

The Effects of a Large Energy Price Shock on Firm Credit

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Summary

This paper uses Danish credit register panel data to provide novel empirical evidence on the impact of energy price shocks on bank credit to firms, using the energy price shock triggered by the Russian invasion of Ukraine as a case study.

The data allow us to identify the causal effect of the energy price shock by comparing the bank credit of high-energy-intensive firms to that of low-energy-intensive firms, accounting for narrowly defined sector-time and bank-time fixed effects.

Credit growth of high-energy-intensity firms declined temporarily by 8.75 percentage points relative to low-energy-intensity firms.

A reduction in credit demand played an important role in this decline in credit growth. This decline in credit demand occurs for precautionary reasons, as less risky firms wanted to increase their distance to their borrowing constraints to avoid becoming financially constrained in the future.

Energy-intensive firms that borrowed after the shock faced higher interest rates, even controlling for loan type composition and borrower risk. This tightening of credit conditions is more pronounced for firms with higher ex-ante probabilities of default.

While a decline in credit demand seems to explain the large drop in credit growth in the second quarter of 2022, the supply of new loans to the more risky energy-intensive firms was tightened.

Background



Figure 1: Energy spot market prices and events during 2022

Denmark is an energy-importing country. In 2023, Denmark imported around half of its total energy consumption.

Because gas is the marginal source of electricity generation in Denmark when electricity demand is high relative to electricity supply, electricity prices and gas prices co-move strongly.

Data

Energy use: bi-annual survey of energy usage for manufacturing establishments in Denmark of firms with ≥ 20 employees.

Credit register: universe of loans from Danish banks, $t=2019Q3$ onwards.

Firm characteristics: information on firm balance sheets, firm demographics, ...

Empirical Design

Main measure: *revenue-based* energy intensity of firm f at time t as a percent of revenue:

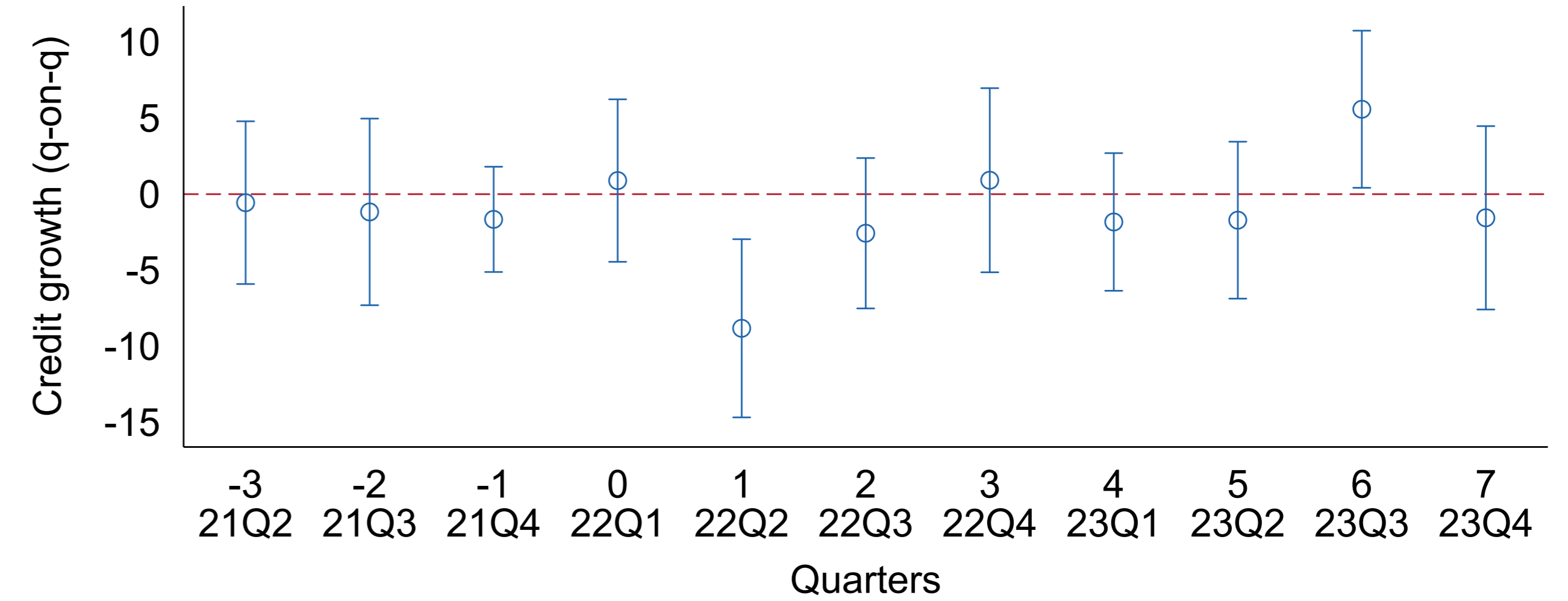
$$EI_{ft} = 100 \times \frac{\text{energy}_{dkt}}{\text{revenue}_{ft}},$$
$$\bar{EI}_f = \frac{1}{5} \sum_{t=2012}^{2020} EI_{ft}.$$

We split firms into low and high energy intensity firms at the median.

$$\text{credit_growth}_{fbt} = \alpha + \sum_{\tau=T_1}^{T_2} \beta_{\tau} \left(1_{\bar{EI}_f=\text{high}} 1_{t=\tau} \right) + \delta_f + \delta_{\text{industry}(f)t} + \delta_{bt} + \varepsilon_{fbt}$$

- $1_{\bar{EI}_f=\text{high}} 1_{t=\tau}$ is a set of time \times high energy intensity dummies
- δ_f is a set of firm dummies
- $\delta_{\text{industry}(f)t}$ is a set of time \times industry dummies
- δ_{bt} is a set of time \times bank dummies
- ε_{fbt} is a residual. We allow residuals to correlate at the industry and quarter levels.
- $T_1 = 2021Q2$, $T_2 = 2023Q4$.

Effects on Firm Credit Growth



Standard errors denote 95% confidence interval
Clustered at sector and quarter level

Figure 2: Effects of the energy price shock on credit growth

Credit growth of high-energy-intensity firms relative to low-energy-intensity firms fell by 8.75 percentage points in the second quarter of 2022.

Economically meaningful: A relative increase in energy expenditure of 1.93 percentage points led to a fall in credit growth of 8.75 percentage points.

Heterogeneity

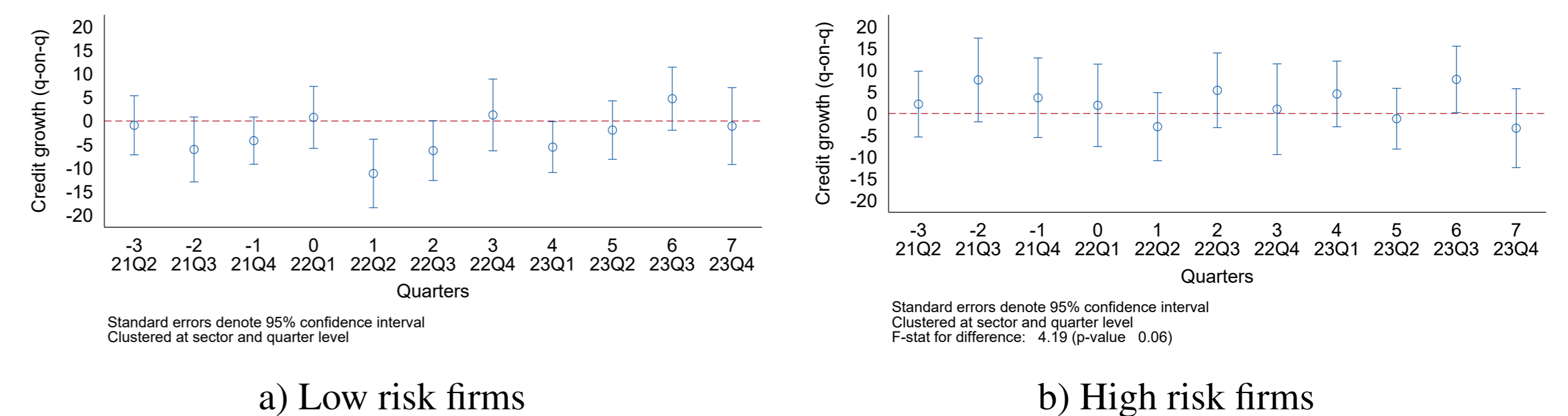


Figure 3: Effects of the energy price shock on the credit growth of different types of firms

Split firms by various **ex-ante** firm characteristics.

The decline in credit growth because of the energy price shock is more pronounced for firms with a high share of debt due in the quarter of the shock, ex-ante smaller, older, less risky firms and firms with higher cash balances.

Effects on Loan Terms

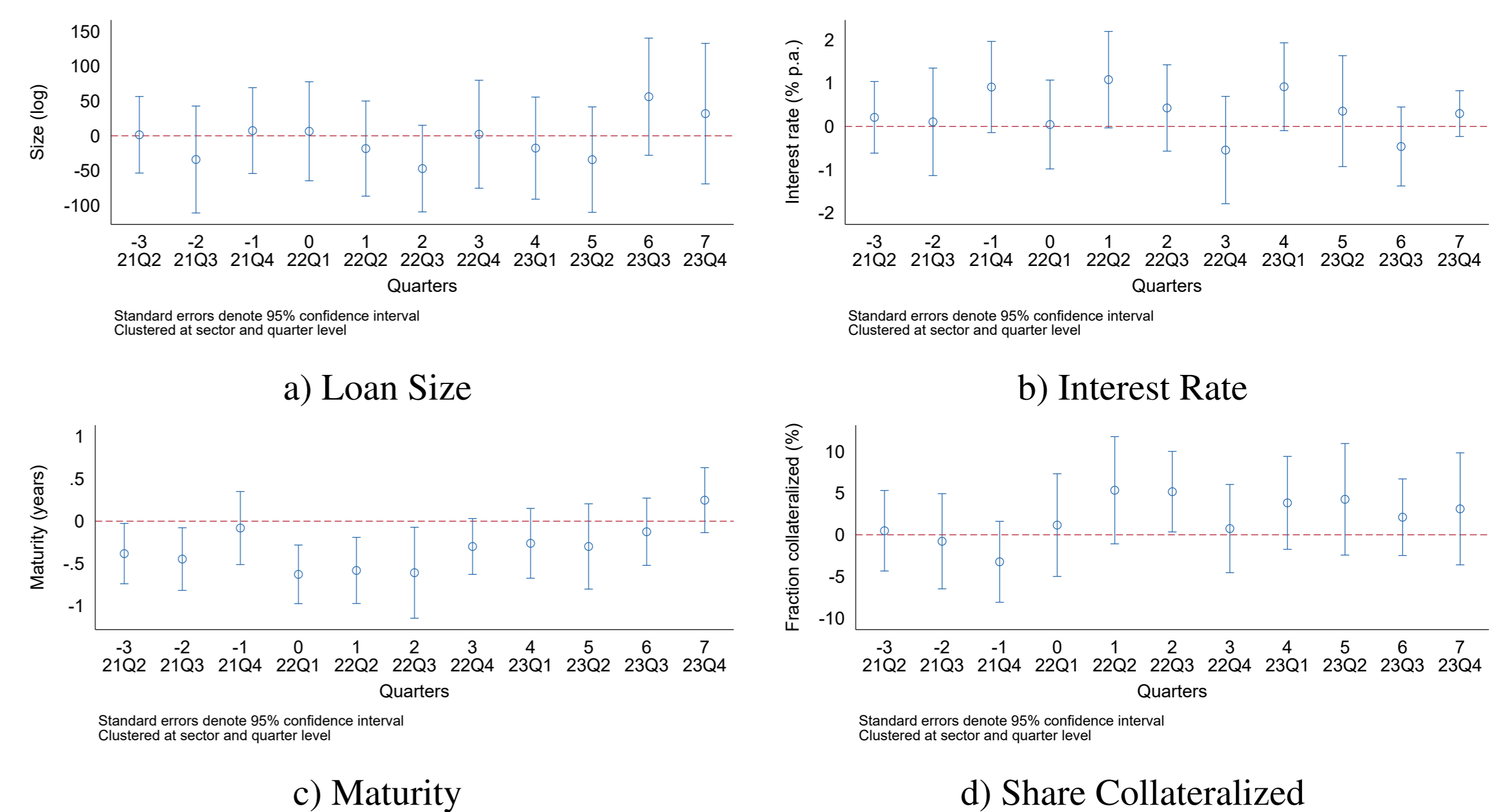


Figure 4: Effects of the energy price shock on new loan terms

Interest rates on new loans of high-energy-intensity firms rose by about 1 percentage point relative to those of low-energy-intensity firms, maturities declined, and collateral requirements rose.

Loan-level results: The interest rate spread on new loans rose but only for younger, larger and more risky firms.

Interpretation

- The energy price shock triggered by the Russian invasion increased the volatility of energy prices and, ultimately, uncertainty for energy-intensive firms.
- The shock caused a sharp decline in credit growth in the quarter following the invasion.
- The decline stemmed mainly from low-risk firms reducing their credit demand to increase the distance from their borrowing constraints.
- Banks tightened the supply of new loans to high-risk firms by charging higher interest rate spreads.