PEDAL TO THE METAL: NATURAL GAS PRICES AND THE CZECH AUTOMOTIVE INDUSTRY*

Michal Hrubý**

Abstract

How do changes to the real price of natural gas following a supply shock impact the automotive industry? This paper examines the volatility of European natural gas prices and its transmission to output and prices in a case study of the Czech automotive industry. Despite an immediate drop following the supply shock, production recovers quickly and increases over the medium term. Producer prices increase immediately and then gradually return to their baseline. I document large heterogeneity between car, body, and parts producer prices. The body producers actually face downward price pressure at the end of the horizon. Moreover, producer prices respond differently to news about yet unrealised natural gas supply disruptions (supply news shocks) than to realised supply shocks, highlighting the role of market expectations: producer prices respond weakly and gradually decrease, driven primarily by car producers. I discuss the findings with respect to the demand channel and buyer-supplier relations.

JEL classification: C32, E32, L62, Q41

Keywords: business cycles, energy shocks, natural gas, supply chains, automotive industry, local projections

Introduction

Europe witnesses a new chapter of the Middle East conflict in 2026, with immediate effects on energy markets. Its impact on natural gas, however, has so far been dwarfed by the 2022 energy shock (the largest for Europe since the 1970s oil crisis) driven by Russia's war with Ukraine. The Dutch Title Transfer Facility (TTF), which accounts for almost 80% of total traded volumes and serves as the European benchmark for both spot and futures natural gas prices, recorded unprecedented price increases (Alessandri and Gazzani, 2025; Colombo and Toni, 2025). The shock was transmitted rapidly to electricity prices through the European marginal pricing mechanism, with an almost immediate pass-through to spot prices (Colombo and Toni, 2025), and its impacts on real economic activity across European countries were severe.

* **Acknowledgement:** The author benefited from the internal IGA project no. F2/34/2024 at the Faculty of International Relations, Prague University of Economics and Business. I acknowledge the use of artificial intelligence for minimal, largely non-generative purposes, including improving language and R code. All mistakes and omissions are mine.

Data availability: All data and the replication R code are available upon request.

** Prague University of Economics and Business, Faculty of International Relations, Department of International Economic Relations, nám. W. Churchilla 1938/4, 130 67 Prague 3 (Žižkov)

While the impact of energy price fluctuations on the real economy has been well-explored (Kilian, 2008), especially in the case of oil [see Kilian (2009) and Baumeister and Hamilton (2019) for differentiation between demand and supply shocks, and Känzig (2021) for supply expectations and high-frequency identification of supply news shocks], natural gas has received less attention. Europe now largely focuses on the macroeconomic impacts of natural gas shocks (Albrizio et al., 2023; Alessandri and Gazzani, 2025; Colombo and Toni, 2025), also highlighting the vulnerable position of Czechia with respect to such supply disruptions (Di Bella et al., 2024), with very little attention to impacts on specific industries.

The automotive industry is one of the pillars of the Czech manufacturing and economy, accounting for 13% of EU passenger car production in 2025 (ACEA, 2026).[1] Natural gas is a key energy input: between 2020 and 2024, it accounted for 36% of final energy consumption in motor vehicle manufacturing (Eurostat, 2026a), with electricity (tied to natural gas through marginal pricing) accounting for an even larger share, 54%. Clearly, during the 2022 supply shock, reducing natural gas use became a top concern for the automotive industry (ACEA, 2022). The Czech automotive industry, in a position of so-called 'integrated periphery' (Pavlínek, 2025), is largely driven by the German and euro-area business cycle, making it particularly exposed to energy shocks that propagate not only domestically but also through these economies.

In this paper, I examine, using linear local projections, how changes in the real price of natural gas following the supply shock in Colombo and Toni (2025) affect the Czech automotive industry. The results indicate that despite an immediate drop in output following a natural gas supply shock, production in the Czech automotive industry recovers quickly and increases over the medium term. Producer prices rise immediately before returning to their baseline, though with substantial heterogeneity across the automotive industry: body producers face downward price pressure at the end of the horizon compared with car and parts producers. Notably, producer prices respond markedly differently to supply news shocks than to realised shocks, highlighting the importance of market expectations. These findings are discussed in light of the demand channel and buyer-supplier relations within the European automotive value chain.

The paper proceeds as follows. The next section discusses the research design. It then reports the findings of the local projections and their impulse responses, discusses economic and policy recommendations, and concludes.

1 European Automobile Manufacturers' Association.

Research design

Literature review

The literature identifies the automotive industry as one of the most exposed industries to oil shocks, operating through three reinforcing channels. On the demand side, Kilian (2008) shows that rising oil prices erode purchasing power and shift consumers toward fuel-efficient vehicles. Lee and Ni (2002) confirm that the automotive industry suffers primarily through demand destruction rather than input cost increases. Ramey and Vine (2011) further show that abrupt shifts in segment size from large to small cars create capacity mismatches within plants, amplifying output declines. On the supply side, Kilian (2008) and Lee and Ni (2002) note that supply-driven price shocks are more contractionary than demand-driven ones. However, for the automotive industry, the cost channel remains secondary to the demand channel. Elder (2018) adds an expectations channel, showing that oil price volatility alone depresses real output because consumers rationally postpone durable-goods purchases under uncertainty.

The impacts of natural gas shocks vary from those of oil shocks. Fuel prices are not directly affected by increases in gas prices, because most cars are diesel- or gasoline-powered. However, the demand channel might be suppressed by erosions in purchasing power. On the supply side, De Santis and Tornese (2025) find that energy shocks cause a significant but only temporary decline in the euro area automotive industry's output, while supply chain disruption shocks generate a comparatively larger and more persistent contraction. Colombo and Toni (2025) confirm that motor vehicles are among the three industries driving the immediate decline in euro area output following a natural gas supply shock. However, the effect is short-lived, with the sector recovering to baseline within months. Both studies agree that the dominant macroeconomic impact of gas supply shocks is inflationary rather than recessionary, with real output effects remaining modest in aggregate. The present paper turns attention from the euro area to a case study of Czechia.

Data

I employ an exogenous, natural gas supply shock series from Colombo and Toni (2025), an updated version downloaded in June 2026. The authors offer a state-of-the-art monthly shock series for the main European gas market, TTF, identified through external instruments in Bayesian vector autoregressions (BVAR). They achieve exogeneity by employing a high-frequency identification, measuring price surprises in gas futures markets within narrow windows around market-relevant supply news, ensuring that identified price movements reflect genuine supply-side information.[2] The shock series is purged of other confounding macroeconomic variables within the BVAR model and is validated as uncorrelated with a broad range of other macroeconomic shocks, including oil supply, monetary policy, and geopolitical risk. Colombo and Toni (2025) extract the first principal component of price surprises across futures contracts of multiple maturities, providing a broader and more forward-looking signal. The shock series spans July 2004 to December 2023 (234 months), which I adopt as the baseline data sample period.

In a robustness exercise, I also use the natural gas supply shock series from Alessandri and Gazzani (2025), an updated 2025 version downloaded in May 2026, who identify the shock using external instruments in a BVAR with a high-frequency identification strategy, and manually select a conservative set of days with supply-driven TTF price movements in the front-month contract only. Colombo and Toni (2025), however, find that the Alessandri and Gazzani (2025) instrument correlates with demand-side indicators and produces theoretically puzzling impulse responses, casting some doubt on its supply-side purity. The two series carry a modest correlation of 0.21 and are therefore complements rather than substitutes. The alternative shock series covers a longer period, from February 2001 to December 2025. I directly compare the two series on the baseline data sample period, and report results for the extended sample (Figures A.1 and A.2).

I focus on selected output and price variables, which serve as dependent variables in the specification. For output, I rely on the seasonally and calendar-adjusted (SCA) monthly production volume index (Czech Statistical Office, 2026a), complemented by a new dataset on car production by final producers operating in Czechia from AutoSAP (2026).[3] For prices, I rely on four monthly producer price index series for (i) the automotive industry, and specifically (ii) producers of cars, (iii) bodies, and (iv) parts, also complemented by the automotive industry export price index available since January 2005 (Czech Statistical Office, 2026b).[4] These disaggregated price indices zoom in on the impacts of energy shocks and enable the identification of supply chain adjustments. Controls include the Czech money market 12-month interest rate (Eurostat, 2026b), SCA harmonised index of consumer prices (HICP) differential between Czechia and the euro area (Eurostat, 2026c), and the average monthly exchange rate between the Czech koruna (CZK) and the euro (EUR) (Czech National Bank, 2026). I also control for broader supply chain conditions using the monthly Global

2 Colombo and Toni (2025) also estimate natural gas demand shocks using a temperature variation instrument. There is a well-established BVAR literature on energy price shocks identified via sign and zero restrictions on the impact matrix (Adolfsen et al., 2024; Bańbura et al., 2026; De Santis and Tornese, 2025; López et al., 2026), whereas I rely on natural gas supply shock series estimated via a high-frequency identification strategy (including Alessandri and Gazzani, 2025).

3 Czech Automotive Industry Association.

4 The four producer prices follow NACE C29, C291, C292, C293, respectively.

Supply Chain Pressure Index (GSCPI) published by the Federal Reserve Bank of New York, based on Benigno et al. (2022). Although the index cannot capture varying supply chain constraints across producers, it nevertheless controls for overall conditions.

Empirical strategy

I employ local projections (Jordà, 2005; Jordà and Taylor, 2025), a flexible econometric approach that, in finite samples, exhibits lower bias at the cost of higher variance than vector autoregressions. Local projections '*approximate the (conditional) mean difference between outcomes when an intervention is administered versus when it is counterfactually withheld*' (Jordà and Taylor, 2025, p. 60). I use 'long-differenced' local projections, measuring log differences of the dependent variable between the base and future horizons, thereby absorbing the deterministic trend and further reducing finite-sample estimation bias, particularly for persistent but stationary processes (Piger and Stockwell, 2025; Xu, 2026).

As a starting point, I consider the following regression-by-regression linear local projections specification:

$$y_{t+h} - y_{t-1} = intercept\ + \beta_h \cdot s_t + controls + \varepsilon_{t+h},$$

where $y_{t+h} - y_{t-1}$ is the long-differenced outcome variable (for example, the seasonally and calendar adjusted monthly log production). The term s_t represents the supply shock. Controls are entered lagged to limit endogeneity concerns, and include twelve lags[5] of (i) the outcome variable in log differences (Δy_{t-1} is the first lag) and (ii) the shock variable. It also includes twelve lags of (iii) the first differences of the Czech money market 12-month interest rate, (iv) the seasonally and calendar adjusted HICP differential between Czechia and the euro area in percentage points, (v) the log differences of the EUR/CZK exchange rate, and (vi) the GSCPI index in standardised deviations from its mean. ε_{t+h} is the error term. However, to smooth the sharp fluctuations in impulse responses (possibly artefacts of noisy measurements and the discontinuous nature of supply chains), I utilise smooth local projections estimated via ridge regression with penalised B-splines (Barnichon and Brownlees, 2019).[6] I report two standard deviations (95%) pointwise confidence intervals (CIs) based on Eicker-Huber-White (EHW) heteroskedasticity-robust standard errors, recommended by Jordà and Taylor (2025). Results are relatively robust to using eight and 16 lags of the control variables (Figure A.3).

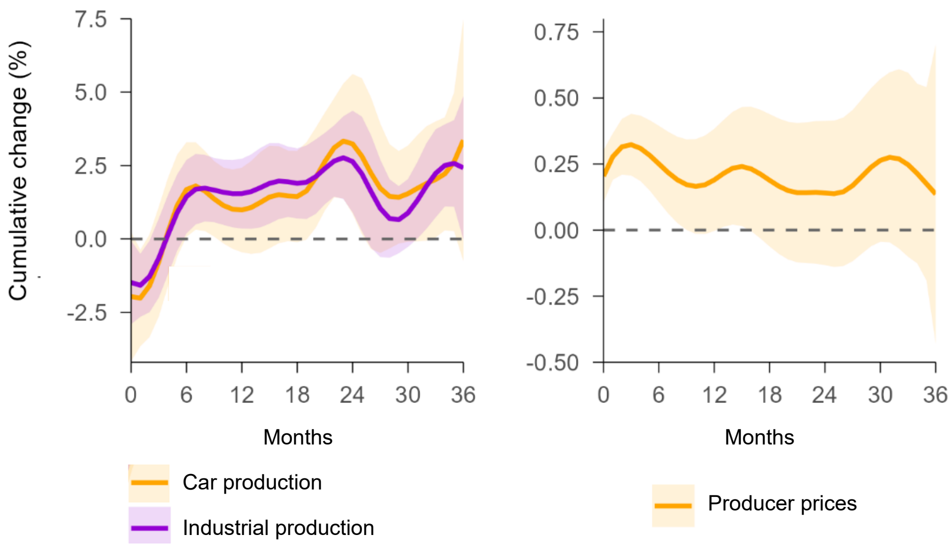
5 Xu (2026) considers 12 lags for monthly data as a starting point. I increase and decrease the lag order by one-third in the robustness exercise (see Figure A.3).

6 I follow Barnichon and Brownlees (2019) and opt for shrinkage toward a quadratic shape of the impulse response, selecting the optimal smoothing parameter from a grid of 30 logarithmically spaced values between 10^{-6} and 10^{-1} using five-fold cross-validation. A replication package was kindly provided by Brownlees, including an R code. I adjusted the smooth local projections code to enable smoothing of long-differenced local projections and to match the (unsmoothed) impulse responses of the lpirfs R package by Adämmer (2019).

Findings

Following a natural gas supply shock, industrial and car production fall immediately by 1.5% and 2.0%, respectively, in the month of the shock (Figure 1). The initial drop is short-lived but economically meaningful, with statistical significance confined to the month of the shock and the first two months after in the case of industrial production. Production recovers quickly over the following four months. It increases over the medium term, reaching cumulative gains of 2.4% and 3.4% for industrial and car production, potentially indicating cumulative compensation for output lost in the negatively affected months. The initial drop aligns in both timing and magnitude with the findings of Colombo and Toni (2025) and De Santis and Tornese (2025) for the euro area. In contrast, the medium-term increase above baseline is new. The robustness check using the Alessandri and Gazzani (2025) shock series yields a qualitatively similar pattern, albeit with a slightly more prolonged and volatile initial contraction (Figure A.1), and generally increased fluctuations of the response. The two employed shock series carry a modest correlation, and the responses do not directly contradict each other. On the price side, producer prices increase immediately by 0.20% following the shock, peak at 0.32% above baseline after three months, and gradually return to their pre-shock level over the medium term (elevated, yet statistically insignificant). These findings align with Colombo and Toni (2025) and De Santis and Tornese (2025) regarding the pro-inflationary yet temporary nature of energy supply shocks. The aggregate producer price index, however, hides substantial heterogeneity within the automotive industry.

Figure 1: Production and producer price responses

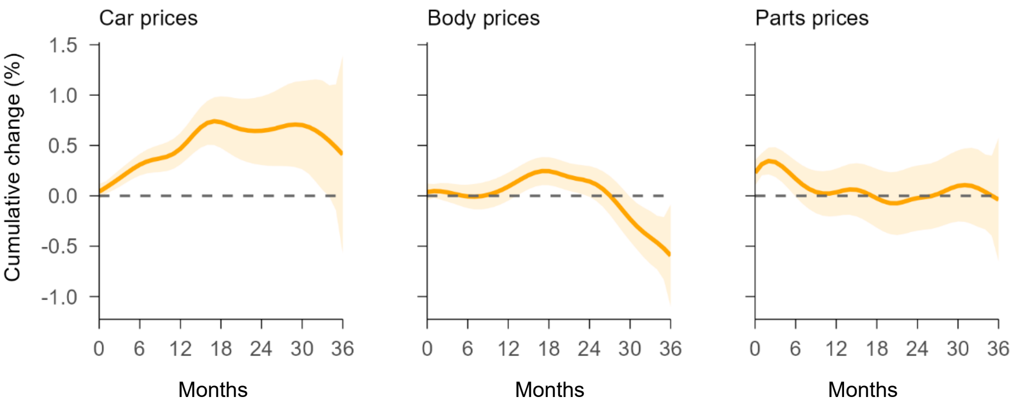


Note: Impulse-response to a one-standard-deviation natural gas supply shock. 95% heteroskedasticity -robust CIs. Data spanning 2004M7-2023M12.

Source: author's calculation.

Figure 2 documents clear differences in producer prices for cars, bodies, and parts. Car producer prices respond gradually over the first 18 months, rising to a cumulative peak of 0.74% above baseline and then slowly returning to pre-shock levels. Parts producers respond immediately, with prices rising by 0.23% on impact and remaining elevated by up to 0.35% over the next two months before returning to normal. The aggregate industry-wide price response broadly mirrors the shape of the parts price impulse response. Body producer prices follow a markedly different trajectory. Despite initial stagnation and even a slight 0.25% increase in the first 18 months, they end with a cumulative decline of 0.60% over the medium term. The robustness check with the Alessandri and Gazzani (2025) shock series confirms the downward price pressure on body producers, while industry-level and parts prices are slightly less robust and more volatile (Figure A.1). Car prices show an opposite short-term price movement (possibly one of the puzzling responses, as also noted by Colombo and Toni, 2025). Figure 3 compares producer and export prices. While there is no significant difference between the two over the medium horizon, export prices initially respond more strongly, rising by 0.31% on impact and reaching 0.55% above baseline after three months, before returning to their pre-shock level 18 months after the shock.

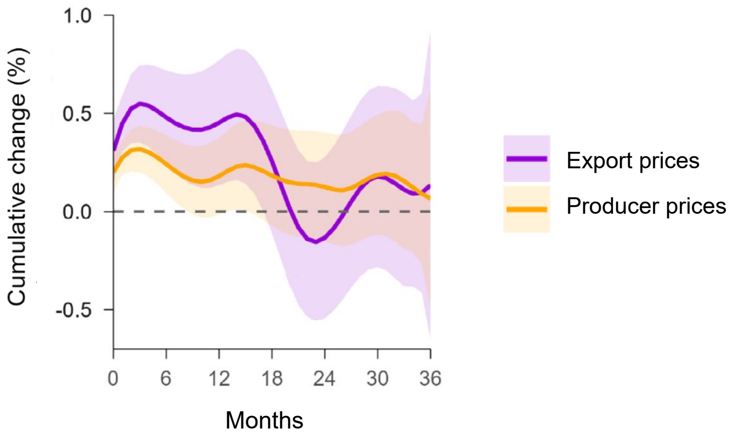
Figure 2: Disaggregated producer price responses



Note: Impulse-response to a one-standard-deviation natural gas supply shock. 95% heteroskedasticity -robust CIs. Data spanning 2004M7-2023M12.

Source: author's calculation.

Figure 3: Producer and export price responses

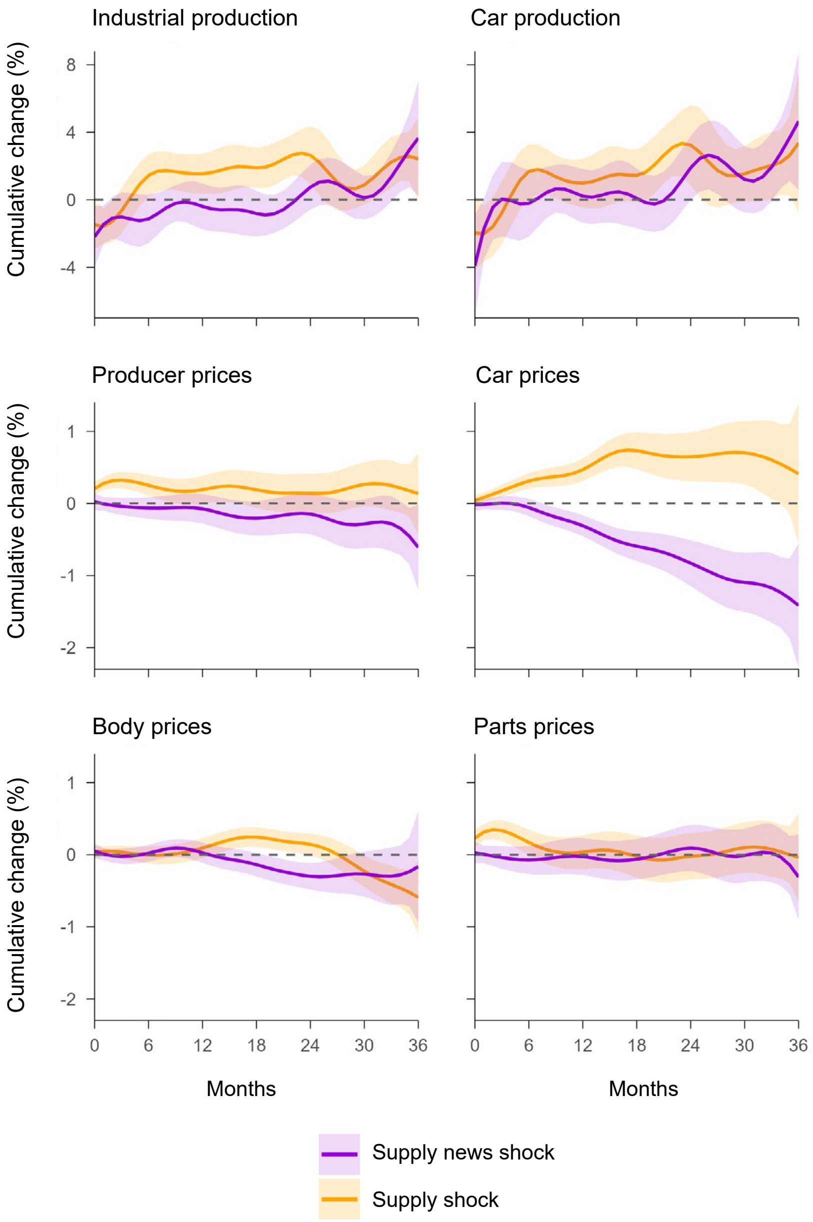


Note: Impulse-response to a one-standard-deviation natural gas supply shock. 95% heteroskedasticity -robust CIs. Data spanning 2005M1-2023M12.

Source: author's calculation.

Finally, Figure 4 contrasts responses to realised supply shocks and to supply news shocks (i.e., yet-unrealised natural gas supply disruptions). Natural gas supply news shocks operate through the expectations channel, prompting automotive industry firms to adjust their operations and plan accordingly (ACEA, 2022). While output responses to both shock types are relatively similar in their initial and final effects, price responses differ markedly. Whereas realised supply shocks are inflationary, supply news shocks are rather deflationary with respect to industry-wide prices, and especially for car prices. Over the medium term, car prices fall by 1.4% and industry-wide prices by 0.61% following a supply news shock. Parts prices see no change, while body prices, despite a tiny decrease, return to their baseline at the end of the horizon. These results further highlight the heterogeneity of producer prices within the automotive industry, particularly with respect to the type of natural gas supply shock. While the exact mechanism of price changes within the automotive industry supply chain is not part of the present case study, I rationalise the findings by the dominant role of the market expectations and demand channel following energy shocks (Kilian, 2008; Känzig, 2021). Supply news shocks, unlike realised supply shocks, do not materialise into actual cost increases for suppliers. Instead, they prompt car producers to anticipate weaker consumer demand, thereby preventing upward price pressures on their suppliers, a trend likely compounded by automotive suppliers' limited bargaining power amid increased energy price volatility (Arquié and Thie, 2023).

Figure 4: Responses to supply and supply news shocks



Note: Impulse responses to one-standard-deviation natural gas supply and supply news shocks. 95% heteroskedasticity-robust CIs. Data spanning 2004M7-2023M12.

Source: author’s calculation.

Discussion and conclusion

This paper examined the impact of natural gas supply shocks on output and prices in the Czech automotive industry, contributing a detailed case study of a structurally dependent economy within the European automotive integrated periphery. The results broadly align with the evidence from the euro area reported by Colombo and Toni (2025) and De Santis and Tornese (2025). The dominant macroeconomic impact of natural gas supply shocks is pro-inflationary rather than recessionary, with negative output effects remaining modest and short-lived. Despite an immediate drop in production following the shock, the Czech automotive industry recovers quickly and increases output over the medium term. The paper documented substantial heterogeneity in producer price responses across the automotive supply chain. Body producers face downward price pressure at the end of the medium-term horizon, in contrast to car and parts producers, whose prices gradually and immediately (respectively) rise before returning to baseline. The markedly different response of producer prices to supply news shocks versus realised supply shocks further underscores the importance of market expectations in shaping price dynamics across the supply chain. This area remains open for future research avenues, including studies of dominant EU economies and 'car nations', such as Germany.

The competitiveness and resilience of the Czech automotive industry remain broadly determined by macroeconomic conditions in and demand from the euro area and broader Western European economies. This exposure makes the industry particularly sensitive to energy shocks that can propagate not only domestically but also through these economies, highlighting the importance of diversification as a longer-term strategic consideration. The focus of both industry and policy must, however, clearly remain on managing supply chain disruptions, which generate comparatively larger and more persistent output contractions than energy supply shocks alone (De Santis and Tornese, 2025). The present case study is limited in scope to a single country. However, the availability of detailed disaggregated data, the use of well-identified shock series, and a robustness exercise strengthen the credibility of the findings. The results speak directly to recent developments in the world economy, commodity markets, and the broader debate on energy shocks in Europe.

References

Adämmer, P. (2019) 'lpirfs: An R Package to Estimate Impulse Response Functions by Local Projections', *The R Journal*, *11(2)*, pp. 421-438.

Adolfsen, J. F., Minesso, M. F., Mork, J. E., & Van Robays, I. (2024). Gas price shocks and euro area inflation. *Journal of International Money and Finance*, *149*, 103183.

Albrizio, S., Bluedorn, J., Koch, C., Pescatori, A. and Stuermer, M., 2023, May. Sectoral shocks and the role of market integration: The case of natural gas. In *AEA Papers and Proceedings* (Vol. 113, pp. 43-46). 2014 Broadway, Suite 305, Nashville, TN 37203: American Economic Association.

Alessandri, P. and Gazzani, A., 2025. Natural gas and the macroeconomy: not all energy shocks are alike. *Journal of Monetary Economics*, *151*, 103749.

Arquié, A. and Thie, M., 2023. *Energy, Inflation and Market Power: Excess Pass-Through in France*. CEPII Working Paper.

Bańbura, M., Bobeica, E. and Martínez Hernández, C., 2026. *What drives core inflation? The role of supply shocks* (No. 2875). European Central Bank Working Paper.

Barnichon, R. and Brownlees, C., 2019. Impulse response estimation by smooth local projections. *Review of Economics and Statistics*, *101*(3), pp. 522-530.

Baumeister, C. and Hamilton, J.D., 2019. Structural interpretation of vector autoregressions with incomplete identification: Revisiting the role of oil supply and demand shocks. *American Economic Review*, *109*(5), pp.1873-1910.

Benigno, G., Di Giovanni, J., Groen, J.J. and Noble, A.I., 2022. *The GSCPI: A new barometer of global supply chain pressures* (No. 1017). Federal Reserve Bank of New York Staff Reports.

Colombo, D. and Toni, F., 2025. *Understanding gas price shocks: Elasticities, volatilities, and macroeconomic transmission* (No. 2025/20). LEM Working Paper Series.

Czech Automotive Industry Association (AutoSAP), 2026. *Manufacture and sale of vehicles*. [online] Available at: https://autosap.cz/en/data-and-statistics/manufacture-and-sale-of-vehicles/ [Accessed 29 March 2026].

Czech National Bank, 2026. *Central Bank Exchange Rate Fixing – EUR Average*. [online] Available at: https://www.cnb.cz/en/financial-markets/foreign-exchange-market/central-bank-exchange-rate-fixing/central-bank-exchange-rate-fixing/currency_average.html?currency=EUR [Accessed 3 May 2026].

Czech Statistical Office, 2026a. *Industry*. [online] Available at: https://csu.gov.cz/industry [Accessed 29 March 2026].

Czech Statistical Office, 2026b. *Prices, inflation*. [online] Available at: https://csu.gov.cz/prices-inflation [Accessed 29 March 2026].

De Santis, R.A. and Tornese, T., 2025. Macroeconomic regime change and the size of supply chain disruption and energy supply shocks. *European Economic Review*, *178*, 105077.

Di Bella, G., Flanagan, M., Foda, K., Maslova, S., Pienkowski, A., Stuermer, M. and Toscani, F., 2024. Natural gas in Europe: the potential impact of disruptions to supply. *Energy Economics*, *138*, 107777.

Elder, J., 2018. Oil price volatility: industrial production and special aggregates. *Macroeconomic Dynamics*, *22*(3), pp. 640-653.

European Automobile Manufacturers' Association (ACEA), 2022. *Energy crisis: Automakers' plans to cut gas consumption*. [online] Available at: https://www.acea.auto/news/energy-crisis-automakers-plans-to-cut-gas-consumption/ [Accessed 3 May 2026].

European Automobile Manufacturers' Association (ACEA), 2026. *Economic and Market Report: Global and EU Auto Industry – Full Year 2025*. Brussels: European Automobile Manufacturers' Association. Available at: https://www.acea.auto/publication/economic-and-market-report-global-and-eu-auto-industry-full-year-2025/ [Accessed 3 May 2026].

Eurostat, 2026a. *Disaggregated Final Energy Consumption in Industry – Quantities by NACE Rev. 2 Activity* [nrg_d_indq_n]. [online] Last updated 21 May 2026. Available at: https://ec.europa.eu/eurostat/databrowser/view/nrg_d_indq_n/default/table [Accessed 22 June 2026].

Eurostat, 2026b. *Money Market Interest Rates – Monthly Data* [irt_st_m]. [online] Last updated 6 May 2026. Available at: https://ec.europa.eu/eurostat/databrowser/view/IRT_ST_M/default/table [Accessed 10 May 2026].

Eurostat, 2026c. *Harmonised Index of Consumer Prices (HICP) – ECOICOP ver.2 – Indices and Rates of Change, Monthly Data* [prc_hicp_minr]. [online] Last updated 30 April 2026. Available at: https://ec.europa.eu/eurostat/databrowser/view/prc_hicp_minr/default/table [Accessed 10 May 2026].

Jordà, Ò., 2005. Estimation and inference of impulse responses by local projections. *American Economic Review*, *95*(1), pp. 161-182.

Jordà, Ò. and Taylor, A.M., 2025. Local projections. *Journal of Economic Literature*, *63*(1), pp. 59-110.

Känzig, D. R. (2021). The macroeconomic effects of oil supply news: Evidence from OPEC announcements. *American Economic Review*, *111*(4), 1092-1125.

Kilian, L., 2008. The economic effects of energy price shocks. *Journal of Economic Literature*, *46*(4), pp. 871-909.

Kilian, L., 2009. Not all oil price shocks are alike: Disentangling demand and supply shocks in the crude oil market. *American Economic Review*, *99*(3), pp. 1053-1069.

Lee, K. and Ni, S., 2002. On the dynamic effects of oil price shocks: a study using industry level data. *Journal of Monetary Economics*, *49*(4), pp. 823-852.

López, L., Odendahl, F., Rodriguez, S.P. and Silgado-Gómez, E., 2026. The pass-through to inflation of gas price shocks. *Journal of Economic Dynamics and Control*, *182*, 105218.

Pavlínek, P., 2025. *Europe's Auto Industry: Global Production Networks and Spatial Change*. Cambridge: Cambridge University Press.

Piger, J. and Stockwell, T., 2025. Differences from differencing: Should local projections with observed shocks be estimated in levels or differences?. *Journal of Applied Econometrics*, *40*(7), pp. 759-787.

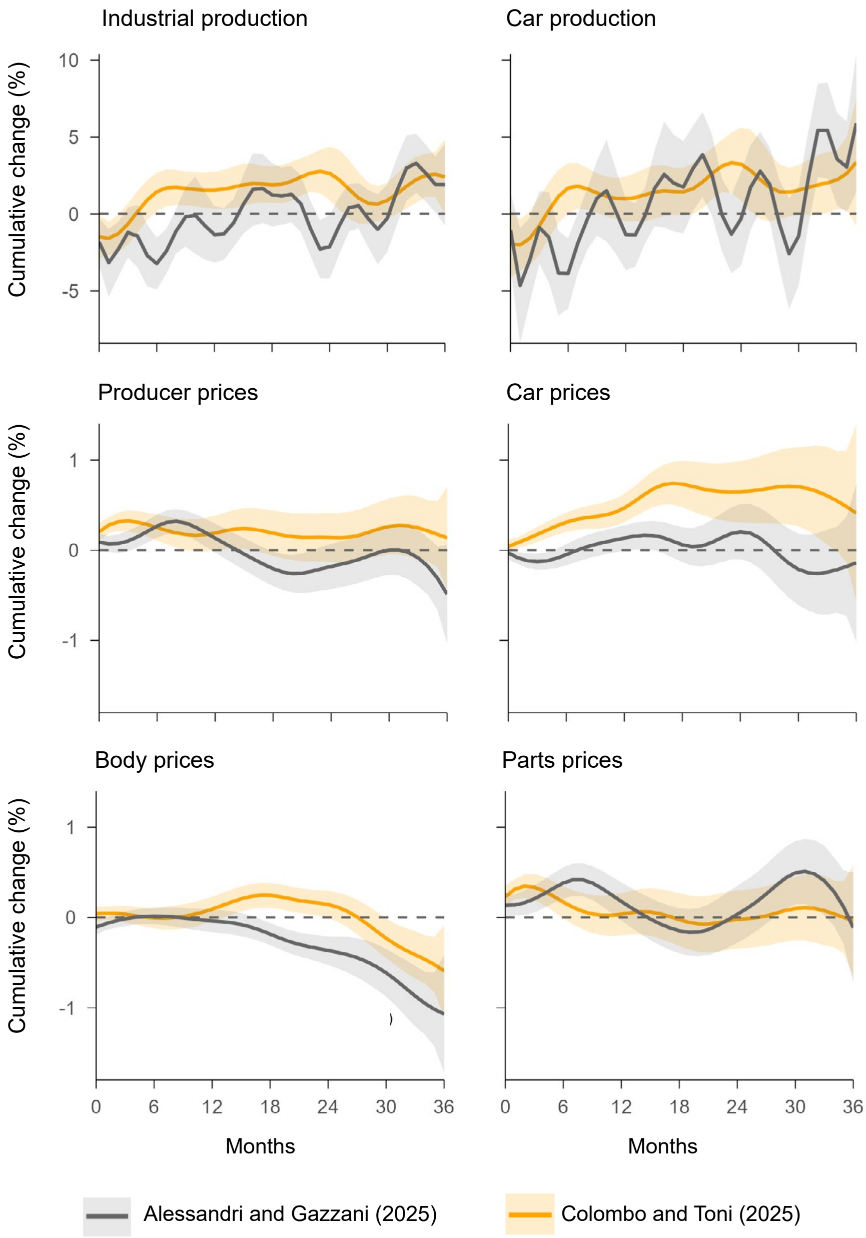
Ramey, V.A. and Vine, D.J., 2011. Oil, automobiles, and the US economy: How much have things really changed?. *NBER Macroeconomics Annual*, *25*(1), pp. 333-368.

Xu, K.-L., 2026. Local projection based inference under general conditions. *Review of Economic Studies*, rdag034.

Michal Hrubý has been a PhD candidate in the Department of International Economic Relations at the Prague University of Economics and Business since 2023. His work focuses on industrial policies, the automotive industry, and technical change. He has experience from the Vienna Institute for International Economic Studies and the German Marshall Fund of the United States.

Appendix

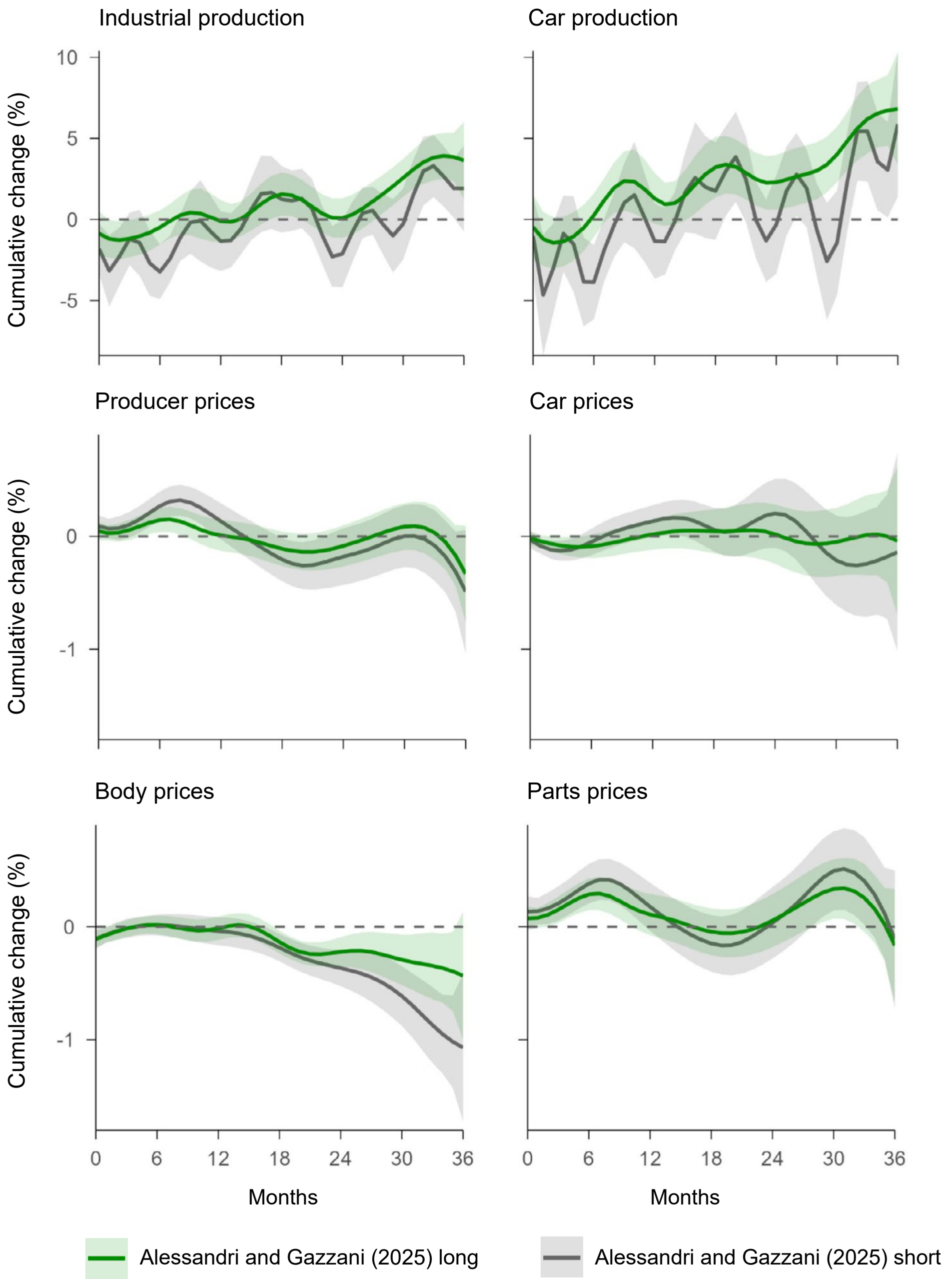
Figure A.1: Responses to alternative supply shocks



Note: Impulse-response to a one-standard-deviation natural gas supply shock. 95% heteroskedasticity -robust CIs. Data spanning 2004M7-2023M12.

Source: author's calculation.

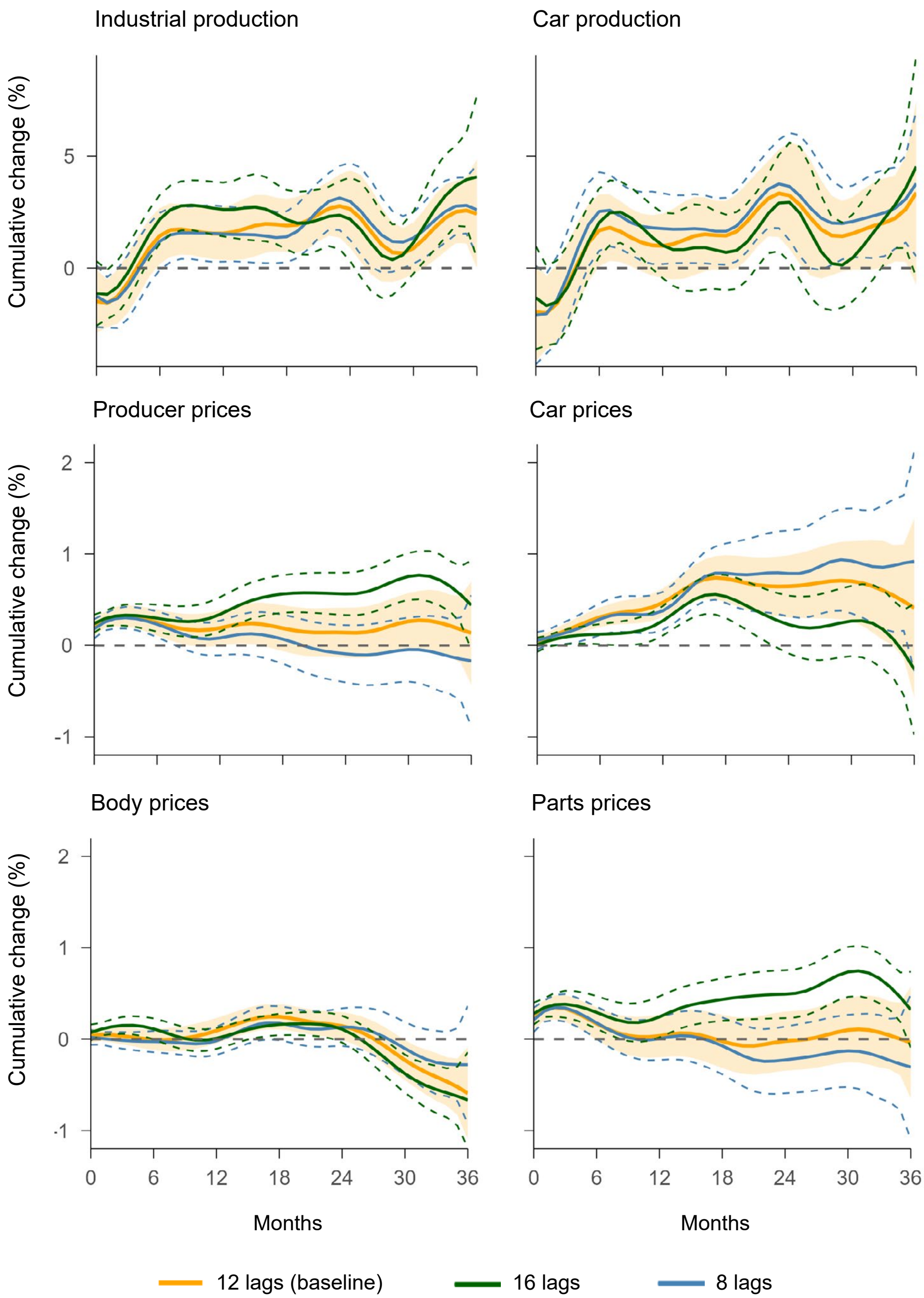
Figure A.2: Responses to extended alternative supply shocks



Note: Impulse-response to a one-standard-deviation natural gas supply shock. 95% heteroskedasticity -robust CIs. Data spanning 2001M2-2025M12 for the 'long' shock series, compared with the 'short' series spanning 2004M7-2023M12.

Source: author's calculation.

Figure A.3: Lag-order robustness of responses



Note: Impulse-response to a one-standard-deviation natural gas supply shock. 95% heteroskedasticity -robust CIs. Data spanning 2004M7-2023M12.

Source: author's calculation.