# Price Shocks and Localization of Supply Chains *

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**Abstract**

Do temporary price shocks permanently relocate supply chains? We answer this by exploiting the surge in global coal prices after the Russia-Ukraine war – a shock that fully reverses within our sample period – together with administrative firm-to-firm transaction data from India. Indian firms were mostly exposed through the price shock as they imported minimal Russian coal prior to the shock. A one-standard-deviation increase in pre-war import dependence lowers foreign coal purchases and raises domestic purchases by 46 and 90 percent respectively. Firms first deepen existing domestic relationships, followed by adding new domestic suppliers a year later. Reshoring does not unwind when world prices return to pre-war levels, demonstrating the sunk costs of link formation. Reshoring occurs only where domestic coal is technologically substitutable and locally available, and it raises prices for firms that never imported.

**Keywords:** Input Price Shock, Supply Chain Reshoring, Supplier relationships, Hysterisis, Import Substitutability

**JEL Codes: D57, E32, L14, Q54**

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# 1 Introduction

Global production networks are routinely exposed to shocks, and a large literature studies how disruptions propagate through firm-to-firm linkages (Barrot and Sauvagnat, 2016; Boehm et al., 2019; Carvalho et al., 2021; Khanna et al., 2022; Chakrabarti et al., 2025). Most of this work examines *quantity* disruptions that mechanically sever supplier relationships, such as natural disasters, port closures, or border restrictions. Yet many important shocks—including commodity price spikes, exchange-rate movements, energy shocks, and tariffs—leave production networks physically intact while changing the relative cost of inputs. How firms reorganize sourcing in response to such price shocks remains less well understood. This distinction is important because changes in supplier relationships following price shocks reflect deliberate reallocation rather than forced adjustment. Moreover, price shocks are often temporary, while supplier relationships are persistent. We ask whether transitory input-price shocks generate lasting changes in sourcing and whether adjustment occurs through existing suppliers or the formation of new relationships. This paper provides direct evidence on these margins.

We study how firms reorganize their input sourcing after a large, exogenous increase in the world price of an essential input. Our setting is the coal market in India after the outbreak of the Russia–Ukraine war in February 2022. Coal futures prices in the Newcastle, Richards Bay and Rotterdam markets rose from a range of USD 170–220 per tonne in early 2022 to more than USD 460 per tonne within weeks of the invasion, and remained elevated through 2022 before returning to pre-war levels during 2023 (Figure 1). India offers a relevant context for two reasons. First, exposure operates purely through the world price. Russian coal accounted for only about 4 percent of India's coal imports before the war, so Indian buyers faced no severed links. This isolates the price channel from the disruption channel that the existing literature identifies. Second, a domestic outside option genuinely exists. India holds one of the world's largest coal reserves and simultaneously imports roughly 20 percent of its coal by volume, so the margin

between foreign and home sourcing is both economically meaningful and quantitatively large.

Our empirical analysis uses administrative E-Way Bill data, generated under India's Goods and Services Tax for every shipment of goods valued above INR 50,000. For one large Indian state we observe the universe of firm-to-firm shipments in which either the buyer or the supplier is registered in that state, from April 2021 to December 2023. Each record contains the identity of the buyer and the supplier, the value and physical quantity shipped, the product code at the HS-8 level, and the origination pin code of the consignment. We classify a shipment as foreign-sourced if it originates within 100 km of one of India's twelve major ports, and as home-sourced otherwise, and we validate this mapping against the known geography of Indian coal production and coal imports (Figure 2).

Our estimation sample is a balanced panel of coal-buying firms, observed at the firm $\times$ coal-variety $\times$ quarter level. We measure a firm's exposure to the shock by its pre-war import share, the value share of foreign coal in its total coal purchases over April 2021–January 2022, and estimate a difference-in-differences specification in which this continuous exposure is interacted with a post-war indicator, absorbing firm, coal-variety and quarter-year fixed effects. We find substantial and relatively rapid reshoring. A one-standard-deviation increase in a firm's pre-war import share lowers the probability of purchasing foreign coal by 4 percentage points and reduces the value of foreign coal purchased by 46 percent. Over the same period, the value of coal purchased from domestic suppliers rises by almost 90 percent, and the share sourced domestically rises by 27 percentage points, or 44 percent relative to its baseline. Given the sharp rise in coal prices, we separately examine physical quantities and find the same pattern of reallocation: foreign quantities fall while domestic quantities rise. Thus, the shift toward domestic sourcing is not driven solely by price changes.

Event-study estimates show no differential pre-trends in any outcome, an effect that emerges roughly two quarters after the war. Importantly, we find that reshoring persists through the end of 2023, roughly three quarters after world coal prices had returned to their pre-war levels.

A temporary price shock thus produces a persistent reorganization of the supply chain. This hysteresis is exactly what a model with fixed costs of activating a domestic supplier link predicts: once the cost of finding and validating a home supplier is sunk, the link remains worth using even after the price advantage that justified it has disappeared. We formalize the main findings through a theoretical model.

Three sets of results speak to the channels behind the observed redirection of demand. First, we decompose reshoring into its intensive and extensive margins by tracking the identity of domestic suppliers. Immediately after the shock, firms do not add domestic suppliers; instead they raise the volume and value of purchases from domestic partners with whom they already transacted before the war. New domestic suppliers appear only about a year later, when firms add close to one additional domestic supplier per quarter. This signals that new seller search requires paying a search cost that only a sufficiently large shock justifies. Second, reshoring is concentrated among buyers whose production technology permits substitution. Non-coking coal users, for whom domestic supply is also abundant, account for the exit from the foreign market and the redirection of demand toward domestic suppliers Third, we show that the foreign–domestic price wedge widens after the war, and does so most clearly at the lower end of the price distribution, where the quality gap between imported and Indian coal is smallest and substitution is therefore most attractive.

Our paper contributes to three literatures. First, we contribute to work on how *input cost shocks* reorganize sourcing. The closest study is Demir et al. (2024), who exploit tax on Turkish imports financed with foreign trade credit and show that the cost shock propagates downstream and is amplified by financially constrained firms. They also show that exposed importers substitute toward the domestic market and lower the share of imported inputs in total costs. Blaum (2024) establishes the same within-firm force in a different setting: across large devaluations in Mexico, Indonesia and a panel of currency crises, individual firms reduce their import intensity and shift toward domestic inputs. Two features distinguish our contribution. Both papers use an input price

shock which is permanent in nature. We instead use a global price shock that subsides in a few quarters. Even with this temporary nature of the shock we find persistence in reshoring by firms towards the domestic market, even 4 quarters after the prices cool down. This is direct evidence of hysteresis. More substantively, this literature measures domestic substitution through supplier counts or imported cost shares, which cannot separate building on an existing relationship from forming a new one. Because we observe supplier identities, we decompose the response and find that the two margins are sequential rather than simultaneous. Lastly, we identify the conditions under which the substitution is feasible at all, using variation in technological substitutability and domestic availability *within* the same input.

We also contribute to a body of work that studies cost shocks generated by trade policy: Fajgelbaum et al. (2020) and Amiti et al. (2019) document near-complete pass-through of the 2018–19 US tariffs to domestic prices, Handley et al. (2025) show that import tariffs depress the exports of the firms that use the taxed inputs and Monarch (2022) shows that US importers switch Chinese partners in response to relative price movements, but do so infrequently and mostly within, rather than across, sourcing countries. We differ in two ways: these shocks are *policy-induced*, so are potentially endogenous to lobbying and sectoral conditions, and typically bundled with the possibility of retaliation and reallocation across foreign origins. We instead use a global price shock that is exogenous to India, unanticipated and orthogonal to Indian trade policy. Importantly, this literature identifies pass-through and propagation of costs, but is largely silent on whether the identity of the supplier changes.

Second, we contribute to the literature on *supply chain disruptions and the dynamics of firm-to-firm links*. Following Barrot and Sauvagnat (2016) and Carvalho et al. (2021), this work establishes that disruptions propagate through production networks and are macroeconomically consequential (Boehm et al., 2019; Lafrogne-Joussier et al., 2023). Whether they durably rewire the network is contested. Chakrabarti et al. (2025) and Fujiy et al. (2024) find a re-orientation of Indian sourcing toward domestic partners after COVID-19; Miyauchi (2024) shows that replacing

a bankrupt Japanese supplier is slow and depends on the local density of potential partners; and Martinez (2026) finds that a temporary loss of Colombian cargo access persistently reshaped importers' portfolios. Against this, Todo et al. (2015) report that only 8 percent of Japanese firms with damaged suppliers switched after 2011. We advance this debate on three fronts. First, identification. In these settings the incumbent supplier cannot transact, so separation is forced and the incumbent's own reliability is called into question; Martinez (2026) attributes her long-run results to buyers updating beliefs about suppliers' exposure to future shocks. Our foreign suppliers never stop selling and the only object that moves is a publicly observed world price, which returns to its pre-war level while we still observe the firm. Non-return is therefore consistent with an important role for sunk costs of forming domestic links, rather than being mechanically driven by damage to incumbent foreign suppliers. Second, the object differs: persistence elsewhere takes the form of portfolio contraction and exit, whereas we find relocation, with total sourcing roughly unchanged and the fall in foreign purchases substantially offset by increased domestic purchases. Third, we date the two margins separately, showing that firms deepen existing domestic links immediately but form new ones only after a year. Ours is thus the firm-to-firm analogue of the classic hysteresis argument (Baldwin, 1988a; Baldwin and Krugman, 1989; Dixit, 1989), previously tested on aggregate import penetration and export-market entry (Roberts and Tybout, 1997; Das et al., 2007), but not on the individual buyer–supplier link.

Third, we contribute to the trade literature on *relative prices, import substitution, and reshoring*. That relative prices govern trade flows is the core of structural gravity and Ricardian frameworks (Anderson and Van Wincoop, 2003; Eaton and Kortum, 2002), and a substantial literature estimates the resulting elasticities (Broda and Weinstein, 2006; Simonovska and Waugh, 2014). This work is, however, overwhelmingly conducted at the country-pair or sector level, and it treats quality as a fixed characteristic of an origin (Hummels and Skiba, 2004; Schott, 2004; Hallak and Schott, 2011). Separately, a fast-growing literature asks whether firms and policymakers should respond to geopolitical risk by diversifying or by reshoring. Grossman et al. (2023) show theoretically that

the optimal policy response to supply risk is not obviously reshoring, and Alfaro and Chor (2023) document a reallocation of US import sourcing away from China that is closer to re-routing than to genuine repatriation. Direct firm-level evidence on *actual* reshoring – and on what makes it feasible – remains scarce, particularly for developing economies, which are large importers of primary inputs. We provide such evidence. Our estimates show that reshoring can occur rapidly and without any policy inducement, purely in response to relative prices, but that it is bounded by two conditions that are absent from the aggregate elasticity literature: the input must be technologically substitutable in the buyer's production process, and domestic supply must exist at sufficient scale to absorb the redirected demand. Our finding that redirected demand raises prices for purely domestic buyers further suggests that the general-equilibrium cost of reshoring is borne partly by firms that never participated in the world market at all, a channel that the policy debate on supply chain localization has largely overlooked.

# 2 Institutional Details

## 2.1 Price shock: Russia-Ukraine war

International coal prices suddenly increases after the outbreak of Russia-Ukraine war on February 24, 2022. Given that Russia is a major coal exporter and overall increase in global geopolitical uncertainty, it led to global price shock. Figure 1 shows a sudden spike in the coal futures price immediately following the war. The coal future prices in New Castle, Richards Bay and Rotterdam markets increased from a range of (170, 220) USD in the first quarter of 2022 to more than 460 USD per tonne immediately after the war began. Then the price subsided but stabilized at a relatively high level of (280, 430) USD per tonne till one full year before coming down to the pre-war values in the year 2023.

For our context, this episode provides an exogenous price shock to the coal market in India.

First, as the above timeline suggests, the outbreak of the war and the associated price shock was completely unanticipated. Second, while India has a significant domestic coal industry, it also relies heavily on coal imports—imported coal comprises roughly 20 percent of the Indian coal market by volume. Importantly, Russian coal accounted for a minuscule 4 percent of India's coal imports. As a result, Indian coal buyers were not directly affected by supply disruptions from Russia, but were indirectly impacted through the sharp increase in foreign coal prices.[1] Third, India is not a major exporter of coal and hence its production does not influence the international coal prices.[2]

## 2.2 Coal in India: Demand and supply

India has a large coal reserve. The *coal belt* ranges from the states of Jharkhand, Odisha, Chhattisgarh, West Bengal and Madhya Pradesh along with some small reserves in other states (for example in the north-eastern states of Assam and Meghalaya). The domestic coal sourcing in our data corresponds to the coal producing states to a very high degree (Figure 2). India imports almost 20 percent of its coal for industrial needs. The major varieties of imported coal are HSN 2701 and 2704, with the former almost comprising of 93 percent of imported coal in the country (TrendEconomy, 2024).[3]

**Quality:** Indian coal exhibits a wide range of quality variations. Before analyzing these in detail, it is useful to describe the basic measures of coal quality. Coal quality can differ substantially across several dimensions, with some of the most prominent measures being calorific value, moisture and ash content, sulfur content, and volatile matter. Higher sulfur content is environmentally harmful,

[1] Major import partners include Indonesia (35%), Australia (32%) and South Africa (13%). Source: Provisional Coal Statistics 2021-22, Ministry of Coal, Govt. of India.

[2] India's coal exports are mostly to neighboring countries (e.g., Nepal, Bangladesh) and are <0.5% of India's annual production. Hence, India is a net coal importer by a huge margin with imports around 200–260 MT per year, versus exports of just 1 MT (Energy Statistics of India).

[3] 2701 is raw coal (briquettes, ovoids and similar solid fuels manufactured from coal; anthracite, bituminous, and other natural coals) and 2704 is coke and semi-coke of coal, of lignite or of peat.

whereas a higher calorific value is desirable for the production process. On average, Indian coal is of lower quality than international coal, although certain Indian states do produce high-quality reserves. On average, domestic coal produced in India is low-grade, with a relatively low calorific value (approximately 4,500 kcal/kg) and high ash content, which reduces efficiency and increases emissions in power generation. In contrast, imported coal (particularly from Australia and South Africa) is generally higher grade, with greater energy density, cleaner combustion, and fewer contaminants. India's major import partners include Indonesia (35%), Australia (32%), and South Africa (13%).[4]

In our heterogeneity analysis, we explicitly differentiate between coking coal buyers and non-coking coal buyers. The difference in quality is stark. Coking coal has close to zero technological substitutability and India imports 90-95% of its coking coal demand. In contrast, non-coking coal is generally cheaper, easy to substitute technologically and India has a large reserve of non-coking coal. Thus overall we would expect non-coking coal sourcing firms to reshore. The future prices for coking and non-coking coal are shown in Figure A.1. While there are periods when the non-coking coal had higher prices than coking coal, that is more of an aberration.[5]

**Prices:** On average, Indian coal is priced lower than international coal, reflecting underlying quality differentials. The effective price paid by coal-consuming firms comprises two components: (i) the product price, and (ii) the cost of transportation. In this paper, price refers exclusively to the product price, excluding transportation costs. Even within domestic markets, transportation represents a significant burden. Domestic coal is generally of lower quality, and lower-grade coal tends to have higher weight for the same level of energy production, thereby increasing transport costs. Nonetheless, fluctuations in domestic transportation costs are modest relative to the volatility of international product prices. Consequently, transport costs within India are

[4]Source: Provisional Coal Statistics 2021–22, Ministry of Coal, Government of India.

[5]As accessed on 2nd August, 2026, coking coal internationally sales at around $215 per ton as opposed $50-130 per tonne for non-coking coal.

unlikely to exert a substantial influence on firms' import decisions.

**Substitutability:** Domestic coal, with relatively low energy density and high ash content, is often ill-suited for industries such as steel and cement that require high-grade inputs like coking coal. Imported coal—particularly from Australia, South Africa, and Indonesia—offers higher calorific value, lower ash, and cleaner combustion, making it more efficient for both industrial use and blending with domestic coal in power generation. While blending strategies can partly mitigate quality gaps, the degree of substitution is imperfect: foreign coal cannot be fully replaced in high-grade applications, and domestic coal is typically preferred where cost considerations dominate. Thus, substitution between the two critically depends on quality and cost considerations. Technically, some production processes may not allow for substitution. For example, coking and non-coking coals cannot be substituted by each other.

**Market structure:** The domestic coal market is less demanding in terms of transaction costs. Primarily, the domestic market is driven by spot transactions as opposed to the international market which is mostly contract-driven. In particular, the domestic market depends heavily on coal auctions—typically conducted by the largest coal-producing organization, Coal India. These auctions are held monthly, with a reserve price explicitly announced in advance and all firms are aware of the reserve price. The final transaction price is then determined by prevailing domestic demand. Thus there is no entry barrier of the importers to the domestic market.

**Criteria for local sourcing:** Since business deals in the international markets take place via long-term contracts, the chances of not honoring the contract – due to exigencies – is naturally higher. For home sourcing, a similar concern arises. One of the most frequently repeated supplier characteristic that a coal buyer looks out for is the number/frequency of prior defaults by the seller, even in the spot market.

**Supply of imported coal:** Most of the imported coal – around 95 percent of the total, is sourced through two major ports of India. They are Vishakhapatnam and Paradip on the eastern seacoast along the Bay of Bengal. We show them with red triangles in Figure 2. The smaller triangles represent other ports of India. The size of the triangle indicates total sourcing within our sample. As is evident, the the two ports on the eastern seacoast are the largest ones. We describe the mapping of locations for coal sourcing in more detail in the data section.

Finally, it is noteworthy that during the same time, many other commodities also saw prices rapidly escalating. Oil is a notable example. But India did not have a large storage of them for substitution by domestic varieties. The domestic availability of coals is an important determinant for import substitution.

# 3 Data

We use administrative E-Way Bills data that provide information on the value and quantity of goods shipments between firms. Beginning 2017, as part of compliance under the Goods and Services Tax (GST), firms are required to generate an E-Way Bill when transporting goods worth more than INR $50,000$ (USD $650$).[6] Each E-Way Bill provides information on the buyer, supplier, and product code (HS-8 level) of the shipment.

We observe the universe of these shipments if the buyer or supplier is located in the focal state for the period 2021–2023. For our analyses, we focus on the set of coal buyers in the focal state and the transactions related to them. Our final sample consists of $302$ coal buying firms that have transacted with suppliers registered under the GST and sourced positive amount of coal from the foreign market in the pre-period, i.e., April 2021–January 2022.[7] For these firms, we

[6] Also see Chakrabarti et al. (2025); Chakrabati and Tomar (2021); Chakrabarti and Tomar (2024) for more information on the GST and E-Way Bills data.

[7] Suppliers not registered with the GST authority are known as unregistered persons (URP's). This could be because their business turnover is below the registration threshold, or they don't meet criteria for mandatory registration.

utilize supply chain information on both their upstream and downstream connections, ranging from purchase of coal in home and foreign markets, variety of coal (HSN 4-digit level), sales value, quantity, location, among others.[8]

We further keep only those firms which purchase non-zero amount of foreign coal in the pre-period. We rely on the pin codes provided in the data for the origination of shipment to classify whether a given consignment is foreign or based within home market. If the consignment originates from within a 100 km radius of any of the 12 major ports in India (Mumbai, Kandla, Jawaharlal Nehru, Mormugao, New Mangalore, Cochin, Chennai, Ennore, Tuticorin, Visakhapatnam, Paradip, and Kolkata), then we classify it as a foreign purchase.[9] Those which originate outside this radius are classified as purchases in the home market. Once purchases are classified into whether they are sourced from foreign or home market, we aggregate the data at the quarter-year level for a given buyer and coal variety.

A map of all coal input sourcing locations is shown in Figure 2. The triangles denote the twelve major ports of India, with size proportional to the coal sourcing through them within our sample. There are three major eastern ports—Vishakhapatnam, Paradip and Kolkata-Haldia. Even in terms of aggregate coal imports, the same three ports are known to be the largest ports for processing coal imports. Within these three, Vishakhapatnam (also known as Vizag) and Paradip deal with around 95 percent of the total import.

The gray circles represent locations from where coal is sourced in the home market. As can be seen, most of the gray circles are in the states of Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha and West Bengal. These represent the major coal producing states in India and hence the coal sourcing locations we identify in our sample almost exactly coincide with the major

[8]Total coal buying firms in our data are 928. Of these 314 purchase some foreign coal in the pre-period. Of these, 302 firms do not have only URP's as suppliers. Our main analysis is on these 302 firms. We do several robustness checks broadening this base sample to incorporate firms with URPs as well as narrowing the sample to exclude 73 intermediaries.

[9]The idea is that sometimes there are warehouses near the port where imported coal is stored before shipping to the final destination. We want to classify them correctly as imported coal rather than domestically sourced coal. The 100 kilometer radius allows us to capture that. A stricter definition of imports keep the results unchanged.

coal reserves in the home market. Some minor coal reserves are found in Maharashtra, Andhra Pradesh and the northeastern states of Assam and Arunachal Pradesh, among others. Again the identified locations plotted as smaller gray circles, correspond to these states.

The summary statistics of firm level data aggregated at quarterly level for each variety of coal are provided in Table 1. We calculate value of foreign coal purchases by a firm for a given coal variety in a quarter-year by aggregating all monthly foreign coal purchases in that period for that variety by that firm. Similarly, we calculate home coal purchases by a firm for a given coal variety in a quarter-year. We then calculate total quarterly coal purchases for a coal variety by a firm as the sum of foreign and home coal purchases in a given quarter-year for that variety. We keep a balanced set of firms and assign zero to foreign, domestic and total coal value purchase in a given quarter-year for a variety if we observe no purchase of foreign coal, domestic coal and total coal respectively for that variety.[10]

The first four rows of Table 1 show the average quarterly value of foreign coal purchases (row 1), home coal purchases (row 2), total coal purchases (row 3) and home share (row 11) of purchased coal value. Home share is only calculated for quarter-years where a firm buys non-zero value of coal, thus, the number of observations are smaller for it. Number of firms are reported in row 13. In our data, a firm buys on average Rs. 12.9 million of foreign coal and Rs. 12.8 million of home coal in a quarter-year in the pre-war period of a given variety. Home share is around 61 percent in our data while pre-war import share (1-home share in pre-period) is 65 percent. This suggests that home share of coal is likely to have increased after the war.

To examine this further, Figure 3, Panel (a), plots the histogram for the share of coal value purchased from the foreign market pre-war and post-war. We clearly see that after the war a larger proportion of firms which were buying coal in the pre-war period do not purchase foreign coal (increase is largest in the category of less than 10 percent foreign share). This is largely driven by a reduction in share of buyers who were purchasing more than 90 percent foreign coal in their

[10] A variety is only assigned to a firm if it has ever purchased that variety.

purchase basket before the war. This is also supported by transitions across quartiles of buyers, defined in terms of foreign coal share pre-war, before and after the war in Figure 4. Clearly, firms which were in the highest quartile of foreign share before the war make the strongest transition to lower quartiles of foreign share, with a substantial proportion of them shifting to not purchasing foreign coal at all. We also observe some transitions from quartile three to quartile two and quartile one of foreign share of coal from pre-war to post-war.

Importantly, Figure 3, Panel (b), shows that this reduction in share of coal purchased from foreign sources occurs only after the war. We do not observe any substantial or persistent reduction in share of foreign coal before the onset of the war. Thus, the overall movement towards home sourcing of coal and transitions for firms from purchasing the highest share of foreign coal to having one of the lowest shares after the war, are likely in response to the steep international coal price rise observed in the aftermath of Russia-Ukraine war.

# 4 Estimation Strategy

In this section, we first examine the effect of the war on firms' coal-sourcing destinations– foreign vs. home. We hypothesize that firms more dependent on imported coal as an input would be more affected by the increase in international coal price and therefore more likely to shift to domestic sourcing. To capture this, we define firm level treatment (exposure to the shock) as the share of imported coal in each firms' total coal expenditure during the pre-war period (April 2021–January 2022). Formally, for firm $i$ we define:

$$Import\ Share_{i,pre} = \frac{\text{Imported Coal Expenditure}_{i,pre}}{\text{Total Coal Expenditure}_{i,pre}} \tag{1}$$

We calculate this share for firms that have non-zero foreign coal purchase in the pre-treatment period, as firms that do not import coal are very different from coal importers. Therefore,

$Import\ Share_{i,pre}$ is always more than zero in our data. Our measure of treatment intensity is similar to Clemens et al. (2018) and Chakrabarti et al. (2025).[11]

For the set of key hypotheses, we develop a model on the basis of Halpern et al. (2015) in Section A.1. This model connects the firm-level decisions to reshore to the local supply of coal, technological substitutability and the nature of the firm-level linkages for reshoring. The primary results predict that in response to an international price shock, domestic firms will reshore. Under conditions on the quantum of the price shock relative to local search cost, the reshoring will be persistent even after the price shock subsides, the firms will not go back to the international market. Finally, coals with lower technological substitutability (specifically, coking coal) will have lesser degree of reshoring than the coal with higher technological substitutability (specifically, non-coking coal). Below, we elaborate on the empirical setup to test these hypotheses.

## 4.1 Impact on coal sourcing

We construct a balanced panel of coal buyers for each coal variety at a quarterly frequency from April 2021 to December 2023. If a firm did not buy a given variety in a given quarter, we record the purchase value as zero. We then estimate the impact of the war on firms' sourcing decision as a function of exposure to the shock, $Import\ Share_{i,pre}$, using the following specification:

$$z_{iv,qy} = \alpha_0 + \alpha_1 \times (\mathbb{1}_{post} \times Import\ Share_{i,pre}) + \delta_i + \delta_v + \delta_{qy} + \varepsilon_{iv,qy} \tag{2}$$

where $z \in$ is the outcome for firm $i$ for coal variety $v$ in quarter $q$ and year $y$. The outcomes include whether a firm sources from a foreign seller (an indicator variable equal to one when foreign coal is purchased by a firm), log total value of coal purchased from foreign suppliers, log total value of coal purchased from domestic (or home) suppliers, and share of coal purchased from home suppliers.[12] $\mathbb{1}_{post}$ is a dummy that equals one in the post-war period (Q1 of 2022 - Q4

[11] The former defines it in the context of labor market, while the latter uses it in the context of domestic trade.

[12] While we have aggregated the data at quarterly level, coal procurement is lumpy and firms may not purchase

of 2023), and zero otherwise.[13] We control for unobservables at buyer level ($\delta_i$), over time ($\delta_{qy}$) and for each coal variety ($\delta_v$). Standard errors are clustered at buyer level.

This specification is akin to a difference-in-differences (DiD) estimation with treatment intensity ($Import\ Share_{i,pre}$). Assuming that trends in the outcomes would have been similar for the firms most affected by the price shock after the war and the less affected ones, the coefficient $\alpha_1$ captures the effect of firms' exposure to the shock on the outcomes. If firms substitute away from foreign sourcing, $\alpha_1$ should be negative for foreign-sourcing outcomes and positive for domestic-sourcing outcomes. Since our treatment measure is continuous, we also show that our results remain robust to the alternatives DiD estimators suggested for continuous treatment (see Callaway et al. (2024)).

Our identification strategy relies on the following assumptions. First, the shock should be exogenous. As we discuss in Section 2, the war was sudden and unexpected. Hence, it is less likely that coal buyers and suppliers anticipated the shock and took preemptive actions to cushion against the increase in coal prices. Coal futures prices spike immediately after the war, corroborating this claim (Figure 1). Second, identification requires that firms' pre-shock import dependence, should not affect their outcomes in the absence of the war, i.e. the parallel trends assumption holds. We assess this by reporting quarter-by-quarter pre-trend coefficients from an event-study specification.

## 4.2 Pre-trends and dynamic effects of the war

Systematic growth rate differences across buyers having different exposure to the foreign market, buyer size, or other firm characteristics, that could be correlated with their exposure to foreign markets, i.e., $Import\ Share_{i,pre}$, could be a potential concern for our estimation strategy. To

coal in every quarter. To accommodate zero purchases we use ln(1+z) as the dependent variable. Results are robust to inverse hyperbolic sine (IHS) transformation.

[13] Quarter 1 includes the months of January-March.

address this, we plot event study estimates:

$$z_{iv,qy} = \sum_{k=Q2-21}^{Q4-23} \alpha_k(\mathbb{1}_k \times Import\ Share_{i,pre}) + \delta_i + \delta_v + \delta_{qy} + \varepsilon_{iv,qy}. \quad (3)$$

The coefficients $\alpha_k$ show the dynamic effects of firms' exposure to the international market on outcomes before and after the war. These allow us to examine pre-trends as well as the evolution of outcomes differentially by treatment intensity after the shock.

# 5 Reshoring

## 5.1 Main Results

Figure 5 plots the coefficients on $Import\ Share_{i,pre}$ in equation 3 for each quarter-year. Panel (a) shows the results at the extensive margin for coal purchase, Panel (b) shows logged value of purchases from foreign and home suppliers, and Panel (c) shows the share procured from home suppliers. Before the war, we observe no discernible pre-trends in any outcome for firms more dependent on coal imports. After the war, there is a sharp decline in the probability of sourcing foreign coal: buyers with a one-standard-deviation higher pre-war import share are 6.3 percentage points ($\hat{\alpha} = -0.18$, which implies a $-0.18 \times 0.35 \times 100 = -6.3$ log-point change) less likely to purchase foreign coal in Q3-22.[14] This effect materializes two quarters after the shock and is mirrored in the decline in the total value of foreign coal purchased (Panel (b)): almost two quarters after the war, there is a distinct decrease in the value of foreign sourcing with a commensurate increase in sourcing from domestic sellers. From Q4-22 onward, the value of foreign coal purchases remains persistently lower and the value of home coal purchases

[14]Throughout the paper, we convert coefficients into standardized magnitudes using the standard deviation of $Import\ Share_{i,pre}$ reported in Table 1 ($SD = 0.35$). In this case, the estimated coefficient in Q4-22, $\hat{\alpha}_k = 0.18$, implies a $0.18 \times 0.35 \times 100 = 6.3$ percentage point larger decline in the probability of sourcing foreign coal for a one-standard-deviation increase in a firm's pre-war import share). For outcomes in logs, we additionally convert the resulting log-point effect into a percentage effect using $\exp(\hat{\alpha} \times SD) - 1$.

persistently higher for these firms: we find a persistent 58 percent lower value of foreign coal purchased for a one-standard-deviation increase in import share,[15] and an almost 100 percent increase in the value of domestic coal purchased.

The substitution of foreign for domestic coal persists through the end of 2023 – roughly three quarters after international coal prices subside. These results point to a sustained increase in domestic coal sourcing among buyers most exposed to the rise in international coal prices – consistent with the hysteresis in reshoring implied by our theoretical framework (Appendix A.1): once a firm pays the fixed cost of activating a domestic supply link, that link remains worth continuing even after international prices normalize.

Table 2 reports the overall difference-in-differences estimates for all outcomes above. A one-standard-deviation increase in a firm's pre-war import share is associated with a 4 percentage point decrease in the probability of purchasing foreign coal (column 1), a 46 percent decrease in the value of foreign coal purchased (column 2), an almost 90 percent increase in the value of domestic coal purchased (column 3). This is also corroborated by a 27 percentage point (or 44 percent, $= 0.27/0.62$) increase in the share of coal sourced from home suppliers (column 4).[16] Thus, the rise in home sourcing closely mirrors the decline in foreign sourcing, consistent with the fall in the foreign expenditure share predicted by our model (Appendix A.1).

## 5.2 Effects on Quantity

The results above track sourcing using the value of coal purchases, but value changes conflate quantity and price effects. Given the sharp spike in coal prices immediately after the war, value may decline less than quantity does. To disentangle this margin, we estimate the impact on the

[15] $\hat{\alpha} = -2.5$, which implies a $-2.5 \times 0.35 \times 100 = -87.5$ log-point change; the exact percentage change, $\exp(-0.875) - 1$, is $-58$ percent.

[16] The observations are smaller in column (4) because this regression sample includes only firms with non-zero coal purchases in a given quarter. If a firm did not buy any domestic or foreign coal in a quarter, the value of share would not exist for that firm in that quarter.

number of transactions and the quantity purchased from the foreign market in Table 4, Panels A and B, respectively.

For a one-standard-deviation increase in import share, the number of foreign coal transactions falls by 11 percent, home transactions rise by 29 percent, and the share of home transactions rises by 14 percent (Panel A). The quantity results, measured in metric tonnes, are similar: foreign coal quantity falls by 29 percent, home quantity rises by 75 percent, and the home share of quantity rises by 15 percent (Panel B).

These quantity dynamics mirror those for purchase value. Appendix Figure A.2 shows the corresponding event-study plots: we find no pre-trends for either foreign or domestic coal quantities as outcomes, and a distinct, persistent fall in foreign coal quantity purchased alongside a simultaneous rise in home coal quantity for firms more exposed to the shock. Taken together, the evidence indicates that more exposed firms substitute away from imported coal toward domestic coal on the quantity margin, not merely the price margin.

## 5.3 Robustness

We examine the robustness of our findings to alternative specifications and sample restrictions.

**Binary Treatment.** Since our baseline treatment intensity is continuous, we also define a categorical measure of exposure using the median pre-war import share as a cutoff (Callaway et al., 2024). Firms with above-median $Import\ Share_{i,pre}$ are classified as more exposed to the coal price shock. Table 3, Panel A, shows that these firms have a 5.2 percentage point (16 percent) lower probability of sourcing from foreign markets after the war; the value of their coal imports falls by 56 percent, the value of coal purchased through the home market rises by almost 400 percent, and the home share of coal sourced rises by 27 percent ($= 0.17/0.62$).

**Narrow Product Variety.** We restrict the sample to the most dominant variety of imported coal (HS 2701) to test whether our results hold within a single, homogeneous product category.[17] This restriction rules out cross-variety substitution between foreign and home markets and harmonizes the quantity estimation around a single product. Panel B reports these results: our findings hold, with larger effect sizes when we restrict the sample to the dominant coal variety.

**Controlling for Buyer Size.** We control for the possibility that our estimated effects reflect buyer size rather than import exposure per se, since firms that imported more coal pre-war may simply be larger. Panel C adds firm size (pre-war total sales value) as a control.[18] All results remain consistent.

**Alternate Dependent Variables.** We use the Inverse Hyperbolic Sine (IHS) transformation of the dependent variables, rather than the log transformation, to address quarters in which firms make no coal purchases. Appendix Table A.1 shows similar results: a 48 percent decrease in the value of foreign sourcing and an almost 100 percent increase in home sourcing for a one-standard-deviation increase in import share.

**Alternate Sampling of Domestic Suppliers.** We check robustness to alternative classifications of home-market purchases since there is a risk of intermediary coal importers being classified as buyers in our data (that import and sell the same coal). First, we restrict the sample of coal suppliers to major coal-producing states and classify all coal sourced from them as home purchases, addressing the concern that intermediaries could resell coal from other states; Appendix Table A.2 shows similar results. Second, we include coal sourced from Unregistered Persons (URPs) – excluded from our baseline sample in Table 2 because they are not registered

[17] We observe the following HSN codes for coal in our data: 2701, 2704, 2706, 2707, and 2708. HS 2701 has the largest share of total pre-war coal value, though its importance varies across markets: it accounts for 90 percent of foreign coal value purchased and 50 percent of home coal value purchased. The second-largest variety, 2704, accounts for 26 percent of domestic purchases and 8 percent of foreign purchases.

[18] The sample shrinks slightly since we do not observe sales for all firms in the pre-war period.

under GST – and again obtain consistent results (Appendix Table A.3). Finally, while reshoring can happen via intermediaries as well as firms which are direct users. In Appendix Table A.4 we drop the intermediaries[19] and recover similar results for firms which are direct users or coal.

# 6 Mechanisms

The results above establish that coal-buying firms substitute foreign coal with domestic coal following the international price increase, and this reshoring persists even after the price shock subsides. We now turn to the channels underlying this substitution. We first show that the adjustment operates primarily along the intensive margin, as firms deepen ties with existing domestic suppliers rather than search for new ones, in the immediate aftermath of the shock. However, they seem to make new connections after an year. We then show that this response is concentrated among coal varieties that are technologically substitutable and locally available, consistent with reshoring being feasible only when domestic supply can plausibly substitute for foreign coal. Finally, we examine the price data directly to assess the underlying economic incentive for reshoring.

## 6.1 New and Old Supplier Connections

We first test whether reshoring operates by forming new supplier relationships or by deepening existing ones, using Table 6. We examine the number of home suppliers a firm sources from in a given quarter-year (column 1), the share of home connections out of a firm's total supplier connections (column 2), the number of pre-war home suppliers a firm continues to source from (column 3), and the value of coal sourced from those pre-war home suppliers (column 4).

We find no statistically significant increase in the number of domestic suppliers immediately after the war, though firms add almost one additional domestic supplier by the last two quarters

[19] In our data, 73 out of 302 firms are intermediaries.

of 2023. This points to a broadening of domestic connections, but only well after the shock – unsurprising given search frictions in identifying new suppliers. Consistent with our results on value and quantity, however, the share of home suppliers out of a firm's total supplier base rises immediately after the war breaks out (column 2).

We next examine adjustment along existing ties, classifying any supplier that transacted with a firm at least once in the pre-period as an "old" connection. Firms continue buying from these old suppliers at an increasing frequency after the war (column 3): the number of old domestic suppliers rises by almost 2 per quarter-year by the end of 2023, and the value of coal purchased from pre-existing home suppliers rises simultaneously (column 4). Taken together, these patterns show that firms deepen relationships with existing domestic suppliers immediately after the shock, while new supplier links emerge only about a year later. This ordering follows directly from our model (Appendix A.1): the intensive margin – selling more through an already-validated supplier link – activates immediately, whereas forming an entirely new link requires paying a search and validation cost that is only worthwhile once the price shock is large enough to clear that higher threshold.

## 6.2 Technological Substitutability and Domestic Availability

A central prediction of our theoretical framework (Appendix A.1) is that the degree of reshoring rises with the technological substitutability between foreign and domestic coal. We test this directly by exploiting heterogeneity between coking and non-coking coal since coking coal cannot be substituted in the production process:[20] Non-coking coal, by contrast, is readily substitutable and India also holds a large domestic reserve of it. This implies that firms facing a shock in the coking coal price cannot reshore substantially to the domestic market.

To test this, we classify buyers according to the technological role coal plays in their production

[20] Coking coal is used primarily in metal plants, especially for steel production, as a direct fuel, a reducing agent, and to provide structural support inside a blast furnace. Non-coking coal cannot be used for any of these purposes.

process. In blast-furnace production, coal must first be converted into metallurgical coke and then consumed as a chemical reducing agent, supplying the carbon that removes oxygen from iron ore while supporting the furnace burden. Because these processes require specific coking, ash and rank characteristics, lower-grade domestic coal cannot be substituted at any blend ratio. In contrast, when coal is used primarily for combustion, quality lies on a continuous margin since firms can partially compensate for lower calorific value through blending or higher fuel consumption, making domestic coal a feasible, though less efficient, substitute. We classify a buyer as exclusively coking if its pre-war downstream output is concentrated in products that can only be produced through the blast-furnace/coke route – pig iron (HSN 7201, 7205) and coke (HSN 2704) – and assign all other classified buyers to the mix-use category. The classification uses only pre-war sales (2021Q2–2021Q4). Each four-digit HSN product is assigned to a production-route category, pre-war sales are aggregated within categories, and each buyer is assigned to the category accounting for the largest share of its output, so that the classification reflects pre-existing production technology rather than post-shock adjustment.

We test our hypothesis in Table 5 using a triple-difference specification. Columns (1–4) show the responses of mixed-usage coal sourcing firms (as opposed to using exclusively coking coal using firms) importing from the foreign market, for the extensive margin, value, quantity, and number of transactions; columns (5–7) show value, quantity, and number of transactions in the home market; and columns 8 and 9 show home shares of value and transactions. The bottom row tests the joint significance of the difference-in-differences coefficient and the triple-difference coefficient. The results show clearly that non-coking coal sourcing firms exited the foreign market and redirected demand to the home market, a pattern visible in value, quantity, and number of transactions alike – exactly as our model predicts for coal varieties with high technological substitutability.

This is also consistent with the literature (Chakrabarti et al., 2025) which shows that reshoring also requires sufficient domestic supply to absorb redirected demand. India imports roughly

90–95% of its coking coal demand, implying negligible domestic availability. Non-coking coal, by contrast, is largely sourced domestically: using Ministry of Coal production and import data for FY2023–24, imports account for only about 18 percent of India's non-coking coal consumption.[21] If our proposed mechanism is correct, the reshoring response documented above should be concentrated among non-coking coal buyers, with exclusively coking-coal-dependent firms unable to reshore due to lack of domestic availability – which indeed turns out to be the case. This will have a contractionary response for the downstream firms of the exclusively coking coal using firms – we check for this in Section 7.2.

# 7 Consequences of Reshoring

Having documented the extent of reshoring and the channels behind it, we turn to its broader consequences about spillovers onto firms that never imported coal, propagation to upstream and downstream markets and effects on firm profitability.

## 7.1 Home Spillover Effects on Non-importing Firms

A direct implication of reshoring is that demand expansion takes place in the home economy, as importing firms redirect demand to the domestic market. Ceteris paribus, this should raise the price of coal in the home market.

To estimate this effect, we identify 508 firms that sourced coal exclusively domestically.[22] We construct an balanced panel of these firms at the firm$\times$quarter level and regress the price of their home-market transactions on quarter dummies – a modification of equation 3 that omits the pre-war import share variable, since these firms have no exposure to the international price

[21] Authors' calculation: non-coking coal imports of 205.72 MT relative to apparent non-coking consumption of $997.83 - 66.82 + 205.72 \approx 1{,}137$ MT, based on domestic production and import data from the Ministry of Coal, Government of India.

[22] Out of these, 83 firms import positive amount of coal in the post-war period.

shock. The resulting coefficients are plotted in Figure A.3.

Panel (a) plots the mean and median price (sales divided by harmonized quantity) of observed transactions in every month. The average home-market price rises substantially after the shock, even though there was no contraction in domestic coal supply at the time – indicating that the redirection of demand from the international to the home market created spillover effects on firms that did not import at all. The price pressure dissipates after three to four quarters, which coincides closely with the cooling of the international market and perhaps pointing to an increase in domestic supply (Figure 1).

Panels (b) and (c) plot the regression coefficients on quarter dummies for value and quantity: both show a contraction in coal sourcing by these exclusively home-sourcing firms, consistent with domestic supply being reallocated toward the firms that redirect demand towards home.

## 7.2 Effects on Upstream and Downstream Firms

Since coal-sourcing firms rearranged their sourcing decisions, this reorganization could propagate to upstream and downstream markets: a fall in total coal sourcing could reduce downstream sales, while complementarities in production could generate upstream propagation. Under near-perfect substitution between foreign and domestic coal, however, neither effect need materialize.

We test both channels empirically; results are in Appendix Tables 7 and 8. Table 7 reports upstream purchases by coal-sourcing firms from all suppliers (for example, a cement producer's purchases of limestone, silica, or iron ore alongside coal), across total value, total quantity, and total number of transactions. All coefficients are insignificant, implying no upstream propagation. Table 8 tests effects on downstream sales including coal (columns 1–2) and excluding it (columns 3–4, restricting to transactions in which purchased coal is converted into a different HSN code). We again find zero effects on downstream sales.

This lack of propagation to focal firms buyers and suppliers provides a useful check on

our heterogeneity results. Exclusively coking-coal-dependent firms have zero or near-zero substitutability and no domestic coking coal reserve to draw on; a coking coal price shock should therefore reduce their total purchases (since they cannot reshore) and, in turn, their downstream sales. Firms with mixed coal usage, which can substitute toward domestic coal, should witness minimal effect. We test this in Table 9 and find exactly this pattern: coking-coal-using firms contract their inputs and downstream sales, quantity, and transactions (significant triple interaction terms), while mixed-usage firms show statistically insignificant effects (insignificant double interaction terms).

In summary, reshoring allows the focal firm to absorb the impact of the global price shock with minimal spillover to their upstream and downstream connections, except in the case of firms where they do not have a domestic substitute for their foreign input.

## 7.3 Financial Outcomes

Finally, we ask how reshoring affected firms' financial performance. Reshoring directly reduces sourcing costs, and if it also propagated upstream or downstream, we would expect further effects on revenue and expenses. Since Section 7.2 finds no upstream or downstream propagation, we might expect no corresponding effect on firm-level profits – though this remains an empirical question.

To explore this, we match firm names and corporate identification numbers in our data to the ORBIS dataset, which provides firm-level profit after taxes at yearly frequency, identifying 126 firms in fiscal years 2021–22 and 2022–23. Treating 2021–22 as the pre-shock period and 2022–23 as the post-shock period, we regress profit after taxes on a post dummy interacted with each firm's pre-war import share; the interaction coefficient captures the responsiveness of firm-level profit to shock exposure. This coefficient is positive (1.729, s.e. 1.007), while the post dummy is negative ($-1.595$, s.e. 0.778), indicating an overall contraction in profit after taxes

alongside a partially offsetting effect for more exposed firms.

# 8 Conclusion

How do firms respond to input price shocks? This question has become important as the global trade network faces series of shocks ranging from geopolitical origin to natural disasters. We exploit the global coal price surge after the Russia-Ukraine war to examine how international coal procuring firms in India adjusted to the sudden shock. We find that firms decreased reliance on foreign coal while simultaneously increasing sourcing of coal from home suppliers. Our findings underscore re-shaping of firms' supply chain strategies in the face of global shocks. We show that price-driven disruptions can trigger a rapid reorientation from international to domestic sourcing. This is driven by initial reliance on established home-country suppliers and a broader diversification of the domestic supplier network over time.

This pattern highlights both the resilience and adaptability of firms when confronted with external volatility, while also illustrating the capacity of global supply shocks to accelerate localization trends. More broadly, the results suggest that policies influencing relative input costs can have far-reaching implications for the structure of supply chains.

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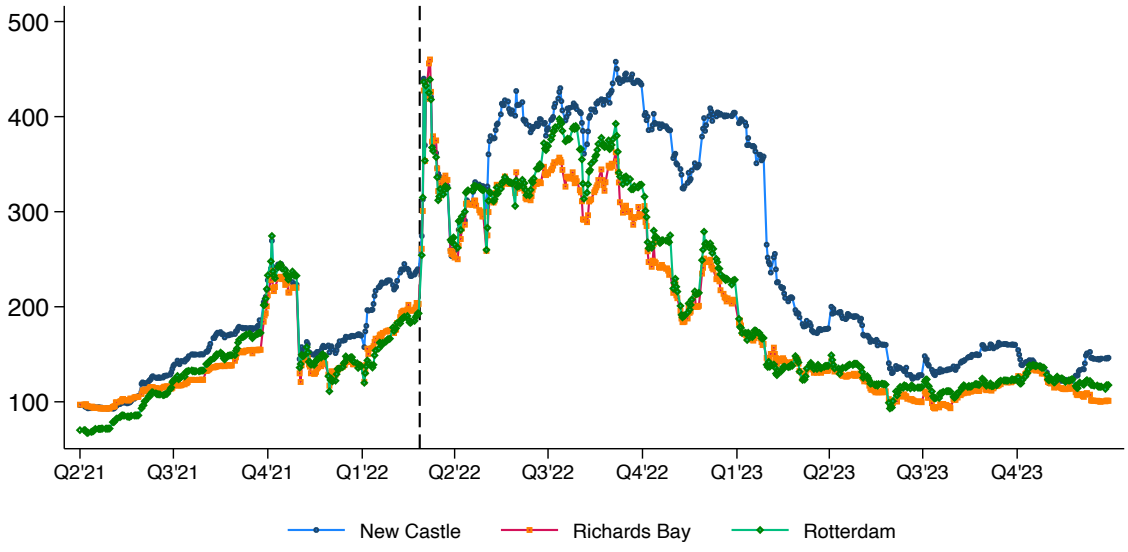
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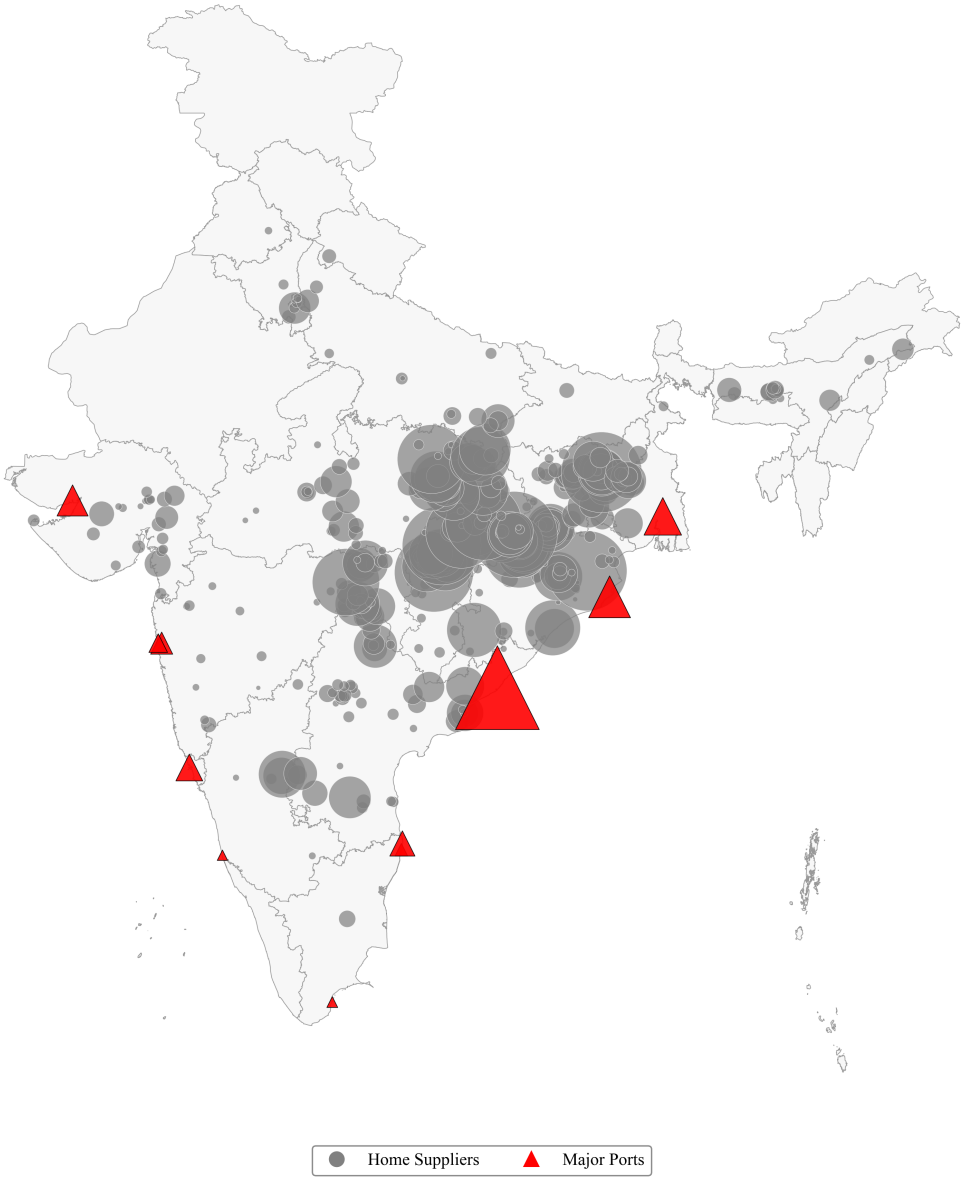
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Figure 1: Coal futures price fluctuations around the Russia-Ukraine War




*Notes:* The figure plots daily coal futures prices (USD per tonne) in the international market, imported by India. The vertical dashed line denotes the start of the Russia–Ukraine conflict on 24 February 2022.

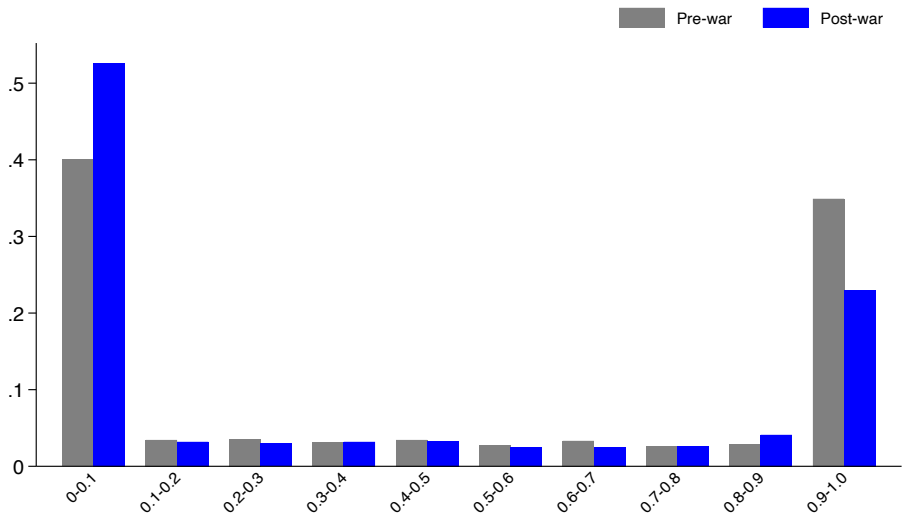
Figure 2: Coal Sourcing locations



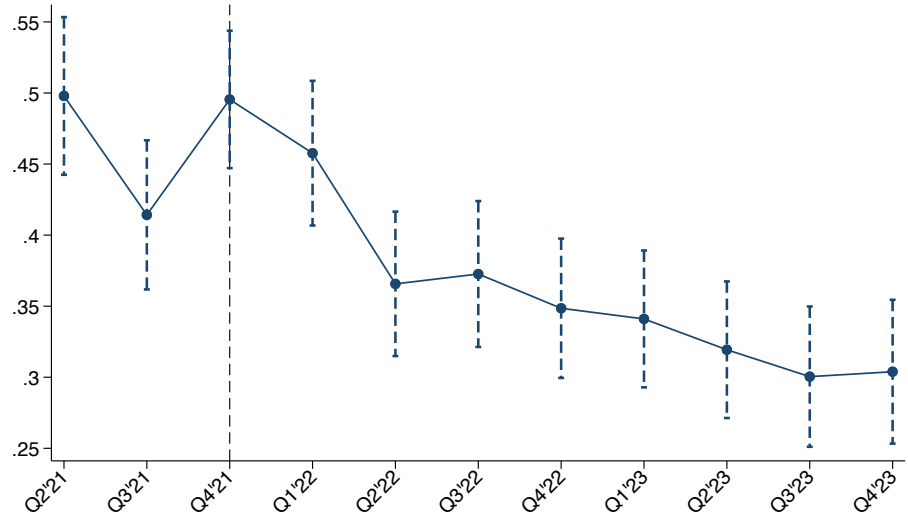

*Notes:* This figure shows the map of India with sourcing locations across states and union territories. The triangles (red) represent the sea-ports. The circles (gray) represent domestic sourcing. The marker sizes of triangles and circles are proportional to the size of imports and domestic sourcing respectively, from the sourcing locations in our data. The large circles in the east of the center of the country overlaps with the coal reserve of India. This provides assurance that our data is representative of sourcing locations being the recognized coal producing regions.

Figure 3: Foreign sourcing share over time

(a) Bar graph : Foreign sourcing share

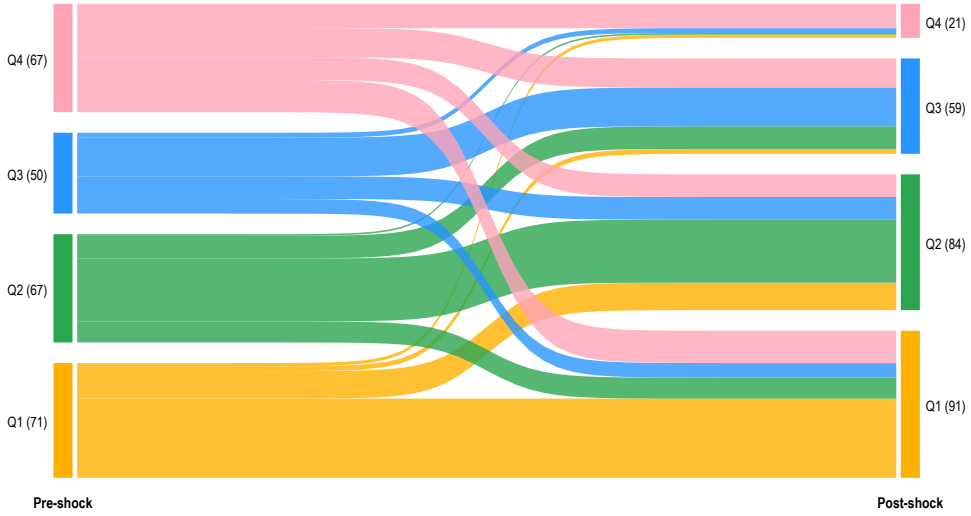



(b) Foreign sourcing share




*Notes:* The plot in panel (a) is a side-by-side bar graph for the pre- and post-war periods, where the x-axis shows ten equal bins of foreign sourcing share (each representing a 0.1 increment), and the y-axis gives the proportion of total transactions in each bin for the two periods ; panel (b) is a trend CI plot of the mean quarterly share of a coal firm's total sourcing that comes from home suppliers ; panel (c) is a trend plot of the mean quarterly share of a coal firm's total sourcing that comes from home suppliers The observations are at Buyer × variety × quarter level. 95% confidence intervals are plotted.

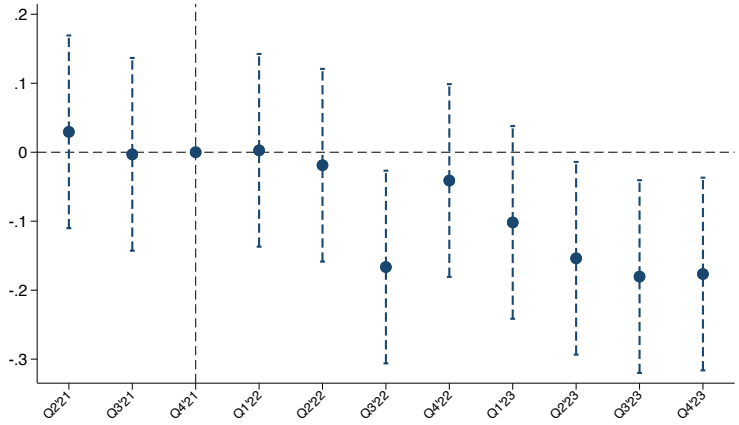
Figure 4: Transition of buyers across foreign sourcing share quartiles in the pre & post shock period



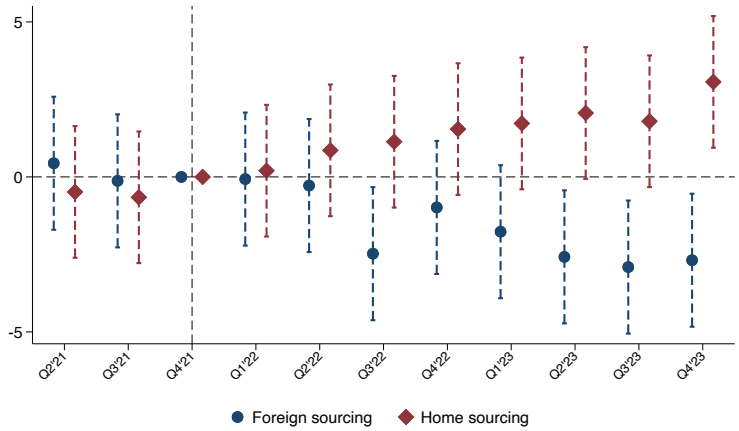

*Notes*: This Sankey diagram demonstrates how buyers who were initially grouped in one quartile based on their foreign sourcing share (in the Pre-shock period) shifted to different quartiles in the Post-shock period.

Figure 5: Impact of war on coal sourcing: Event study

(a) Foreign sourcing indicator




(b) Foreign vs Home sourcing




*Notes:* The plots show the $\alpha_k$ estimates from equation 3, capturing the impact of the war on coal sourcing by firms using imported coal as an input. The dependent variable is an indicator variable which equals one when a firm sources foreign coal (Panel (a)) and log value of coal sourced from foreign suppliers and log value of coal sourced from home suppliers (Panel (b)) by a firm-product in a quarter-year. The treatment variable is the pre-war import share, defined as the proportion of coal value a buyer sourced from foreign suppliers relative to their total value of coal sourcing. We control for firm fixed effects, variety fixed effects and quarter-year fixed effects in all specifications. Standard errors are clustered at buyer level and 95% confidence intervals are plotted.

Table 1: Summary statistics

| | Q2-Q4'21 | | | 2022 | | | 2023 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Obs | Mean | SD | Obs | Mean | SD | Obs | Mean | SD |
| Foreign purchases | 1440 | 9.81 | 50.36 | 1920 | 19.83 | 197.78 | 1920 | 8.36 | 42.93 |
| Home purchases | 1440 | 10.36 | 46.64 | 1920 | 15.04 | 54.55 | 1920 | 12.47 | 47.7 |
| Total purchases | 1440 | 20.17 | 80.36 | 1920 | 34.87 | 213.11 | 1920 | 20.83 | 71.21 |
| Foreign transactions | 1440 | 14.19 | 54.41 | 1920 | 16.62 | 64.89 | 1920 | 11.75 | 55.07 |
| Home transactions | 1440 | 52.95 | 399.89 | 1920 | 45.05 | 280.09 | 1920 | 56.9 | 421.42 |
| Total transactions | 842 | 114.82 | 527.48 | 1127 | 105.07 | 377.12 | 1064 | 123.89 | 568.44 |
| Foreign quantity | 1440 | 2034.86 | 24145.84 | 1920 | 16644.47 | 617372.5 | 1920 | 826.67 | 4863.07 |
| Home quantity | 1440 | 3447.24 | 27826.12 | 1920 | 51551.12 | 2122824 | 1920 | 18480.39 | 627609.5 |
| Total quantity | 1440 | 5482.1 | 37541.04 | 1920 | 68195.59 | 2210448 | 1920 | 19307.06 | 627621.4 |
| Foreign share | 842 | .47 | .44 | 1127 | .39 | .43 | 1064 | .32 | .41 |
| Home share | 842 | .53 | .44 | 1127 | .61 | .43 | 1064 | .68 | .41 |
| Import share (pre-war) | 302 | .65 | .35 | . | . | . | . | . | . |
| No of Firms | . | 302 | 0 | . | 302 | 0 | . | 302 | 0 |

*Notes:* The table reports summary statistics for buyers' coal purchases during the period Q2'21-Q4'23, based on aggregated transactions at the buyer × variety × quarter-year level. 'Import share' is defined as the proportion of coal a buyer sourced from foreign suppliers relative to their total coal sourcing in the pre-war period. 'No. of firms' indicates the number of distinct buyers trading in a given quarter. 'Total purchases' (in INR million) represents buyers' total coal purchases, further broken down into 'Foreign purchases' and 'Home purchases'. 'Home share' is the share of domestic coal value in total coal value sourced by a firm.

Table 2: Impact of war on coal sourcing

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Foreign | | Home | |
| | Extensive | Value | Value | Share |
| $\mathbb{1}_{post}\times$ Import Share | −0.113*** | −1.824*** | 1.928*** | 0.273*** |
| | (0.040) | (0.622) | (0.563) | (0.042) |
| Observations | 5280 | 5280 | 5280 | 3004 |
| R-Squared | 0.32 | 0.35 | 0.45 | 0.56 |
| Mean DV | 0.32 | 4.92 | 6.99 | 0.62 |
| No. of Buyer firms | 302 | 302 | 302 | 273 |
| No of Buyer-HSN | 480 | 480 | 480 | 451 |
| Buyer FE | Yes | Yes | Yes | Yes |
| Variety FE | Yes | Yes | Yes | Yes |
| Quarter-year FE | Yes | Yes | Yes | Yes |

*Notes:* The dependent variable is an indicator variable which equals one when a firm sources foreign coal (column 1), log value of coal sourced from foreign suppliers (column 2), log value of coal sourced from home suppliers (column 3) and share of foreign coal purchase of the total coal purchase (column 4) by a firm-product in a quarter-year. The treatment variable is the pre-war import share, defined as the proportion of coal a firm sourced from foreign suppliers relative to its total coal sourcing from April 2021-January 2022. $\mathbb{1}_{post}$ equals one after the war i.e., from Q1'22-Q4'23; 0 otherwise. We keep only firms that purchase non-zero foreign coal in the pre-war period. Standard errors are clustered at buyer level. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 3: Impact of war on coal sourcing: Robustness

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Foreign | | Home | |
| | Extensive | Value | Value | Share |
| Panel A: Median import share | | | | |
| $\mathbf{1}_{\text{post}} \times \mathbf{1}_{\text{Import Share}}$ | –0.052* | –0.849* | 1.677*** | 0.172*** |
| | (0.030) | (0.470) | (0.391) | (0.034) |
| Observations | 5280 | 5280 | 5280 | 3004 |
| R-Squared | 0.32 | 0.35 | 0.45 | 0.55 |
| MeanDV | 0.32 | 4.92 | 6.99 | 0.62 |
| No. of Buyer firms | 302 | 302 | 302 | 273 |
| No of Buyer-HSN | 480 | 480 | 480 | 451 |
| Panel B: Keeping dominant coal variety | | | | |
| $\mathbb{1}_{post} \times$ Import Share | –0.126** | –2.312** | 2.875*** | 0.358*** |
| | (0.061) | (0.946) | (0.846) | (0.065) |
| Observations | 2805 | 2805 | 2805 | 1652 |
| R-Squared | 0.42 | 0.47 | 0.57 | 0.51 |
| MeanDV | 0.44 | 7.00 | 6.38 | 0.44 |
| No. of Buyer firms | 255 | 255 | 255 | 227 |
| No of Buyer-HSN | 255 | 255 | 255 | 227 |
| Panel C: Controlling buyer size | | | | |
| $\mathbb{1}_{post} \times$ Import Share | –0.099*** | –1.645*** | 2.213*** | 0.262*** |
| | (0.041) | (0.639) | (0.587) | (0.043) |
| Observations | 4961 | 4961 | 4961 | 2902 |
| R-Squared | 0.32 | 0.35 | 0.44 | 0.56 |
| MeanDV | 0.32 | 4.98 | 7.27 | 0.63 |
| No. of Buyer firms | 279 | 279 | 279 | 258 |
| No of Buyer-HSN | 451 | 451 | 451 | 430 |
| Buyer FE | Yes | Yes | Yes | Yes |
| Variety FE | Yes | Yes | Yes | Yes |
| Quarter-year FE | Yes | Yes | Yes | Yes |

*Notes:* The dependent variable is an indicator variable which equals one when a firm sources foreign coal (column 1), log value of coal sourced from foreign suppliers (column 2), log value of coal sourced from home suppliers (column 3) and share of foreign coal purchase of the total coal purchase (column 4) by a firm-product in a quarter-year. The treatment variable is the pre-war import share, defined as the proportion of coal a firm sourced from foreign suppliers relative to its total coal sourcing from April 2021-January 2022. $\mathbb{1}_{post}$ equals one after the war i.e., from Q1'22-Q4'23; 0 otherwise. We keep only firms that purchase non-zero foreign coal in the pre-war period. Standard errors are clustered at buyer level. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 4: Impact of war on coal sourcing: Quantity

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Foreign | | Home | |
| | Extensive | Number | Number | Share |
| | Panel A: Transactions | | | |
| $\mathbf{1}_{\text{post}} \times$ Import Share | –0.113*** | –0.309*** | 0.305*** | 0.261*** |
| | (0.040) | (0.119) | (0.112) | (0.040) |
| Observations | 5280 | 5280 | 5280 | 3004 |
| R-Squared | 0.32 | 0.42 | 0.52 | 0.56 |
| MeanDV | 0.32 | 0.78 | 1.29 | 0.65 |
| No. of Buyer firms | 302 | 302 | 302 | 273 |
| No of Buyer-HSN | 480 | 480 | 480 | 451 |
| | Panel B: Quantity | | | |
| $\mathbf{1}_{\text{post}} \times$ Import Share | –0.113*** | –0.817*** | 0.708*** | 0.270*** |
| | (0.040) | (0.252) | (0.237) | (0.041) |
| Observations | 5280 | 5280 | 5280 | 3004 |
| R-Squared | 0.32 | 0.40 | 0.49 | 0.56 |
| MeanDV | 0.32 | 1.88 | 2.77 | 0.64 |
| No. of Buyer firms | 302 | 302 | 302 | 273 |
| No of Buyer-HSN | 480 | 480 | 480 | 451 |
| Buyer FE | Yes | Yes | Yes | Yes |
| Variety FE | Yes | Yes | Yes | Yes |
| Quarter-year FE | Yes | Yes | Yes | Yes |

*Notes:* The dependent variable in panel A is an indicator variable which equal when one when a firm sources foreign coal (column 1), log value of coal transactions from foreign suppliers (column 2), log value of coal transactions from home suppliers (column 3) and share of foreign coal purchase transactions of the total coal transactions (column 4) by a firm-product in a quarter-year. The dependent variable in panel B is an indicator variable which equal when one when a firm sources foreign coal (column 1), log value of coal quantity (in metric tonnes) from foreign suppliers (column 2), log value of coal quantity from home suppliers (column 3) and share of foreign coal purchase quantity of the total coal quantity (column 4) purchased by a firm in a quarter-year. The treatment variable is the pre-war import share, defined as the proportion of coal a firm sourced from foreign suppliers relative to its total coal sourcing from April 2021-January 2022. $\mathbb{1}_{post}$ equals one after the war i.e., from Q1'22-Q4'23; 0 otherwise. We keep only firms that purchase non-zero foreign coal in the pre-war period. Standard errors are clustered at buyer level. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 5: Impact of war on coal sourcing: Exclusively Coking vs. Mixed-usage buyers

| | Foreign | | | | Home | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Extensive (1) | Value (2) | Quantity (3) | Transactions (4) | Value (5) | Quantity (6) | Transactions (7) | Share(value) (8) | Share(quantity) (9) |
| $\mathbb{1}_{post}\times$ Import Share | −0.370*** | −6.255*** | −2.589*** | −0.927*** | −4.631* | −2.030* | −0.941* | 0.137 | 0.156 |
| | (0.106) | (1.545) | (0.615) | (0.225) | (2.790) | (1.074) | (0.496) | (0.204) | (0.207) |
| $\mathbb{1}_{post} \times \mathbb{1}_{\text{Mixed-usage}}$ | 0.147* | 2.103* | 0.809* | 0.376* | −0.939 | −0.569 | −0.190 | −0.162 | −0.175* |
| | (0.080) | (1.196) | (0.452) | (0.201) | (1.791) | (0.722) | (0.344) | (0.099) | (0.098) |
| $\mathbb{1}_{post}\times$ Import Share $\times\mathbb{1}_{\text{Mixed-usage}}$ | 0.221* | 3.892** | 1.571** | 0.559** | 6.391** | 2.601** | 1.112** | 0.157 | 0.134 |
| | (0.115) | (1.697) | (0.673) | (0.258) | (2.862) | (1.106) | (0.509) | (0.209) | (0.212) |
| Observations | 4235 | 4235 | 4235 | 4235 | 4235 | 4235 | 4235 | 2474 | 2474 |
| R-Squared | 0.31 | 0.33 | 0.39 | 0.40 | 0.44 | 0.48 | 0.49 | 0.54 | 0.54 |
| MeanDV | 0.31 | 4.81 | 1.83 | 0.75 | 7.48 | 2.96 | 1.39 | 0.65 | 0.67 |
| No. of Buyer firms | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 211 | 211 |
| No of Buyer-HSN | 385 | 385 | 385 | 385 | 385 | 385 | 385 | 367 | 367 |
| Buyer FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Variety FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Quarter-year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| ***Lincom results*** | | | | | | | | | |
| Mixed-usage (total) | −0.149*** | −2.363*** | −1.017*** | −0.368*** | 1.761*** | 0.571** | 0.171 | 0.294*** | 0.291*** |
| | (0.046) | (0.703) | (0.275) | (0.126) | (0.637) | (0.264) | (0.116) | (0.049) | (0.049) |

*Notes:* The sample is a quarterly panel of the 238 classified buyers (buyer × coal-variety × quarter). Dependent variables in columns (1)-(4) are the buyer's foreign (imported) coal purchases: (1) an extensive-margin indicator equal to one if any foreign purchase is recorded in the quarter, and the log of (2) purchase value, (3) physical quantity, and (4) number of transactions; columns (5)-(7) are the corresponding logs for home (domestic) purchases; columns (8)-(9) are the home share of the buyer's total coal purchases, by value and by number of transactions. $\mathbb{1}_{post}$ is an indicator for the post-shock quarters (following the February 2022 Russia-Ukraine war); Import Share is the buyer's pre-war share of coal sourced from abroad (treatment intensity); $\mathbb{1}_{Mixed-usage}$ equals one for buyers in the Medium and Low coal-quality tiers (n=225) and zero for coking, High-tier buyers (n=13), which is the omitted reference group. Reported coefficients are the interactions $\mathbb{1}_{post}$ × Import Share, $\mathbb{1}_{post} \times \mathbb{1}_{Mixed-usage}$, and their triple interaction; the level terms of $\mathbb{1}_{post}$, Import Share, and the group indicator are absorbed by the fixed effects. All columns include buyer, coal-variety, and quarter-year fixed effects. The Coking (total) and Rest (total) rows report each group's total $\mathbb{1}_{post}$ × Import Share slope, computed via lincom as a linear combination of the base coefficient and the Mixed-usage interaction (Coking = base; Mixed-usage = base + interaction), with standard errors from the same clustered variance matrix. Columns (8)-(9) use fewer observations because singleton buyer–variety cells are dropped. Standard errors, clustered at the buyer level, are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Impact of war on supplier connections

| | All home connections | | Old home connections | |
|---|---|---|---|---|
| | Number | Share | Number | Value |
| | (1) | (2) | (3) | (4) |
| $\mathbb{1}_{q2'21}\times$ Import Share | 0.412 | –0.174** | 0.412 | –0.187 |
| | (0.306) | (0.076) | (0.306) | (1.111) |
| $\mathbb{1}_{q3'21}\times$ Import Share | –0.168 | –0.010 | –0.168 | –0.473 |
| | (0.227) | (0.072) | (0.227) | (0.883) |
| $\mathbb{1}_{q4'21}\times$ Import Share | 0.000 | 0.000 | 0.000 | 0.000 |
| | (.) | (.) | (.) | (.) |
| $\mathbb{1}_{q1'22}\times$ Import Share | –0.093 | 0.035 | 0.766*** | –0.547 |
| | (0.280) | (0.069) | (0.217) | (0.787) |
| $\mathbb{1}_{q2'22}\times$ Import Share | 0.175 | 0.125* | 1.610*** | 1.382 |
| | (0.288) | (0.072) | (0.235) | (0.949) |
| $\mathbb{1}_{q3'22}\times$ Import Share | 0.034 | 0.175** | 1.705*** | 1.344 |
| | (0.285) | (0.080) | (0.250) | (1.011) |
| $\mathbb{1}_{q4'22}\times$ Import Share | 0.374 | 0.185** | 1.963*** | 1.222 |
| | (0.318) | (0.082) | (0.259) | (0.983) |
| $\mathbb{1}_{q1'23}\times$ Import Share | 0.500 | 0.222*** | 2.156*** | 2.394** |
| | (0.308) | (0.081) | (0.269) | (1.092) |
| $\mathbb{1}_{q2'23}\times$ Import Share | 0.345 | 0.237*** | 1.999*** | 2.120* |
| | (0.393) | (0.085) | (0.264) | (1.082) |
| $\mathbb{1}_{q3'23}\times$ Import Share | 0.698** | 0.170* | 2.195*** | 3.024*** |
| | (0.321) | (0.087) | (0.270) | (1.025) |
| $\mathbb{1}_{q4'23}\times$ Import Share | 0.988*** | 0.271*** | 2.361*** | 3.581*** |
| | (0.342) | (0.079) | (0.275) | (1.080) |
| Observations | 3322 | 2178 | 3322 | 3322 |
| R-Squared | 0.75 | 0.59 | 0.77 | 0.75 |
| MeanDV | 1.63 | 0.58 | 0.89 | 5.77 |
| No. of Buyer firms | 302 | 273 | 302 | 302 |
| Buyer FE | Yes | Yes | Yes | Yes |
| Quarter-year FE | Yes | Yes | Yes | Yes |

*Notes:* The dependent variable is the number of home connections from whom coal is purchased by a firm (column 1); share of home connections in the total number of connections for sourcing coal for a firm (column 2), number of old home connections from whom coal is purchased by a firm (column 3), total value of coal sourcing from old home connections for a firm in a quarter-year (column 4). The treatment variable is the pre-war import share, defined as the proportion of coal a firm sourced from foreign suppliers relative to its total coal sourcing from April 2021-January 2022. $\mathbb{1}_{post}$ equals one after the war i.e., from Q1'22-Q4'23; 0 otherwise. We keep only firms that purchase non-zero foreign coal in the pre-war period. Standard errors are clustered at buyer level. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 7: Upstream suppliers' response to the shock

| | (1) | (2) | (3) |
|---|---|---|---|
| | Total value | Total quantity | Total transactions |
| $\mathbb{1}_{post} \times$ Import Share | –1.040 | –0.439 | –0.089 |
| | (0.665) | (0.292) | (0.142) |
| Observations | 5280 | 5280 | 5280 |
| R-Squared | 0.40 | 0.48 | 0.52 |
| MeanDV | 9.03 | 3.60 | 1.68 |
| No. of Buyer firms | 302 | 302 | 302 |
| No of Buyer-HSN | 480 | 480 | 480 |
| Buyer FE | Yes | Yes | Yes |
| Variety FE | Yes | Yes | Yes |
| Quarter-year FE | Yes | Yes | Yes |

*Notes:* The dependent variables are the log of total purchase value (column 1), log of total purchase quantity (column 2), and log of the number of purchase transactions (column 3) by a firm-product in a quarter-year. The treatment variable is the pre-war import share, defined as the proportion of coal sourced from foreign suppliers relative to a firm's total coal sourcing during April 2021–January 2022. 1 post equals one for the post-war period, i.e., from 2022Q1 onward, and zero otherwise. All specifications include buyer–HSN and quarter-year fixed effects. Standard errors are clustered at buyer level. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 8: Downstream sales response to the shock

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Downstream sales | | Downstream sales (excluding coal) | |
| | Log Sales | Log No. of transactions | Log Sales | Log No. of transactions |
| $\mathbb{1}_{post} \times$ Import Share | –0.281 | –0.064 | –0.289 | –0.060 |
| | (0.397) | (0.052) | (0.413) | (0.052) |
| Observations | 50490 | 50490 | 47212 | 47212 |
| R-Squared | 0.26 | 0.34 | 0.27 | 0.36 |
| MeanDV | 4.67 | 0.71 | 4.52 | 0.68 |
| No. of Buyer firms | 287 | 287 | 256 | 256 |
| No of Buyer-HSN | 4590 | 4590 | 4292 | 4292 |
| Buyer FE | Yes | Yes | Yes | Yes |
| Variety FE | Yes | Yes | Yes | Yes |
| Quarter-year FE | Yes | Yes | Yes | Yes |

*Notes:* The dependent variables are the log of downstream sales (columns 1 and 3) and the log of the number of downstream transactions (columns 2 and 4) by a firm in a quarter-year. Columns (1)–(2) use all downstream sales, while columns (3)–(4) exclude coal products from downstream sales. The treatment variable is the pre-war import share, defined as the proportion of coal sourced from foreign suppliers relative to a firm's total coal sourcing during April 2021–January 2022. 1 post equals one for the post-war period, i.e., from 2022Q1 onward, and zero otherwise. All specifications include buyer, variety, and quarter-year fixed effects. Standard errors are clustered at buyer level. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 9: Upstream & Downstream propagation by technological substitutability: Coking vs. Mixed-usage buyers

| | Upstream purchases | | | Downstream sales | | |
|---|---|---|---|---|---|---|
| | Value | Quantity | Transactions | Value | Quantity | Transactions |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}$(Post) × Import Share | −1.121 | −0.515 | −0.190 | −0.297 | −0.083 | −0.065 |
| | (0.754) | (0.322) | (0.146) | (0.420) | (0.122) | (0.054) |
| $\mathbb{1}$(Post) × Import Share × $\mathbb{1}$(Coking) | −9.488*** | −3.925*** | −1.511*** | −5.137* | −2.612*** | −1.044*** |
| | (2.581) | (1.046) | (0.487) | (2.800) | (0.729) | (0.305) |
| Observations | 4235 | 4235 | 4235 | 48312 | 48312 | 48312 |
| R-Squared | 0.60 | 0.71 | 0.78 | 0.56 | 0.72 | 0.82 |
| MeanDV | 9.29 | 3.69 | 1.73 | 4.68 | 1.48 | 0.71 |
| No. of Buyer firms | 229 | 229 | 229 | 229 | 229 | 229 |
| No of Buyer-HSN | 385 | 385 | 385 | 4392 | 4392 | 4392 |
| Buyer-HSN FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Quarter-year FE | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes:* The dependent variables are the log of upstream purchase value (column 1), the log of upstream purchase quantity (column 2), the log of the number of upstream purchase transactions (column 3), the log of downstream sales value (column 4), the log of downstream sales quantity (column 5), and the log of the number of downstream sales transactions (column 6) by a firm-product pair in a quarter-year. The treatment variable is the pre-war import share, defined as the proportion of coal a firm sourced from foreign suppliers relative to its total coal sourcing from April 2021–January 2022. $\mathbb{1}_{Coking}$ equals one for coking coal buyers and 0 otherwise. $\mathbb{1}_{post}$ equals one for the post-war period, i.e., from 2022Q1 onward, and zero otherwise. All specifications include buyer–HSN and quarter-year fixed effects. Standard errors are clustered at the buyer level.

# A Appendix

## A.1 Theoretical model

We use a simplified version of the model developed by Halpern et al. (2015) to model the the firm decision for input sourcing decision from within the country (Home $H$) and internationally (Foreign $F$).

There are multiple industries in the economy. We model the decision of the firms within the industry that purchase coal (*focal* industry) as an intermediate input along with all other inputs. These firms combine imported inputs along with domestically sourced inputs to produce their final good. Examples of firms in this *focal* industry would include those manufacturing steel, electricity generating companies, cement producers among others.

Firm $j$ in the *focal* industry has a Cobb-Douglas production function:

$$Q_j = \Omega_j K_j^{\alpha} L_j^{\beta} \prod_{i=1}^{N} X_{ji}^{\gamma_i} \tag{A.4}$$

where the firm combines labor, capital and intermediate inputs to produce the final good $j$. $\Omega$ denotes a Hicks-neutral total factor productivity. We assume that 1, . . ., $N_j$ number of inputs the firm can purchase from the international market. The rest are nontradabales – following the basic structure of Halpern et al. (2015).

This is a partial equilibrium model at the industry-level – the firm takes capital and labor as given and determines optimal inputs and output. All goods are tradable and we assume that they arranged in a decreasing order of their weight in the production function such that the Cobb-Douglas weight $\gamma_a \geq \gamma_b$ if $a \geq b$.

### A.1.1 Domestic coal-sourcing through a bundle of supplier links

For each coal input $i$, domestic coal is assembled from the set $\mathcal{H}_{ji}$ of active home suppliers:

$$X_{jiH} = \left[ \sum_{\ell \in \mathcal{H}_{ji}} \left( b_{ji\ell} x_{ji\ell} \right)^{\frac{\varepsilon-1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon-1}}, \qquad \varepsilon > 1, \tag{A.5}$$

where $x_{ji\ell}$ is the physical quantity procured from home supplier $\ell$ and $b_{ji\ell}$ converts that quantity into effective coal services. While we could have made the domestic coal varieties enter with different weights, we keep the weights identical – setting $b_{ji\ell} = 1$ – to simplify the exposition.

Denoting the price by $p^H_{ji\ell}$, the unit cost of the home bundle is

$$P_{jiH} = \left[ \sum_{\ell \in \mathcal{H}_{ji}} \left( p^H_{ji\ell} \right)^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}}. \tag{A.6}$$

Now, we are in a position to analyze the effect of adding one home supplier. Let the mass of links be $m_{ji} = |\mathcal{H}_{ji}|$. Then

$$P_{jiH}(m_{ji}) = p^H_{ji} m_{ji}^{-\frac{1}{\varepsilon-1}}, \qquad \frac{\partial \log P_{jiH}(m_{ji})}{\partial \log m_{ji}} = -\frac{1}{\varepsilon - 1} < 0. \tag{A.7}$$

This implies, adding a home supplier lowers the effective price of the home bundle.

### A.1.2 Foreign versus home sourcing and the price shock

Intermediate goods are assembled from imported and domestic inputs in the following way:

$$X_{ji} = \left[ (B_{ji} X_{jiF})^{\frac{\theta-1}{\theta}} + X_{jiH}^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}}. \tag{A.8}$$

There are two dimensions along which the inputs enter the production function. First, the model allows for quality differential across inputs sourced from $H$ and foreign $F$ through the parameter

$B$. Second, the parameter $\theta$ captures the degree of substitutability across inputs sourced from $H$ and $F$.[1] Let us denote the monetary price of the two different inputs by $P_{iF}$ and $P_{iH}$ for foreign and home, respectively. Thus the price-adjusted quality of the foreign input is given by

$$A_{ji} = \frac{B_{ji}P_{iH}}{P_{iF}}. \tag{A.9}$$

For simplification, assume that the price-adjusted quality $A_{ji} = A$. Now, we introduce the shock in the sense of comparative static. Let $p^0_{iF}$ be the pre-shock delivered foreign price. We assume that the international market receives a shock of $\tau$ on prices. This is exogenous to the home country. Thus, we have

$$p_{iF}(\tau) = \tau p^0_{iF}. \tag{A.10}$$

The pre-war regime has $\tau = \tau_0$ and the price-shock regime has $\tau = \tau_1 > \tau_0$. The effective price of the composite inputs is given by

$$P_{ji} = [P_{iH}^{1-\theta} + (P_{iF}/B_{ji})^{1-\theta}]^{1/(1-\theta)} = P_{iH}[1 + A^{\theta-1}]^{1/(1-\theta)}. \tag{A.11}$$

We can take log to write the markup of the composite price over the domestic price as:

$$log\left(\frac{P_{ji}}{P_{iH}}\right) = \frac{\log[1 + A^{\theta-1}]}{1-\theta}. \tag{A.12}$$

[1] In the context of coal, the degree of substitutability at the plant level is not necessarily an unique number. Our surveys of the company managers have different degree of belief about substitutability. In many cases, there are technological challenges as often the chemical process at a given plant is equipped to handle only one or very few types of coal. The quality differential is acknowledged by almost all managers – stating that domestic (Indian) coal is of lesser calorific value with respect to foreign coal. Thus the ability to substitute coal inputs varies across industries. For blast furnaces and steel production, typically coking coal is used which is nearly impossible to substitute via non-coking coal. However, for cement production and industrial heating, firms use non-coking coal which is generally cheaper and lower quality. India has a large reserve of non-coking coal making foreign to hoe substitution more feasible.

This ratio captures the gain due to import as a function of the degree of substitution. With imperfect substitution, a convex combination of inputs sourced from $H$ and $F$ is used in the production process and the optimal share of foreign inputs expenditure is given by

$$S^F = A^{\theta-1}/(1+A^{\theta-1}) < 1, \qquad S^H = 1 - S^F. \tag{A.13}$$

Note that given Equation A.9, $\delta A/\delta\tau < 0$. Therefore we can derive an important result.

$$\frac{\delta S^F}{\delta\tau} < 0, \qquad \frac{\delta S^H}{\delta\tau} > 0. \tag{A.14}$$

Thus a positive price shock would reduce the foreign share in total expenditure. Finally, firms have to pay fixed costs for accessing foreign inputs: $f_j^i$ (Gopinath and Neiman, 2014). Thus to access a sequence of $\kappa$ inputs, the firm has to pay the total fixed cost – $\sum_{l=0}^{\kappa} f_j^l$.

### A.1.3 Pre-war exposure

There is a continuum of consumers with demand for good $s$:

$$U(\{Q_j\}_{j=1}^{J^s}) = [\sum_{j=1}^{J^s} Q_j^{(\eta-1)/\eta}]^{\eta/(\eta-1)} \tag{A.15}$$

The next step for the firm is to decide how many inputs to import. The following increasing and concave function provides the relative importance of the inputs in an increasing order:

$$G(n_j) = \frac{\sum_{i=1}^{n_j}\gamma_i}{\sum_{i=1}^{N}\gamma_i} = \frac{\sum_{i=1}^{n_j}\gamma_i}{\gamma}. \tag{A.16}$$

Combining the expenditure share of the imports and the $G(.)$ function, we arrive at the expression of spending share on imports –

$$\frac{M_j^F}{M_j} = S^F \frac{\sum_{i=1}^{n_j} \gamma_i}{\gamma} = S^F G(n_j). \tag{A.17}$$

The firm, in particular, will maximize the profit function to determine the optimal number of inputs:

$$n_j = \arg\max_{\tilde{n}} \pi(\tilde{n}) - \sum_{i=1}^{\tilde{n}} f_j^i. \tag{A.18}$$

### A.1.4 Price shock and home sourcing

Consider adding one domestic supplier to an input that currently has $m$ active domestic links. Conditional on the required input quantity bundle $\bar{X}_{ji}$, the gross variable-cost saving in response to $\tau$ price shock is

$$\Delta_{ji}^H(\tau, m) \equiv \bar{X}_{ji} \left[ P_{ji}(\tau, m) - P_{ji}(\tau, m+1) \right] > 0. \tag{A.19}$$

This inequality holds due to Equation A.7.

Now we need to model search in the home market for new suppliers. There are of course two margins. The supplier base can be expanded via extensive margin. But searching and validating entirely new suppliers require a flow cost $r_{ji\ell}^N \geq 0$ and a sunk cost $\kappa_{ji\ell}^N \geq 0$. In the intensive margin, the existing supplier base can sell more. For them, the sourcing firms have already paid the search and validation cost. A pre-existing supplier link may require a small order cost $r_{ji\ell}^O \geq 0$. Combining the above, we impose the natural ordering

$$\max_{\ell \in \mathcal{O}_{ji}} r_{ji\ell}^O < \min_{\ell \in \mathcal{N}_{ji}} \left( r_{ji\ell}^N + \kappa_{ji\ell}^N \right), \tag{A.20}$$

where $\mathcal{O}_{ji}$ is the pool of old suppliers and $\mathcal{N}_{ji}$ is the pool of existing suppliers.

Now, note that the value of an additional domestic supplier rises with the foreign price. To show this, we follow the price equation. Recall from Equation A.21 that

$$P_{ji} = [P_{iH}^{1-\theta} + (P_{iF}/B_{ji})^{1-\theta}]^{1/(1-\theta)}. \tag{A.21}$$

Write $c = P_{jiF}(\tau)/B_{ji}$ and $h_m = P_{jiH}(m)$, with $h_m > h_{m+1}$, again due to Equation A.7. Taking a partial derivative, we get

$$\frac{\partial P_{ji}(c,h)}{\partial c} = \left(\frac{P_{ji}(c,h)}{c}\right)^{\theta}. \tag{A.22}$$

Since $P_{ji}(c,h_m) > P_{ji}(c,h_{m+1})$, it follows that

$$\begin{aligned} \frac{\partial \Delta_{ji}^{H}(\tau,m)}{\partial \tau} &= \bar{X}_{ji}\left(\frac{\delta P_{ji}(\tau,m)}{\delta \tau} - \frac{\delta P_{ji}(\tau,m+1)}{\delta \tau}\right) \\ &> 0 \qquad \text{using Eqn. A.22.} \end{aligned} \tag{A.23}$$

### A.1.5 Home sourcing: Race between the old and new

Entry during the international price shock requires

$$\Delta_{ji}^{H}(\tau_1,m) \geq r_{ji} + k_{ji}, \tag{A.24}$$

whereas retaining the link after price normalization in the international market requires a less strignetn condition –

$$\Delta_{ji}^{H}(\tau_0,m) \geq r_{ji}. \tag{A.25}$$

Because $k_{ji} > 0$, the entry threshold is strictly above the continuation threshold. This gap creates a range of normalized prices at which an entirely new supply link would not be created. Consequently, once such a link is created, it will continue to remain active.

### A.1.6 Key results

Now we collate the results and their implication from the above. The first result is about reshoring due to price shocks.

**Result 1** *Suppose $\theta > 1$. For a price shock in the international market $\tau_1 > \tau_0$, the foreign expenditure share falls.*

This follows from Equation A.14. Next, we explore the home sourcing decision.

**Result 2** *Given the price shock in the international market $\tau_1 > \tau_0$ and same input bundle demand, total home demand rises. Conditional on the same set of home suppliers, the intensive margin activates i.e. each home sellers sells more. In addition, new link shave an activation cost over and above the flow cost. Thus, they enter once the price shock crosses the threshold to justify the higher cost.*

This result ties back to the finding that coal buying firms would first increase their sourcing from existing home sellers before creating new connections.

**Result 3** *Consider a price shock with the following ordering:*

$$r_{ji} \leq \Delta_{ji}^{H}(\tau_0, m) < r_{ji} + k_{ji} \leq \Delta_{ji}^{H}(\tau_1, m). \tag{A.26}$$

*In this case, during the price shock, the coal-sourcing firm would reshore its input-buying location to the home market. And, after that, even if the international prices normalize back to the pre-shock level, the existing connections are worth continuing given the search cost has already been paid. In addition, there is a second order effect coming from Equation A.7 that as the home supplier mass increases, they get a price advantage which further reinforces reshoring.*

Condition (A.26) is the static hysteresis band invoked in trade models such as Baldwin (1988b) and Baldwin and Krugman (1988).

Finally, recall from Equation A.13 that

$$S^F = A^{\theta-1}/(1+A^{\theta-1}) < 1, \qquad S^H = 1 - S^F. \tag{A.27}$$

Therefore, we can write $S^F/S^H = A^{\theta-1}$. Recall that $A = (B_{ij}P_{iH}/P_{iF}$. Using this, we have the final result as follows.

**Result 4** *For any input that is bought both in home as well as in the international market, the following derivative holds –*

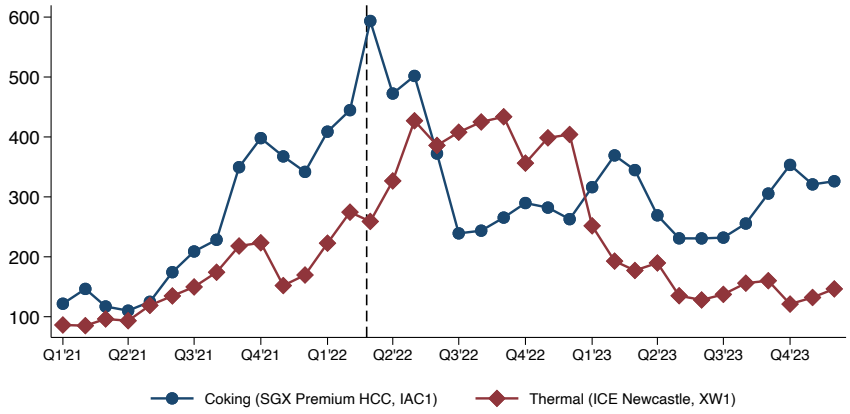
$$\frac{\partial}{\partial \log \tau} \log \left( \frac{S^H_{ji}}{S^F_{ji}} \right) = \theta_j - 1. \tag{A.28}$$

*Thus, for sectors which would have high substitutability (high $\theta$), for the same price shock the degree of reshoring would be more than the sector which has low substitutability ($\theta$ close to 1).*

This implies that for sectors like steel production or any production processes using blast furnace, will substitute less (as they use less substitutable coking coal) as opposed to industrial heat production and cement manufacturing plants (which use more substitutable non-coking coal).

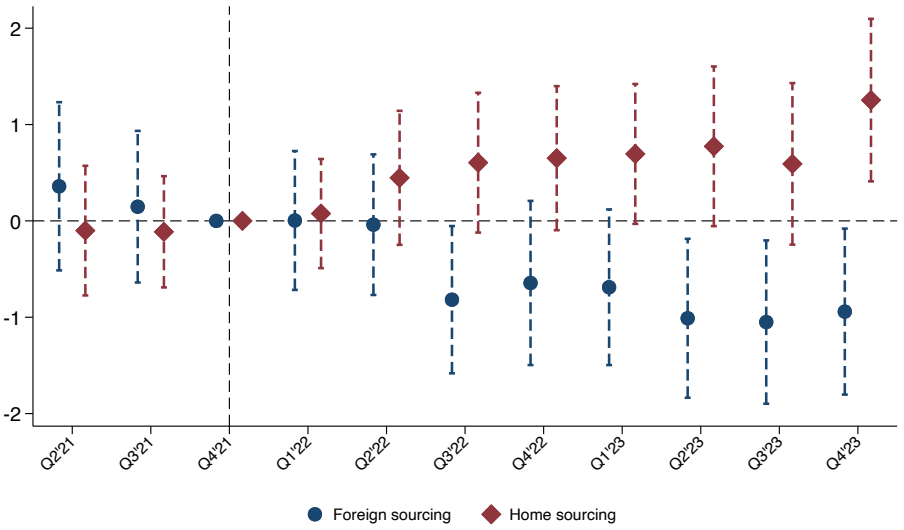
## A.2 Additional Figures and Tables

Figure A.1: Coking (IAC1) vs. non-coking / thermal (XW1) coal futures price fluctuations around the Russia-Ukraine War




*Notes:* This figure plots monthly futures prices for coking coal (IAC1) and non-coking/thermal coal (XW1). The vertical dashed line denotes the start of the Russia–Ukraine conflict on 24 February 2022.

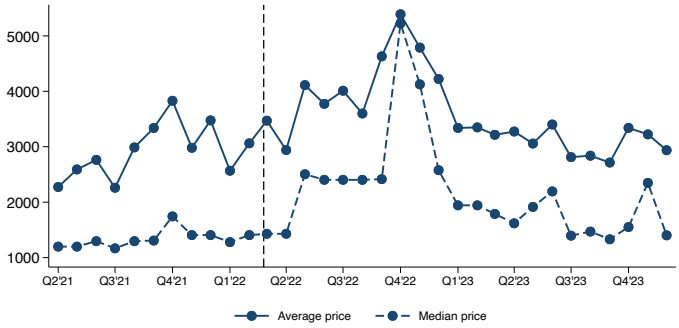
Figure A.2: Effect of war on sourcing of coal (quantity): Event study



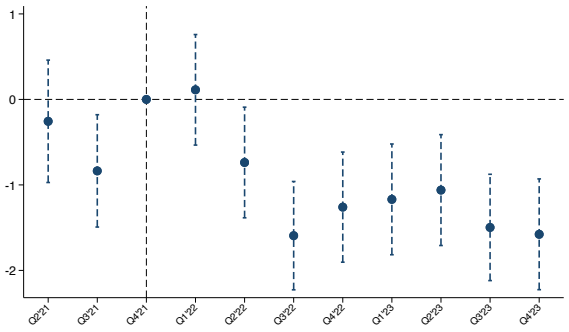

*Notes:* The plots show the $\alpha_k$ estimates from equation 3, capturing the impact of the war on coal sourcing by firms using imported coal as an input. The dependent variable is log quantity of coal sourced from foreign suppliers and log quantity of coal sourced from home suppliers by a firm-product in a quarter-year. The treatment variable is the pre-war import share, defined as the proportion of coal value a buyer sourced from foreign suppliers relative to their total value of coal sourcing. We control for firm fixed effects, variety fixed effects and quarter-year fixed effects in all specifications. Standard errors are clustered at buyer level and 95% confidence intervals are plotted.

Figure A.3: Effect of war on home prices, quantity and total value purchased of domestic coal: Time trend

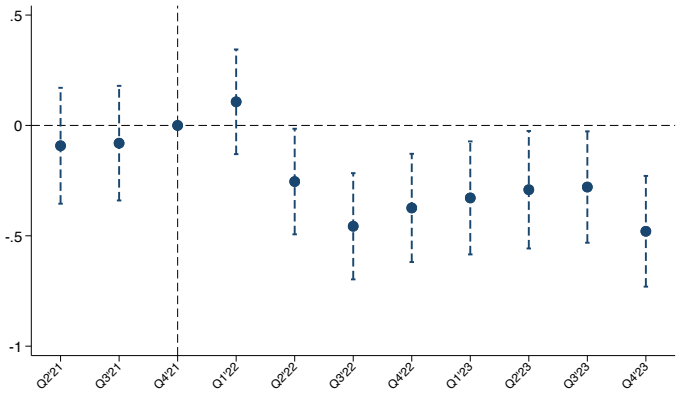
(a) Home sourced coal prices




(b) Home sourced coal total value




(c) Home sourced coal total quantity




*Notes:* The plots show the $\alpha_k$ estimates from a regression model analogous to equation 3 – instead of difference-in-differences, this model regresses sales and quantity on a quarter-year dummy, capturing the time-trend of coal sourcing by non-importing firms. We control for firm fixed effects, variety fixed effects in all specifications (panels (b) and (c)). Standard errors are clustered at buyer level and 95% confidence intervals are plotted.

Table A.1: Impact of war on coal sourcing: Alternative functional forms

| | (1) | (2) |
|---|---|---|
| | Foreign | Home |
| $\mathbb{1}_{post}\times$ Import Share | −1.902*** | 2.029*** |
| | (0.649) | (0.588) |
| Observations | 5280 | 5280 |
| Mean DV | 5.14 | 7.30 |
| No. of Buyer firms | 302 | 302 |
| No of Buyer-HSN | 480 | 480 |
| Buyer FE | Yes | Yes |
| Variety FE | Yes | Yes |
| Quarter-year FE | Yes | Yes |

*Notes:* The dependent variable is value of coal sourced from foreign suppliers (column 1) and value of coal sourced from home suppliers (column 2) by a firm in a quarter-year. Columns 1-2 use the Inverse Hyperbolic Sine (IHS) transformation of the dependent variables. The treatment variable is the pre-war import share, defined as the proportion of coal a firm sourced from foreign suppliers relative to its total coal sourcing from April 2021-January 2022. $\mathbb{1}_{post}$ equals 1 after the war i.e., from Q1'22-Q4'23; 0 otherwise. We keep only firms that purchase non-zero foreign coal in the pre-war period. Standard errors are clustered at buyer level. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table A.2: Impact of war on coal sourcing: Sourcing from major coal producing states states

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Foreign | | Home | |
| | Extensive | Value | Value | Share |
| $\mathbb{1}_{post}\times$ Import Share | −0.138*** | −2.179*** | 1.671*** | 0.241*** |
| | (0.039) | (0.611) | (0.556) | (0.042) |
| Observations | 5214 | 5214 | 5214 | 2906 |
| R-Squared | 0.32 | 0.35 | 0.45 | 0.58 |
| MeanDV | 0.32 | 4.98 | 6.47 | 0.58 |
| No. of Buyer firms | 302 | 302 | 302 | 272 |
| No of Buyer-HSN | 474 | 474 | 474 | 444 |
| Buyer FE | Yes | Yes | Yes | Yes |
| Variety FE | Yes | Yes | Yes | Yes |
| Quarter-year FE | Yes | Yes | Yes | Yes |

*Notes:* The dependent variable is an indicator variable which equals one when a firm sources foreign coal (column 1), log value of coal sourced from foreign suppliers (column 2), log value of coal sourced from home suppliers (column 3) and share of foreign coal purchase of the total coal purchase (column 4) by a firm-product in a quarter-year. The treatment variable is the pre-war import share, defined as the proportion of coal a firm sourced from foreign suppliers relative to its total coal sourcing from April 2021-January 2022. $\mathbb{1}_{post}$ equals one after the war i.e., from Q1'22-Q4'23; 0 otherwise. We keep only firms that purchase non-zero foreign coal in the pre-war period. We keep firms in the home-state that source at least once from contiguous states. Standard errors are clustered at buyer level. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table A.3: Impact of war on coal sourcing: Including unregistered persons (URPs)

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Foreign | | Home | |
| | Extensive | Value | Value | Share |
| $\mathbb{1}_{post}\times$ Import Share | −0.102*** | −1.677*** | 1.917*** | 0.266*** |
| | (0.039) | (0.602) | (0.567) | (0.042) |
| Observations | 5610 | 5610 | 5610 | 3147 |
| R-Squared | 0.33 | 0.36 | 0.44 | 0.54 |
| MeanDV | 0.31 | 4.90 | 6.89 | 0.61 |
| No. of Buyer firms | 314 | 314 | 314 | 285 |
| No of Buyer-HSN | 510 | 510 | 510 | 480 |
| Buyer FE | Yes | Yes | Yes | Yes |
| Variety FE | Yes | Yes | Yes | Yes |
| Quarter-year FE | Yes | Yes | Yes | Yes |

*Notes:* The dependent variable is indicator variable which equal when one when a firm sources foreign coal (column 1), log value of coal sourced from foreign suppliers (column 2), log value of coal sourced from home suppliers (column 3) and share of foreign coal purchase of the total coal purchase (column 4) by a firm-product in a quarter-year. The treatment variable is the pre-war import share, defined as the proportion of coal a firm sourced from foreign suppliers relative to its total coal sourcing from April 2021-January 2022. $\mathbb{1}_{post}$ equals one after the war i.e., from Q1'22-Q4'23; 0 otherwise. We keep only firms that purchase non-zero foreign coal in the pre-war period. We also include coal purchased from unregistered persons (URP's) in this analysis. Standard errors are clustered at buyer level. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table A.4: Impact of war on coal sourcing : Excluding Intermediaries

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Foreign | | Home | |
| | Extensive | Value | Value | Share |
| $\mathbb{1}_{post}\times$ Import Share | −0.138*** | −2.208*** | 1.664*** | 0.282*** |
| | (0.044) | (0.684) | (0.626) | (0.048) |
| Observations | 4235 | 4235 | 4235 | 2474 |
| R-Squared | 0.30 | 0.33 | 0.44 | 0.54 |
| MeanDV | 0.31 | 4.81 | 7.48 | 0.65 |
| No. of Buyer firms | 229 | 229 | 229 | 211 |
| No of Buyer-HSN | 385 | 385 | 385 | 367 |
| Buyer FE | Yes | Yes | Yes | Yes |
| Variety FE | Yes | Yes | Yes | Yes |
| Quarter-year FE | Yes | Yes | Yes | Yes |

*Notes:* The dependent variable is an indicator variable which equals one when a firm sources foreign coal (column 1), log value of coal sourced from foreign suppliers (column 2), log value of coal sourced from home suppliers (column 3) and share of foreign coal purchase of the total coal purchase (column 4) by a firm-product in a quarter-year. The treatment variable is the pre-war import share, defined as the proportion of coal a firm sourced from foreign suppliers relative to its total coal sourcing from April 2021-January 2022. $\mathbb{1}_{post}$ equals one after the war i.e., from Q1'22-Q4'23; 0 otherwise. We retain firms that purchased non-zero quantities of foreign coal during the pre-war period and exclude intermediaries. Standard errors are clustered at buyer level. *** p < 0.01, ** p < 0.05, * p < 0.1.