added sharing? In columns (5) and (8), the value added per euro of sales is broken down, respectively, between the wage bill per euro of sales and the profit margin (= profit per euro of sales). As shown, the value-added shock is transmitted to the profit margin, while the wage bill per euro of sales is unaffected. This result is in line with the literature highlighting for example wage rigidities in downturn (Babecký et al., 2010).

I further break down the wage bill into growth in real wages (column(6)) and growth in the number of employees (column(7)). There appears to be no significant impact on these two components. This is in line with the previous remark on the insignificant impact on the wage bill.

Is there a significant change in the distribution of value added? Column (9)

reports the effect on the labor share, measured as the change in the ratio of the wage bill to value added. It highlights the increase of labor share in the face of oil-price increases. This finding is consistent with the rigidity of the wage bill in the face of oil price increase (see column (5)), while the profit margin adjusts (column (8)). Again, there is an asymmetry between oil price increases and decreases: there is no significant impact on the labor share in the case of oil price decreases. This result is consistent with Figure (3). Figure (3) is a bin-scatter plot showing the relationship between firms' labor share on the y-axis and weight oil-specific shocks on the x-axis. Figure (3) illustrates the asymmetry of the impact of oil shocks: (i) when oil price rises, the labor share increases, (ii) conversely, oil price decreases do not seem to have any significant effect on the labor share, or at least the slope is less steep than for increases in oil prices.

Finally, columns (10) and (11) report the impact on cash holdings and financial debt, respectively. While no significant effect is found on cash holdings[20], indebtedness increases, suggesting that firms may borrow to preserve their liquidity.

The analysis of adjustment channels has so far focused on price increases: in the face of oil price increases, (i) fuel expenditures rise, (ii) value added per euro of sales declines, (iii) the wage bill, the average wage and number of employees are unaffected, (iv) profit margins shrink, (v) the labor share increases, and (vi) the debt increases. Do these effects translate into a deterioration in firms' overall financial health over the medium term?

In column (12) of Table (4), the dependent variable is the change in the firm's probability of default over a three-year horizon provided by the Banque de France.

[20]With or without financial controls, in particular lagged liquidity ratio, the key results for these two columns remain the same.

As shown in column (12), the coefficient is positive, as expected, but not significant: despite the deterioration in financial ratios, there is no significant impact on the company's probability of default in the medium term.

I have shown a deterioration in companies' short-term financial ratios –at least in the year of the shock–whether in terms of value added, profit, or debt, but there is no medium-term impact, at least over a three-year horizon. The following section aims to reconcile these two findings regarding the impact of the shock over time.

4.4.3 Are these effects long-lasting?

To analyze if oil shocks have long-lasting effects, I use local projections (Jordà, 2005). I run a series of regressions on a variable of interest at various horizons (h) after year t of the oil price shock, on the independent variable of interest at t (the Bartik instrument) and on control variables. I estimate the following equation for the different horizons ($h = 0, 1, 2$ years):

$$y_{f,t+h} = \beta_{y,h} \times Z_{f,t} + \rho_{f,h}.x_{f,t-1} + \alpha_f + \theta_{s,t+h} + \epsilon_{f,t+h} \tag{12}$$

where y is the dependent variable of interest (here the profit margin), $Z_{f,t}$ is the Bartik instrument (see Equation (9)) and $\beta_{y,h}$ is the dynamic causal effect of interest at horizon (h), that is, the impulse response function. The vector x is a set of controls: namely, the one-year lag of the Bartik instrument (so $p = 1$), and the one-year lag of financial ratios computed at the firm level (the share of cash holdings over total assets, the leverage, and the logarithm of total assets). As in the main equation, the dummies α_f are firm-level fixed effects and $\theta_{s,t+h}$ are sector-by-year

fixed effects.

Due to the asymmetry between price increases and decreases, the main variable of interest is broken down between price increases and decreases, and the reporting focuses on oil price increases: Figure (4) shows the dynamics following oil price increases at the different time-horizons. The line shows the point estimates and the shaded areas shows the 95% confidence bands.

Figure (4) indicates that the profit margin decreases significantly on impact. Then the effect vanishes after one year, becoming nonsignificant. The fact that profit deterioration is confined to the year of the shock suggests that firms experience only temporary distress. Although these difficulties may lead some companies to default, those that weather the storm are subsequently able to restore their profit margins. And, on average over a three-year period, there is no significantly higher failure rate among the most dependent companies, as noted in the previous section.

4.5 Evidence from the 2022 Energy Crisis

The analysis conducted so far has focused on a period outside any energy crisis periods. This work could be extended to energy crisis, for example to assess the impact of the government support during that time.

To mitigate the impact of soaring fuel prices at the pump in 2022, caused by the energy crisis triggered by the outbreak of the Russia-Ukraine conflict, the government has implemented several support measures: (i) some measures were unconditional, such as a per-liter discount on the price of fuel at the pump, effective April 1, 2022. The measure is unconditional, as it applied uniformly to all fuels and to both

private and professional uses.[21] (ii) Others measures consisted of operating subsidies intended, for example, to road transport companies, contingent on the number and type of vehicles.[22]

4.5.1 Was the conditional aid to the road transport sector directed toward vulnerable companies?

As mentioned, the government supported businesses through production subsidies during the 2022 energy crisis, and this assistance was substantial compared to typical operating subsidies, as shown by Figure (5). This Figure shows (i) the total amount of operating subsidies and (ii) the average amount of operating subsidies relative to value added granted to companies in the road freight transport sector during the period 2000-2024. Regardless of the indicators used, there has been a sharp increase in business aid for the year 2022. But to what extent was this conditional support to the road transport sector directed toward vulnerable companies?

Figure (6) shows the relation between ex-ante vulnerability and the government support in 2022. Namely, Figure (6) is a binscatter plot illustrating the relationship between (i) the operating subsidy in 2022, measured at the firm level and expressed as a percentage of 2019 sales, and (ii) firms' fuel dependence as measured in 2019. This figure shows a clear positive relationship between the aid received by a company during the 2022 crisis and its anticipated vulnerability, as calculated in 2019.

But ultimately, how did the company's vulnerability –due to its dependence on fossil fuels– and the aid it received during the crisis affect its profits during the

[21] https://static.eurofound.europa.eu/covid19db/cases/FR-2022-14_2344.html, Accessed on 10 June 2026.

[22] See https://static.eurofound.europa.eu/covid19db/cases/FR-2022-15_2394.html and https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000045536740, Accessed on 10 June 2026.

energy crisis? Said differently, to what extent did fuel dependence remain a source of vulnerability during the 2022 energy crisis?

4.5.2 To what extent did energy dependence remain a source of vulnerability during the 2022 energy crisis?

The estimates made so far have been conducted outside the context of any energy crisis: in the former sections, I quantify the impact of oil shocks over 2000-2019. It is now time to examine the impact during an energy crisis: that is, to what extent does ex ante vulnerability translate into financial consequences during an energy crisis? And to what extent did government support mitigate the impact of the energy crisis on exposed firms? To answer these questions, I draw on the 2022 energy crisis by extending the analysis conducted so far on the period 2000-2019 to the period including the 2022 energy crisis. The results are reported in Table (5).

To assess the mitigating role of government support, I augment the main specification with a triple interaction (see Equation (13)) between the weighted oil shocks, a dummy identifying the 2022 energy crisis, and the government aid: for simplicity, I build a dummy for the 50% of the most supported firms as measured by the ratio subsidy in year t scaled by sales in year $t-1$.

In Equation (13), the coefficient β_1 captures the baseline effect of the shock exposure on firm performance, the coefficient β_2 measures how the effect of exposure changes during the energy crisis –a negative β_2 would indicate that the crisis amplified the adverse consequences of the shock–, and the coefficient β_3 is the coefficient of interest: it captures whether the effect of fuel dependence during the energy crisis differs for firms receiving relatively high government support.

$$
\begin{aligned}
\Delta\Big(\frac{\pi}{SA}\Big)_{f,t} &= \beta_1 \times Z_{f,t} \\
&+ \beta_2 \times Z_{f,t} \times \mathbb{1}_{\text{Energy Crisis}} \\
&+ \beta_3 \times Z_{f,t} \times \mathbb{1}_{\text{Energy Crisis}} \times \mathbb{1}_{\text{top 50\% of } \frac{Subsidy}{lag(Sales)}} \\
&+ \mathbb{1}_{\text{top 50\% of } \frac{Subsidy}{lag(Sales)}} \\
&+ X_{f,t-1} + \alpha_f + \theta_{s,t} + \epsilon_{f,t}
\end{aligned}
\tag{13}
$$

Column (1) of Table (5) reports the same result as column (1) of Table (2), that is an analysis carried out on the period 2000-2019. In Column (2), I introduce the triple interaction terms to assess whether government support altered the effect of oil price shocks on firms during the 2022 energy crisis: (i) the baseline coefficient β_1 remains close to its usual magnitude and remains statistically significant. (ii) The coefficient β_2 is negative but statistically insignificant, suggesting that the energy crisis did not significantly amplify the effect of fuel dependence. The coefficient β_3 is positive and larger in absolute value than β_1, suggesting that, for the firms that benefited from government support, the government support more than fully offset the adverse impact of the energy crisis associated with firms' fuel dependence.

So the anticipated vulnerability did not result in a greater impact during the energy crisis, which is consistent with the implementation of measures designed to assist businesses during the energy crisis. Taken together, the results suggest that the link between profit margins and fuel dependence was substantially weakened during the 2022 energy crisis. In other words, the historical vulnerability of fuel-dependent firms to energy price shocks seems to have been largely offset by

government support.

Preliminary conclusion As mentioned before, the decision to invest in a low-carbon transition is a choice that goes beyond a simple comparison of two costs: (i) the profit loss due to oil price increases, (ii) and the cost of a green investment (illustrated in Section (4.3.1)). However, the loss of profits due to rising oil prices is a key factor, as is a carbon tax designed to encourage the transition to a low-carbon economy.

The present analysis highlights that whatever the situation, "normal" period (2000-2019) or period of energy crisis (2022), these two periods did not provide an incentive to invest in low-carbon technologies. (i) In "normal" times, the profit loss related to oil price increases remains low: without government backing for the transition, price incentives alone are not strong enough to give an incentive to investment in the low-carbon transition. And (ii) in the 2022 energy crisis, government aid mitigates –or even cancels out– the effect of energy price increases.

One might object that, in the comparison I am making, there is (i) a period, 2000–2019, with little or no public intervention in financing the low-carbon transition, and (ii) a period of energy crisis during which the government intervenes to assist businesses. But the two cases are "homogeneous" from the perspective of the low-carbon transition[23], precisely because the aid provided during the energy crisis is not intended to finance the transition, but rather to address the immediate emergency by helping businesses (and households) mitigate the temporary effects of the energy shock.

[23]Hence the request for a report on the subject of transition financing by the head of government, Pisani-Ferry and Mahfouz (2023).

4.6 Additional and Robustness Results

I conduct a series of robustness checks, including an assessment of external validity, and an analysis of the impact of different definitions of the oil shock.

4.6.1 External validity: do these results hold across other European countries?

These results for France do not allow to draw conclusions about transport dynamics in other European countries. For example, in Europe, the importance of road or rail freight transport varies from one EU country to another: the share of rail in freight transport varies from 4% in Spain, to 10% in France, 12% in Italy and even 30% in Austria. To address this issue, I rely on a cross-country dataset covering several European countries, which allows me to address the external validity of the former results: I use financial data on non-financial corporations in Spain and Italy coming from the iBACH database (that latter is described in the appendix see Section (8)).

Table (6) presents the same analysis as that shown in Table (2) but for Spain and Italy. As reported in Table (6), the main results remain: (i) when the sign of the oil shock is not taken into account, oil shocks generally have a negative impact overall (see column (1)); (ii) but once I distinguish between oil price increases and decreases, asymmetric effects are reported depending on the shock sign (see column (2)); (iii), the effects are driven by the road transport sector (see columns (3)-(4)), and (iv) diminishing effects are observed as the size of the company increases (almost three times smaller between the bottom 25% smallest firms and the top 25% largest firms, see column (5)).

4.6.2 Two-Stage Least Squares (2SLS) estimation

I use a 2SLS estimation using the Bartik instrument as an IV to instrument the dynamics of firms' fuel costs per unit of sales, $\left(\frac{FC}{SA}\right)_{f,t}$.

The results related to the 2SLS estimation of Equation (10) are reported in Table (7). The columns reported in Table (7) are the same as the in columns of Table (4) but I focus the reporting to the key variables of interest: value added, wage bill and profit margin.

In the bottom part of the table, I report the first-stage coefficient (testing the relevance of the IV) and the Kleibergen–Paap Wald F-statistics (weak-IV test). These statistics confirm the relevance of the IV –through a significant and positive correlation between the Bartik instrument and fuel costs–, as well as the absence of weak-IV bias problem.

Overall, the results are consistent with the expectation: (i) as shown in column (1) of Table (7), a 1 pp change in the fuel costs per euro of sales results in -0.381 pp change in the profit margin. That is, 38% of a change in the fuel costs per euro of sales is absorbed by the value added. This figure should be compared with the 44% from the reduced-form specification (=0.051/0.116).[24]

As reported in columns (2) to (3) of Table (7), the value added shock is then essentially transmitted to the profit margin, in line with former results.

[24]Those coefficients are taken from columns (2) and (1) of Table (4)), see also Section (4.4.2).

4.6.3 Additional Robustness Tests, Including Alternative Measures of Oil Shocks

The baseline measure of oils shocks captures oil-price innovations that are orthogonal to broad commodity-price movements. As a complementary analysis, I consider two alternative measures of oil shocks: (i) a measure of oil price shocks that should be closely aligned with truck fuel prices, namely the Low-Sulfur Gas Oil (LSGO) price, and (ii), a measure from the literature, namely the structural oil supply shocks identified by Baumeister and Hamilton (2019).

Since Baumeister and Hamilton (2019) shocks are available at a monthly frequency,[25] for each calendar year, the annual innovation based on Baumeister and Hamilton (2019) is constructed by taking the arithmetic mean of the twelve corresponding monthly innovations. Then the alternative shift-share variable is built by interacting the annual shock with each firm's dependence to oil (see Equation (9)). The results are reported in Table (8).

In this section I also test to what extent results are robust to alternative weighting schemes: in the baseline specifications, observations are weighted by firm-level employment, measured immediately before the shock : (i) this weighting scheme reduces the influence of very small firms, who may generate volatile or noisy observations. And (ii) measuring employment before the shock ensures that the weights are predetermined rather than affected by firms' subsequent responses. I thus re-estimate the basic specifications without weights to assess to what extent the results are affected by the weighting scheme.

Columns (1) and (2) of Table (8) report the baseline results for the road freight

[25]Here: https://sites.google.com/site/cjsbaumeister/datasets, accessed July 2026.

transport: column (1) of Table (8) shows a similar analysis as column (1) of Table (2), but applied only to the road freight transport. And column (2) of Table (8) reports the results of column (4) of Table (2). These two columns of results serve as the benchmark for comparing the other estimates of the table.

Columns (3) and (4) of Table 8 replicate the analysis reported in Columns (1) and (2), but without weighting the estimations. In contrast, the baseline results are weighted by firm employment in the year preceding the shock. The main results remains.

Columns (5) and (6) of Table 8 replicate the analysis reported in Columns (1) and (2), but using the LSGO price to compute the oil-specific shocks instead of the Brent Crude oil price. The main results remains.

Columns (7) and (8) of Table 8 replicate the analysis reported in Columns (1) and (2) but using structural oil supply shocks identified by Baumeister and Hamilton (2019). Again, the main results remains.

5 Conclusion

Fluctuations in oil spot prices highlight the risks associated with the transition risk, as does an increase in the carbon tax. The present study provides estimates of the impact of oil-specific shocks both outside and during energy crises in the transport sector. It is worth comparing these impacts (i) with the incremental cost of a clean investment and (ii) the effect of government emergency aid in an energy crisis. This article shows that, over the period 2000–2022, oil price shocks did not spur the transition, regardless of whether the period was marked by an energy crisis or not.

Indeed, first, outside energy crisis, in the transport sector, the impact of oil shocks are (i) economically significant, but (ii) temporary and do not affect the medium-term survival of firms. And, (iii) in any case, without public aid, a net present cost analysis shows that the profit losses related to oil price increases are significantly lower than those associated with an green investment. Second, in an energy crisis, government aid mitigates –or even cancels out– the effect of price increases.

From a policy perspective, the evidence also suggests that policy maker tool like climate stress-testing should explicitly account for heterogeneous effects of energy shocks (by the sign of the shock and by firm size), regardless of their origin (e.g. climate risks, greenhouse gas taxes or geopolitical risks).

Although the paper evaluates external validity for continental European countries, a natural extension would be to examine the same issues in economies with more flexible labor markets, such as Anglo-Saxon countries. Another avenue for research would be to apply a similar analysis to other business sectors, in particular to explore cross-sectoral heterogeneity in behavior, or to extend the analysis to shocks beyond those specific to the oil market.

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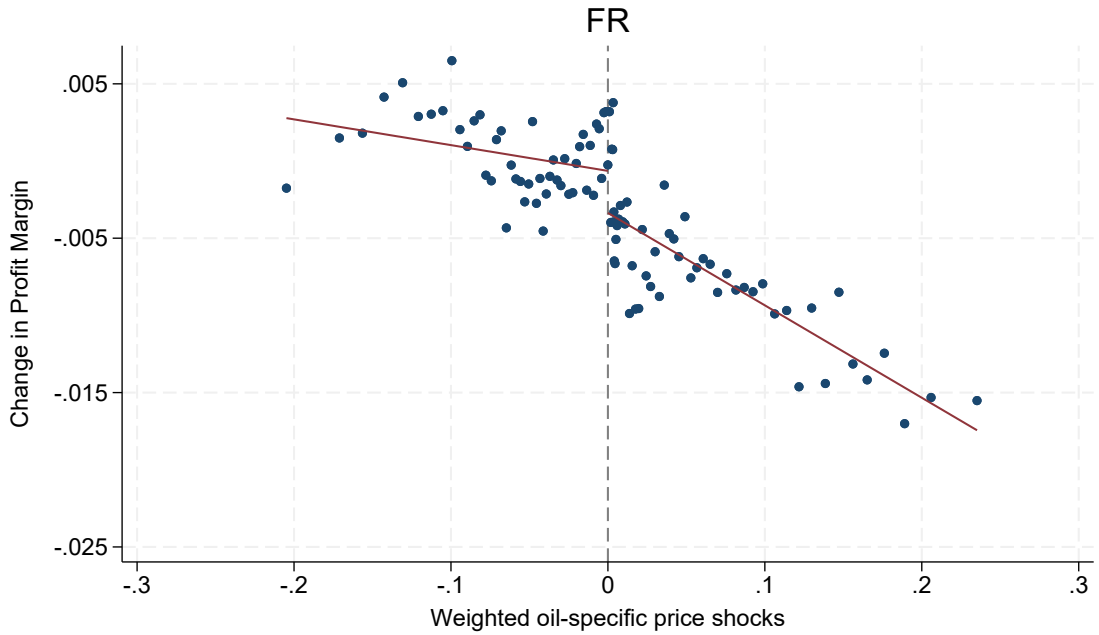
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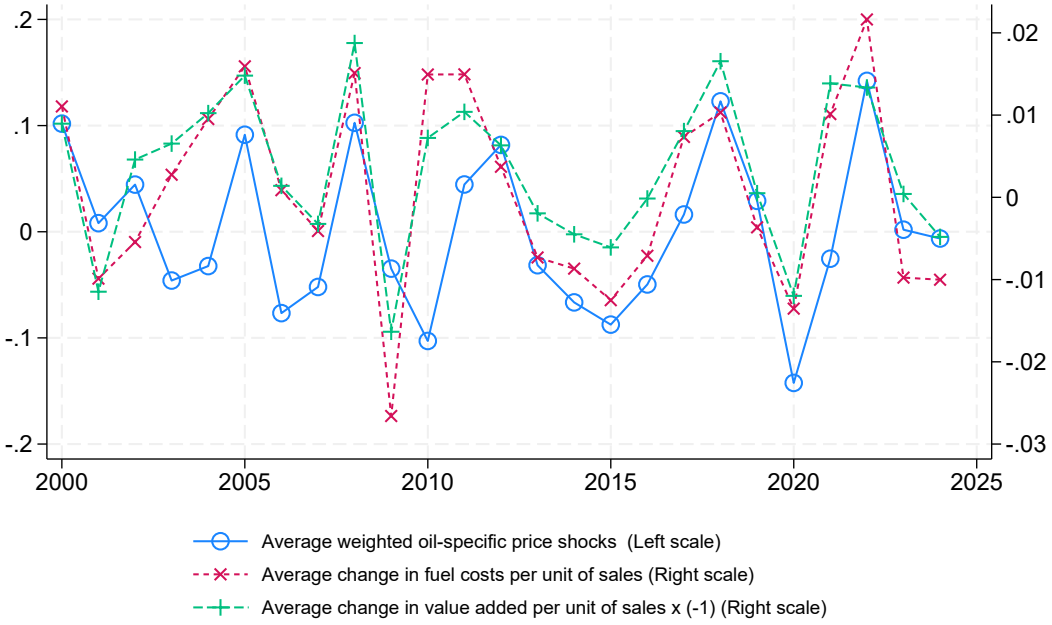
6 Figure

Figure 1: **The relationship between weighted oil-specific price shocks & profit margin**



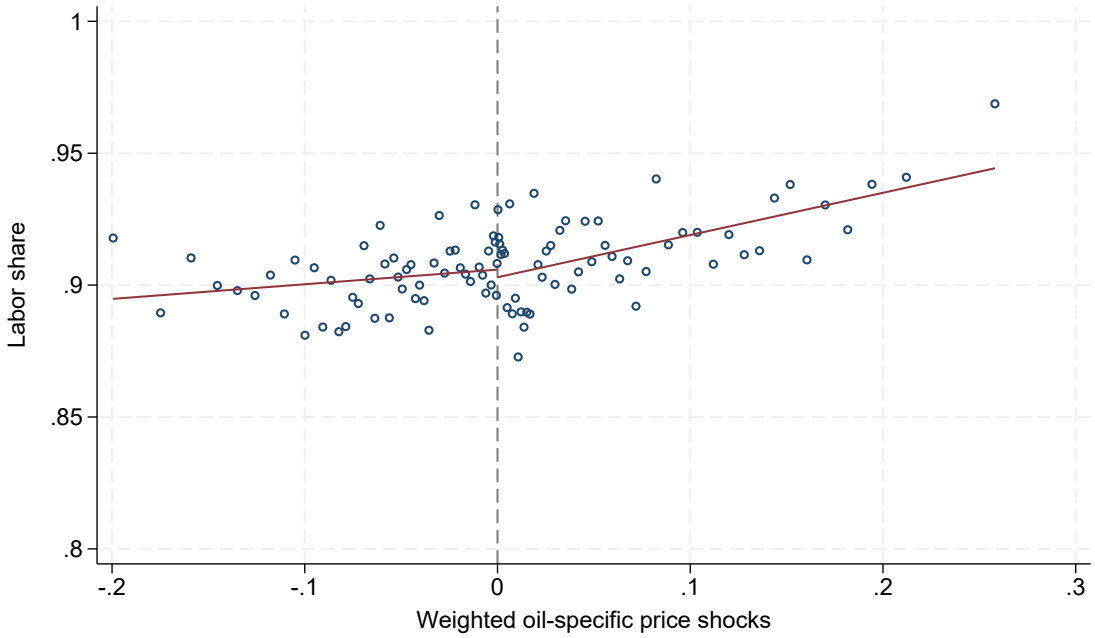
Note: This Figure is a binscatter plot of changes in profit margins (y-axis) as a function of weighted oil-specific shocks (x-axis), after controlling for firm fixed effects. The figure shows that positive weighted oil price shocks are associated with lower profit margins, while negative shocks do not seem to have any significant effect on profit margins.

Figure 2: **The relationship between weighted oil-specific price shocks, fuel costs, and value added**



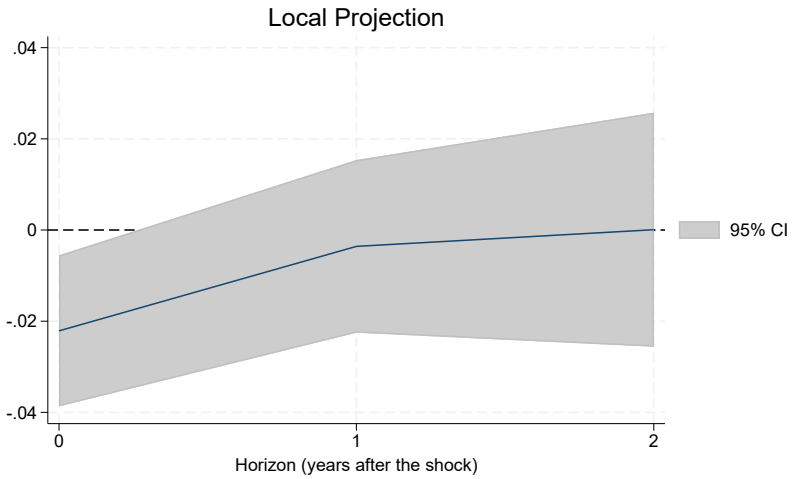
Note: This figure plots (i) the average weighted oil-specific shocks (that is, the average Bartik instrument defined in Equation (9)) over time, (ii) the average changes in firms' fuel costs per euro of sales, and (iii) the average changes in firms' value added per euro of sales. The average change in value added is presented with a "times-minus-one" transformation to be consistent with the (expected) negative relationship with the other variables.

Figure 3: **The relationship between weighted oil-specific price shocks & labor share**



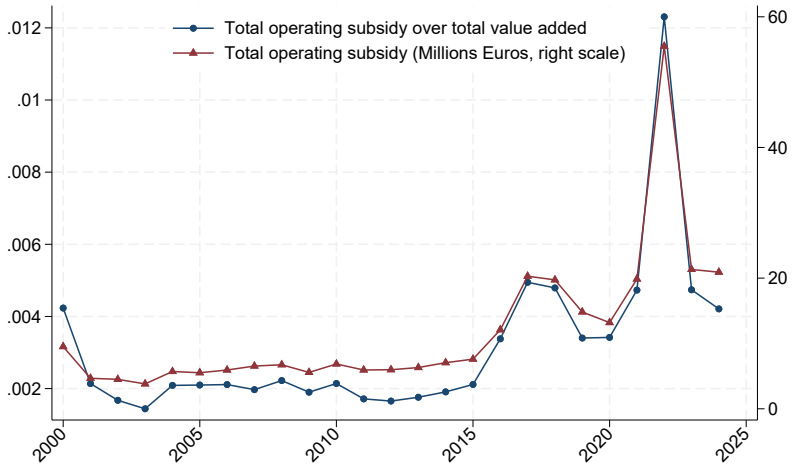
Note: This Figure is a binscatter plot of changes in the labor share (y-axis) as a function of weighted oil-specific shocks (x-axis), after controlling for firm fixed effects. The figure shows a different adjustment of labor share in the face of positive vs negative oil shocks.

Figure 4: **The effect of positive oil-specific shocks on profit margin**



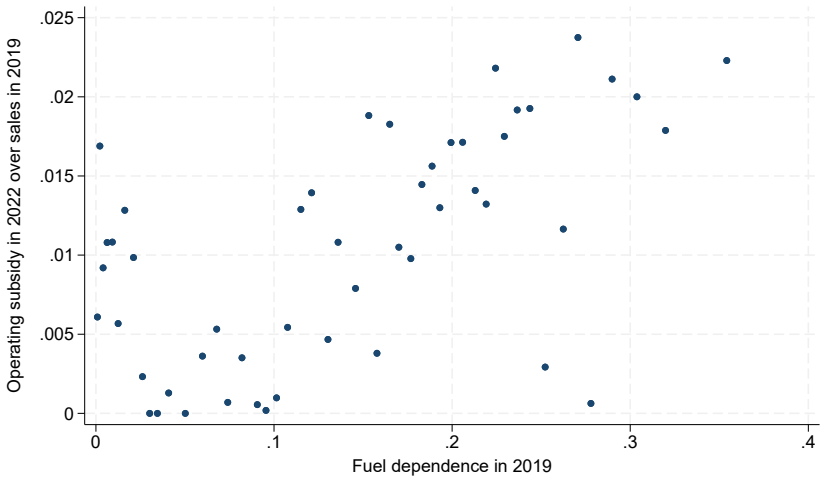
Note : Impulse responses of profit margin to (weighted) oil-specific shocks (price increases) on the period 2000-2019. Solid line: point estimate. Shaded area: 95% confidence bands.

Figure 5: **Total Operating Grants Over Time**



Note : This figure illustrates the evolution of operating subsidies granted to freight transport firms over time.

Figure 6: **Relationship between operating subsidy in the 2022 energy crisis and firm's fuel dependence**



Note : This figure is a binscatter plot showing the relationship between the median ratio of operating subsidy granted in 2022 over sales in 2019 (y-axys) and fuel dependence measured as the fuel expenditures in 2019 over sales in 2019.

7 Tables

Table 1: **Descriptive Statistics (all prices are in 2000 euros)**

	p10	p50	Mean	p90	SD
Panel A: All observations (28,430 obs., Firms 3,264)					
Sales (M€)	1,0	3,2	8,2	15,1	118,6
Employees	10	32	61,2	139	111,7
Proxy of fuel expenditures / Sales	1,2%	15,5%	15,2%	28,9%	10,4%
Wage bill / Sales	20,3%	32,2%	32,4%	44,3%	9,6%
Value added / Sales	22,5%	36,1%	36,5%	51,2%	11,3%
Labor share (=Wage bill/VA)	70,4%	90,2%	90,6%	109,6%	18,0%
Gross average wage (K€)	25,7	31,7	32,7	40,7	6,7
Productivity (K€/head)	26,1	35,4	37,7	51,2	12,8
Profit margin	-2,8%	3,3%	4,1%	12,4%	6,5%
Liquidity/TA	0,4%	10,3%	14,9%	37,0%	14,7%
Equity/TA	11,4%	31,4%	32,9%	58,1%	19,0%
Log(TA)	6,1	7,3	7,4	8,8	1,1
Weighted Oil-specific shocks	-9,7%	0,0%	0,3%	12,4%	8,4%
Weighted oil supply shocks of Baumeister and Hamilton (2019) × -1	-7,2%	0,5%	1,3%	9,6%	6,3%
Panel B: Freight Road Transport					
Road	p10	p50	Mean	p90	SD
Sales (M€)	1,0	3,2	6,5	14,8	14,5
Employees	10	32	59,6	137	102,4
Proxy of fuel expenditures / Sales	1,2%	15,7%	15,3%	29,0%	10,4%
Wage bill / Sales	20,4%	32,2%	32,4%	44,3%	9,5%
Value added / Sales	22,5%	36,1%	36,4%	51,1%	11,2%
Labor share (=Wage bill/VA)	70,9%	90,3%	90,8%	109,6%	17,8%
Gross average wage (K€)	25,7	31,6	32,5	40,3	6,5
Productivity (K€/head)	26,1	35,3	37,3	50,5	11,6
Profit margin	-2,8%	3,3%	4,0%	12,2%	6,4%
Liquidity/TA	0,4%	10,3%	14,9%	37,0%	14,7%
Equity/TA	11,4%	31,3%	32,8%	58,0%	19,0%
Log(TA)	6,1	7,2	7,3	8,8	1,0
Weighted Oil-specific shocks	-9,8%	0,0%	0,3%	12,4%	8,5%
Weighted oil supply shocks of Baumeister and Hamilton (2019) × -1	-7,3%	0,5%	1,4%	9,7%	6,3%
Panel C: Other Freight Transport (air, rail, water)					
Other	p10	p50	Mean	p90	SD
Sales (M€)	1,5	8,0	162,1	150,5	1102,6
Employees	7	37,5	200,3	504,5	411,2
Proxy of fuel expenditures / Sales	0,8%	6,3%	7,8%	18,1%	6,9%
Wage bill / Sales	10,3%	25,3%	27,5%	45,7%	14,1%
Value added / Sales	10,9%	36,5%	37,8%	66,7%	18,9%
Labor share (=Wage bill/VA)	38,9%	68,0%	72,0%	102,1%	28,0%
Gross average wage (K€)	28,7	45,3	45,9	63,6	13,0
Productivity (K€/head)	32,4	66,3	75,2	131,8	38,5
Profit margin	-0,4%	9,9%	11,6%	28,3%	12,0%
Liquidity/TA	0,2%	8,7%	15,5%	43,6%	17,3%
Equity/TA	6,8%	40,7%	38,7%	66,4%	22,3%
Log(TA)	6,9	9,0	9,2	11,8	2,0
Weighted Oil-specific shocks	-4,9%	-0,1%	-0,1%	5,0%	4,3%
Weighted oil-supply shocks of Baumeister and Hamilton (2019) × -1	-3,7%	0,1%	0,3%	4,1%	3,4%

Table 2: **The Impacts of Oil-Specific Shocks by Shock Sign & Transportation Mode**

Dependent			Δ (Profit Margin)				
Transportation Modes			All modes		All but Road	Road	
			(1)	(2)	(3)	(4)	(5)
Weighted Oil Price Shocks			-0.013*				
			(0.007)				
Weighted Oil Price Shocks	× Oil Price Increase Dummy			-0.040***	0.889	-0.046***	
				(0.015)	(0.549)	(0.013)	
	× Oil Price Decrease Dummy			0.022	-0.416*	0.025	
				(0.016)	(0.237)	(0.016)	
(Unweighted) Oil Price Shocks	× Oil Price Increase Dummy	× High Fuel Dependence Dummy					-0.008***
							(0.002)
	× Oil Price Decrease Dummy	× High Fuel Dependence Dummy					0.004
							(0.003)
Observations			28,430	28,430	318	28,112	28,112
R-squared			0.214	0.214	0.576	0.160	0.160
No firms			3264	3264	40	3224	3224
Within R2			0.0393	0.0397	0.0615	0.0427	0.0427
Controls			Yes	Yes	Yes	Yes	Yes
Industry-year			Yes	Yes	Yes	Yes	Yes
Firm level cluster			Yes	Yes	Yes	Yes	Yes

This table shows the impact of weighted oil-specific shocks on firms' profit margin in the freight transport sector (see Equation (10) and the identification strategy in Section (2)). The explanatory variable is a Bartik (shift-share) instrument, where the shocks ("shift" part) are oil-specific price shocks and the exposure to shocks ("share" part) are the firms' dependence on fuel (first observed value in the dataset for each firm). The usual one-year lagged controls are implemented, namely: (i) the share of cash holdings in total assets to control for firms' liquidity level, (ii) leverage, to control for firms' indebtedness, and (iii) the logarithm of total assets to control for firms' size. All estimations are carried out with firm fixed effects, industry(3 digits)-year fixed effects, and weighted by firm's number of employees prior to the shock. Standard errors, reported in parentheses, are clustered at firm level. ***, **, * indicate significance levels at 1%, 5% and 10%.

Table 3: **The Impacts of Oil-Specific Shocks by Shock sign and Firm Size**

Dependent			Δ (Profit Margin)	
Transportation Mode			Road	
			(1)	(2)
Weighted Price Shocks	× Oil Price Increase Dummy		-0.046***	
			(0.013)	
	× Oil Price Decrease Dummy		0.025	
			(0.016)	
Weighted Price Shocks	× Oil Price Increase Dummy	× Firm Size[p0-p25)		-0.055***
				(0.018)
		× Firm Size[p25-p50)		-0.060***
				(0.016)
		× Firm Size[p50-p75)		-0.054***
				(0.015)
		× Firm Size[p75-p100]		-0.035**
				(0.016)
	× Oil Price Decrease Dummy	× Firm Size[p0-p25)		-0.002
				(0.023)
		× Firm Size[p25-p50)		0.019
				(0.020)
		× Firm Size[p50-p75)		0.039**
				(0.019)
		× Firm Size[p75-p100]		0.023
				(0.018)
Observations			28,112	28,112
R-squared			0.160	0.161
No firms			3224	3224
Within R2			0.0427	0.0443
Controls			Yes	Yes
Industry-year			Yes	Yes
Firm level cluster			Yes	Yes

This table is similar to Table (2) but the results are now broken down by firm size. Firm size is defined through a yearly segmentation of the sales distribution in the spirit of Covas and Den Haan (2011), based on quartiles. The size used is the size before the shock. Standard errors, reported in parentheses, are clustered at firm level. ***, **, * indicate significance levels at 1%, 5% and 10%.

Table 4: **Impacts of Oil-Specific Shocks: Analysis of Transmission Channels**

		Fuel Expenditures	Value Added		Sales	Value Added Components				Labor Share	Cash Holdings	Financial Debt	Default Proba.
						Wage Bill			Profit				
Dependent		$\Delta(RM/SA)$	$\Delta(VA/SA)$	gr(VA)	gr(SA)	$\Delta(W/SA)$	gr(ω)	gr(N)	$\Delta(P/SA)$	$\Delta(W/VA)$	$\Delta(Cash\ H.)/lag(TA)$	$\Delta(Debt)/lag(TA)$	Δ(Default Proba)
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Weighted Price Shocks	× Price Increase Dummy	0.116***	-0.051***	-0.120**	-0.004	-0.005	0.016	-0.035	-0.046***	0.109**	-0.075	0.248**	3.612
		(0.008)	(0.012)	(0.052)	(0.035)	(0.010)	(0.037)	(0.039)	(0.013)	(0.043)	(0.071)	(0.098)	(3.261)
	× Price Decrease Dummy	-0.006	0.005	0.016	-0.002	-0.020	-0.039	-0.012	0.025	-0.084	-0.037	-0.061	-3.168
		(0.008)	(0.016)	(0.069)	(0.056)	(0.014)	(0.042)	(0.056)	(0.016)	(0.067)	(0.055)	(0.145)	(4.222)
Observations		28,112	28,112	28,112	28,112	28,112	28,112	28,112	28,112	28,112	28,112	28,112	28,112
R-squared		0.429	0.189	0.242	0.328	0.182	0.082	0.235	0.160	0.157	0.171	0.136	0.131
No firms		3224	3224	3224	3224	3224	3224	3224	3224	3224	3224	3224	3224
Within R2		0.0367	0.0228	0.0121	0.0147	0.00778	0.000242	0.0122	0.0427	0.0302	0.0706	0.0287	0.0241
Controls		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year & Firm FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm level cluster		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table is similar to column (4) of Table (2), but with different left-hand side variables: it shows the impact of oil shocks on firms through different key financial and operational metrics. Standard errors, reported in parentheses, are clustered at firm level. ***, **, * indicate significance levels at 1%, 5% and 10%.

Table 5: **Did the ex-ante fuel dependence lead to financial consequences during the 2022 Energy Crisis?**

Dependent			Δ (Profit Margin)	
Transportation Modes			Road	
Period			2000-2019	2000-2022
			(1)	(2)
Weighted Price Increases			-0.046***	-0.034**
			(0.013)	(0.016)
Weighted Price Increases	× Dummy(2022 Energy Crisis)			-0.006
				(0.019)
Weighted Price Increases	× Dummy(2022 Energy Crisis)	× Dummy(top-50% of Subsidy/lag(sales))		0.122**
				(0.060)
		Dummy(top-50% of Subsidy/lag(sales))		0.001
				(0.001)
Weighted Price Increases		× Dummy(top-50% of Subsidy/lag(sales))		-0.011
				(0.012)
	Dummy(2022 Energy Crisis)	× Dummy(top-50% of Subsidy/lag(sales))		-0.015
				(0.013)
Weighted Price Decreases			0.025	0.019
			(0.016)	(0.018)
Weighted Price Decreases		× Dummy(top-50% of Subsidy/lag(sales))		-0.008
				(0.012)
Observations			28,112	32,327
R-squared			0.160	0.152
No firms			3224	3489
Within R2			0.0427	0.0413
Controls			Yes	Yes
Industry-year			Yes	Yes
Firm level cluster			Yes	Yes

Column (1) of this table reports the column (4) of Table (2). Then in column (2), I assess the mitigating role of government support during the 2022 energy crisis by augmenting the specification with a triple interaction (see Equation (13)) between the weighted oil shocks, a dummy identifying the 2022 energy crisis, and the government aid. For simplicity, I build a dummy for the 50% of the most supported firms as measured by the ratio subsidy in year t scaled by sales in year $t-1$. Standard errors, reported in parentheses, are clustered at firm level. ***, **, * indicate significance levels at 1%, 5% and 10%.

Table 6: **External Validity: The Impacts of Oil-Specific Shocks on Spanish and Italian Firms**

Dependent			Δ (Profit Margin)				
Transportation Modes			All modes		All but Road	Road	
			(1)	(2)	(3)	(4)	(5)
Weighted Oil Price Shocks			-0.026***				
			(0.005)				
Weighted Oil Price Shocks	× Oil Price Increase Dummy			-0.040***	0.022	-0.042***	
				(0.010)	(0.089)	(0.010)	
	× Oil Price Decrease Dummy			-0.010	-0.003	-0.010	
				(0.010)	(0.103)	(0.010)	
Weighted Price Shocks	× Price Increase Dummy	× Firm Size[p0-p25)					-0.094***
							(0.018)
		× Firm Size[p25-p50)					-0.031**
							(0.014)
		× Firm Size[p50-p75)					-0.048***
							(0.012)
		× Firm Size[p75-p100]					-0.038***
							(0.011)
Weighted Price Shocks	× Price Decrease Dummy	× Firm Size[p0-p25)					0.023
							(0.018)
		× Firm Size[p25-p50)					-0.019
							(0.013)
		× Firm Size[p50-p75)					-0.013
							(0.011)
		× Firm Size[p75-p100]					-0.005
							(0.011)
Observations			107,728	107,728	1,913	105,815	105,815
R-squared			0.188	0.188	0.190	0.189	0.194
No firms			20287	20287	378	19921	19921
Within R2			0.00801	0.00809	0.00881	0.00943	0.0156
Controls			Yes	Yes	Yes	Yes	Yes
Industry-year			Yes	Yes	Yes	Yes	Yes
Firm level cluster			Yes	Yes	Yes	Yes	Yes

This table applies the same analytical framework as Table (2) to Spain and Italy, except that the specification includes also country-by-year fixed effects, thereby controlling for country-specific shocks over time. Standard errors, reported in parentheses, are clustered at firm level. ***, **, * indicate significance levels at 1%, 5% and 10%.

Table 7: **Impacts of Oil-Specific Shocks on Firms: 2SLS Estimation**

	Value Added	Wage Bill	Profit Margin
Dependent	$\Delta(VA/SA)$	$\Delta(W/SA)$	$\Delta(P/SA)$
	(1)	(2)	(3)
Changes in Fuel Costs/Sales	-0.423***	-0.187**	-0.236**
	(0.109)	(0.081)	(0.098)
Observations	28,112	28,112	28,112
No firms	3224	3224	3224
Industry-year & Firm FE	Yes	Yes	Yes
Firm level cluster	Yes	Yes	Yes
First-stage IV coef.	0.0628	0.0628	0.0628
First-stage IV pvalue	0	0	0
K-P Wald F-stat	230.4	230.4	230.4

This table is similar to Table (4) but 2SLS estimation are carried out using the Bartik instrument as an IV to instrument the dynamics of firms' fuel costs per euro of sales. Only the results on key metrics are reported: value added, wage bill, and profit margin. Standard errors, reported in parentheses, are clustered at firm level. ***, **, * indicate significance levels at 1%, 5% and 10%.

Table 8: **The Impacts of Oil-Specific Shocks Using Alternative Oil Shock Measures**

Dependent		Δ (Profit Margin)							
Transportation Modes		Road Transport							
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Weighted Oil Price Shocks		-0.015**		-0.009*					
		(0.006)		(0.005)					
Weighted Oil Price Shocks	× Oil Price Increase Dummy		-0.046***		-0.031***				
			(0.013)		(0.011)				
	× Oil Price Decrease Dummy		0.025		0.020				
			(0.016)		(0.013)				
Weighted Low-Sulfur Gas Oil Price Shock						-0.014*			
						(0.008)			
Weighted Low-Sulfur Gas Oil Price Shock	× Oil Price Increase Dummy						-0.041**		
							(0.017)		
	× Oil Price Decrease Dummy						0.017		
							(0.012)		
Oil supply shocks of Baumeister and Hamilton (2019) × -1								-0.017*	
								(0.009)	
Negative oil supply shocks of Baumeister and Hamilton (2019) × -1									0.006
									(0.016)
Negative oil supply shocks of Baumeister and Hamilton (2019) × -1									-0.039**
									(0.018)
Observations		28,112	28,112	28,112	28,112	28,112	28,112	27,812	27,812
R-squared		0.159	0.160	0.156	0.156	0.159	0.160	0.159	0.159
No firms		3224	3224	3224	3224	3224	3224	3206	3206
Within R2		0.0422	0.0427	0.0476	0.0478	0.0422	0.0428	0.0420	0.0421
Weight by lag(employment)		Yes	Yes	-	-	Yes	Yes	Yes	Yes
Controls		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm level cluster		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table shows the basic regressions carried out with different oil-shock measures: (i) the reference measure in columns (1) to (4), that is oil-price innovations that are orthogonal to broad commodity-price movements, (ii) a measure of oil-specific shocks [2]based on the Low-Sulfur Gas Oil price rather than Brent crude oil prices in columns (5) to (8), and (iii) the structural oil supply shocks identified by Baumeister and Hamilton (2019). Regressions are weighted with the number of employees prior to the shock in columns (1)-(2), (5)-(6), and (7)-(8), and unweighted in columns (3)-(4). Standard errors, reported in parentheses, are clustered at firm level. ***, **, * indicate significance levels at 1%, 5% and 10%.

8 Online Appendix

8.1 Data Source and Overview for Spain and Italy

The non-financial corporation data for Spain and Italy are sourced from the iBACH database, developed by a working group of European national central banks and the European Central Bank.

Since 2015, a Working Group, known as iBACH and built in the frame of the EC-CBSO (European Committee of Central Balance Sheet Data Offices)[26] has brought together experts to harmonize accounting definitions and make firm-level data from different European countries suitable for comparative analysis. Thus the iBACH database is a harmonized firm-level database of unconsolidated balance sheet, income statements of non-financial corporations. This database was created for research and analysis purposes.

Currently, the database covers seven countries: Austria, Belgium, France, Italy, Portugal, Slovakia, Spain. The countries providing the highest coverage of their national economies are Belgium, Spain, Italy, and Portugal.

Figures (7) and (8)) provide an idea of the coverage of this database. The iBACH database provides a rich setting with more than two decades of data on non-financial firms from European countries. However, data collection did not begin at the same time for all countries. The number of observations has strongly increased over time (see Figure (7)). In 2005 the database has gathered around 1,000,000 observations provided by four countries (Belgium, France, Italy and Portugal). It almost reaches 2,000,000 observations in 2008 with the addition of data from Spain. It exceeds

[26] See https://www.eccbso.org/ accessed on 12 June 2026.

3,000,000 observations from 2022 with growing contributions of existing participants and the addition of data from Austria and Slovakia (whose series starts respectively in 2010 and 2011).

To give an idea of iBACH's coverage, I use the Structural Business Statistics (SBS). SBS is a set of statistics compiled by Eurostat, describing the structure, activity, and performance of businesses in Europe over time. The SBS data "*come from the national statistical authorities in the EU [...]. They implement the most appropriate data collection methods on a national level. Generally, they use a combination of sources, such as: direct statistical surveys of businesses, administrative data, such as tax declarations or information, relating to social security contributions, information in statistical business registers, estimations and modelling.*"[27] SBS are used here as a reference to assess the coverage of iBACH data compared to the firm population for each country.

Figure (8)[28] shows to what extent the iBACH data cover the number of employees in each country. The first characteristic that emerges in the coverage of employees is the stability of the coverage by country throughout, except for Austria. But remember Austria became a participant in the project at a subsequent point, integrating data with a history extending back to 2010, and with a gradually increasing coverage reaching 30% in 2020.

Austria aside, employee coverage for the other countries shows a stable pattern over time: most countries cover more than 50% of employees: the coverage is close to 90% for Portugal, and approximately 60% or more for Belgium, Italy, and Spain

[27] See "Information on Data" at https://ec.europa.eu/eurostat/web/structural-business-statistics/

[28] I am deeply grateful to Nicola Benatti for his valuable help in producing this graph.

in 2020. Analyzing the iBACH coverage in terms of firm's output, using SBS as a benchmark, provide similar level and dynamics.

In the present paper, the analysis is limited to countries of a comparable size to France, namely Spain and Italy, but the analysis could be extended to other countries.

Figure 7: **Number of observations (in thousands) by country in the iBACH database over the period 2000–2023**

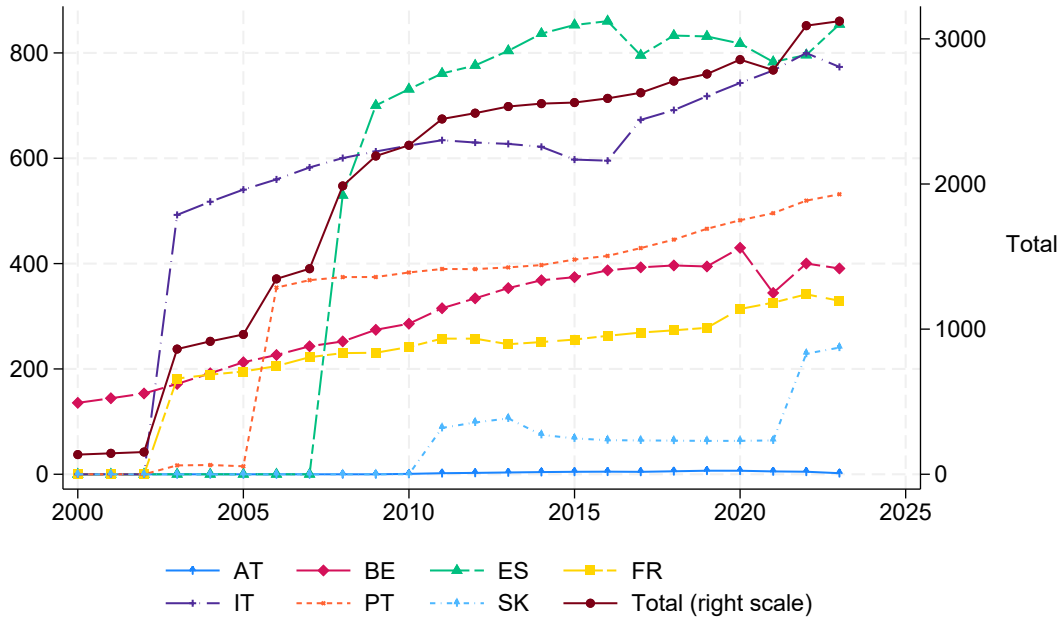


Figure 8: **Evaluating iBACH Coverage Using the Ratio of Employees Reported in iBACH to Employees Reported in Eurostat Structural Business Statistics (Benchmark)**

