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LABOR SHARE, INDUSTRY CONCENTRATION AND ENERGY PRICES: EVIDENCE FROM EUROPE

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Labor Share, Industry Concentration and Energy Prices: Evidence from Europe

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Abstract

Climate change policies are often met with resistance due to fears over the loss of competitiveness and employment. This paper studies the effect of energy prices, which are a proxy for a carbon tax, on the labor share of income and industry concentration. Using aggregated administrative data from 15 European countries and 56 sectors for the years 2000-2016, and applying a shift-share instrumental variable approach, we find that the energy price has a negative and quantitatively significant effect on the labor share. Exploring the potential mechanisms, we document strong evidence that the degree of substitution between energy and labor is lower than the substitution between energy and capital. Reallocation among firms, changes in aggregate markups or the value-added to output ratio induced by energy price shocks do not lead to sizable changes in the labor share. We find no robust evidence that energy prices affect industry concentration and markups. These results indicate sizable potential redistributional impacts of climate change policies, at least in the short-run, as the transitional costs differ across the primary factors.

Keywords: Energy price, labor share, market concentration, factor substitution

JEL Codes: E24, E25, Q40, Q50

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1 Introduction

The need to address climate change while limiting the adverse economic effects of climate policies is arguably one of the central challenges faced by policymakers today. Meeting the targets agreed in the 2015 Paris Agreement requires drastic changes in the economy with significant costs during the transition. As the transitional costs are likely to differ across economic groups, climate change policies are expected to have sizable implications for income inequality and the degree of competition. This asymmetric exposure to policies often rationalizes the political attitudes against adopting more ambitious environmental regulations as experienced, for instance, during the yellow vests protests in Europe.

In this paper, we contribute to the debate on the redistributional consequences of climate policy by empirically investigating the effect of energy prices (i) on the labor share and identifying the role of potential channels, i.e. markups, factor substitution, reallocation, and the value-added to output ratio, and (ii) on industry concentration by utilizing firm and industry level data from 15 European countries between 2000 and 2016.[1]

The labor share is a direct measure of the functional distribution of income, captures the wedge between the productivity of labor and its compensation in total value added and is a commonly used statistic to evaluate inequality over time and across countries. The decline of the labor share in recent decades is a central development in economics and the subject of a recent voluminous literature.[2] Although the labor share is typically constructed as labor payments relative to value added, which excludes energy costs, a change in energy prices might affect the labor share (i) when it leads to reallocation towards firms with systematically high or low labor share, (ii) if the elasticity of substitution between capital and energy is different than the one between labor and energy, (iii) when it changes the markups, or (iv) when it influences the value-added to output ratio.

[1]Climate policy, be it through carbon taxes, emission trading schemes or non-market instruments, is likely to increase energy prices, at least for as long as industries rely on fossil fuels to power their production. Hence, studying the effects of energy prices on economic outcomes is informative of the potential impacts of more stringent climate policy.

[2]See Elsby et al. (2013), Karabarbounis and Neiman (2014) for earlier studies and Gutiérrez and Piton (2020) for a comparison of the trends in the labor share across advanced economies. Grossman and Oberfield (2022) presents an excellent review of this vast literature.

A prominent explanation for the decline in the labor share put forward in the literature is the rise in industry concentration, which has also been shown to affect the investment rates and productivity growth (Covarrubias et al., 2020), business dynamism (Akcigit and Ates, 2021), and income inequality (Furman and Orszag, 2018). The recent empirical literature on the labor market effects of climate policy has documented that the estimated employment and output effects often correlate with firm size (Dechezleprêtre et al. 2020; Dussaux 2020). A potential implication of these findings is that climate policies, in our case proxied by changing energy prices, might have first order effects on industry concentration, especially when there is heterogeneity in the exposure to aggregate price changes over the firm size distribution (Amiti et al., 2019). Hence, studying the effect of energy prices on industry concentration is informative of the potential anti-competitive and redistributional effects of climate policy.

We estimate the effect of energy price shocks on the labor share and industry concentration at the country-sector level for 15 European countries for the period 2000-2016. We obtain exogenous variation in the energy prices relevant for industry level outcomes by using a shift-share approach standard in the literature, where we interact the initial shares of different resources in energy production of country-industry pairs with the national or continent-wide resource prices over time. As elaborated in Goldsmith-Pinkham et al. (2020), the identifying assumption is satisfied when the initial shares of energy inputs and the subsequent changes in their prices are exogenous to the outcome variable. The exogeneity of the resource price changes is plausibly satisfied since we use the nation or continent wide price changes. In order to address the issue of inherent differences in the evolution of the labor shares depending on the initial energy share of the industry, we only use the changes in the price without interacting it with the energy intensity of the country-industry pair in our baseline specifications.[3]

Our first set of results investigates the relationship between energy prices and the labor share and the channels through which the former affects the latter. We find that the labor share in value added exhibits strong declines in response to increases in energy prices. This relationship is quantitatively large and robust to the control of country-industry level characteristics. Our findings suggest that an industry facing a 100 percent higher increase in energy

[3]We further show that the initial shares of the main resources in energy production such as coal and natural gas are not correlated with the subsequent evolution of the labor share at the country-industry level.

prices would experience a 4 percentage points larger decline in the labor share, which is close to the level of the global decline in the labor share from 1975 to 2012 documented in Karabarbounis and Neiman (2014). Controlling for changes in industry-level markups, the effects of reallocation within sectors captured by the covariance of value added and the labor share, and the value added to output ratio in the industry does not lead to sizable changes in the coefficient estimates of the energy prices, which indicates that the relationship between the energy prices and the labor share is primarily driven by factor substitution between energy and the primary inputs.

Furthermore, we document that exogenous changes in energy prices do not induce significant changes in the capital share. The sign and magnitude of the estimate in these estimations are informative about the relative degree of substitution between the primary inputs and energy. For instance, a coefficient estimate which is negative and similar in magnitude to the response of the labor share would imply a similar degree of complementarity between energy and the capital-labor composite and the decline in the labor share is mainly driven by the margins of adjustment other than factor substitution. On the other hand, a significantly different impact of energy prices on the capital share shows that the degree of substitution between energy and labor is different than that of energy and capital. As a result, energy price changes also lead to a change in the capital-labor ratio and redistribution between capital and labor. Our findings are in line with the latter case and a higher degree of complementarity between labor and energy compared to capital and energy, as we do not find any evidence for a significant association between the capital share and energy prices.

Finally, we show that increases in energy prices lead to a significant rise in the capital-labor ratio in production and also increase the investment rate at the country-industry level, which are consistent with the nature of complementarities between inputs implied by the findings on the responses of the factor shares. These results point out that climate change policies are likely to have important redistributional consequences across the primary input factors, at least in the short-run.

Our second set of results analyzes energy price pass-through at the firm level and the effect of energy prices on industry concentration and markups at the sector level. The goal of this part of the analysis is to assess the redistributional consequences across firms with different size and potentially "anti-competitive" effects of climate policies. An important empirical challenge in assessing the determinants of the changes in industry concentration is the lack of employment and output data that is representative for the underlying population of firms and comparable across countries and over time. This has led researchers to restrict their sample to individual countries or rely on existing data sources with low coverage especially for small firms.[4] Furthermore, the extent of coverage also changes over time in these cross-country datasets with different rates across industries and countries, which might lead to spurious trends in industry concentration.[5] We address this issue by utilizing the novel feature of the CompNet database, which provides different indicators of industry concentration based on the administrative data on non-financial firms for 19 European countries.[6] Our estimates show no clear and robust relationship between energy prices and industry concentration or industry-wide markups.

In order to test whether this result is driven by the absence of a relationship between the degree of pass-through and firm size in our sample, we also investigate the pass-through of industry level energy price shocks into firm level employment and output. Using firm-level balance sheet data for about 1.7 million firms operating in our baseline sample of country-industry pairs, which is broader in terms of coverage than the existing studies, we document that the employment and output losses are indeed less pronounced for larger firms.[7] We show the robustness of this finding to the inherent parameter heterogeneity problem in the reduced-form pass-through estimations with strategic interactions using non-parametric techniques as in Berman et al. (2012). These findings highlight that the mapping from the pass-through heterogeneity across firms to industry concentration eventually depends on the *strength* of

[4]The issue of missing observations for firm employment data is even more pronounced than revenue or labor costs since firm level data are typically obtained from the balance sheets reported by the firms (Gopinath et al., 2017).

[5]See, for instance, Gopinath et al. (2017) (online Appendix), Kalemli-Ozcan et al. (2019) and Bajgar et al. (2020).

[6]The details of the dataset and variable definitions are provided in Section 3.

[7]The rate of pass-through over the firm size distribution is potentially the result of the interaction between the strategic pricing behavior of firms in imperfectly competitive markets and various sources of differential exposure to energy price shocks, e.g the energy intensity, and credit constraints. Since we do not have data on the energy intensity and therefore the exposure to energy price shocks at the firm level, we are unable to identify the role of these factors separately.

micro-level responses, which, in the case of energy prices, is weak, and the initial firm size distribution as we show in Section 2.

Our paper is related to the voluminous literature on the competitiveness effects of energy prices and climate policies at different levels of aggregation (e.g., Aldy and Pizer 2015; Dechezleprêtre and Sato 2017). In particular, we relate to the empirical literature studying the employment effects of environmental regulation and energy prices, which often frames the debate as a "jobs versus the environment" trade-off (Morgenstern et al., 2002). Though most studies indeed find a negative relation between energy prices and employment (Deschênes 2012; Kahn and Mansur 2013; Bijnens et al. 2021; Marin and Vona 2021), Hille and Möbius (2019) find no significant effect. Marin and Vona (2019) show that employment effects are heterogeneous across skill groups. Dechezleprêtre et al. (2020) and Dussaux (2020) document heterogeneity in responses to energy price shocks across the firm size distribution. Bretschger and Jo (2021) estimate the elasticity of substitution between energy and labor and find strong complementarity between the two. Çakır Melek and Orak (2021) take a more macroeconomic approach and find strong substitutability between energy and equipment capital. Hafstead and Williams (2018) highlight that empirical estimates of employment effects should be treated with caution as they often disregard general equilibrium effects, such as employment shifts within and between sectors. We contribute to this literature by focusing on the labor share and show that climate change policies are likely to have important redistributional consequences in the transition. We also provide evidence on the relationship between energy prices and industry concentration, which has been argued to be an important determinant of various macroeconomic trends in the advanced economies.

We also contribute to the extensive literature on the evolution and the determinants of the labor share. The constancy of the labor share over time has long been recognized as one of the strongest empirical regularities in economics and is one of the Kaldor (1957) facts which have been used to characterize the process of economic growth. However, numerous studies have documented a significant decline in the labor share, especially in the last four decades, albeit at different degrees across countries and industries, and explaining the determinants in the fall of the labor share has been one of the most active research lines in economics. The decline in the labor share in the last four or five decades, especially in the US, has been attributed to several factors including the decline in the relative price of investment goods (Karabarbounis and Neiman, 2014), the rise of the superstar firms with high markups and low labor shares (Autor et al., 2020), improvements in ICT and automation (Eden and Gaggl 2018; Dinlersoz and Wolf 2018; Lashkari et al. 2021), and the increased use of robots (Acemoglu and Restrepo 2018; Dauth et al. 2021). Yet, the possible impact of energy prices on the labor share has not been explored in the literature. To our knowledge, Castro Vincenzi and Kleinman (2022) is the first study to highlight the role of fluctuations in the intermediate input prices, mainly materials which also include energy, on the evolution of the labor share and attributes a significant role to the adjustments in the value-added to output ratio in explaining the negative relationship between material prices and the labor share they document. Our paper differs in terms of the focus, the context and the findings. We focus on the role of energy prices explicitly to highlight the potential redistributional impacts of climate change policies, test the contribution of the potential mechanisms using the novel features of our data, and find that the factor substitution channel rather than the adjustments in the value-added to output ratio explains the significant declines in the labor share in response to the increases in energy prices in Europe.

The rest of the paper proceeds as follows. In Section 2, we present the theoretical setup which guides the empirical analysis. Section 3 describes the data and the construction of our main variables. Section 4 presents the empirical methodology and Section 5 presents the main results. Robustness tests are reported in Section 6. Section 7 concludes.

2 Theoretical framework

In this section, we present a simple theoretical setup to guide our empirical analysis and demonstrate the potential channels through which energy prices influence the labor share at the industry level. We consider an industry populated by heterogeneous firms indexed by $i \in \mathbb{I}$. We define the industry level labor share relative to value added in line with the literature as $s_l \equiv \sum_{i \in \mathbb{I}} s_i^{va} s_{li}$, where s_i^{va} is the share of firm i in the aggregate industry level value added. Totally differentiating s_l, we obtain:

$$ds_l = \sum_{i \in \mathbb{I}} s_i^{va} ds_{li} + \sum_{i \in \mathbb{I}} ds_i^{va} s_{li}, \tag{1}$$

Hence, the change in the industry-wide labor share is driven by the reallocation of the value added between firms with possibly different levels of labor share and a convex combination of the changes in the labor shares at the firm level. In order to pin down the determinants of the labor share at the firm level, we specify a production function which allows for different degrees of substitution among the input factors in the following.

Production. The firms use the following production technology which takes a two-tier CES form as in Sato (1967) with labor and a capital-energy composite as the inputs:

$$y_i = h_i \left(l_i^{\frac{\varepsilon-1}{\varepsilon}} + x_i^{\frac{\varepsilon-1}{\varepsilon}} \right)^{\frac{\varepsilon}{\varepsilon-1}}, \tag{2}$$

$$x_i = \left(k_i^{\frac{\theta-1}{\theta}} + e_i^{\frac{\theta-1}{\theta}} \right)^{\frac{\theta}{\theta-1}}, \tag{3}$$

where y_i, l_i, e_i and k_i are the levels of output, labor, energy and capital, respectively and h_i captures the level of firm productivity in the final goods production. ε denotes the substitution elasticity between labor and the composite input and similarly θ is the elasticity of substitution between capital and energy in the production of the composite input. We assume that there is imperfect competition in the final goods production while the factor markets are perfectly competitive without frictions.

Factor shares and capital-labor ratio. Given the level of wages (w), rental rate of capital (r) and energy price (p_e), the output and composite input prices are equal to:

$$p_i = M_i \frac{(w^{1-\varepsilon} + p_x^{1-\varepsilon})^{\frac{1}{1-\varepsilon}}}{h_i}, \tag{4}$$

$$p_x = \left(r^{1-\theta} + p_e^{1-\theta} \right)^{\frac{1}{1-\theta}}, \tag{5}$$

where M_i is the level of markup over marginal costs. We define the marginal cost in the final goods production for the firm with unit productivity, i.e. $c = (w^{1-\varepsilon} + p_x^{1-\varepsilon})^{\frac{1}{1-\varepsilon}}$, which will be helpful in the exposition. Totally differentiating the labor share using the factor demand schedules, we find that:

$$\hat{s}_{li} = -\hat{M}_i + (1-\varepsilon)\, s_{xi}^c \left(\hat{w} - s_{ki}^x \hat{r} \right) - (1-\varepsilon)\, s_{ei}^c \hat{p}_e + \hat{\Omega}_i, \tag{6}$$

where ˆ denotes the proportional changes, s_{ni}^{m} is the expenditure share of factor n in m, and Ω_i is the revenue to value-added ratio of firm i. Equation (6) decomposes the growth of the labor share into the growth of markups (*competition channel*), the differential growth of factor prices (*factor substitution channel*) and the growth of the value added to revenue ratio. Since factor markets are perfectly competitive and firms differ only in their Hicks neutral productivity in the final goods production and the demand elasticity they face, in equilibrium the cost shares of input factors will be identical across firms within an industry. Aggregating firm-level changes in the labor share to industry level using (6) and (1), we find:

$$ds_l = (1-\varepsilon)\, s_x^c s_l \left(\hat{w} - s_k^x \hat{r}\right) - (1-\varepsilon)\, s_e^c s_l \hat{p}_e + \sum_{i \in \mathbb{I}} ds_i^{va} s_{li} - \hat{M}_l + \hat{\Omega}_l, \tag{7}$$

where $\hat{M}_l = \sum_{i \in \mathbb{I}} s_i^{va} s_{li} \hat{M}_i$ is the growth of industry level markups adjusted by the correlation between the labor share and value added at the firm level. $\hat{\Omega}_l = \sum_{i \in \mathbb{I}} s_i^{va} s_{li} \hat{\Omega}_i$ captures a similar change in the revenue to value added ratio at the industry level. Equation (7) is the main expression that we take to the data in our empirical analysis. It shows that the industry-level labor share changes when there is a change in aggregate markups, the factor prices grow at different rates, reallocation towards firms with higher or lower labor shares, and/or there is a change in the value-added to output ratio. Guided by equation (7), we control for the industry level markups, wages and the rental rate of capital, the covariance between the value added and the labor shares, and the revenue to value-added ratio in the industry in our baseline specifications to control for the effects of these possibly confounding factors.[8] In order to shed more light on the nature and magnitude of the degrees of substitution between input factors, we utilize the equilibrium relationship between the growth of the capital share and energy prices. The proportional change in the capital share in our theoretical setup is given by:

$$ds_k = (1-\varepsilon)\, s_k s_l^c \left(\left(s_k^x + \frac{(1-\theta) s_e^x}{(1-\varepsilon) s_l^c} \right) \hat{r} - \hat{w} \right) - \left(\theta - 1 + (1-\varepsilon) s_l^c\right) s_k s_e^x \hat{p}_e + \sum_{i \in \mathbb{I}} ds_i^{va} s_{ki} + -\hat{M}_k + \hat{\Omega}_k. \tag{8}$$

[8]It is worth to note that the last mechanism, i.e. the adjustments in the revenue to value-added ratio, affects the labor share entirely due to the particular definition of the labor share as the labor costs relative to value added and would not influence the labor share in total output. We use this observation to assess the relevance of the last channel by also using the labor share in total output.

where $\hat{M}_k = \sum_{i \in \mathbb{I}} s_i^{va} s_{ki} \hat{M}_i$ is the growth of industry level markups adjusted by the correlation between the capital share and value added at the firm level, and $\hat{\Omega}_k = \sum_{i \in \mathbb{I}} s_i^{va} s_{ki} \hat{\Omega}_i$ captures a similar change in the revenue to value added ratio at the industry level.

The partial semi-elasticities of the labor share and capital share with respect to the energy prices are equal to:

$$\frac{\partial s_l}{\partial log(p_e)} = (\varepsilon - 1)\, s_l s_e^c, \tag{9}$$

$$\frac{\partial s_k}{\partial log(p_e)} = (\theta - 1 + (1-\varepsilon) s_l^c)\, s_k s_e^x, \tag{10}$$

respectively. Hence, a negative estimate in the labor share regressions implies complementarity between energy and labor and an insignificant estimate in the capital share regressions indicates that the substitution between capital and energy is higher than that of labor and the energy-capital composite, i.e. $0 < \varepsilon < \theta < 1$.[9] Similarly, the elasticity of the capital-labor ratio to the energy price is given by:

$$\frac{\partial log(k_i/l_i)}{\partial log(p_e)} = (\theta - \varepsilon)\, s_e^c, \tag{11}$$

which enables a more direct assessment of the relative magnitude of θ and ε.

Industry concentration. We define the Herfindahl index as $\mathcal{H} \equiv \sum_{j \in \mathbb{J}} s_j^2$, where s_j is the market share of firm j and $\mathbb{J}$ denotes the set of active firms. For simplicity, we assume that the set of firms is fixed, i.e. the response of the extensive margin has a negligible impact on market concentration. Log-differentiating the Herfindahl index, we obtain its partial elasticity to the energy price p_e as:

$$\epsilon_{p_e}^{\mathcal{H}} \equiv \frac{\partial ln(\mathcal{H})}{\partial ln(p_e)} = \frac{2}{\mathcal{H}} \sum_{j \in \mathbb{J}} s_j^2 \epsilon_{p_e}^s(s_j) \tag{12}$$

Postulating an approximately linear relationship between the degree of pass-through and firm size, i.e. $\epsilon_{p_e}^s(s_j) \approx -a + b s_j$,[10] and using that the changes in the market shares should sum

[9] The share of energy in total costs (s_e^c) exceeds the coefficient estimate in absolute value (0.04); hence, $0 < \varepsilon < 1$. Furthermore, the insignificant relationship between the capital share and energy prices implies that $\theta = 1 + (\varepsilon - 1)s_l^c > \varepsilon$, which concludes that $0 < \varepsilon < \theta < 1$ since $s_l^c < 1$.

[10] In Section 5.2, we document that a linear relationship between firm size and output/employment elasticity to industry-level energy price is a reasonable approximation.

up to zero, the pass-through of the shock into industry concentration is given by

$$\epsilon_{p_e}^{\mathcal{H}} = \frac{2}{\mathcal{H}} \left[\sum_{j \in \mathbb{J}} a s_j^2 \left(\frac{s_j}{\mathcal{H}} - 1 \right) \right]. \tag{13}$$

Equation (13) shows that the magnitude of the change in market concentration in response to changes in the energy prices depends on a, i.e. the degree of pass-through for firms with a negligible market share, and on the initial firm size distribution.

3 Data

In this section we elaborate on the data that we use. Namely, we discuss the construction of our weighted energy price variables, the industry level variables including the factor shares, concentration, markups and reallocation measures, and introduce the firm level balance sheet data which we utilize to assess the degree of pass-through at the firm level and complement the industry-level estimations.

3.1 Energy prices

We compute the energy price as the weighted average of the prices for coal, electricity, gas and oil, where the weight of each resource in the energy price index is equal to the share of each resource in total energy use. As further discussed in Section 4, our empirical strategy makes use of a shift-share instrumental variable approach. We thus compute two versions of the energy price, namely one with time-variant weights, which accounts for changes in the energy mix but suffers from potential endogeneity issues, and one with predetermined and time-invariant weights, which will be used as an instrument as in Sato et al. (2019). Besides being exogenous to the subsequent technology or demand shocks which might also influence the factor shares directly, the fixed-weight index captures the changes in the effective energy prices for the polar case when there is no substitution between different resources in the energy mix. This variation is particularly useful to understand the potential implications of climate policy on factor shares, since various climate policies such as carbon taxation induce joint price increases for different resources, albeit at different degrees.[11]

[11]For instance, when the energy composite is homogeneous of degree one in resources and the climate policy increases the use price of each resource at the same rate, the fixed weight index will capture the

We combine country-level energy prices of four fuels with weights based on energy use at the country-sector level. The variable weight energy price (P^{EV}) for country c, sector s and year t is computed as follows.

$$P^{EV}_{cst} = \sum_f w^f_{cst} P^f_{ct}, \qquad \text{where} \qquad w^f_{cst} = \frac{E^f_{cst}}{\sum_f E^f_{cst}}, \tag{14}$$

where P^f is the price of fuel f, and weight w^f is the share of fuel f in total energy use in the corresponding sector. The fixed weight energy price (P^{EF}) is computed using the weights from the year 2000, i.e. the last year of the pre-sample period.

$$P^{EF}_{cst} = \sum_f w^f_{cs,2000} P^f_{ct}. \tag{15}$$

The price data is compiled from the International Energy Agency's Energy Prices and Taxes Database (IEA, 2021). We select the database with end-use prices for industry in national currency per tonne of oil equivalent.[12] This data includes taxes, but not value-added taxes. We convert these prices into real dollars using PPP exchange rates from the OECD and keep prices for coal, electricity, gas and oil.[13] We largely follow Sato et al. (2019) to extend the coverage of the price data and impute the missing observations using the fuel-specific real energy price indices from the same IEA database, which have fewer missing values than the price data.[14] Figure B2 in the Appendix shows the evolution of energy prices for a selection of countries.

The data on gross energy use is from the Environmental Accounts of the World Input-Output Database (WIOD) (Corsatea et al., 2019). It covers the years 2000-2016 and 56

relevant variation.

[12] One tonne of oil equivalent is equal to 41.87 GJ (IEA, 2021).

[13] The database offers multiple categories for coal (steam coal and coking coal) and oil (low and high sulphur fuel oil and light fuel oil). We use steam coal as it is more widely used than coking coal (Sato et al., 2019), and low sulphur fuel oil as it is mostly used in industry, rather than in electricity generation (IEA, 2021). These fuels also have relatively few missing observations.

[14] We use energy prices for four fuels, 19 countries and the years 1995-2020, i.e. 1976 data points. Of these, 71% are non-missing and 13% are imputed by interpolation or extrapolation using a country's own fuel-specific real energy price index. If neither a price nor an index is available for some or all years for a specific country-fuel pair, we impute the median price computed from the 10 countries with complete data after using the indices (these countries are Austria, Belgium, the Czech Republic, Finland, France, Great Britain, Italy, Poland, Portugal and Switzerland).

sectors, defined using the NACE Rev. 2 classification. Table B1 in the Appendix reports the set of sectors covered in our analysis.[15] Usage data is available for 12 categories of fuel, which we match with our four categories of price data.[16] An advantage of using the Environmental Accounts data is that it covers substantially more sectors than the IEA's World Energy Balances, used by Sato et al. (2019), though the IEA data covers a longer time span (1995-2020).[17] Figure B3 in the Appendix shows the average energy mix by sector for the year 2000.

We then combine the resource price series and their weights to compute variable and fixed weight energy prices as in (14) and (15). The evolution of weighted prices is shown for selected countries in Figure B4 in the Appendix. Though we follow Sato et al. (2019) in many respects, some differences remain. For instance, we use price levels, rather than indices, for our fixed weight variable, and we take the weighted arithmetic mean, rather than the log of the weighted geometric mean. Furthermore, we impute the median price from a set of 10 countries when data for a particular fuel is missing and we cannot use country-fuel specific indices (see footnote 14). In this case, Sato et al. (2019) would use a more general (i.e. not fuel-specific) index at the country level.

3.2 Industry characteristics

Our data on industry characteristics is from the 8th vintage of the CompNet database (CompNet, 2021). This database aggregates firm level micro data to variables at the country, sector and regional level. The micro data is mostly from administrative data sets. CompNet applies identical methods across countries to compute the different moments of the distribution for a

[15] Most sectors are defined at the two-digit level, though some are grouped together. For instance, we have the total energy use for sectors C13 (manufacture of food products), C14 (beverages) and C15 (tobacco products) together. Hence, we assign the same weights to these three two-digit sectors, as the data on industry characteristics are available at the two-digit sector level.

[16] We use coal/coke/crude for coal, electr/heatprod for electricity, natgas and othgas for gas, and fueloil, diesel, jetfuel, gasoline and othpetro for oil.

[17] The advantage of the Environmental Accounts, compared to previous releases of the WIOD is its coverage of more recent years. The studies which use the older versions such as Hille and Möbius (2019) and Marin and Vona (2019) have samples that end in 2009 and 2011, respectively.

large set of variables, and reports these at a more aggregated level.[18] It covers a range of variables in different categories, such as competitiveness, productivity, labor, finance and trade. Its target population consists of all non-financial corporations with at least one employee. What makes CompNet an especially rich data set is that it provides not only the mean, but also additional moments of the distribution of several variables of interest. Moreover, since CompNet data is derived mostly from administrative data sources, it is less vulnerable to the selection bias that is an issue when working with databases like Orbis (Bighelli et al., 2021).

CompNet covers 19 European countries, 15 of which we can use in our analysis.[19] It also covers 56 two-digit NACE Rev. 2 sectors, for all of which we have weighted energy prices. The time span differs per country with coverage starting in the early 2000s for most countries and ending in either 2018 or 2019. We have data for all 15 countries from 2009 until 2018, though we end our baseline regressions in 2016 due to the availability of the variable weights we use for the energy price.

An important advantage of Compnet over other sector level databases like Eurostat and EU KLEMS is that several moments and joint distributions of many combinations of variables are provided. This allows us to control for the industry level markups estimated in 6 different methods and to track the covariance between the labor share and value added, which captures the contribution of reallocation within sectors to the labor share as reflected in equation (7).[20]

We use the commonly used definition of the labor share as the ratio of labor costs to value added. Similarly, we define the capital share as total capital costs divided by value added. Sector level concentration is measured by the standard Herfindahl-Hirschman Indices (HHI) and the top 10 firms' share in total revenues, labor costs and employment. We also use financial variables like revenue, value added, labor costs, number of employees, capital stock, capital costs and investment. In addition, CompNet reports six estimates of the industry-level markups constructed following De Loecker and Warzynski (2012) under different assumptions

[18]See Compnet (2018) Comparability Report for an elaborate analysis of the coverage and representativeness of Compnet data across countries.

[19]The countries we use are Belgium, the Czech Republic, Denmark, Finland, France, Germany, Italy, Lithuania, the Netherlands, Poland, Portugal, Slovakia, Spain, Sweden and Switzerland. We do not use Croatia, Hungary, Romania and Slovenia as we lack energy price data for those countries.

[20]The covariance between labor share and firm size is negative for most sectors, indicating that larger firms tend to have a lower labor share, which is in line with Autor et al. (2020).

on the production function and using 2 different estimators.[21]

Being based on the entire distribution of firms makes CompNet unique in terms of providing representative and comparable measures of reallocation, markups and concentration across country-industry pairs, compared to the available firm level datasets used for these purposes. The main firm-level database that covers European countries is Orbis, which is maintained by Bureau van Dijk. It is well established that Orbis has highly limited coverage and representativeness for small firms, especially those with fewer than 10 employees (e.g., Gopinath et al. 2017; Kalemli-Ozcan et al. 2019; Bajgar et al. 2020). Hence, aggregating firm-level data from Orbis to obtain proxies for industry concentration and labor share is problematic. Furthermore, changes in the coverage in this type of data sets are likely to create spurious trends in industry aggregates.

Some variables can be used directly from the CompNet data files, such as the real wage, HHIs, the shares of top 10 firms, covariance between value added and labor share, and markups. Other variables need to be constructed from the available data by multiplying the average across firms by the number of firms. This is the case for number of employees, labor costs, value added, turnover, capital stock and capital costs.[22] We use the capital costs variable divided by the total capital stock from CompNet as a proxy for the price of capital and refer to this as the rental rate. For the markups, we use the average value weighted by firm size.

Finally, we omit observations with negative value added, as these give us a negative labor share, and drop the observations with a labor share larger than 1.[23] Appendix A elaborates more on the CompNet database and the procedures we use in constructing the variables in the analysis precisely.

[21] The six versions are, numbered from 0 to 5: 0) OLS and Cobb-Douglas (CD) with constant returns to scale; 1) OLS and CD 2) OLS and translog (TL); 3) OLS and CD with time-varying output elasticities; 4) GMM and CD; 5) GMM and TL. For the GMM estimations, the method of Ackerberg et al. (2015) is used. See page 80 of CompNet (2021) for details.

[22] Value added is defined as revenue − intermediate inputs. Capital costs are depreciation + interest paid + imputed interest on equity.

[23] The markup estimates are highly skewed, which range from 0.2 to 14,000, for instance obtained under the assumption of a Cobb-Douglas production function estimated using OLS. We thus trim all markup variables at the 10th and 90th percentile. After winsorization, the mean markup value is equal to 1.40 in the same specification.

3.3 Firm-level data

To complement our sector level analysis we use firm level data from Orbis, a database with firm level financials maintained by Bureau van Dijk. Orbis contains balance sheet data on a large number of public and private firms around the world. We make use of the December 2020 version of the Orbis Historical product. The variables that we extract from Orbis are revenue, value added, labor costs and number of employees. We gather data on the same 15 countries that we study at the sector level and on all the sectors for which we have energy price data (see Table B1). Coverage in Orbis differs substantially by country, over time and per variable. For instance, Spain, Italy and Portugal have excellent coverage, whereas coverage for the Netherlands and Denmark is highly limited for some or all variables. We use the years 2009-2018 for our firm level analysis, as coverage in Orbis is very limited for earlier years. This gives us over 16 million observations for which the relevant variables are non-missing, of which over 8 million remain after imposing a firm size restriction.

Orbis has severe limitations when it is used for cross-country analysis (Bajgar et al., 2020). For instance, firms in Orbis are disproportionately large and productive, even within size classes, and this bias may vary across countries, sectors and over time. To address these issues, we only use unconsolidated accounts to avoid double counting of firms and omit the observations with unrealistic values for the variables that we use, following Kalemli-Ozcan et al. (2019).[24] In addition, we apply a size restriction before using the data, as representativeness in Orbis is better for large firms than for small firms (Bajgar et al., 2020). We only use firms with at least 10 employees. We use firms' core sector classification to match firm level financials with country-sector level energy prices.

[24]We drop firms with negative employment, labor costs or revenue. We drop firms with more than 2,000,000 employees. We also drop firms with unrealistic growth in their employment and revenue variables (applying the same thresholds as Kalemli-Ozcan et al. (2019) for each size bin). Cleaning also includes assigning a year to variables that are not reported at the end of the year. We follow Kalemli-Ozcan et al. (2019) and assign an account to the previous year if it is reported in January-May and to the current year if is reported after May. We rescale flow variables that do not reflect 12 months in the data by multiplying by 12/reflected number of months. We do not make this adjustment to stock variables.

3.4 Descriptive statistics

Table 1 shows summary statistics for our main variables. Combining our energy price and usage data with the CompNet data leaves us with an unbalanced sample for the years 2000-2018. Energy prices with variable weights end in 2016, whereas those with fixed weights extend until 2018. CompNet data starts in different years for different countries while it is complete for the years 2009-2018. The number of observations differs across variables, mainly due to missing data points in CompNet.[25] This issue is particularly pronounced for markups as the estimation of markups is relatively more demanding in terms of data requirements. We take the natural logarithm of all variables, except shares, markups and covariances.

4 Empirical strategy

In our empirical analysis, we estimate different variants of the following specification:

$$y_{cst} = \beta_1 \log P^E_{cst-1} + \beta_2 \log w_{cst-1} + \beta_3 \log P^K_{cst-1} + X_{cst-1}\delta + \gamma_{cs} + \mu_t + \epsilon_{cst}, \tag{16}$$

where the dependent variable y can be the labor share, market concentration, the capital-labor ratio or markups. P^E and P^K are the prices of energy and capital, respectively and w is the wage rate. X includes control variables, namely the covariance between the labor share and value added, the revenue to value added ratio and the average markup. γ_{cs} and μ_t are country-sector and year fixed effects, respectively. ϵ is the error term. We use lagged variables of the covariates to allow time for the factors to adjust.

Our coefficient of interest is β_1, which is the effect of energy prices on the dependent variable. The energy price is constructed by weighting the country level prices of coal, electricity, gas and oil by their gross use at the sector level, as explained in Section 3. A challenge in identifying β_1 is the possibility that energy mixes are endogenous to sector-specific demand and technology shocks. We tackle this issue by using a shift-share instrumental variable approach, as introduced by Bartik (1991) and is common in the literature on the effects of energy prices (e.g., Linn 2008; Marin and Vona 2019, 2021; Sato et al. 2019). We instru-

[25]The difference in the number of observations for P^{EV} and P^{EF} is due to the fact that we have prices until 2018 and (variable) weights until 2016. Since we use the weights from the year 2000 for the P^{EF}, we have two more years of data compared to the P^{EV}. We can only use these extra years in reduced form regressions.

Table 1: Descriptive statistics

	Obs.	Mean	Median	S.D.	Min.	Max.
Energy prices						
Log variable weight energy price	10794	6.708	6.726	0.479	5.149	8.038
Log fixed weight energy price	12388	6.678	6.700	0.459	5.149	8.053
Factor shares and prices, ratios						
Labor share	9422	0.628	0.658	0.186	0.034	0.999
Labor share in revenue	9566	0.253	0.224	0.141	0.017	0.986
Capital share	9403	0.136	0.104	0.122	0.001	0.993
Log wage	10415	3.127	3.244	0.617	0.156	5.737
Log rental rate	9601	-1.809	-1.788	0.496	-3.791	1.835
Log capital labor ratio	9633	3.257	3.257	1.181	-1.606	8.150
Log investment	7161	12.310	12.312	1.725	4.541	19.500
Cov(L-share, v.a.)	10045	-0.310	-0.163	0.502	-4.633	0.261
Log(revenue / v.a.)	9896	1.015	1.000	0.523	0.000	3.536
Market concentration measures						
Log HHI employment	10424	-5.003	-4.873	2.136	-11.728	-0.087
Log HHI labor costs	10435	-4.612	-4.475	2.051	-12.676	-0.100
Log HHI revenue	10393	-4.598	-4.454	2.064	-12.684	-0.147
Top 10 share employment	9829	0.404	0.345	0.257	0.005	1.000
Top 10 share labor costs	9837	0.451	0.401	0.257	0.001	1.000
Top 10 share revenue	9809	0.483	0.448	0.262	0.001	1.000
Markups						
Markup (spec 0)	6945	1.202	1.107	0.262	0.929	2.231
Markup (spec 1)	7484	1.396	1.266	0.380	1.009	3.058
Markup (spec 2)	7640	1.336	1.253	0.251	1.049	2.177
Markup (spec 3)	6542	1.394	1.262	0.387	1.004	3.118
Markup (spec 4)	4318	1.348	1.207	0.400	0.890	2.675
Markup (spec 5)	4227	1.196	1.115	0.383	0.691	2.648

ment the variable weight energy price by the fixed weight version. The P^{EF} is unaffacted by changes in the energy mix which are correlated with unobservable and thus omitted variables, as long as country level energy price shocks are exogenous, which is what we assume.

An instrument is valid if it is relevant, i.e. correlated with the endogenous regressor, and exogenous, i.e. uncorrelated with the error term. Relevance is likely to hold in our case, as our instrument is closely related to our endogenous regressor (same prices with different weights). We include the first stage F statistic in our regression tables to test for weak instruments.

A recent body of research focuses on the validity of Bartik style instruments, and presents different ways to test the validity of the exclusion restrictions (Goldsmith-Pinkham et al. 2020; Borusyak et al. 2022). Assuming that energy prices themselves are exogenous, the exogeneity of the instrument depends on whether the pre-sample, time-invariant weights are correlated with subsequent changes in the dependent variable. It is important to note that a correlation between the weights and subsequent changes, not levels, of the labor share would violate the exogeneity of the instrument as we control for country-sector fixed effects. We follow Goldsmith-Pinkham et al. (2020) and Bretschger and Jo (2021) and assess the correlation between our pre-sample weights and the growth rate of our main dependent variable, the labor share. As shown in Table B2 and Figure B1 in the Appendix, there is virtually no relationship between the pre-sample shares of resources and the subsequent changes in the labor share, which suggests that our instrument is valid.

5 Results

5.1 Labor share

Table 2 shows the baseline estimations on the effect of energy prices on the labor share at the country-sector level. All specifications include country-sector and year fixed effects. Column 1 presents the OLS results with the variable-weight energy price where the coefficient estimate is negative and significant at the 10% level. Column 2 reports the same parsimonious specification where the variable-weight energy price index is instrumented by the fixed-weight index. The effect of energy prices on the labor share is stronger and significant at the 5% level. When the factor prices of labor and capital are included as in column 3, the coefficient on the energy price becomes even more negative and significant at 1%. Adding the covariance term to control for within-sector reallocation, the revenue value added ratio and the (weighted) average markup in columns 4 through 6 does not significantly affect the coefficient on the energy prices. In our preferred specification (column 4), the coefficient estimate is equal to -0.043, which implies that, other things equal, a 10% increase in the energy price would reduce the labor share by about 0.43 percentage points. A radical carbon tax that would double the energy price would thus be associated with a 4.3 percentage point decline in the

Table 2: Labor share

	(1)	(2)	(3)	(4)
	OLS	IV	IV	IV
Log energy price	-0.017*	-0.031**	-0.039***	-0.043***
	(0.010)	(0.013)	(0.013)	(0.013)
Log wage			0.014	0.020*
			(0.010)	(0.011)
Log rental rate			0.006	0.005
			(0.006)	(0.007)
Cov(L-share, v.a.)				0.008**
				(0.004)
Log(revenue / v.a.)				0.021
				(0.017)
Markup (spec 2)				-0.057***
				(0.013)
First stage F stat.		7845.6	7343.6	5814.6
Country-sector FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	8036	8028	7547	5865

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

labor share in the short-run.

We find that the coefficients of the wage level and the rental rate are weakly significant or insignificant across specifications. It is worth to note that the measurement error in factor prices, especially the rental rate of capital, is sizable (see Section 3). As expected, a rise in the covariance between the labor share and value added leads to an increase in the industry level labor share while higher markups suppress the labor share. The revenue to value added ratio has the expected sign but is insignificant.

The results in Table 2 document a significant and negative effect of energy prices on the labor share. This result is robust to the inclusion of factor prices, markups, the revenue to value added ratio and a control for within-sector reallocation. In the next subsection, we investigate the empirical relevance of the potential mechanisms through which energy prices affect the labor share.

5.1.1 Potential mechanisms

Factor substitution. In this section, we assess the role of different degrees of substitution between energy and the primary inputs on the main findings documented in the previous section using alternative tests. First, we test the relationship between the energy price and the capital share, defined as capital costs over value added. If the degree of substitution between energy and labor is different from the one between energy and capital, the changes in energy prices induce reallocation between factors and influence factor shares. The results are reported in Table 3. We find no effect in any of the specifications, indicating that the elasticities of substitution between energy and labor and between energy and capital are likely to be different. Given the negative coefficient estimate in the labor share estimations, we find that the degree of complementarity is higher between energy and labor, i.e. $0 < \varepsilon < \theta < 1$, as shown in Section 2.

Second, we estimate the effect of energy prices on the capital-labor ratio and present the results in Table 4. Consistent with our findings in Tables 2 and 3, i.e. a negative effect on the labor share and no effect on the capital share, we find that the energy price positively affects the capital-labor ratio. A 10% increase in the energy price leads, other things equal, to a 1.5% increase in the capital-labor ratio in our preferred specification using IV and all controls in column 4. These results are in line with the conclusion that energy and labor are complementary inputs and consistent with the findings of Bretschger and Jo (2021).

Finally, we estimate the effect of energy prices on the investment rates at the industry level. The results are shown in Table 5. We find a strong and positive effect of energy prices on the investments rates, which might imply even a higher degree of substitution between capital and energy in the medium to long-run.

Table 3: Capital share

	(1) OLS	(2) IV	(3) IV	(4) IV
Log energy price	0.009	-0.004	-0.002	0.006
	(0.012)	(0.012)	(0.011)	(0.013)
Log wage			0.002	0.014**
			(0.005)	(0.006)
Log rental rate			0.038***	0.039***
			(0.005)	(0.006)
Cov(L-share, v.a.)				-0.001
				(0.003)
Log(revenue / v.a.)				0.014
				(0.014)
Markup (spec 2)				-0.019
				(0.012)
First stage F stat.		7563.9	7627.8	5920.4
Country-sector FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	8027	8019	7862	6027

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. The dependent variable is the ratio of capital costs to value added. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The evidence which we present on the responses of the capital share, the capital-labor ratio and investment rates support the conclusion that the factor substitution channel is likely to play an important role in the negative effect of energy prices on the labor share.

Revenue to value-added ratio. The third channel that was discussed in Section 2 is the

Table 4: Capital-labor ratio

	(1) OLS	(2) IV	(3) IV	(4) IV
Log energy price	0.191***	0.145***	0.138**	0.176***
	(0.049)	(0.055)	(0.055)	(0.062)
Log wage			0.055	0.176***
			(0.038)	(0.043)
Log rental rate			0.008	0.039
			(0.028)	(0.032)
Cov(L-share, v.a.)				0.006
				(0.012)
Log(revenue / v.a.)				0.076
				(0.059)
Markup (spec 2)				0.093
				(0.066)
First stage F stat.		7547.9	7580.2	5877.3
Country-sector FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	8193	8185	8016	6083

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. The dependent variable is the natural logarithm of the capital labor ratio. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

adjustments in the revenue to value added ratio. As standard in the literature, we define the labor share in value added in our baseline estimations. In this section, we repeat our analysis using the labor share in total revenue as the dependent variable. The extent of the change in the coefficient estimate is useful in assessing the quantitative role of this channel in explaining the decline in the labor share in response to rising energy prices. Table 6 reports the results.

Table 5: Investment

	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	IV
Log energy price	0.428***	0.534***	0.696***	0.892***
	(0.103)	(0.138)	(0.143)	(0.157)
Log wage			0.131	0.341***
			(0.095)	(0.092)
Log rental rate			0.151**	0.175***
			(0.060)	(0.065)
Cov(L-share, v.a.)				-0.047
				(0.032)
Log(revenue / v.a.)				0.243*
				(0.137)
Markup (spec 2)				-0.078
				(0.140)
First stage F stat.		7670.2	7161.9	4547.0
Country-sector FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	6016	6008	5566	4115

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. The dependent variable is the natural logarithm of investment. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We leave out the revenue to value added ratio in this table, as this term would not appear when one would define the labor share as labor expenditures divided by total output and then derive the elasticity of the labor share with respect to the energy price as in Section 2. The effect of the energy price on the labor share in revenue is significantly negative. Our estimate in the most complete specification is somewhat smaller than the one we find when

Table 6: Labor share in revenue

	(1) OLS	(2) IV	(3) IV	(4) IV
Log energy price	-0.017**	-0.030***	-0.034***	-0.030***
	(0.007)	(0.009)	(0.010)	(0.009)
Log wage			0.009	0.025***
			(0.013)	(0.010)
Log rental rate			0.012**	0.009*
			(0.005)	(0.005)
Cov(L-share, v.a.)				0.005***
				(0.002)
Markup (spec 2)				-0.006
				(0.009)
First stage F stat.		7998.8	7494.5	5839.8
Country-sector FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	8480	8472	7933	6110

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). For energy intensity we use a time-variant specification. The interaction of the P^{EV} with time-variant energy intensity is instrumented using the interaction of P^{EF} and pre-sample energy intensity. The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

using the labor share in value added. That is consistent with the facts that the labor share in total output is always smaller than the labor share in value added, and that we do not take logs for the labor share. This, together with the fact that controlling for the revenue to value added ratio in our baseline regressions has little effect on the coefficient estimate of the energy price, leads us to conclude that the revenue to value added ratio is not driving the finding that energy prices negatively affect the labor share.

5.2 Firm-level evidence

In this section, we use firm level data from Orbis to test the presence of pass-through heterogeneity of energy prices over the firm size distribution. A recent literature documents that pass-through rates are correlated with firm size, which means that energy prices may have a first-order effect on industry concentration. To check whether such heterogeneous pass-through is also present in the countries and sectors that we study, we estimate the impact of energy prices on different firm-level outcomes as a function of firm size. We restrict our sample to firms in the countries and sectors that are also in our CompNet data set with at least 10 employees, as Orbis is more representative for large than for small firms. We match firms to energy prices on country-sector-year combination. We use reduced form regressions for the years 2009-2018. Our energy price variable is the fixed weight version with weights from 2008.

In the firm-level analysis, we regress revenue, value added, labor costs and employment on the energy price and interactions of the price with size bins. We create the bins as follows. First, we take the average revenue for each firm over all available years. Second, we create bins based on each firm's average size decile within its country-sector. Hence, if a firm's average revenue is in the top 10% of its country-sector, it is in the 10th decile, even if it is not in the top 10% of the entire firm size distribution.[26] We then create indicators for each bin and interact these with the energy price.

Table B3 in the Appendix shows the results. In the specifications without size bin interactions, we find a negative effect on all outcome variables. The results that include size bin interactions show that smaller firms are affected the most by changes in the energy price. In fact, for all outcome variables except the labor share, the effect on the first bin (i.e. the coefficient for Log energy price * bin 1) is negative, while the effect on the largest firms (i.e. the coefficient on Log energy price * bin 10) is positive. We find a mostly monotonic effect across bins, where the smallest firms experience the largest negative effect. While as we move to larger firms within their industry, the effect becomes less negative and turns positive for the larger firms in their corresponding country-industry.

[26] Similarly, a firm may be in the top 10% of the entire firm size distribution, but not in the top 10% of its industry if it is in an industry with particularly large firms.

We document that the degree of pass-through of energy prices in employment and output varies over the firm size distribution, which implies that energy prices may directly affect industry concentration and markups. We estimate these potential "anti-competitive" effects of climate policies in the next subsection.

5.3 Industry concentration and markups

In this section, we investigate whether energy prices affect the industry concentration. We regress different measures of market concentration and markups on the factor prices. If the energy intensity and firm size are correlated and firms show heterogeneous pass-through of energy prices, which would be consistent with a setting with variable markups (Muehlegger and Sweeney, 2021), then an energy price increase would directly influence the industry concentration. Clearly, if energy intensity is unrelated to firm size but still heterogeneous across firms, there would be reallocation within sectors, but not necessarily an effect on the market concentration.

We employ two commonly used measures of market concentration, namely the Herfindahl-Hirschman Index (HHI) and the market share of the top 10 firms in a two-digit sector.[27] Both measures are defined for three different variables, namely employment, labor costs and revenue.

Table 7 shows the results for the HHIs. We find that energy prices have a positive effect only on employment concentration, which is only significant in the IV specification and at the 10% level. There seems to be no effect on the labor cost and revenue concentration. To further test the robustness of these results to the alternative measures of the industry concentration, we use the top 10 shares of employment, labor costs and revenue as our dependent variable in different specifications. The results are presented in Table 8. We find a negative effect of the energy price on the top 10 share for all three variables. This effect is only significant at the 10% level in columns 4 and 6 and insignificant in the other specifications. While these conflicting results might be rationalized by the presence of a non-linear relationship between the degree of energy price pass-through and firm size, it is not possible to reliably identify these effects given the limited variation in industry concentration in our sample.

[27] The HHI is defined as the sum of squared market shares. The market share by the top 4 or top 8 firms are not available in the CompNet database.

Table 7: HHI

	(1)	(2)	(3)	(4)	(5)	(6)
	Log HHI empl.		Log HHI lab. cost		Log HHI revenue	
	OLS	IV	OLS	IV	OLS	IV
Log energy price	0.153	0.201*	0.107	0.084	-0.053	-0.096
	(0.094)	(0.117)	(0.090)	(0.108)	(0.100)	(0.115)
Log wage	-0.111	-0.112	-0.202*	-0.202*	-0.166	-0.166
	(0.099)	(0.099)	(0.120)	(0.120)	(0.107)	(0.107)
Log rental rate	-0.013	-0.011	-0.024	-0.024	-0.014	-0.014
	(0.047)	(0.047)	(0.052)	(0.052)	(0.053)	(0.053)
First stage F stat.		7642.7		7637.0		7655.6
Country-sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8100	8092	8103	8095	8081	8073

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We further present estimates on the firm-level pass-through and its variation over the firm size distribution in Section 5.2, which are not in line with non-linear pass-through rates and hollowing out of the medium-sized firms. Hence, we conclude that these findings do not indicate a robust relationship between energy prices and the industry concentration.

Next, we estimate the effect of the energy prices on average markups of price over marginal costs, weighted by firm size. CompNet estimates markups at the firm level following the method of De Loecker and Warzynski (2012) and reports (weighted and unweighted) averages at the sector level. As briefly described in Section 3, based on different production function assumptions and estimators, the CompNet database provides 6 estimates of the average

Table 8: Top 10 share

	(1)	(2)	(3)	(4)	(5)	(6)
	Top 10 employment		Top 10 labor costs		Top 10 revenue	
	OLS	IV	OLS	IV	OLS	IV
Log energy price	-0.012	-0.017	-0.010	-0.026*	-0.016	-0.028*
	(0.012)	(0.014)	(0.012)	(0.014)	(0.013)	(0.014)
Log wage	-0.002	-0.002	-0.004	-0.004	-0.007	-0.007
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
Log rental rate	-0.001	-0.001	0.002	0.002	-0.004	-0.004
	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)
First stage F stat.		6579.3		6579.8		6604.2
Country-sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7619	7611	7623	7615	7606	7598

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

markup at the country-sector-year level. It is well known that these markup estimates based on the ratio estimator are sensitive to underlying assumptions on the production function and the use of revenue-based output measures to proxy for the physical output, especially in the presence of market power (e.g., Bond et al. 2021). These issues are reflected in the very low correlation between the markup estimates using slightly different methods for the same set of firms both in the cross-section and over time. We use these variables as they are still the most reliable methods given the data limitations and restrict the sample to exclude the unrealistic values as elaborated in Section 3. Table 9 shows the results for all 6 markup estimates.[28]

[28] The notes below the table report the different production function assumptions and estimators that are used. For more information, see CompNet (2021).

Table 9: Markups

	(1)	(2)	(3)	(4)	(5)	(6)
	Spec. 0	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5
Log energy price	-0.002	-0.048	-0.062***	-0.055*	-0.007	-0.058
	(0.024)	(0.032)	(0.023)	(0.031)	(0.037)	(0.044)
Log wage	0.000	0.018	0.043***	-0.001	0.030	0.039**
	(0.015)	(0.022)	(0.014)	(0.025)	(0.023)	(0.017)
Log rental rate	-0.012	0.012	0.019	0.004	0.005	0.016
	(0.010)	(0.014)	(0.012)	(0.016)	(0.017)	(0.021)
First stage F stat.	5293.8	5541.5	5893.9	5235.0	3323.2	3910.7
Country-sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5709	5834	6272	5171	3384	3480

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. All regressions use IV estimation. For energy price we use the variable weight (P^{EV}) specification, instrumented by the fixed weight (P^{EF}) version. The markup estimations are performed by CompNet, specifications 0 through 5 refer to the following: 0) OLS and Cobb-Douglas (CD) with constant returns to scale; 1) OLS and CD 2) OLS and translog (TL); 3) OLS and CD with time-varying output elasticities; 4) GMM and CD; 5) GMM and TL. The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We find a negative effect of the energy price on the size-weighted average markup in all 6 specifications, though it is only significant at 5% in specification 2. We conclude that we find no robust evidence of an effect of energy prices on markups or industry concentration.

The main explanation that we propose for the strong, positive and linear relationship between firm size and the degree of pass-through with insignificant changes in the industry concentration and markups is that the effect of energy price shocks on the Herfindahl index can be very small, depending on the degree of pass-through of firms with negligible market shares and the initial firm size distribution, as mentioned in Section 2.[29]

6 Robustness

This section tests the sensitivity of our main finding, i.e. a negative impact of energy prices on the labor share to the uses of alternative data sources on the labor share, controlling for additional covariates, and the heterogeneity across sectors. We elaborate on this series of robustness checks and report the corresponding tables in the Appendix.

6.1 Alternative labor share data

To compute the labor share at the sector level we multiply the unweighted mean labor costs and value added by their respective number of firms in the population and then take the ratio. Though the population-weighted CompNet data should be representative of the population, we use EU KLEMS data to confirm our findings. We compute the labor share at the sector level using aggregate data from the EU KLEMS Statistical National Accounts and Statistical Growth Accounts databases. We divide labor costs by value added and include labor costs divided by number of employees as the wage. We use total capital expenditures as a proxy for the price of capital. EU KLEMS covers all the sectors, countries and years that we use in Compnet, but groups some of the two digit sectors together. We thus estimate our regressions in this section at the EU KLEMS sector level. We cannot control for markups and the covariance of the labor share and value added, as these variables are not available in EU KLEMS. Table B4 shows the results. The effect of the energy price is highly significant and negative. In terms of its size, it is slightly less negative than the Compnet estimate, though quite close (-0.032 compared to -0.043). The differences in the coefficient might be due to the coverage of years and the grouping of sectors between the datasets or the differences in the average energy intensity of the industries in the sample (see equation (9)).

6.2 Controlling for concentration

In Table B5 we estimate our baseline regression and control for market concentration, measured in six different ways. We use the HHIs and the top 10 shares for employment, labor

[29] The limitations of the Orbis dataset discussed in Section 3 also offer a natural explanation.

costs and revenue. As shown in Table B5, our baseline findings are robust to the control of different measures of market concentration, which is consistent with the absence of a relationship between energy prices and industry concentration we document. The coefficient hardly changes in size and remains significant at the 1% level.[30]

6.3 Energy-intensive sectors

In this section, we investigate the heterogeneity in the relationship between energy prices and factor shares across industries with different degrees of energy intensity. Although it is predicted that energy-intensive sectors are typically influenced more by the energy price shocks than sectors that rely less on energy, our baseline energy price shock does not incorporate the cost share of energy (s_e^c or s_e^x) for two reasons. First, the energy intensity of a sector is endogenous to the substitution elasticities between factors, which might attenuate the relationship between energy price elasticity of the labor share and the energy intensity of a sector. Second, it is not possible to construct s_e^c and s_e^x in an accurate way across industries given the data limitations. As a result, we construct bins of different energy intensities based on the energy use of sectors in 2008 and interact them with the fixed weight energy price using weights from 2008. These regressions are reduced form for the period 2009-2018. As reported in columns 2 and 4 of Table B6, the effect of energy prices on the labor share is stronger for more energy intensive sectors while the differences between bins are not always significant and the effect is not linear.

Manufacturing sectors are generally more energy intensive than service sectors, which is why a substantial part of the literature on the employment effects of energy prices only focuses on manufacturing.[31] Tables B7 through B9 report the results of our main regressions for a restricted sample, only consisting of manufacturing sectors (NACE Rev.2 code C). Consistent with the fact that manufacturing tends to be energy-intensive, the effect of the energy price on the labor share is negative and larger in size than for the entire sample. Interestingly, we

[30] The effect of industry concentration on the labor share differs across specifications and is sometimes negative as these concentration measures respond differently to the changes in the firm size distribution and the omitted underlying shocks, which induce within industry reallocation, might also be correlated with the movements in the factor shares at the industry level directly.

[31] E.g., Dechezleprêtre et al. (2020), Dussaux (2020), Bretschger and Jo (2021), Marin and Vona (2021).

also find a negative effect on the capital share, which suggests that the degree of substitution between energy and the primary inputs may be similar for manufacturing than for other industries, at least in the short run. Consistent with this result, we find no effect on the capital-labor ratio. Nevertheless, we do find a strong and positive effect on investment, which suggests that substitution towards capital does play a role in the medium run. Our results on concentration show a positive effect of the energy price on the employment HHI, but no effect on the other concentration measures. Our findings for markups are similar to those with our baseline sample.

6.4 Dynamic effects

Our baseline results are mainly on the short run relationship between energy prices and our outcome variables. A potential alternative explanation that might rationalize the main findings on the factor shares is that capital is less variable than labor in the short-run and bulk of the adjustment in factor use in response to the changes in energy prices takes place via the labor employment. In this case, the decline in the labor share in response to rising energy prices might be short-lived and the ordering of the substitution elasticities between the primary factors and energy might change in the medium to long-run. Although the time period we study is short for a full investigation of the dynamic effects,[32] we provide some suggestive evidence as to the longer run effects of energy price shocks in this section. Tables B10 and B11 show the results of the baseline regressions where the average value of the labor and capital shares between year t and $t + 2$ are the dependent variables, respectively. The results are in line with the baseline findings and confirm the negative of effect of energy prices on the labor share and the absence of a relationship between the capital share and energy prices also in the medium run. Tables B12 and B13 show the results for the capital labor ratio and investment are also in line with the baseline results.[33]

[32]Note that our sample spans 2000-2018, but our variable weights end in 2016 and CompNet data starts only after 2000 for many countries.

[33]Alternatively, we report the results of the baseline regressions where different lags of the energy prices are used as the main independent variable in Tables B14 through B20. The effect of the energy price on the labor share is negative for all the lags we include (contemporaneous until the fifth lag), and significantly so until the fourth lag. These results indicate a certain degree of persistence in the negative effects of energy prices on the labor share. Interestingly, and consistent with the strong and positive effect we find for investment, the effect

6.5 Weighted regressions and alternative fixed effects specifications

To check whether our results may be driven by small sectors that may have little impact on the aggregate labor share, we perform weighted regressions in this section. We weight sectors by the log of total revenue in 2008 and perform the regression for the years 2009-2016. We also use weights from 2008 for the P^{EF} instrument. Table B21 shows the results. The effect of the energy price is similar to our baseline regressions in all specifications, though the coefficient size decreases a bit when we include the full set of controls in column 4.

In addition, we check the robustness of our results to the saturation of the baseline specification with the country-year and sector-year fixed effects which capture the general equilibrium effects and aggregate fluctuations along the relevant dimensions. While the inclusion of these fixed effects partial out the aggregate confounding factors, they also subsume important changes in the variables of interest induced by the exogenous changes in the energy prices in general equilibrium.[34] Despite the substantial number of the fixed effects controlled in these regressions, Table B22 shows that the energy price has a negative impact on the labor share. Tables B23 through B25 show that the results in our preferred specification (column 4 in each table) are robust to including both country-year and sector-year fixed effects.

7 Conclusion

This paper documents the effect of energy prices on two important macroeconomic variables. First, we find a negative impact of energy prices on the labor share. Exploring the mechanisms behind this result, we find that factor substitution plays a dominant role, while no robust evidence is found for an effect through reallocation within sectors, increased markups,

on the capital share is zero at first and becomes significantly positive for the third through fifth lag. This suggests that the elasticity of substitution between capital and energy is potentially higher in the medium-run than in the short-run. The effect on the capital labor ratio is consistently positive and significant across all lags for the entire sample, and not distinguishable from zero for manufacturing (except for the contemporaneous value). The effect on the markup (specification 2, i.e. the only one for which we find a significant effect in our baseline) is consistently negative and significant.

[34] Grossman and Oberfield (2021) discusses the advantages and caveats of controlling for fixed effects at different levels in the identification and the relevance of the estimated effects in the context of the labor share regressions.

or changes in the revenue to value added ratio. These findings contribute to the "jobs versus the environment" debate and have important implications for policy discussions on stringent climate policy, which will increase energy prices. Our results indicate that there is indeed a trade-off between jobs and the environment, as labor and energy seem to be complementary in production and the degree of complementarity is higher than that of capital and energy. In fact, our results indicate that workers bear a disproportionate share of the negative consequences of climate policy, relative to other groups. Higher energy prices induced by climate change policies are likely to decrease the labor share and lead to losses of employment. As such, climate policy may have important redistributional consequences, at least in the short-run. These consequences should not be disregarded by policymakers in the design of policies targeting climate change. A potential way to soften the negative employment effects and improve the political acceptability of climate policy would be to use the carbon tax revenues to lower labor income taxes. That way, governments partially replace a tax that distorts the labor market by a tax that corrects a negative externality, thereby potentially generating a double dividend (Goulder, 1995). We stress, however, that our results mainly allow us to draw conclusions about the short to medium run impact of energy prices while endogenous changes in investment, technology and the direction of innovation may compensate for the possible losses in the labor share (e.g., Hassler et al. 2021). We leave the assessment of the long run effects of energy prices on the labor share to future research.

Finally, we document that despite the presence of heterogeneous pass-through of energy price shocks across the firm size distribution, i.e. shocks are passed on to employment and output differently for large compared to small firms, industry concentration is not significantly affected by energy prices. Hence, though small firms are likely to respond more strongly to climate policy than large firms, the aggregate anti-competitive effects seem to be limited.

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Appendix

A The CompNet database

The CompNet database contains a variety of financial variables for 19 European countries at different levels of aggregation, such as the country, region and (two digit) sector. Because CompNet is based on administrative micro data, it provides not only aggregate or mean values for these variables, but many moments of their (joint) distributions. For instance, it provides the percentiles (1, 5, 10, 25, 50, 75, 90, 95, 99), mean, standard deviation, skewness and kurtosis. Moreover, production functions are estimated using 6 different methods, which allows CompNet to report variables like markups, productivities, and indicators of factor misallocation. All these are estimated at the firm level using data from an individual country, and the aggregate statistics are then merged for the various countries.

Though based on administrative data, CompNet variables are still computed from a sample, and so the database provides both weighted and unweighted data sets. Unweighted sets provide the sample moments, and weighted data sets use weights based on the (population) firm size distribution to compute representative statistics for the population of firms (with at least one employee). We use the weighted data set. CompNet also has separate files based only on firms with at least 20 employees, which are available for a larger set of country-sector pairs.[35] However, we are interested in the effects for the entire firm-size distribution and, being based on administrative data, CompNet is especially useful for its coverage of smaller firms. Thus, we use the "all firms" data files.

CompNet provides mean values for certain variables, which we need at the aggregate country-sector-year level. We obtain these values by multiplying the mean by the provided number of firms in the population. We do this for variables like employees and labor costs, i.e. where the aggregate statistic at the sector level is more informative than the average across firms. CompNet also provides the unweighted mean of variables for which we are interested in the firm size-weighted mean. We obtain these from the data file that applies the Olley and Pakes (1996) decomposition. The weighted average is computed as the sum of the unweighted average and the covariance between the variable of interest and firm size.

[35] E.g., France only has data for the "20 employees or more" sample, as do some German sectors.

Note that this is not related to the weighted/unweighted decision described above. We use the population-weighted data set (representative of the population of firms), which reports the mean for variables like the markup. This is referred to as the unweighted mean, even though it is in the population-weighted data set. We are, however, interested in the firm size-weighted average markup, for which we use the decomposition files.

B Tables and figures

Table B1: Sectors in CompNet and WIOD

Two digit sector in CompNet (NACE Rev. 2)	One digit	WIOD
10 - Manufacture of food	C	C10_12
11 - Manufacture of beverages	C	C10_12
12 - Manufacture of tobacco	C	C10_12
13 - Manufacture of textiles	C	C13_15
14 - Manufacture of wearing apparel	C	C13_15
15 - Manufacture of leather and related	C	C13_15
16 - Manufacture of wood, cork, straw and plaiting	C	C16
17 - Manufacture of paper products	C	C17
18 - Printing and reproduction of recorded media	C	C18
20 - Manufacture of chemicals products	C	C20
21 - Manufacture of basic pharmaceutical products	C	C21
22 - Manufacture of rubber and plastic	C	C22
23 - Manufacture of non-metallic mineral products	C	C23
24 - Manufacture of basic metals	C	C24
25 - Manufacture of fabricated metal prod	C	C25
26 - Manufacture of computer, electronic, optical prod	C	C26
27 - Manufacture of electric equipment	C	C27
28 - Manufacture of machinery and equipment n.e.c.	C	C28
29 - Manufacture of motor vehicles, trailers	C	C29

Continued on next page

Table B1 – continued from previous page

Two digit sector in CompNet (NACE Rev. 2)	One digit	WIOD
30 - Manufacture of other transport equipment	C	C30
31 - Manufacture of furniture	C	C31_32
32 - Other manufacturing	C	C31_32
33 - Repair and installation of machinery	C	C33
41 - Construction of buildings	F	F
42 - Civil engineering	F	F
43 - Specialised construction	F	F
45 - Wholesale, retail and repair of motorvehicles	G	G45
46 - Wholesale except motorvehicles	G	G46
47 - Retail except motorvehicles	G	G47
49 - Land transport and via pipelines	H	H49
50 - Water transport	H	H50
51 - Air transport	H	H51
52 - Warehousing and support for transportation	H	H52
53 - Postal and courier activities	H	H53
55 - Accommodation	I	I
56 - Food and beverage services	I	I
58 - Publishing	J	J58
59 - Multimedia services	J	J59_60
60 - Programming and broadcasting activities	J	J59_60
61 - Telecommunications	J	J61
62 - Computer programming, consultancy et al.	J	J62_63
63 - Information services	J	J62_63
68 - Real Estate activities	L	L68
69 - Legal and accounting	M	M69_70
70 - Activities of head offices; consultancy	M	M69_70
71 - Architectural and engineering	M	M71

Continued on next page

Table B1 – continued from previous page

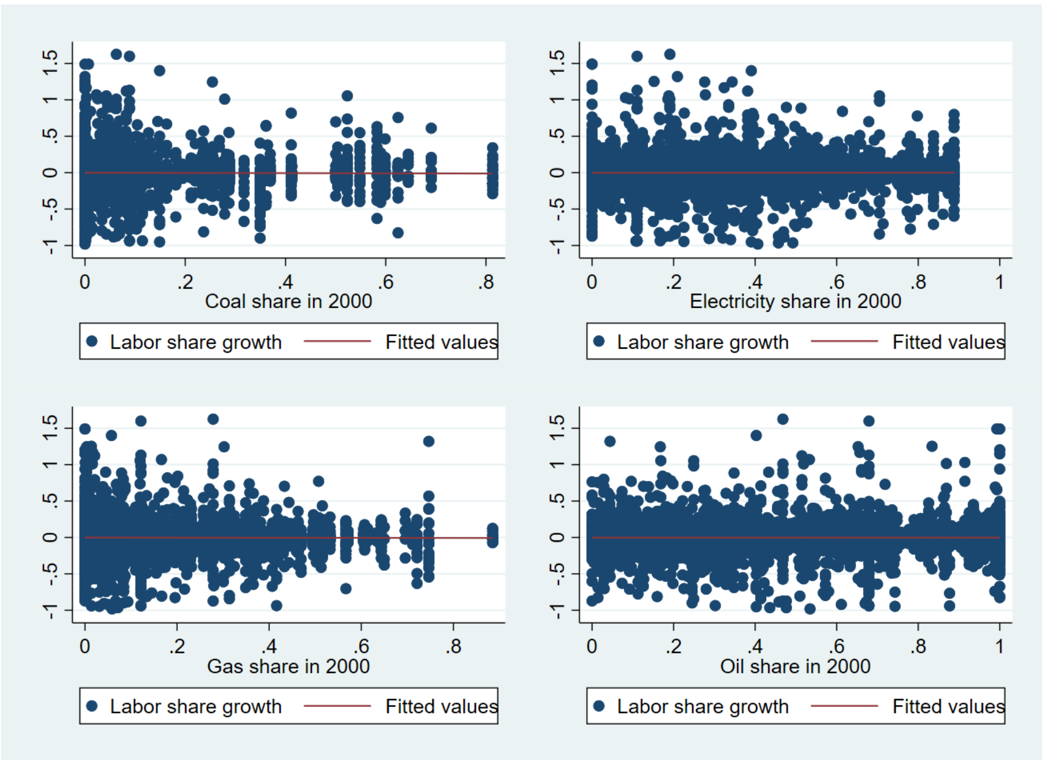
Two digit sector in CompNet (NACE Rev. 2)	One digit	WIOD
72 - R&D	M	M72
73 - Advertising and market research	M	M73
74 - Other professional, scientific and technical activities	M	M74_75
75 - Veterinary activities	M	M74_75
77 - Rental and leasing activities	N	N
78 - Employment activities	N	N
79 - Travel services	N	N
80 - Security services	N	N
81 - Services to buildings and landscap noisilye	N	N
82 - Office admin, office support and other business support	N	N

Table B2: Correlations between weights and labor share growth

	Share in total energy use in 2000			
	Coal	Electricity	Gas	Oil
Labor share growth 2001	-0.008	0.054	-0.067	-0.001
Labor share growth 2002	-0.118	0.011	-0.002	0.027
Labor share growth 2003	-0.011	-0.029	-0.006	0.032
Labor share growth 2004	0.018	-0.049	-0.001	0.027
Labor share growth 2005	0.054	-0.067	0.018	0.025
Labor share growth 2006	-0.058	-0.090	-0.017	0.125
Labor share growth 2007	0.119	0.001	-0.028	-0.029
Labor share growth 2008	0.050	0.078	0.054	-0.091
Labor share growth 2009	-0.008	0.018	-0.027	0.008
Labor share growth 2010	-0.001	-0.001	-0.035	0.029

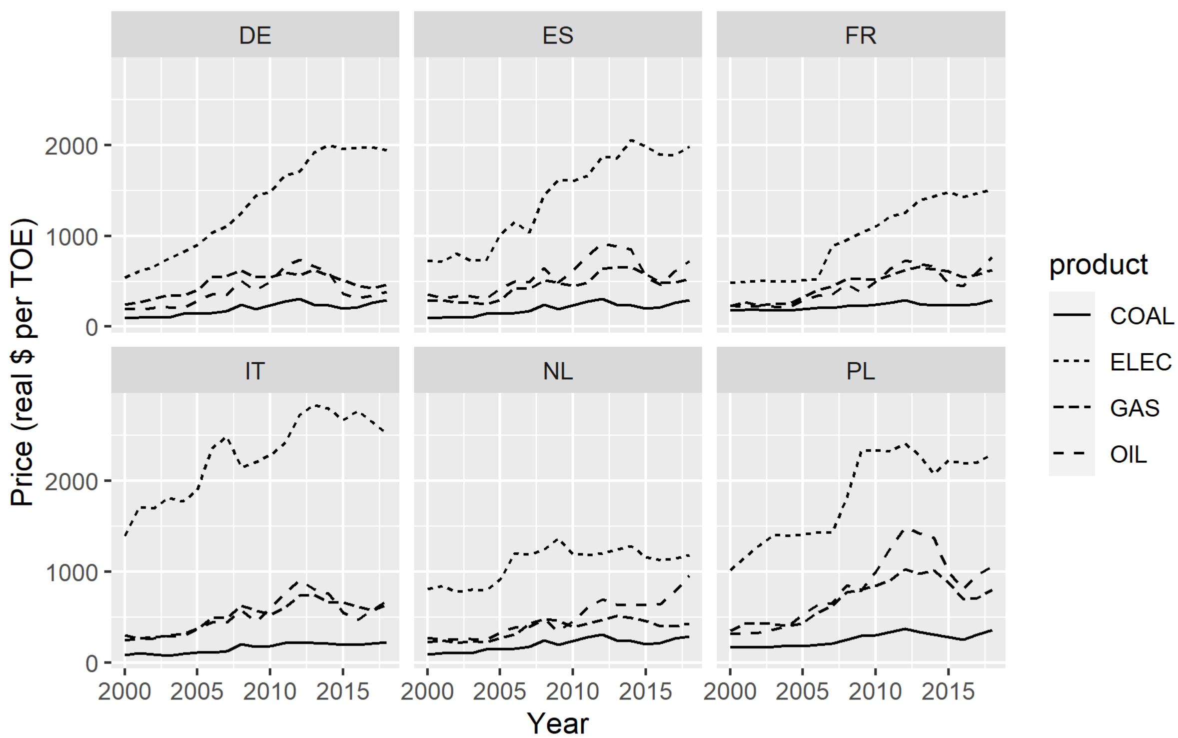
Notes: Correlation coefficients for the growth rate of the labor share (the dependent variable in our main regressions) and pre-sample weights for the four fuels we consider.

Figure B1: Scatter plots of weights and labor share growth



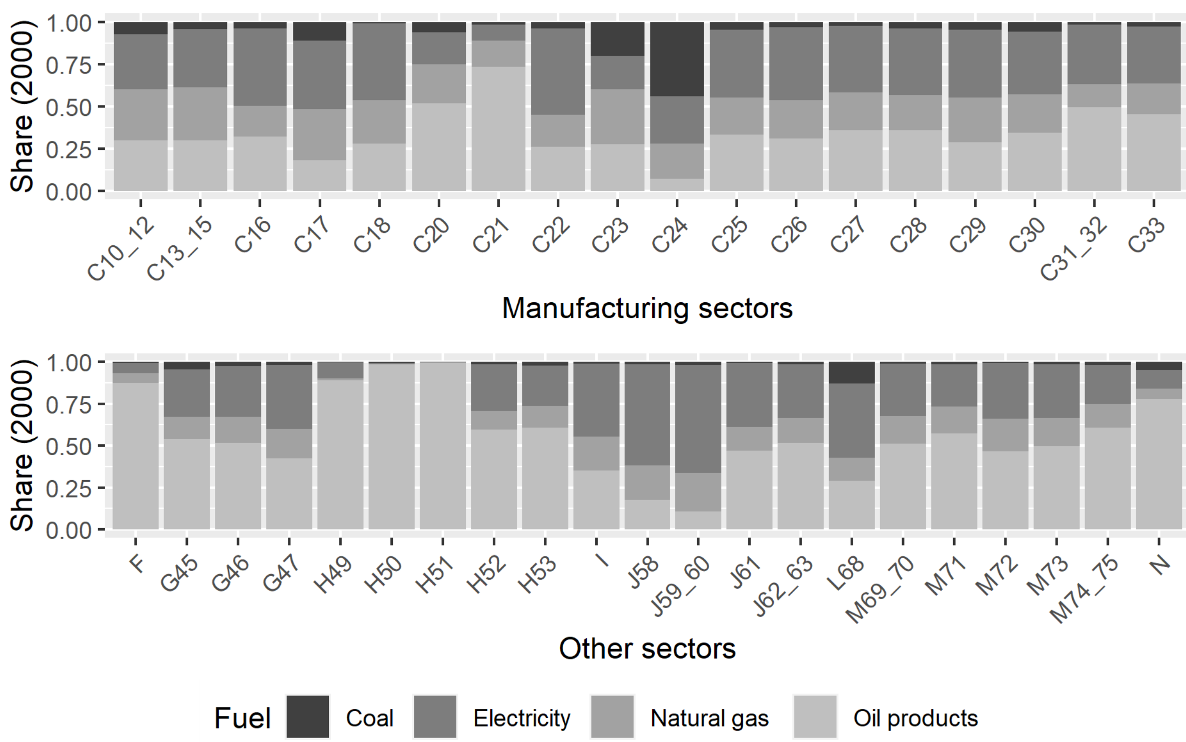
Notes: Labor share growth is on the vertical axis and pre-sample weights are on the horizontal axis.

Figure B2: Energy price evolution for selected EU countries



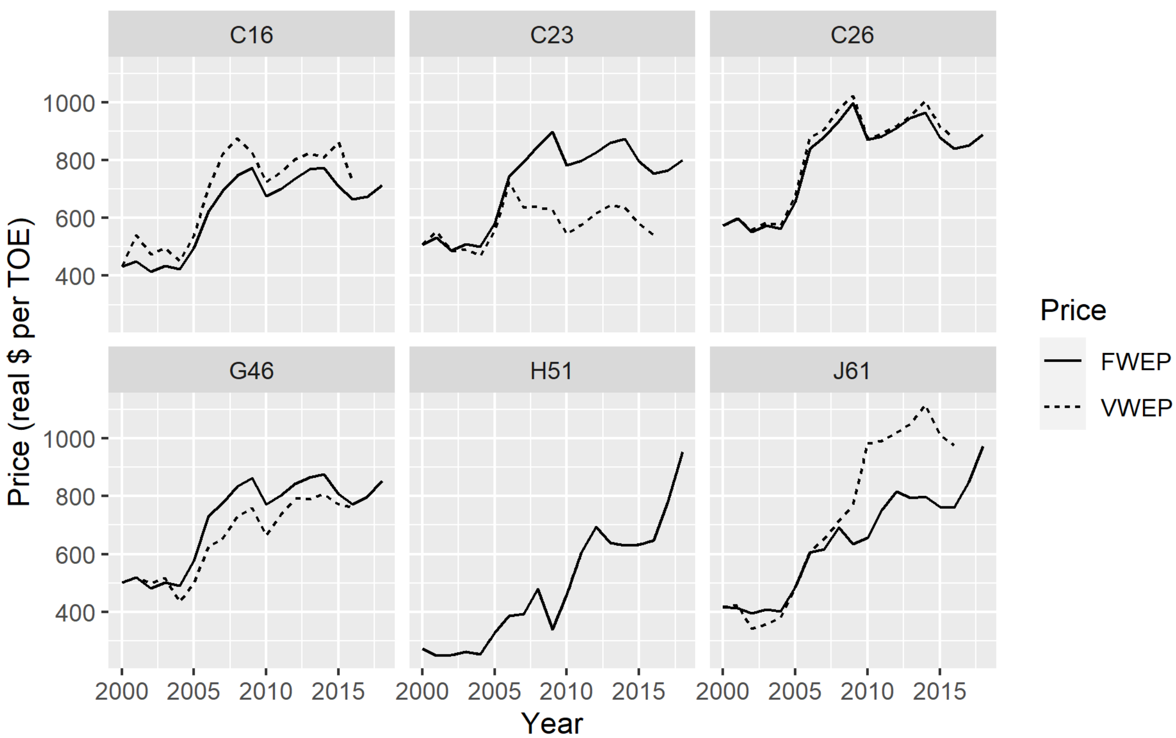
Notes: Source: IEA.

Figure B3: Average energy shares by sector



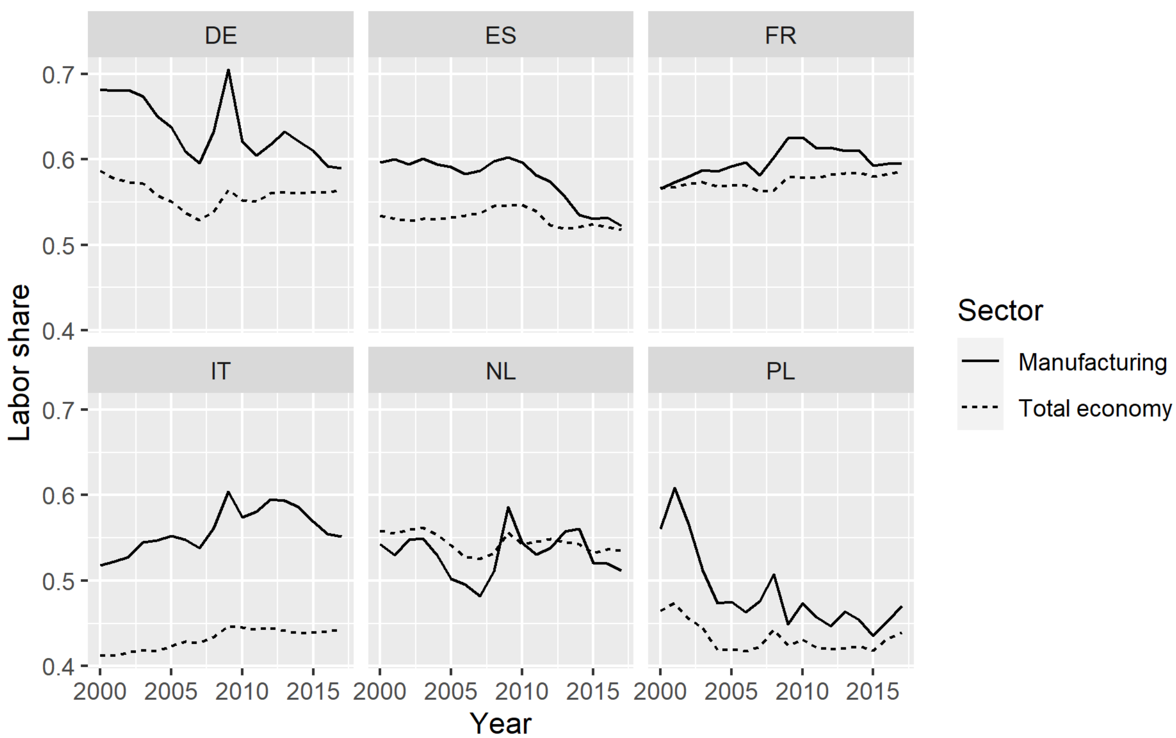
Notes: Source: WIOD.

Figure B4: Weighted energy price evolution for selected EU countries



Notes: FWEP is the fixed weight energy price and VWEP is the variable weight energy price. Sources: IEA, WIOD.

Figure B5: Labor share evolution for selected EU countries



Notes: Source: EU KLEMS.

Table B3: Firm level results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Revenue	Revenue	Value added	Value added	Labor costs	Labor costs	Employment	Employment	Labor share	Labor share
Log energy price	-0.034***		-0.063***		-0.082***		-0.057***		-0.012***	
	(0.003)		(0.003)		(0.003)		(0.003)		(0.001)	
Log energy price * bin 1		-0.130***		-0.176***		-0.227***		-0.061***		-0.027***
		(0.007)		(0.008)		(0.010)		(0.006)		(0.003)
Log energy price * bin 2		-0.111***		-0.155***		-0.208***		-0.072***		-0.029***
		(0.007)		(0.007)		(0.009)		(0.006)		(0.002)
Log energy price * bin 3		-0.106***		-0.151***		-0.199***		-0.090***		-0.025***
		(0.006)		(0.006)		(0.008)		(0.006)		(0.002)
Log energy price * bin 4		-0.091***		-0.136***		-0.180***		-0.095***		-0.021***
		(0.006)		(0.006)		(0.007)		(0.006)		(0.002)
Log energy price * bin 5		-0.078***		-0.116***		-0.139***		-0.096***		-0.015***
		(0.006)		(0.006)		(0.007)		(0.006)		(0.002)
Log energy price * bin 6		-0.065***		-0.096***		-0.120***		-0.086***		-0.013***
		(0.006)		(0.005)		(0.006)		(0.005)		(0.002)
Log energy price * bin 7		-0.046***		-0.078***		-0.086***		-0.077***		-0.005***
		(0.005)		(0.005)		(0.006)		(0.005)		(0.002)
Log energy price * bin 8		-0.016***		-0.045***		-0.046***		-0.060***		-0.004***
		(0.005)		(0.005)		(0.006)		(0.005)		(0.001)
Log energy price * bin 9		0.011**		-0.008		-0.006		-0.038***		-0.003**
		(0.005)		(0.005)		(0.005)		(0.005)		(0.001)
Log energy price * bin 10		0.079***		0.070***		0.069***		0.018***		-0.004***
		(0.005)		(0.004)		(0.005)		(0.004)		(0.001)
Log wage	0.071***	0.070***	0.102***	0.102***	0.199***	0.198***	-0.010***	-0.011***	0.022***	0.022***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Firms	1,700,913	1,700,913	1,700,913	1,700,913	1,700,913	1,700,913	1,700,913	1,700,913	1,700,913	1,700,913
Observations	8,203,567	8,203,567	8,203,567	8,203,567	8,203,567	8,203,567	8,203,567	8,203,567	8,203,567	8,203,567

Notes: Robust standard errors are clustered at the firm level and reported in parentheses. All regressions are reduced form for 2009-2018, and include firm fixed effects and year fixed effects. All independent variables are lagged one year. For energy price we use the fixed weight (P^{EF}) specification with 2008 weights. Included firms are those in our CompNet sample countries and sectors that have average annual revenues of at least 100,000 dollars (and appear in Orbis). Bins are defined by deciles of average annual revenues over the available years within a country-sector (firms do not switch bins).

Table B4: Labor share from EU KLEMS

	(1)	(2)	(3)	(4)	(5)
	OLS	IV	IV	IV	IV
Log energy price	-0.023	-0.031*	-0.022*	-0.032***	-0.022*
	(0.014)	(0.017)	(0.012)	(0.010)	(0.013)
Log wage			0.053***	0.044***	0.045***
			(0.013)	(0.011)	(0.013)
Log capital expenditure			-0.073***	-0.063***	-0.072***
			(0.005)	(0.005)	(0.007)
Log(revenue / v.a.)				0.080***	0.061***
				(0.017)	(0.018)
First stage F stat.		3973.0	3846.0	3574.2	1569.6
Country-sector FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Sectors	All	All	All	All	Manuf.
Observations	6466	6466	6327	6184	2907

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. The dependent variable is the labor share computed using the EU KLEMS database. The wage, capital expenditures and revenue to value added ratio are also from EU KLEMS. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B5: Labor share controlling for concentration

	(1)	(2)	(3)	(4)	(5)	(6)
	IV	IV	IV	IV	IV	IV
Log energy price	-0.040***	-0.038***	-0.039***	-0.036***	-0.036***	-0.039***
	(0.013)	(0.013)	(0.013)	(0.014)	(0.014)	(0.013)
Log wage	0.017*	0.021**	0.016	0.016	0.016	0.015
	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)
Log rental rate	0.006	0.006	0.006	0.007	0.007	0.006
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Cov(L-share, v.a.)	0.006*	0.006*	0.006*	0.006*	0.006*	0.005*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Log(revenue / v.a.)	0.070***	0.069***	0.067***	0.063***	0.064***	0.068***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.018)	(0.017)
Log HHI employment	0.005					
	(0.003)					
Log HHI labor costs		0.006**				
		(0.002)				
Log HHI revenue			-0.002			
			(0.003)			
Top 10 share employment				-0.050		
				(0.031)		
Top 10 share labor costs					-0.012	
					(0.023)	
Top 10 share revenue						-0.142***
						(0.026)
First stage F stat.	7356.9	7250.5	7146.4	6267.6	6300.9	6179.6
Country-sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7252	7252	7252	6789	6789	6789

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B6: Labor share with energy share bin interactions

	(1)	(2)	(3)	(4)	(5)	(6)
Log energy price	-0.042***		-0.029**		-0.072***	
	(0.015)		(0.014)		(0.022)	
Log energy price * bin 1		-0.026		-0.034*		-0.067**
		(0.020)		(0.018)		(0.026)
Log energy price * bin 2		-0.015		-0.003		-0.200***
		(0.024)		(0.024)		(0.075)
Log energy price * bin 3		-0.033		-0.018		-0.041
		(0.023)		(0.025)		(0.060)
Log energy price * bin 4		-0.089***		-0.067**		-0.087*
		(0.028)		(0.031)		(0.050)
Log energy price * bin 5		-0.027		-0.019		-0.092*
		(0.028)		(0.029)		(0.049)
Log energy price * bin 6		-0.043		-0.030		-0.133***
		(0.030)		(0.030)		(0.044)
Log energy price * bin 7		-0.122***		-0.097***		-0.056
		(0.033)		(0.033)		(0.044)
Log energy price * bin 8		-0.071**		-0.033		-0.103***
		(0.031)		(0.027)		(0.040)
Log energy price * bin 9		-0.081**		-0.053*		-0.049
		(0.035)		(0.031)		(0.063)
Log energy price * bin 10		-0.034		-0.002		0.008
		(0.038)		(0.031)		(0.040)
Log wage			0.041***	0.040***	0.038*	0.037*
			(0.014)	(0.014)	(0.022)	(0.023)
Log rental rate			0.003	0.002	0.005	0.007
			(0.009)	(0.009)	(0.017)	(0.017)
Cov(L-share, v.a.)			0.005	0.005	0.014**	0.014**
			(0.004)	(0.004)	(0.006)	(0.006)
Log(revenue / v.a.)			0.036	0.038	0.075**	0.074**
			(0.023)	(0.024)	(0.030)	(0.030)
Markup (spec 2)			-0.024	-0.021	0.027	0.032
			(0.019)	(0.019)	(0.028)	(0.029)
Country-sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sectors	All	All	All	All	Manuf.	Manuf.
Observations	4837	4837	3686	3686	1651	1651

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All regressions are reduced form for 2009-2018, and include country-sector fixed effects and year fixed effects. All independent variables are lagged one year. For energy price we use the fixed weight (P^{EF}) specification with 2008 weights. Bins are defined as deciles of the energy share in total costs (computed using country level energy prices and sector level use) for the year 2008.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B7: Factor substitution for manufacturing sectors

	(1) L share	(2) K share	(3) Log K/L	(4) Log investment	(5) L share (rev)
Log energy price	-0.054***	-0.022**	0.052	0.666***	-0.029***
	(0.016)	(0.010)	(0.068)	(0.209)	(0.009)
Log wage	0.009	0.016**	0.103**	0.130	0.042***
	(0.015)	(0.008)	(0.043)	(0.108)	(0.015)
Log rental rate	0.011	0.052***	0.085**	0.234**	0.016*
	(0.012)	(0.006)	(0.033)	(0.101)	(0.009)
Cov(L-share, v.a.)	0.014**	-0.001	0.011	-0.121**	0.006*
	(0.007)	(0.007)	(0.017)	(0.061)	(0.003)
Log(revenue / v.a.)	0.086***	0.029**	-0.004	0.396**	0.001
	(0.024)	(0.014)	(0.058)	(0.196)	(0.023)
Markup (spec 2)	-0.048**	-0.036***	-0.049	-0.361**	-0.021
	(0.023)	(0.013)	(0.086)	(0.171)	(0.014)
First stage F stat.	1361.5	1414.2	1419.9	1417.3	1419.7
Country-sector FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	2646	2703	2733	1858	2733

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. All regressions use an IV specification. For energy price we use the variable weight (P^{EV}) specification, instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B8: Industry concentration for manufacturing sectors

	(1)	(2)	(3)	(4)	(5)	(6)
	Log HHI			Top 10 share		
	Employment	Labor costs	Revenue	Employment	Labor costs	Revenue
Log energy price	0.275**	0.069	-0.080	-0.001	-0.008	-0.024
	(0.135)	(0.141)	(0.158)	(0.017)	(0.018)	(0.016)
Log wage	-0.075	-0.162	-0.052	-0.006	-0.005	0.000
	(0.051)	(0.118)	(0.073)	(0.007)	(0.006)	(0.008)
Log rental rate	-0.041	-0.051	-0.014	0.007	0.010	0.001
	(0.056)	(0.070)	(0.075)	(0.006)	(0.007)	(0.008)
First stage F stat.	1571.7	1570.5	1581.9	1331.5	1330.8	1345.0
Country-sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3254	3257	3237	3069	3073	3058

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B9: Markups for manufacturing sectors

	(1)	(2)	(3)	(4)	(5)	(6)
	Spec. 0	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5
Log energy price	-0.005	-0.065*	-0.092***	0.019	-0.034	-0.042
	(0.030)	(0.037)	(0.030)	(0.042)	(0.035)	(0.056)
Log wage	0.015	0.032*	0.037**	-0.016	0.071**	0.013
	(0.013)	(0.018)	(0.015)	(0.022)	(0.030)	(0.020)
Log rental rate	-0.023*	0.018	0.018*	-0.003	-0.002	0.007
	(0.014)	(0.017)	(0.011)	(0.014)	(0.013)	(0.023)
First stage F stat.	1262.0	1256.5	1407.4	1434.0	818.0	1009.3
Country-sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2622	2575	2766	2280	1634	1464

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. All regressions use IV estimation. For energy price we use the variable weight (P^{EV}) specification, instrumented by the fixed weight (P^{EF}) version. The markup estimations are performed by CompNet, specifications 0 through 5 refer to the following: 0) OLS and Cobb-Douglas (CD) with constant returns to scale; 1) OLS and CD 2) OLS and translog (TL); 3) OLS and CD with time-varying output elasticities; 4) GMM and CD; 5) GMM and TL. The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B10: Labor share (average over time t until $t + 2$)

	(1)	(2)	(3)	(4)
	OLS	IV	IV	IV
Log energy price	-0.030***	-0.042***	-0.043***	-0.043***
	(0.009)	(0.011)	(0.011)	(0.012)
Log wage			0.004	0.010
			(0.007)	(0.009)
Log rental rate			0.001	-0.003
			(0.005)	(0.005)
Cov(L-share, v.a.)				0.004
				(0.003)
Log(revenue / v.a.)				-0.013
				(0.013)
Markup (spec 2)				-0.053***
				(0.012)
First stage F stat.		6532.2	6080.7	5298.3
Country-sector FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	6979	6972	6565	5182

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B11: Capital share (average over time t until $t+2$)

	(1)	(2)	(3)	(4)
	OLS	IV	IV	IV
Log energy price	0.014	0.002	0.003	0.006
	(0.010)	(0.011)	(0.011)	(0.013)
Log wage			0.007*	0.012**
			(0.004)	(0.005)
Log rental rate			0.012***	0.013***
			(0.003)	(0.004)
Cov(L-share, v.a.)				0.000
				(0.002)
Log(revenue / v.a.)				0.012
				(0.009)
Markup (spec 2)				-0.023**
				(0.010)
First stage F stat.		6443.3	6645.4	5691.1
Country-sector FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	7186	7179	7070	5451

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B12: Log capital labor ratio (average over time t until $t+2$)

	(1)	(2)	(3)	(4)
	OLS	IV	IV	IV
Log energy price	0.167***	0.107*	0.105*	0.136**
	(0.051)	(0.058)	(0.058)	(0.062)
Log wage			0.067**	0.110***
			(0.029)	(0.041)
Log rental rate			0.022	0.044
			(0.025)	(0.030)
Cov(L-share, v.a.)				0.005
				(0.010)
Log(revenue / v.a.)				0.169**
				(0.077)
Markup (spec 2)				0.107*
				(0.057)
First stage F stat.		6528.1	6691.7	5584.4
Country-sector FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	7439	7432	7299	5543

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B13: Log investment (average over time t until $t+2$)

	(1)	(2)	(3)	(4)
	OLS	IV	IV	IV
Log energy price	0.422***	0.490***	0.640***	0.638***
	(0.091)	(0.119)	(0.123)	(0.137)
Log wage			0.148**	0.185**
			(0.066)	(0.089)
Log rental rate			0.092*	0.089*
			(0.054)	(0.053)
Cov(L-share, v.a.)				0.020
				(0.031)
Log(revenue / v.a.)				0.026
				(0.139)
Markup (spec 2)				-0.221*
				(0.126)
First stage F stat.		6780.6	5789.4	4234.3
Country-sector FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	4709	4702	4340	3170

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B14: Labor share with different lags of energy price

	(1)	(2)	(3)	(4)	(5)	(6)
Log energy price (t)	-0.036***					
	(0.013)					
Log energy price ($t-1$)		-0.043***				
		(0.013)				
Log energy price ($t-2$)			-0.032***			
			(0.012)			
Log energy price ($t-3$)				-0.026*		
				(0.013)		
Log energy price ($t-4$)					-0.016	
					(0.014)	
Log energy price ($t-5$)						-0.007
						(0.012)
Log wage	0.015	0.019*	0.023**	0.022*	0.019	0.019
	(0.010)	(0.011)	(0.011)	(0.013)	(0.013)	(0.015)
Log rental rate	0.007	0.006	0.003	-0.005	-0.011	-0.010
	(0.007)	(0.007)	(0.007)	(0.008)	(0.009)	(0.010)
Cov(L-share, v.a.)	0.006*	0.007**	0.005	0.005	0.004	0.004
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Log(revenue / v.a.)	0.016	0.026	0.027*	0.027*	0.028*	0.022
	(0.017)	(0.016)	(0.015)	(0.016)	(0.016)	(0.017)
Markup (spec 2)	-0.054***	-0.050***	-0.043***	-0.035**	-0.037**	-0.052***
	(0.015)	(0.014)	(0.015)	(0.016)	(0.016)	(0.017)
First stage F stat.	6055.5	5799.8	5884.8	5573.4	4534.4	4269.2
Country-sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5421	5895	5949	5538	5111	4691

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables other than the energy price are lagged one year. All regressions use IV estimation. For energy price we use the variable weight (P^{EV}) specification, instrumented by the fixed weight (P^{EF}) version. The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B15: Labor share with different lags of energy price for manufacturing sectors

	(1)	(2)	(3)	(4)	(5)	(6)
Log energy price (t)	-0.023					
	(0.018)					
Log energy price ($t-1$)		-0.055***				
		(0.016)				
Log energy price ($t-2$)			-0.039***			
			(0.015)			
Log energy price ($t-3$)				-0.019		
				(0.016)		
Log energy price ($t-4$)					0.003	
					(0.018)	
Log energy price ($t-5$)						0.029*
						(0.015)
Log wage	0.004	0.009	0.022	0.029	0.029	0.026
	(0.015)	(0.015)	(0.016)	(0.018)	(0.019)	(0.021)
Log rental rate	0.012	0.011	0.008	-0.003	-0.003	-0.003
	(0.013)	(0.012)	(0.012)	(0.014)	(0.017)	(0.019)
Cov(L-share, v.a.)	0.015**	0.013**	0.013**	0.013**	0.013**	0.012**
	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)
Log(revenue / v.a.)	0.057**	0.078***	0.069***	0.065***	0.060**	0.054**
	(0.024)	(0.025)	(0.024)	(0.025)	(0.025)	(0.026)
Markup (spec 2)	-0.065***	-0.051**	-0.040	-0.027	-0.024	-0.021
	(0.024)	(0.023)	(0.025)	(0.025)	(0.026)	(0.028)
First stage F stat.	1315.6	1360.2	1498.4	1488.3	1306.9	1141.0
Country-sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2440	2647	2656	2464	2271	2075

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables other than the energy price are lagged one year. All regressions use IV estimation. For energy price we use the variable weight (P^{EV}) specification, instrumented by the fixed weight (P^{EF}) version. The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B16: Capital share with different lags of energy price

	(1)	(2)	(3)	(4)	(5)	(6)
Log energy price (t)	-0.001					
	(0.013)					
Log energy price ($t-1$)		0.006				
		(0.013)				
Log energy price ($t-2$)			0.015			
			(0.014)			
Log energy price ($t-3$)				0.031**		
				(0.013)		
Log energy price ($t-4$)					0.050***	
					(0.014)	
Log energy price ($t-5$)						0.062***
						(0.013)
Log wage	0.018***	0.015**	0.010	0.012*	0.008	0.009
	(0.007)	(0.006)	(0.006)	(0.006)	(0.007)	(0.008)
Log rental rate	0.034***	0.039***	0.035***	0.033***	0.034***	0.036***
	(0.006)	(0.006)	(0.006)	(0.007)	(0.008)	(0.008)
Cov(L-share, v.a.)	-0.001	-0.002	-0.002	-0.002	-0.003	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Log(revenue / v.a.)	0.004	0.016	0.015	0.020	0.015	0.016
	(0.014)	(0.014)	(0.014)	(0.013)	(0.014)	(0.014)
Markup (spec 2)	-0.021*	-0.018	-0.027**	-0.032**	-0.036***	-0.038***
	(0.012)	(0.012)	(0.013)	(0.013)	(0.014)	(0.014)
First stage F stat.	6146.3	5897.1	6101.3	5862.9	4850.2	4456.3
Country-sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5579	6060	6112	5688	5241	4805

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables other than the energy price are lagged one year. All regressions use IV estimation. For energy price we use the variable weight (P^{EV}) specification, instrumented by the fixed weight (P^{EF}) version. The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B17: Capital share with different lags of energy price for manufacturing sectors

	(1)	(2)	(3)	(4)	(5)	(6)
Log energy price (t)	-0.015					
	(0.011)					
Log energy price ($t-1$)		-0.022**				
		(0.010)				
Log energy price ($t-2$)			-0.011			
			(0.011)			
Log energy price ($t-3$)				0.007		
				(0.011)		
Log energy price ($t-4$)					0.028**	
					(0.012)	
Log energy price ($t-5$)						0.052***
						(0.012)
Log wage	0.019**	0.016**	0.015**	0.020**	0.015*	0.009
	(0.009)	(0.008)	(0.007)	(0.009)	(0.009)	(0.011)
Log rental rate	0.046***	0.052***	0.044***	0.046***	0.045***	0.046***
	(0.006)	(0.006)	(0.007)	(0.008)	(0.010)	(0.010)
Cov(L-share, v.a.)	-0.003	-0.001	0.001	0.001	-0.001	0.001
	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)
Log(revenue / v.a.)	0.019	0.027**	0.028**	0.027**	0.024*	0.025**
	(0.013)	(0.012)	(0.012)	(0.013)	(0.012)	(0.011)
Markup (spec 2)	-0.037***	-0.036***	-0.034**	-0.040***	-0.037**	-0.027
	(0.013)	(0.013)	(0.013)	(0.013)	(0.015)	(0.017)
First stage F stat.	1385.9	1414.2	1539.1	1531.6	1321.4	1173.1
Country-sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2494	2704	2710	2514	2312	2112

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables other than the energy price are lagged one year. All regressions use IV estimation. For energy price we use the variable weight (P^{EV}) specification, instrumented by the fixed weight (P^{EF}) version. The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B18: Capital labor ratio with different lags of energy price

	(1)	(2)	(3)	(4)	(5)	(6)
Log energy price (t)	0.214***					
	(0.063)					
Log energy price ($t-1$)		0.172***				
		(0.062)				
Log energy price ($t-2$)			0.152**			
			(0.061)			
Log energy price ($t-3$)				0.152**		
				(0.061)		
Log energy price ($t-4$)					0.140**	
					(0.057)	
Log energy price ($t-5$)						0.147***
						(0.050)
Log wage	0.176***	0.181***	0.197***	0.192***	0.139***	0.116**
	(0.045)	(0.043)	(0.042)	(0.044)	(0.045)	(0.045)
Log rental rate	0.038	0.036	0.007	-0.046	-0.027	-0.036
	(0.034)	(0.032)	(0.036)	(0.040)	(0.039)	(0.040)
Cov(L-share, v.a.)	0.011	0.008	0.004	0.008	0.009	0.009
	(0.013)	(0.012)	(0.012)	(0.011)	(0.011)	(0.010)
Log(revenue / v.a.)	0.061	0.064	0.036	0.021	-0.017	0.025
	(0.060)	(0.058)	(0.060)	(0.054)	(0.057)	(0.051)
Markup (spec 2)	0.068	0.077	0.031	0.012	0.024	-0.001
	(0.072)	(0.067)	(0.070)	(0.074)	(0.077)	(0.079)
First stage F stat.	6161.6	5862.2	6058.1	5790.7	4782.1	4536.8
Country-sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5613	6116	6162	5735	5284	4844

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables other than the energy price are lagged one year. All regressions use IV estimation. For energy price we use the variable weight (P^{EV}) specification, instrumented by the fixed weight (P^{EF}) version. The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B19: Capital labor ratio with different lags of energy price for manufacturing sectors

	(1)	(2)	(3)	(4)	(5)	(6)
Log energy price (t)	0.180**					
	(0.070)					
Log energy price ($t-1$)		0.054				
		(0.068)				
Log energy price ($t-2$)			0.036			
			(0.062)			
Log energy price ($t-3$)				-0.022		
				(0.055)		
Log energy price ($t-4$)					-0.050	
					(0.054)	
Log energy price ($t-5$)						0.032
						(0.053)
Log wage	0.104**	0.105**	0.124***	0.142***	0.085*	0.041
	(0.043)	(0.043)	(0.045)	(0.045)	(0.047)	(0.057)
Log rental rate	0.082**	0.084**	0.060*	-0.007	-0.011	-0.030
	(0.036)	(0.034)	(0.032)	(0.035)	(0.041)	(0.042)
Cov(L-share, v.a.)	0.010	0.012	0.010	0.016	0.024	0.019
	(0.017)	(0.017)	(0.016)	(0.017)	(0.017)	(0.014)
Log(revenue / v.a.)	0.022	0.019	-0.009	-0.009	-0.026	0.023
	(0.058)	(0.063)	(0.060)	(0.063)	(0.074)	(0.065)
Markup (spec 2)	-0.059	-0.042	-0.032	0.002	0.067	0.074
	(0.096)	(0.086)	(0.086)	(0.088)	(0.083)	(0.080)
First stage F stat.	1363.9	1419.9	1551.1	1559.0	1373.3	1217.4
Country-sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2505	2734	2738	2542	2339	2137

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables other than the energy price are lagged one year. All regressions use IV estimation. For energy price we use the variable weight (P^{EV}) specification, instrumented by the fixed weight (P^{EF}) version. The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B20: Markup (spec. 2) with different lags of energy price

	(1)	(2)	(3)	(4)	(5)	(6)
Log energy price (t)	-0.071***					
	(0.025)					
Log energy price ($t-1$)		-0.062***				
		(0.023)				
Log energy price ($t-2$)			-0.048**			
			(0.022)			
Log energy price ($t-3$)				-0.055***		
				(0.021)		
Log energy price ($t-4$)					-0.077***	
					(0.024)	
Log energy price ($t-5$)						-0.089***
						(0.025)
Log wage	0.031**	0.043***	0.051***	0.041**	0.034*	0.031*
	(0.013)	(0.014)	(0.017)	(0.018)	(0.019)	(0.017)
Log rental rate	0.023*	0.019	0.014	0.014	0.007	-0.000
	(0.012)	(0.012)	(0.012)	(0.013)	(0.015)	(0.016)
First stage F stat.	6259.6	5893.9	6145.7	5212.9	3820.0	3603.2
Country-sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5785	6272	6301	5848	5400	4938

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables other than the energy price are lagged one year. All regressions use IV estimation. For energy price we use the variable weight (P^{EV}) specification, instrumented by the fixed weight (P^{EF}) version. The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B21: Labor share (weighted regressions)

	(1)	(2)	(3)	(4)	(5)
	OLS	IV	IV	IV	IV
Log energy price	-0.034***	-0.042***	-0.051***	-0.028**	-0.066***
	(0.011)	(0.014)	(0.015)	(0.014)	(0.021)
Log wage			0.015	0.040***	0.038
			(0.013)	(0.015)	(0.023)
Log rental rate			-0.000	0.002	0.003
			(0.007)	(0.009)	(0.018)
Cov(L-share, v.a.)				0.004	0.015**
				(0.004)	(0.007)
Log(revenue / v.a.)				0.039*	0.085***
				(0.023)	(0.029)
Markup (spec 2)				-0.019	0.037
				(0.018)	(0.029)
First stage F stat.		5173.7	5366.2	4954.4	2230.7
Country-sector FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Sectors	All	All	All	All	Manuf.
Observations	4927	4927	4738	3742	1653

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. Results for weighted regressions for the years 2009-2016. Weights are based on the log of 2008 revenue. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). For energy intensity we use a time-variant specification. The interaction of the P^{EV} with time-variant energy intensity is instrumented using the interaction of P^{EF} and pre-sample energy intensity. The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B22: Labor share with country-year and sector-year fixed effects

	(1)	(2)	(3)	(4)	(5)
	OLS	IV	IV	IV	IV
Log energy price	-0.028*	-0.053*	-0.052**	-0.032	-0.081**
	(0.015)	(0.028)	(0.026)	(0.025)	(0.036)
Log wage			0.008	0.000	-0.010
			(0.011)	(0.011)	(0.019)
Log rental rate			0.000	0.005	0.015
			(0.007)	(0.008)	(0.017)
Cov(L-share, v.a.)				0.008**	0.015**
				(0.003)	(0.006)
Log(revenue / v.a.)				0.018	0.079***
				(0.017)	(0.025)
Markup (spec 2)				-0.058***	-0.018
				(0.015)	(0.028)
First stage F stat.		1495.3	1401.3	856.6	349.8
Country-sector FE	Yes	Yes	Yes	Yes	Yes
Country-year FE	Yes	Yes	Yes	Yes	Yes
Sector-year FE	Yes	Yes	Yes	Yes	Yes
Sectors	All	All	All	All	Manuf.
Observations	8021	8013	7526	5824	2636

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B23: Capital share with country-year and sector-year fixed effects

	(1)	(2)	(3)	(4)	(5)
	OLS	IV	IV	IV	IV
Log energy price	0.002	-0.003	-0.004	0.022	-0.025
	(0.022)	(0.025)	(0.025)	(0.027)	(0.018)
Log wage			0.004	0.007	0.014**
			(0.006)	(0.008)	(0.007)
Log rental rate			0.021***	0.018***	0.019***
			(0.007)	(0.006)	(0.007)
Cov(L-share, v.a.)				0.001	0.006
				(0.003)	(0.005)
Log(revenue / v.a.)				-0.000	0.033**
				(0.014)	(0.016)
Markup (spec 2)				-0.017	-0.008
				(0.015)	(0.012)
First stage F stat.		1554.7	1421.8	900.8	343.5
Country-sector FE	Yes	Yes	Yes	Yes	Yes
Country-year FE	Yes	Yes	Yes	Yes	Yes
Sector-year FE	Yes	Yes	Yes	Yes	Yes
Sectors	All	All	All	All	Manuf.
Observations	8011	8003	7845	5984	2695

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B24: Log capital labor ratio with country-year and sector-year fixed effects

	(1)	(2)	(3)	(4)	(5)
	OLS	IV	IV	IV	IV
Log energy price	0.091	0.167	0.151	0.254**	0.024
	(0.073)	(0.107)	(0.107)	(0.110)	(0.112)
Log wage			-0.008	0.088**	0.076**
			(0.038)	(0.041)	(0.038)
Log rental rate			-0.097***	-0.062*	-0.089*
			(0.031)	(0.032)	(0.046)
Cov(L-share, v.a.)				-0.001	0.016
				(0.011)	(0.016)
Log(revenue / v.a.)				-0.023	0.024
				(0.056)	(0.061)
Markup (spec 2)				0.063	0.034
				(0.072)	(0.079)
First stage F stat.		1342.2	1334.9	899.5	352.9
Country-sector FE	Yes	Yes	Yes	Yes	Yes
Country-year FE	Yes	Yes	Yes	Yes	Yes
Sector-year FE	Yes	Yes	Yes	Yes	Yes
Sectors	All	All	All	All	Manuf.
Observations	8182	8174	8006	6044	2725

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B25: Log investment with country-year and sector-year fixed effects

	(1)	(2)	(3)	(4)	(5)
	OLS	IV	IV	IV	IV
Log energy price	-0.118	-0.173	-0.117	0.923**	0.327
	(0.228)	(0.323)	(0.317)	(0.408)	(0.396)
Log wage			-0.069	0.123	-0.002
			(0.106)	(0.090)	(0.101)
Log rental rate			0.055	0.065	0.155
			(0.065)	(0.069)	(0.112)
Cov(L-share, v.a.)				-0.067*	-0.102*
				(0.039)	(0.062)
Log(revenue / v.a.)				0.317**	0.472**
				(0.150)	(0.217)
Markup (spec 2)				-0.018	-0.075
				(0.132)	(0.183)
First stage F stat.		557.1	572.8	255.4	184.5
Country-sector FE	Yes	Yes	Yes	Yes	Yes
Country-year FE	Yes	Yes	Yes	Yes	Yes
Sector-year FE	Yes	Yes	Yes	Yes	Yes
Sectors	All	All	All	All	Manuf.
Observations	5977	5969	5523	4019	1834

Notes: Robust standard errors are clustered at the country-sector level and reported in parentheses. All independent variables are lagged one year. For energy price we use the variable weight (P^{EV}) specification. In the IV specifications it is instrumented using the fixed weight energy price (P^{EF}). The first stage F statistic refers to the Kleibergen-Paap rk Wald F statistic to test for weak instruments.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.