CHAPTER 1

COMMODITY SPECIAL FEATURE: ONLINE ANNEX 1.1

This online annex describes the empirical methodology, data, and additional results.[1]

Methodology

1.1 Network exposures: Descriptive Evidence

There is an extensive literature studying the propagation and amplification of sectoral shocks on the macroeconomy through production networks. Balke and Wynne (2000), for example, studied a closed economy model featuring input-output linkages and sectoral productivity shocks in the spirit of Long and Plosser (1983).[2] In this class of models, the exposure of a given sector i to a productivity shock, say in the the metals (M) sector, is given by the element iM of a version the Leontief inverse matrix $(I - \Omega)^{-1}_{iM}$. The element iM of the matrix Ω is the ratio between the expenditure on input M, by sector i, and the total gross output of sector i. The element iM of the Leontief inverse characterizes the direct and the indirect effect of an increase in metals prices, due to decline in productivity, in sector i's total intermediate input costs. This term not only considers the direct share of metals in the production of i but also the share of metals in the production of i's suppliers, and the suppliers of i's suppliers as well. This simple metrics of metals dependence is used in the descriptive statistics section to highlight the role of metals in the production structure. Given that in many countries a large fraction of metals and oil are imported, the results in Figures 1.SF.4 and 1.SF.5 also consider intermediate input imports of metals and oil by domestic sectors.[3]

The results in Figure 1.SF.4 use data from the BEA input-output matrices for the US in 2018. The sectoral exposures considered are calculated using $(I - \Omega)^{-1}_{iM}$ for a given sector i.

In Figure 1.SF.5 a country's aggregate exposure to metals or oil is defined as follows. The GDP deflator (DGDP) and the consumer price index (CPI) in the model are defined as

$$\log DGDP_t = \sum va_k \cdot log\ p_{kt} \quad \text{and} \quad \log CPI_t = \sum b_k \cdot log\ p_{kt}$$

in which va_k and b_k are the value-added share of sector k and the final consumption expenditure share of sector k, respectively. As emphasized above, the price of sector k depends on metals productivity through the Leontief inverse element kM. Hence, if the only shock in the economy is the shock to metals' productivity, the change in the GDP deflator and the CPI are defined as

[1] This Special Feature is based on Miranda-Pinto and others (2024). Focusing on metals as inputs in the production of investment goods, it contributes to the literatures on production networks (see vom Lehn and Winberry 2022; Silva 2023; and Silva and others 2024) and on the drivers of inflation co-movement across countries (for example, Auer, Levchenko, and Sauré 2019; Baumeister and others 2024; Bernanke and Blanchard 2023; Miranda-Pinto and others 2023; Degasperi, Hong, and Ricco 2024). The inflationary effects of metals price changes following US monetary policy shocks are documented in Miranda-Pinto and others (2023).

[2] See also Horvath (1998), Foerster et al. (2011), Acemoglu et al. (2012), and Baqaee and Farhi (2019), among others.

[3] In the quantitative part of the analysis, the open economy nature of the metals and oil is explicitly considered by following the small open economy model in Silva (2023). In such a model, rather than a productivity shock to the metals sector, small open economies receive shocks to the international price of metals or oil. The effects of this shock permeate the economy through the domestic production network as domestic sectors rely on imported metals and oil for their production.

$$d\log DGDP_t = \sum \ \mathrm{va_k} \cdot \frac{\partial logp_{kt}}{\partial logZ_M} = \sum va_k\, (I-\Omega)^{-1}_{kM} \qquad \text{and}$$

$$\mathrm{d}\log CPI_t = \sum b_k \cdot \frac{\mathrm{d}logp_{kt}}{\partial logZ_M} = \sum b_k (I-\Omega)^{-1}_{kM} \,.$$

These equations gauge the importance of metals for each sector component in the GDP deflator and the consumer price index (CPI). This approach captures the inflationary pressure stemming from an exogenous shock to metals prices. The overall impact on CPI, instead, will depend on the chosen monetary policy rule. In this case, nominal variables are pinned down by assuming that money supply targets a given level of nominal GDP.

1.2 Theoretical Framework for Cross-country regressions

The model presented here is based on the work of Silva (2023) and consists of a small open economy model with production networks.

There exist a collection of *N* goods and services produced within the country, with each good identified as *i*. These domestically produced goods have multiple uses: they can be consumed within the country, serve as intermediate inputs for other domestic industries, or be exported. The set of imported goods is symbolized by *M*, with each imported item denoted by *m*. These imports can either be used as intermediate inputs in the production of domestic goods or consumed directly as final products. Additionally, there exists a set *F* that comprises various factors of production, each factor labeled as *f*. The notation employed in this context includes matrices and vectors, which are indicated in bold, such as $\mathbf{Y}$, and their transposes are similarly denoted. Changes in logarithmic values are represented as d log $Y = \hat{Y}$.

Representative Household

A representative household consumes both domestic and foreign goods, deriving instantaneous utility represented by $U(C_D, C_M)$,where $C_D = \{C_i\}_{i\in N}$ indicates domestic goods consumption and $\boldsymbol{C}_M = \{C_m\}_{m\in N}$ represents foreign goods consumption. Consumption of these goods is tied to their respective price vectors $\boldsymbol{P}_D = \{P_i\}_{i\in N}$ for domestic and $\boldsymbol{P}_M = \{P_m\}_{m\in N}$ for foreign goods, typically in local currency unless specified otherwise. The utility function (U(.)) is assumed to scale linearly with its inputs. This household owns and supplies all production factors at fixed prices. It seeks to minimize costs given the price vectors of both domestic and foreign goods.

$$\mathrm{PC} = \min_{\mathrm{C_D,C_M}} \sum_{\mathrm{i\in N}} \mathrm{P_i C_i} + \sum_{\mathrm{m\in M}} \mathrm{P_m C_m} \quad \text{subject to} \quad \mathrm{U}(\mathbf{C}_\mathrm{D}, \mathbf{C}_\mathrm{M}) \geq \bar{\mathrm{U}}$$

The solution to this problem yields a price index that is a function of good prices: $P = P(\boldsymbol{P}_D, \boldsymbol{P}_M)$. Up to a first order, prices in this economy satisfy:

$$\hat{P} = \overline{\mathbf{b}_D^T}\widehat{\boldsymbol{P}_D} + \overline{\mathbf{b}_M^T}\boldsymbol{P_M},$$

where

$$\overline{\boldsymbol{b}_D} = \{\overline{\mathrm{b_i}}\} = \frac{\mathrm{P_i C_i}}{\mathrm{E}}, \quad \overline{\mathbf{b}_\mathrm{M}} = \{\overline{\mathrm{b_m}}\} = \frac{\mathrm{P_m C_m}}{\mathrm{E}}; \quad \mathrm{E} = \mathbf{P}_\mathrm{D}^\mathrm{T}\mathbf{C}_\mathrm{D} + \mathbf{P}_\mathrm{M}^\mathrm{T}\mathbf{C}_\mathrm{M} = \mathrm{PC}$$

are the expenditure share on domestically produced goods $\bar{b}_i$, imported goods, and total expenditure (E), respectively. The consumer's budget constraint is given by:

$$\mathrm{PC} + \mathrm{T} = \sum_{f \in F} W_f L_f + \sum_{i \in N} \Pi_i,$$

in which T is an exogenous net transfer to the rest of the world, W_f and L_f are the price and quantity, respectively, of factor f. Π_i denotes sector i's profits.

Firms

Within each sector i there is a representative firm with a constant return to scale (CRS) production function of the form

$$Q_i = Z_i F^i\left(\{L_{if}\}_{f \in F}, \{M_{ij}\}_{j \in N}, \{M_{im}\}_{m \in M}\right).$$

Z_i is a sector specific productivity, L_{if} is demand for factor f by firm i, M_{ij} represents intermediate input demand for good $j \in N$ by firm i, and M_{im} represents input demand for imported good $m \in M$.

The cost minimization for firm i delivers a marginal cost that only depends on productivity and input prices

$$MC_i = MC_i(Z_i, \mathbf{P}_D, \mathbf{P}_M, \mathbf{W}),$$

where $\boldsymbol{W} = \{W_f\}_{f \in F}$ is a vector of factor prices. The assumption of constant returns to scale is key for this result. Moreover, in perfectly competitive markets with constant returns to scale, each firm operates at zero profit:

$$P_i Q_i = \sum_{f \in F} W_f L_{if} + \sum_{j \in N} P_j M_{ij} + \sum_{m \in M} P_m M_{im} \quad \text{for all } i \in N$$

Equilibrium

The market clearing conditions for sectoral output given by

$$Q_i = C_i + X_i + \sum_{j \in N} M_{ji} \quad \text{for each } i \in N$$

X_i is an exogenous variable so that there is always a price that clears the market for each domestically produced good, even if the good is exported.

Nominal Anchor

As this model is in real terms a money rule is needed. Assume the following cash-in-advance constraint

$$\mathrm{PC} \leq Mu = E\,.$$

In the small open economy, the central bank, with money supply (Mu) as an exogenous factor, dictates nominal spending (E) to maintain a set benchmark. By monitoring consumption (C), affected by real factors, can implement any price level (P) accordingly.

Equilibrium is achieved by taking factor prices ($\boldsymbol{W}$) and expenditure (E) as given to pinpoint both feasible and equilibrium allocations.

1. Households select $(\boldsymbol{C_D}, \boldsymbol{C_M})$ to maximize utility, constrained by their budget, based on sequences $(\boldsymbol{W}, \boldsymbol{P_D}, \boldsymbol{P_M}, \boldsymbol{\pi})$ and exogenous parameters (T).
2. Given $(\boldsymbol{W}, \boldsymbol{P_D}, \boldsymbol{P_M})$ and production technologies, firms choose (L_i, M_i) to minimize production costs.
3. Market clearance is achieved given $\boldsymbol{X}$.
4. The cash-in-advance constraint is binding: $PC = Mu = E$

Changes in the price index

Here, the role of imported goods prices and production networks in driving inflation are studied through a log-linear approximation of changes in the consumer price index $\widehat{P}$. This approach examines inflation from a cross-sectional view, rather than the traditional time-based analysis.

The main result in Silva (2023) is summarized in Proposition 1. In particular, consider a perturbation $\left(\widehat{\boldsymbol{Z}}, \widehat{\boldsymbol{W}}, \widehat{\boldsymbol{P}}_{\boldsymbol{m}}\right)$ around some initial equilibrium. Up to a first order, changes in the aggregate price index, $\widehat{P}$, satisfy.

$$\widehat{\mathrm{P}} = -\left(\widetilde{\boldsymbol{\lambda}^{\mathrm{T}}} - \widetilde{\boldsymbol{\lambda}^{\mathrm{T}}}\right)\widehat{\mathbf{Z}} + \left(\widetilde{\boldsymbol{\Lambda}^{\mathrm{T}}} - \widetilde{\boldsymbol{\Lambda}^{\mathrm{T}}}\right)\widehat{\mathbf{W}} + \left(\overline{\mathbf{b}_{\mathrm{M}}^{T}} + \widetilde{\mathbf{b}_{\mathrm{M}}^{T}}\right)\widehat{\boldsymbol{P}_M} \quad (1),$$

where

$$\widetilde{\boldsymbol{\lambda}^{\mathrm{T}}} = \overline{\boldsymbol{x}^{T}}\boldsymbol{\Psi}_{\mathbf{D}}; \quad \widetilde{\boldsymbol{\Lambda}^{\mathrm{T}}} = \overline{\boldsymbol{x}^{T}}\boldsymbol{\Psi}_{\mathbf{D}}\mathbf{A}; \quad \widetilde{\mathbf{b}_{\mathbf{M}^{\mathrm{T}}}} = \overline{\boldsymbol{b}_D^{T}}\boldsymbol{\Psi}_{\mathbf{D}}\boldsymbol{\Gamma}; \quad \boldsymbol{\Psi}_{\mathbf{D}} = (I - \boldsymbol{\Omega}_{\mathbf{D}})^{-1}$$

The first two terms in Equation (1) contain the effects of shocks to sectoral productivity and wages.

The last term considers the effect of changes in import prices. Import prices influence inflation via intersectoral connections and the network-adjusted share of import consumption. Consider a fixed factor prices and the absence of productivity shocks, $\widehat{\boldsymbol{W}} = \boldsymbol{0_F}$ and $\widehat{\boldsymbol{Z}} = \boldsymbol{0_N}$ and examine the effects of import price shocks (be metal price shocks or oil price shocks). Equation (1) becomes:

$$\widehat{P} = \underbrace{\left(\overline{\boldsymbol{b}}_{\boldsymbol{M}}^{\boldsymbol{T}} + \overline{\boldsymbol{b}}_{\boldsymbol{D}}^{\boldsymbol{T}}\boldsymbol{\Psi}_{\boldsymbol{D}}\boldsymbol{\Gamma}\right)}_{\text{Network-adjusted import consumption share}} \widehat{\boldsymbol{P}_{\boldsymbol{M}}} \quad (2).$$

This equation underscores the importance of recognizing both direct import consumption $\left(\overline{\mathbf{b}_{\mathrm{M}}}\right)$ and indirect consumption via imports in domestic production $\left(\overline{\boldsymbol{b}}_{D}^{T}\boldsymbol{\Psi}_{\boldsymbol{D}}\boldsymbol{\Gamma}\right)$, with an emphasis on metals/oil. An increase in metal prices m elevates producer h 's marginal costs $\boldsymbol{\Gamma}_{\mathbf{hm}}$, pushing up prices for their products P_h, and indirectly affecting other goods i through intermediate input networks. This impact, along with sectoral spending on metals(oil), reflects on the consumer price index through consumption shares $\overline{\mathbf{b}}_{\mathrm{D}}$.

The metals and oil exposure considered is then based on Equation (2). For a given country, $\underbrace{\left(\overline{\boldsymbol{b}}_{\boldsymbol{M}}^{\boldsymbol{T}} + \overline{\boldsymbol{b}}_{\boldsymbol{D}}^{\boldsymbol{T}} \boldsymbol{\Psi}_{\boldsymbol{D}} \boldsymbol{\Gamma}\right)}$ is measured. In particular, $\overline{\boldsymbol{b}}_{\boldsymbol{M}}, \overline{\boldsymbol{b}}_{\boldsymbol{D}}, \boldsymbol{\Psi}_{\boldsymbol{D}}, \boldsymbol{\Gamma}$, are the imported share of metals (oil) in household spending, the vector of sectoral domestic consumption expenditures, the domestic Leontief inverse matrix, and the vector of sectoral shares of imported metals (oil) in gross output, respectively.

Intuition from the model

The results from Silva (2023) emphasize two primary mechanisms by which a metal price shock is eventually reflected in the inflationary pressures of a given country, resulting from both the different spending share on goods and the different exposures to metals of each good consumed in that country. On the spending variable, each representative household in each country that consumes a given good will spend a relatively different amount of their income on such a good (for example, 3.29% spend share on cars in the case of Germans compared to 0.84% for the French). This is expected and stems from partially preferences that vary across economies. For example, Germans spend more than 30% more on passenger cars than their French counterparts, who are below the EU average for average car spend. Second and on the exposure variable, a given good consumed in a country is oftentimes differently exposed to metals (for example, 9.65% car exposure to metals in the case of Germany compared to China's 28.06%). This is also to be expected and partially results from the different production cost components across economies. For example, a car produced in Germany has more than three times spending share going to labor costs and R&D costs compared to a car produced in China (Liu, 2018).

Stemming from the interaction of these two variables are two illustrative case scenarios for the two inflationary mechanisms. The first is one with countries with a similar metal exposure but different consumption shares and the second is one with countries with similar consumption shares but different metal exposures. For example, Germans (9.65%) and French (9.94%) cars have a similar metals exposure but as outlined above, French households spend relatively less on cars (0.84%) compared to the German ones (3.29%); hence, Germany's consumer prices would be more impacted by a metals price shock by virtue of the higher spending share, all else equal. Second, Germans (3.29%) and Chinese (2.83%) spend comparable amounts on cars but cars bought by Germans are less exposed to metals (9.65%) compared to their Chinese counterparts (28.06%); thence, China's consumer prices would be more impacted by a metal price shock because of the higher metal exposure even if their final consumption shares are comparable.

1.3 Panel Local Projections

The first empirical exercise aims to gauge the inflation effects of shocks to primary metals prices. To this end we propose the following Local Projection (LP) regression (Jorda, 2005):

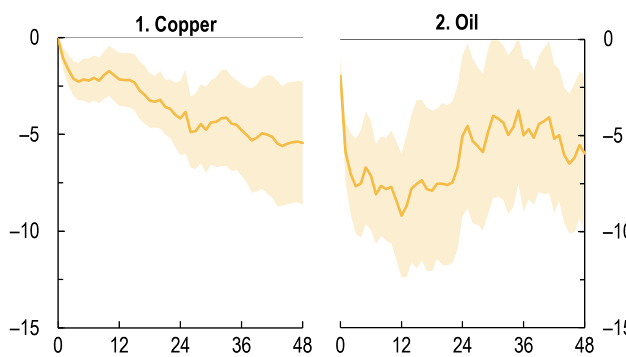
$$\ln CPI_{i,t+h} - \ln CPI_{i,t-1} = \alpha_i^h + \beta_1^h p_t^c + \beta_2^h p_t^c \cdot (z_i - \bar{z}) + \sum_{l=0}^{L} \phi_{xl}^h X_{t-l}^i + \epsilon_{it+h},$$

where $CPI_{i,t+h}$ is the consumer price index (headline or core) of country i at time t+h. α_i is the country fixed effect. p_t^c is log of copper (or oil) price at time t. Prices are deflated using the trend of US CPI derived from the Hodrick-Prescott filter. The set of controls X_{t-l}^i include a global economic activity index, US treasury bill rates, bilateral exchange rates, and excess bond premium, as well as $L = 12$ lags of the log change of inflation and lags of the log copper (oil) prices. We also control contemporaneous and lags of log food prices and oil (copper) prices for the regression for copper (oil). The interaction variable z_i represents country i's network exposure to metals (oil) based on Silva (2023). All data sources are summarized in the Data section. In particular, $z_i = \bar{\boldsymbol{b}}_{\boldsymbol{m}} + \bar{\boldsymbol{b}}_{\boldsymbol{D}}^{\boldsymbol{T}} \boldsymbol{\Psi}_{\boldsymbol{D}} \boldsymbol{\Gamma}_m$, where $\bar{\boldsymbol{b}}_{\boldsymbol{m}}$ is the consumption expenditure share of imported metals (oil) in total household consumption expenditure; $\bar{\boldsymbol{b}}_{\boldsymbol{D}}^{\boldsymbol{T}}$ the vector of domestic consumption expenditure shares, $\boldsymbol{\Psi}_{\boldsymbol{D}}$ the Leontief inverse of the domestic input-output network, and $\boldsymbol{\Gamma}_{\boldsymbol{m}}$ the vector of sectoral intermediate import shares of metals (or oil) in total cost. The term $\beta_1^h p_t^c + \beta_2^h p_t^c \cdot (z_i - \bar{z})$ captures the inflationary impact of an increase in copper (oil) prices.

The identification strategy consists of using commodity price shocks identified in the literature as instruments for copper (oil) prices. There is a small and recent literature identifying shocks to metal prices. For instance, Baumeister, Ohnsorge, and Verduzco-Bustos (2024) construct identified supply and/or demand shocks to copper and aluminum using a Bayesian SVAR with sign restrictions. Boer, Pescatori, and Stuermer (2024) identify annual metal supply and metal-specific demand shocks for four energy transition metals.

We use Baumeister, Ohnsorge, and Verduzco-Bustos (2024) for copper, and Baumeister and Hamilton (2019) for oil. [Online Annex 1.1 Figure1.SF.1] shows responses of real copper price and real oil prices to a one standard deviation shock to copper and oil supply.

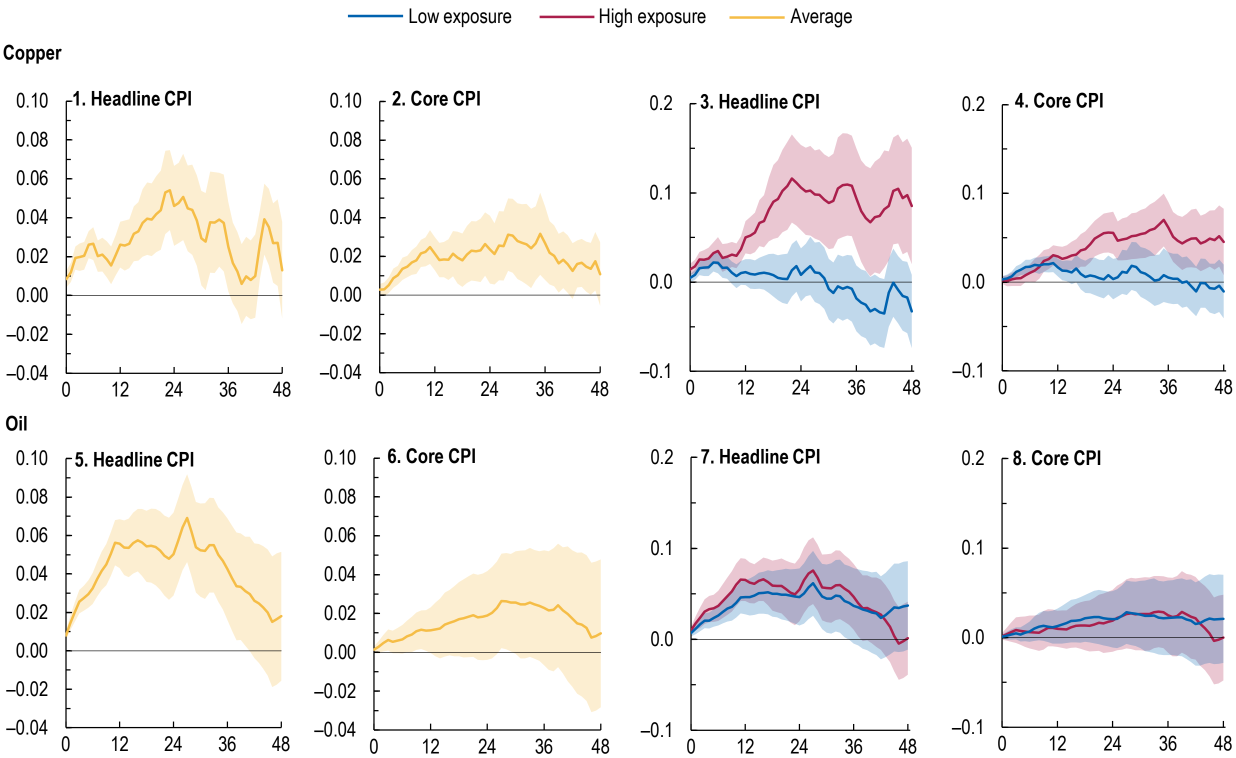
Online Annex Figure 1.SF.1. Responses of Commodity Prices to Supply Shocks
(Percent)



Sources: Baumeister and Hamilton (2019); Baumeister, Ohnsorge, and Verduzco-Bustos (2024); and IMF staff calculations.
Note: Impulse responses of real copper (oil) prices to positive copper (oil) supply shocks. Responses are estimated using local projection, with 12 lags of shocks on the RHS. Shaded areas are 90 percent confidence bands based on Newey-West standard errors with h lags. Sample: 1996:M2 to 2019:M12.

The regression is estimated using monthly data from 1996:m2 to 2019:m12, for a balanced panel with 39 countries. [Online Annex 1.1 Figure1.SF.2] shows impulse responses[4]. We evaluate the impact of a one percent increase in copper prices (top) and oil prices (bottom) with metal (oil) exposure at the 90th and 10th percentiles of our sample. Average shows the average inflationary effect, estimated from running the LP regression without the interaction term.

Online Annex Figure 1.SF.2. Impulse Responses to 1 Percent Increases in Commodity Prices
(Percent)



Sources: Baumeister and Hamilton (2019); Baumeister, Ohnsorge, and Verduzco-Bustos (2024); World Bank; and IMF staff calculations.
Note: Copper = impulse responses to copper supply shock. Oil = impulse responses to oil supply shock. "High exposure" and "Low exposure" indicate the 90th and 10th percentiles of network exposure to metals (for copper shock) and oil (for oil shock). Shaded areas are 90 percent confidence bands. Sample: 1996:M2 to 2019:M12.

Data

We collect data on commodity prices and indices for the period January 1996 to December 2020, at a monthly frequency. We obtain headline CPI and core CPI data from the global inflation database assembled by Ha et al. (2023). For controls variables, we use Global economic activity index from Baumeister et al. (2022), US 1 year treasury bill yield from FRED, bilateral exchange rates from BIS, the Gilchrist and Zakrajšek (2012) excess bond premium (EBP) for the USA.

[4] These results complement the findings in Auer, Levchenko, and Sauré (2019) showing the importance of production networks in shaping the effects of cost shocks, and Silva and others (2024) showing the importance of production networks in shaping the effects of commodity price shocks on sectoral prices.

To correct for the potential endogeneity in copper prices, we use the estimated copper supply shock from Baumeister, Ohnsorge, and Verduzco-Bustos (2024) for the same period. For oil supply shocks, we use Baumeister and Hamilton (2019).

We also collect information on input-output data from the BEA for the US (71 sectors) and from the OECD (45 sectors) for cross-country comparisons for the year 2018. See [Online Annex Table 1.SF.1] and See [Online Annex Table 1.SF.2] for details on the sectoral classification.

Online Annex Table 1.SF.1. BEA Sectoral Classification

Farms	Water transportation
Forestry, fishing, and related activities	Truck transportation
Oil and gas extraction	Transit and ground passenger transportation
Mining, except oil and gas	Pipeline transportation
Support activities for mining	Other transportation and support activities
Utilities	Warehousing and storage
Construction	Publishing industries, except internet (includes software)
Wood products	Motion picture and sound recording industries
Nonmetallic mineral products	Broadcasting and telecommunications
Primary metals	Data processing, internet publishing, and other information services
Fabricated metal products	Federal Reserve banks, credit intermediation, and related activities
Machinery	Securities, commodity contracts, and investments
Computer and electronic products	Insurance carriers and related activities
Electrical equipment, appliances, and components	Funds, trusts, and other financial vehicles
Motor vehicles, bodies and trailers, and parts	Housing
Other transportation equipment	Other real estate
Furniture and related products	Rental and leasing services and lessors of intangible assets
Miscellaneous manufacturing	Legal services
Food and beverage and tobacco products	Computer systems design and related services
Textile mills and textile product mills	Miscellaneous professional, scientific, and technical services
Apparel and leather and allied products	Management of companies and enterprises
Paper products	Administrative and support services
Printing and related support activities	Waste management and remediation services
Petroleum and coal products	Educational services
Chemical products	Ambulatory health care services
Plastics and rubber products	Hospitals
Wholesale trade	Nursing and residential care facilities
Motor vehicle and parts dealers	Social assistance
Food and beverage stores	Performing arts, spectator sports, museums, and related activities
General merchandise stores	Amusements, gambling, and recreation industries

Other retail	Accommodation
Air transportation	Food services and drinking places
Rail transportation	Other services, except government

Sources: U.S. Bureau of Economic Analysis; and IMF staff calculations.
Note: This classification considers the list of sectors used in our empirical analysis.

Online Annex Table 1.SF.2. OECD sectoral classification

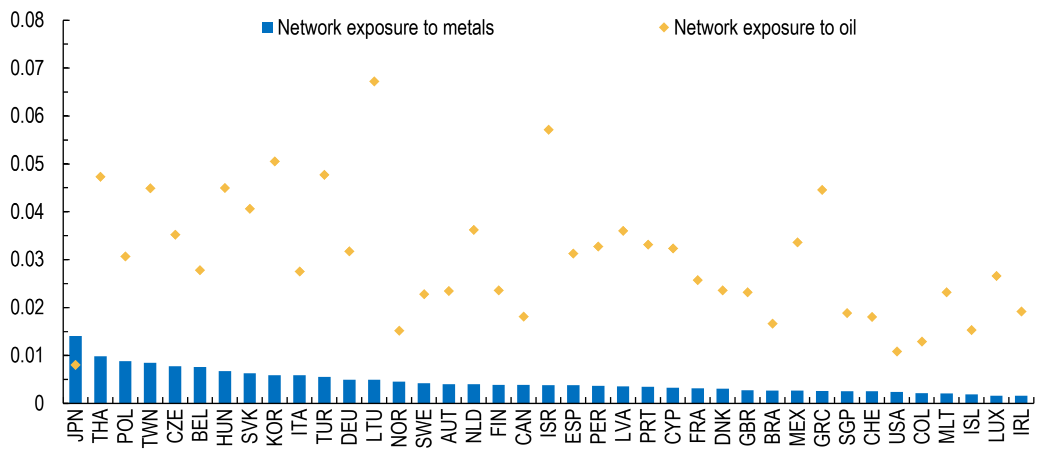
Agriculture, hunting, forestry	Electricity, gas, steam and air conditioning supply
Fishing and aquaculture	Construction
Mining and quarrying, energy producing products	Wholesale and retail trade; repair of motor vehicles
Mining and quarrying, non-energy producing products	Land transport and transport via pipelines
Mining support service activities	Water transport
Food products, beverages and tobacco	Air transport
Textiles, textile products, leather and footwear	Warehousing and support activities for transportation
Wood and products of wood and cork	Postal and courier activities
Paper products and printing	Accommodation and food service activities
Coke and refined petroleum products	Publishing, audiovisual, and broadcasting activities
Chemical and chemical products	Telecommunications
Rubber and plastics products	IT and other information services
Other non-metallic mineral products	Financial and insurance activities
Basic metals	Real estate activities
Fabricated metal products	Professional, scientific, and technical activities
Computer, electronic and optical equipment	Administrative and support services
Electrical equipment	Education
Machinery and equipment, nec	Human health and social work activities
Motor vehicles, trailers, and semi-trailers	Arts, entertainment and recreation
Other transport equipment	Other service activities
Manufacturing nec; repair and installation of machinery and equipment	Water supply; sewerage, waste management and remediation activities
Pharmaceuticals, medicinal chemical and botanical products	Public administration and defence; compulsory social security

Sources: Organisation for Economic Co-operation and Development (OECD); and IMF staff calculations.
Note: This classification considers the list of sectors used in our empirical analysis.

Additional Figures

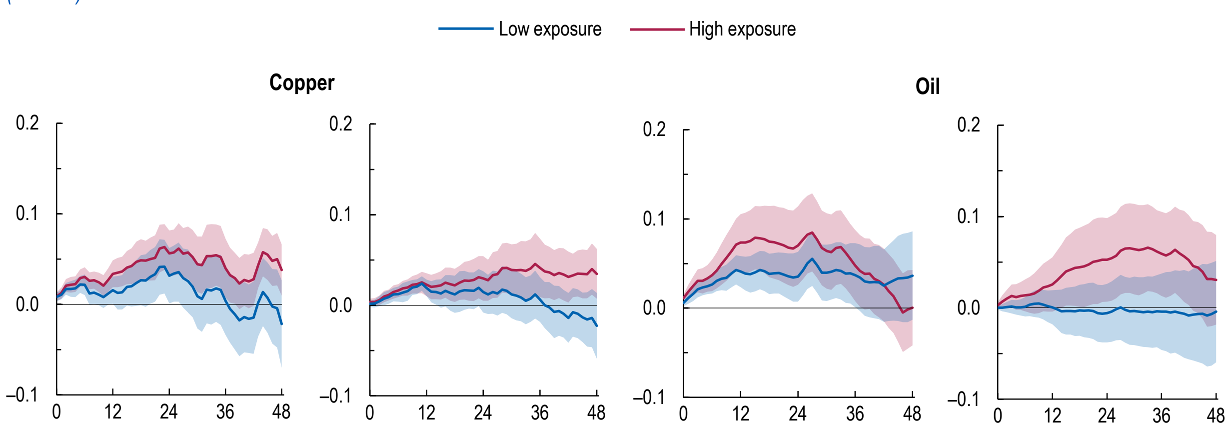
Online Annex 1.1 Figure1.SF.3 shows the network exposure to metals and oil based on Silva (2023) for the 39 economies in our sample. While Online Annex 1.1 Figure1.SF.4 presents additional impulse responses examining the importance of production networks in the transmission of metals (oil) shocks, where we use the metals (oil) consumption share as an exposure measure, i.e., non-network-adjusted exposure.

Online Annex Figure 1.SF.3. Countries' Network Exposure to Metals and Oil
(Percent)



Sources: Organisation for Economic Co-operation and Development (OECD); and IMF staff calculations.
Note: Figure depicts network exposure for the year 2018. Data labels in the figure use International Organization for Standardization (ISO) country code.

Online Annex Figure 1.SF.4. Impulse Responses to 1 percent Increases in Commodity Prices
(Percent)



Sources:Baumeister and Hamilton (2019); Baumeister, Ohnsorge, and Verduzco-Bustos (2024); World Bank; and IMF staff calculations.
Note: Copper = impulse responses to copper supply shock. Oil = impulse responses to oil supply shock. "High exposure" and "Low exposure" indicate the 90th and 10th percentiles of exposure to metals (for copper shock) and oil (for oil shock). Shaded areas are 90 percent confidence bands. Sample: 1996:M2 to 2019:M12.

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