INSTITUTE FOR EMPLOYMENT RESEARCH

The Research Institute of the Federal Employment Agency

IAB-DISCUSSION PAPER

Articles on labour market issues

10|2022 Russia-Ukraine War: Short-run Production and Labour Market Effects of the Energy Crisis

Christian Hutter, Enzo Weber

ISSN 2195-2663

Russia-Ukraine War: Short-run Production and Labour Market Effects of the Energy Crisis

Christian Hutter (Institute for Employment Research (IAB)),
Enzo Weber (Institute for Employment Research (IAB), University of Regensburg)

Mit der Reihe „IAB-Discussion Paper" will das Forschungsinstitut der Bundesagentur für Arbeit den Dialog mit der externen Wissenschaft intensivieren. Durch die rasche Verbreitung von Forschungsergebnissen über das Internet soll noch vor Drucklegung Kritik angeregt und Qualität gesichert werden.

The "IAB-Discussion Paper" is published by the research institute of the German Federal Employment Agency in order to intensify the dialogue with the scientific community. The prompt publication of the latest research results via the internet intends to stimulate criticism and to ensure research quality at an early stage before printing.

Contents

1 **Introduction** 6

2 **Data** 7

3 **Methodology** 11

4 **Results** 12

5 **Conclusion** 15

References 16

Abstract

With the Russian war against Ukraine, global economic conditions changed abruptly. We provide first causal evidence of effects of the energy crisis on Germany as Europes most important economy. Combining cost structure data, national accounts and administrative labour market data, we identify effects in a sectoral panel setting. The results show that via the channel of energy intensity, production decreased by about 1 percent with the onset of the war, but turnover increased, mirroring sales from stock. Firms safeguard employment via short-time work with 10 percent additional applications. Vacancy posting was reduced already in anticipation by 8 percent.

Zusammenfassung

Mit dem russischen Krieg gegen die Ukraine änderten sich schlagartig die weltwirtschaftlichen Rahmenbedingungen. Wir liefern erste kausale Evidenz für Effekte der Energiekrise in Deutschland als wichtigster Volkswirtschaft Europas. Durch die Kombination von Kostenstrukturdaten, Daten der Volkswirtschaftlichen Gesamtrechnungen und administrativen Arbeitsmarktdaten identifizieren wir Effekte in einem Branchen-Panel. Die Ergebnisse zeigen, dass über den Kanal der Energieintensität die Produktion mit Kriegsbeginn um rund 1 Prozent zurückging, der Umsatz jedoch stieg, was Lagerabbau widerspiegelt. Unternehmen sichern Beschäftigung durch Kurzarbeit mit 10 Prozent zusätzlichen Anzeigen. Die Schaffung neuer Stellen wurde bereits im Vorfeld des Krieges um 8 Prozent reduziert.

JEL

E23, H56, J63, Q43

Keywords

Russia-Ukraine war, energy, production, labour market, Germany

Danksagung

We are grateful to Markus Hummel for valuable help with the data.

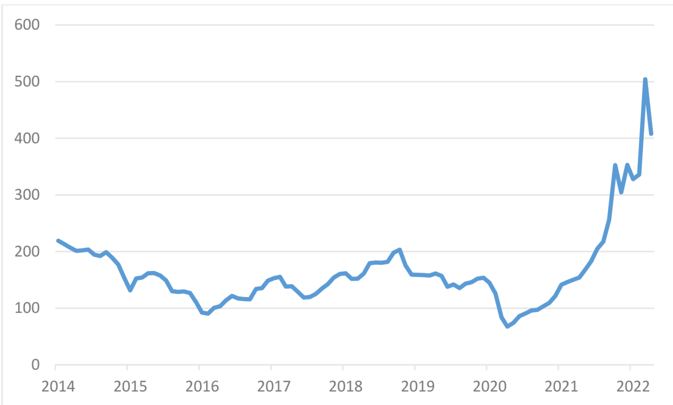
1 Introduction

With Russia's war against Ukraine and the imposed sanctions, global economic conditions changed abruptly in February 2022. Manufacturing worldwide is coming under pressure especially from rising energy prices. In this note, we provide first causal evidence of economic effects of the energy crisis in Germany as Europes most important economy.

We focus on monthly key indicators: production, real turnover, new vacancies, unemployment entries and short-time work. This mirrors the consequences on output and the labour market. Considering short-time work is important in view of recent evidence that this instrument has been used extensively to buffer the effects of the COVID-19 crisis in both Germany (Gehrke/Weber (2020)) and Europe (e.g. Giupponi/Landais/Lapeyre (Forthcoming)). Early simulation studies for the war in Ukraine projected considerable economic effects due to spikes in energy prices (e.g. Wolter et al. (2022)). Indeed, gas prices doubled after the onset of the war. The HWWI Energy Raw Materials index shown in Figure 1 witnessed a strong increase.

We make use of energy intensity of manufacturing industries as a treatment variable. Combining cost structure data, national accounts and administrative labour market data, we identify causal effects in a sectoral panel setting.

Figure 1: HWWI Energy Raw Materials index



Notes: HWWI Energy Raw Materials index. Monthly time series from January 2014 to April 2022. Unit: index (2020=100).
Source: HWWI. ©IAB

Our study relates to several strands of literature. The negative output effects of increasing energy (especially oil) prices are analysed in studies such as Baumeister/Hamilton (2019), Kilian (2008) or Carstensen/Elstner/Paula (2013). Ordonez/Sala/Silva (2011) focus on the labour market dynamics following oil price shocks. Belin/Hanousek (2021) and Crozet/Hinz (2020), amongst others, investigate the economic effects of sanctions in the countries concerned. The labour market reactions and robustness to economic fluctuations are studied, for instance, in Giupponi/Landais/Lapeyre (Forthcoming) and Klinger/Weber (2020).

The paper is structured as follows: The subsequent section introduces our data on energy intensity and the outcome variables. Section 3 discusses the methodology. Section 4 shows empirical results. The last section concludes our findings.

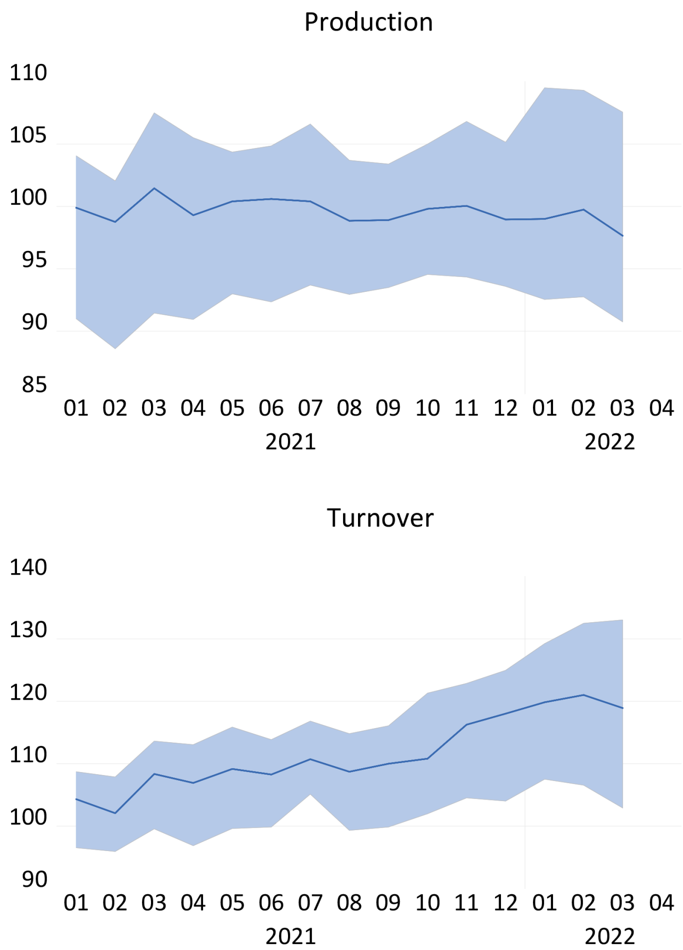
2 Data

For our analysis, we combine cost structure data, national accounts and administrative labour market data on a sectoral level. Indices of production and real turnover (2015=100) are obtained from destatis. New vacancies, unemployment entries from employment in the primary labour market, and short-time work notifications[1] are taken from the Statistics of the Federal Employment Agency. Energy intensity is defined as energy usage in 2019 divided by gross output value and is obtained from the destatis cost structure statistics (Kostenstrukturerhebung).

All variables are combined in the dimension of economic sectors. Disaggregation at the 2-digit level yields 24 different subsectors of the manufacturing industry. We focus on subsectors of manufacturing for several reasons. Firstly, the cost structure data is not available for the service sector. Secondly, energy intensive firms usually belong to manufacturing. Thirdly, parallel pre-treatment trends, i.e., the identifying assumption in a difference-in-difference approach, are likely to hold within manufacturing. In contrast, the recovery from the recent corona waves could lead to diverging trends especially in contact-intensive service sectors.

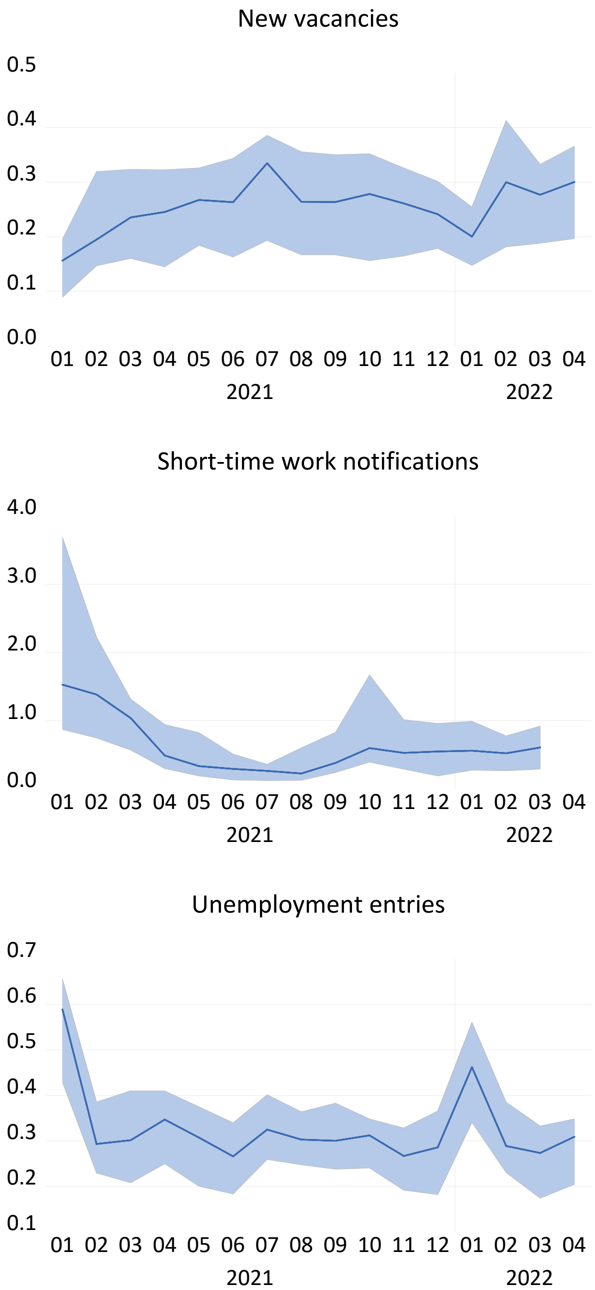
[1] Before short-time work can begin, a notification is required. During short-time work, the employees receive wage replacement benefits from the unemployment insurance for the reduced working time. While high energy prices as such do not justify short-time work, an induced loss of orders due to the need to raise sales prices would be sufficient.

Figure 2: Production and turnover



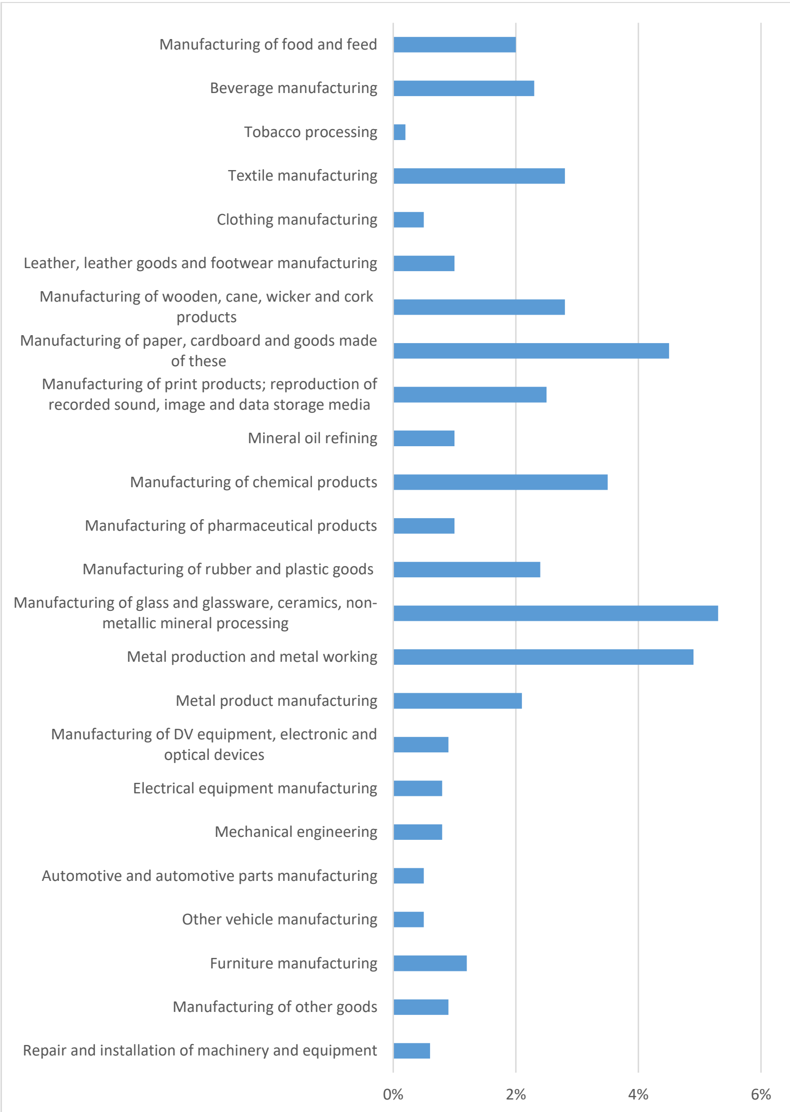
Notes: The upper line chart shows the median among 24 subsectors in the manufacturing industry of the production index together with 75 percent and 25 percent quantiles as upper and lower bounds. The lower line chart shows the median among 24 subsectors in the manufacturing industry of the turnover index together with 75 percent and 25 percent quantiles as upper and lower bounds. Unit: index (2015=100). Observation period: January 2021 to March 2022.
Source: destatis. ©IAB

Figure 3: Labour market variables



Notes: The figure shows the median among 24 subsectors in the manufacturing industry of new vacancies (upper panel), short-time work notifications (middle panel), and unemployment entries from employment in the primary labour market (lower panel). All variables are divided by the number of employees subject to social security contributions. Shaded areas: 75 percent and 25 percent quantiles serve as upper and lower bounds. Unit: percent. Observation period: January 2021 to April 2022.
Source: Statistics of the Federal Employment Agency. ©IAB

Figure 4: Energy intensity



Notes: Energy intensity defined as energy usage in 2019 divided by gross output value.
Source: destatis. ©IAB

Figure 2 shows the development of the median among 24 subsectors in the manufacturing industry of the production index and the turnover index together with 75 percent and 25 percent quantiles as upper and lower bounds. Analogously, Figure 3 shows the development of new vacancies (upper panel), short-time work notifications (middle panel), and unemployment entries from employment in the primary labour market (lower panel). All labour market variables are divided by the number of employees subject to social security contributions. Figure 4 shows the energy intensity for 24 subsectors in the manufacturing industry. The observation period of all variables starts in January 2021 and ends at the current edge (March or April 2022, depending on the publication lag of the respective variables). Following increase before the war, both production and turnover have recently fallen significantly, but not exorbitantly. Unemployment entries and short-time work notifications increased moderately, new vacancies witnessed a temporary decline.

3 Methodology

We estimate the economic war effects in a sectoral panel model. For the purpose of identification, we make use of differences in energy intensity across sectors. The combination of the time and sector dimensions yields 360 to 384 observations in our panel setting, depending on data availability.

The dependent variables are production, real turnover, new vacancies, unemployment entries, and short-time work notifications. The explanatory variable is given by energy intensity, interacted with a dummy for the Russia-Ukraine war. We use sector-fixed effects to control for general sector differences. Time-fixed effects take into account specifics of the months including seasonal effects. The panel model is shown in equation (3.1):

$$y_{it} = c_1 + c_2 x_i \times d_t + \mu_i + \gamma_t + \epsilon_{it}, \tag{3.1}$$

where c_1 and c_2 are the coefficients, y is the outcome (unemployment entries, vacancies, short-time work notifications, production, turnover), x is the treatment variable (energy intensity), d the war dummy, μ_i the sector fixed effects, γ_t the time fixed effects and ϵ_{it} the error terms. The index for the sectors is denoted by i and the time index by t.

For production, turnover, and short-time work notifications, the cut-off date for measurement is the end of a month. As the war began on February 24th, February already contains five post-treatment days. Hence, for the estimations of these three variables, d is zero until January, $\frac{5}{28}$ in February, and 1 in March. By contrast, unemployment entries and new vacancies are measured between the two cut-off dates around the mid of a month (in case of March between February 14 and March 14). Here, the February values do not include pre-war days, but the March values do (9 days). Therefore, in these estimations, we set d to zero until February, to $\frac{28-9}{28}$ in March, and to 1 in April.

A wartime effect can be presumed if energy intensity has an additional effect on the outcome variable during the war period. This procedure can be seen as a type of a difference-in-difference approach with February 24th as the treatment date. We use a special application of this approach by replacing the binary treatment by the bite, i.e., different intensities. We borrow this procedure from the literature that is concerned with the measurement of the effects of a nationwide minimum wage on employment; see, for instance, Card (1992) or recent applications in Bauer/Weber (2021) and Caliendo et al. (2018).

4 Results

Table 1 shows the results for the treatment interaction effect. With the onset of the war, one additional percentage point in energy intensity decreases production by 0.42 index points. This suggests that the peak in energy prices dampened economic activity, especially in energy-intensive sectors. In contrast, turnover is increased by 3.97 points. Logically, this must be explained by additional sales from stock as compared to less energy-intensive sectors. A plausible reason would be the strong demand from customers trying to secure critical intermediate products, with energy-intensive sectors often being part of the primary industry.

The labour market results show that with the onset of the war, one additional percentage point in energy intensity leads to 0.056 additional short-time work applications per 100 employees, and 0.010 fewer new vacancies per 100 employees. Put into context, 0.902 short-time work applications per 100 employees and 0.239 new vacancies per 100 employees could be expected on average per month in a typical 2-digit subsector of the manufacturing industry during the pre-war period. Entries to unemployment did not react significantly. Evidently, firms safeguard employment via short-time work and reduce their hiring activities. This is in line with the negative effects on production, which is, more than turnover, the relevant determinant for labour demand.

Table 1: Estimated treatment interaction effects

	Dependent variable				
	Production	Turnover	New vacancies	Short-time work	Unemployment entries
Effect (p-value)	-0.415 (0.002)	3.968 (0.000)	-0.010 (0.000)	0.056 (0.049)	-0.008 (0.438)
Observations	360	360	384	360	384

Notes: Estimated treatment interaction effects following Equation (3.1). Estimation period: 2021:1 to 2022:3 (production, turnover, new vacancies) or to 2022:4 (Short-time work, unemployment entries). White cross-section (period cluster) standard errors and covariance were used to calculate p-values.
Source: Own calculations. ©IAB

As an illustration, we quantify the overall effects following from our estimations in a counterfactual scenario. For this purpose, we calculate a hypothetical development without the war, i.e., d remains zero.[2] The differences of this counterfactual and the actual development are cumulated over the treatment period. We find that the energy channel leads to an overall production loss of 0.92 points on sectoral average. Furthermore, it is accompanied by a total of 8,400 (or 10.1%) additional short-time work applications and 2,200 (or 8.1%) less vacancy postings.

The danger of war loomed already in the weeks leading up to February 24 due to troop movements in Russia and Belarus and the development of the geopolitical situation. Therefore, we check for potential anticipatory effects. This is achieved by adding the treatment interaction term with a lead, $x_i \times d_{t+1}$, to equation (3.1). We find no anticipatory effects for production and short-time work. However, the effects on turnover and new vacancies already appeared one month in advance (and persisted afterwards). This seems plausible as vacancy posting is a typical forward-looking activity, depending on the expected profits from a filled job in standard search-and-matching models (Mortensen/Pissarides (1994)). By the same token, customers seem to have ordered energy-intensive products in advance. A further lead by two months does not play an additional role. This insignificance of a pre-treatment indicator also provides evidence supporting the assumption of common trends.

We conduct several robustness checks. Firstly, we define d as a conventional dummy, i.e., being 0 until February and 1 from March. Secondly, in addition we shorten the pre-treatment period to 2021:4 to exclude the second corona lockdown in Germany. Thirdly, energy intensity is also available with a higher sectoral disaggregation. This might allow for a sharper identification of very energy-intensive subsectors, but potentially with the drawback of higher noise in small sectors. We repeat the estimations with 213 manufacturing sectors (87 for unemployment entries[3]). The results are shown in Table 2.

[2] An alternative interpretation would be that energy intensity is zero for all sectors.
[3] The maximum disaggregation level is typically 4 digits, but only 3 digits for unemployment entries.

The numbers are comparable to the baseline estimations. The rather high coefficient of turnover becomes more moderate.

Table 2: Robustness checks

	Dependent variable				
	Production	Turnover	New vacancies	Short-time work	Unemployment entries
	Estimation with binary war dummy (1 from March 2022)				
Effect (p-value)	-0.404 (0.001)	3.472 (0.000)	-0.009 (0.000)	0.065 (0.012)	-0.005 (0.569)
Observations	360	360	384	360	384
	Estimation with shortened pre-treatment period				
Effect (p-value)	-0.395 (0.005)	3.015 (0.000)	-0.009 (0.000)	0.049 (0.039)	-0.001 (0.9329)
Observations	288	288	312	288	312
	Estimation with higher sectoral disaggregation				
Effect (p-value)	-0.410 (0.001)	2.422 (0.000)	-0.001 (0.591)	0.050 (0.002)	-0.005 (0.331)
Observations	3135	3195	3408	3195	1392
	Controlling for supply chain bottlenecks				
Difference of effects	+0.0449	+0.189	-0.000	-0.002	-0.001
Observations	285	285	304	285	304

Notes: Estimated treatment interaction effects following Equation (3.1). White cross-section (period cluster) standard errors and covariance were used to calculate p-values. Bottom section: Difference of coefficients from models with and without bottleneck variable.
Source: Own calculations. ©IAB

The war did not only trigger economic pressures due to rising energy prices, but also due to aggravated supply chain bottlenecks. If bottlenecks are correlated with energy intensity, this may bias our estimates. Therefore, we include an additional variable in the regressions, namely the change of material shortages interacted with the war dummy. Data are obtained from a survey of the ifo institute where firms are asked about a lack of primary and intermediate products. Here, out of the 24 sectors at the 2-digit level only 19 are available. Therefore, we repeat the baseline estimation with the smaller sample and report the difference of the coefficients from the models with and without the bottleneck variable in the bottom section of Table 2. Reassuringly, the results do not strongly change.

In our estimations, we treat direct effects on the sectors via energy intensity. However, while each sector is directly hit, effects in other sectors could lead to reduced demand due to dampened economic activity (Guerrieri et al. (Forthcoming)). Therefore, we consider input-output linkages between the sectors. To do so, we pre-multiply the treatment vector by an input-output matrix (obtained from the destatis National Accounts) and repeat the regression with the new variable. This results in only small changes.

5 Conclusion

We present first causal evidence for economic effects of the Russia-Ukraine war abroad. Using data for economic sectors in Germany, we estimate short-run consequences of the energy crisis.

Via the identification channel of sectoral energy intensity, we find that the energy crisis has already had a sizeable impact on industrial production in the short run. This is notable as macroeconometric studies such as Kilian (2008) estimate GDP effects to amplify over several quarters after the shock hits. In this sense, our results call for a warning signal: While sales of energy-intensive sectors were still able to contribute to their financial situation right after the onset of the war, the drop in production will cause further harm over time. These industries, such as metal, chemistry, or glass, usually stand at the beginning of production chains, which implies macroeconomic relevance. Indeed, supply bottlenecks had already reached a significant level due to Corona (e.g. Krolikowski/Naggert (2021)) and were exacerbated by the Ukraine war. Hummel/Hutter/Weber (2022) show that supply bottlenecks on the labour market are primarily compensated for by short-time work and only lead to job losses to a limited extent.

The risk of further economic damage calls for economic policy instruments that support sustaining production instead of buffering losses of working hours, as short-time work does (Weber (2022)). At the same time, policy should support the ecological transition in the direction of decarbonisation and energy efficiency, which can also boost economic growth (Diaz et al. (2019)). Future research, in addition to the short-run effects investigated in this note, could treat long-run consequences of the energy crisis (compare Yoon/Ratti (2011)). For instance, this could concern investment or energy intensity itself. Moreover, further economic effects of the Russia-Ukraine war, e.g. via trade and inflation, can be studied.

References

Bauer, Anja; Weber, Enzo (2021): Lockdown length and strength: labour-market effects in Germany during the COVID-19 pandemic. In: IAB-Discussion Paper 10/2021, URL https://ideas.repec.org/p/iab/iabdpa/202110.html.

Baumeister, Christiane; Hamilton, James D. (2019): Structural Interpretation of Vector Autoregressions with Incomplete Identification: Revisiting the Role of Oil Supply and Demand Shocks. In: American Economic Review, Vol. 109, No. 5, p. 1873–1910, URL https://ideas.repec.org/a/aea/aecrev/v109y2019i5p1873-1910.html.

Belin, Matej; Hanousek, Jan (2021): Which sanctions matter? analysis of the EU/russian sanctions of 2014. In: Journal of Comparative Economics, Vol. 49, No. 1, p. 244–257, URL https://ideas.repec.org/a/eee/jcecon/v49y2021i1p244-257.html.

Caliendo, Marco; Fedorets, Alexandra; Preuss, Malte; Schröder, Carsten; Wittbrodt, Linda (2018): The short-run employment effects of the German minimum wage reform. In: Labour Economics, Vol. 53, No. C, p. 46–62, URL https://ideas.repec.org/a/eee/labeco/v53y2018icp46-62.html.

Card, David (1992): Using Regional Variation in Wages to Measure the Effects of the Federal Minimum Wage. In: Industrial and Labor Relations Review, Vol. 46, No. 1, p. 22–37, URL https://ideas.repec.org/a/sae/ilrrev/v46y1992i1p22-37.html.

Carstensen, Kai; Elstner, Steffen; Paula, Georg (2013): How Much Did Oil Market Developments Contribute to the 2009 Recession in Germany? In: Scandinavian Journal of Economics, Vol. 115, No. 3, p. 695–721, URL https://ideas.repec.org/a/bla/scandj/v115y2013i3p695-721.html.

Crozet, Matthieu; Hinz, Julian (2020): Friendly fire: the trade impact of the Russia sanctions and counter-sanctions. In: Economic Policy, Vol. 35, No. 101, p. 97–146, URL https://ideas.repec.org/a/oup/ecpoli/v35y2020i101p97-146..html.

Diaz, Antonia; Marrero, Gustavo A.; Puch, Luis A.; Rodriguez, Jesus (2019): Economic growth, energy intensity and the energy mix. In: Energy Economics, Vol. 81, No. C, p. 1056–1077, URL https://ideas.repec.org/a/eee/eneeco/v81y2019icp1056-1077.html.

Gehrke, Britta; Weber, Enzo (2020): Short-time work, layoffs, and new hires in Germany: how the corona crisis differs from the financial crisis of 2009. In: IAB-Forum 16th of December 2020.

Giupponi, Giulia; Landais, Camille; Lapeyre, Alice (Forthcoming): Should We Insure Workers or Jobs During Recessions? In: Journal of Economic Perspectives, forthcoming.

Guerrieri, Veronica; Lorenzoni, Guido; Straub, Ludwig; Werning, Ivan (Forthcoming): Macroeconomic Implications of COVID-19: Can Negative Supply Shocks Cause Demand Shortages. In: American Economic Review, URL https://www.aeaweb.org/articles?id=10.1257/aer.20201063.

Hummel, Markus; Hutter, Christian; Weber, Enzo (2022): Labour Market Effects of Supply Chain Bottlenecks. In: IAB-Discussion Paper 9/2022.

Kilian, Lutz (2008): A Comparison of the Effects of Exogenous Oil Supply Shocks on Output and Inflation in the G7 Countries. In: Journal of the European Economic Association, Vol. 6, No. 1, p. 78–121, URL https://EconPapers.repec.org/RePEc:tpr:jeurec:v:6:y:2008:i:1:p:78-121.

Klinger, Sabine; Weber, Enzo (2020): GDP-Employment Decoupling in Germany. In: Strucural Change and Economic Dynamics, Vol. 52, p. 82–98.

Krolikowski, Pawel; Naggert, Kristoph (2021): Semiconductor Shortages and Vehicle Production and Prices. In: Economic Commentary, Vol. 2021, No. 17, p. 1–7, URL https://ideas.repec.org/a/fip/fedcec/92853.html.

Mortensen, Dale T.; Pissarides, Christopher A. (1994): Job Creation and Job Destruction in the Theory of Unemployment. In: Review of Economic Studies, Vol. 61, p. 397–415.

Ordonez, Javier; Sala, Hector; Silva, Jose I. (2011): Oil Price Shocks and Labor Market Fluctuations. In: The Energy Journal, Vol. 0, No. Number 3, p. 89–118, URL https://ideas.repec.org/a/aen/journl/32-3-a04.html.

Weber, Enzo (2022): Wirtschaftshilfen zu Zeiten des Ukraine-Kriegs: Maßgeschneiderte Instrumente für multiple Herausforderungen. In: IAB-Forum 8th of April 2022.

Wolter, Marc Ingo; Helmrich, Robert; Meier, Tobias; Weber, Enzo; Zika, Gerd; Großmann, Anett; Dreuw, Peter (2022): Zeitenwende: Russischer Angriff auf die Ukraine - Herausforderungen für den Arbeitsmarkt und die Wirtschaft - eine Sortierung. In: QuBe-Essay. (GWS-Kurzmitteilung, 2022,2).

Yoon, Kyung Hwan; Ratti, Ronald A. (2011): Energy price uncertainty, energy intensity and firm investment. In: Energy Economics, Vol. 33, No. 1, p. 67–78, URL https://ideas.repec.org/a/eee/eneeco/v33y2011i1p67-78.html.

List of Figures

Figure 1: HWWI Energy Raw Materials index 6
Figure 2: Production and turnover 8
Figure 3: Labour market variables 9
Figure 4: Energy intensity 10

List of Tables

Table 1: Estimated treatment interaction effects 13
Table 2: Robustness checks 14

Imprint

IAB-Discussion Paper 10|2022

Publication Date
16. May 2022

Publisher
Institute for Employment Research
of the Federal Employment Agency
Regensburger Strasse 104
90478 Nürnberg
Germany

Download
https://doku.iab.de/discussionpapers/2022/dp1022.pdf

All publications in the series "IAB-Discusssion Paper" can be downloaded from
https://www.iab.de/en/publikationen/discussionpaper.aspx

Website
www.iab.de/en

ISSN
2195-2663

DOI
10.48720/IAB.DP.2210

Corresponding author
Christian Hutter
Telefon 0911 179 3057
E-Mail christian.hutter@iab.de