

## 6 Online Appendix

Table A.1: Country distribution

| Country        | Total firms | Sales share (%) |
|----------------|-------------|-----------------|
| Australia      | 1,215       | 81.15           |
| Austria        | 43          | 90.15           |
| Belgium        | 100         | 76.79           |
| Brazil         | 274         | 74.67           |
| Bulgaria       | 51          | 58.61           |
| Canada         | 1,359       | 55.94           |
| China          | 3,793       | 57.71           |
| Croatia        | 51          | 80.53           |
| Cyprus         | 28          | 14.03           |
| Czech Republic | 10          | 85.88           |
| Denmark        | 81          | 44.26           |
| Estonia        | 15          | 87.80           |
| Finland        | 143         | 91.94           |
| France         | 475         | 71.08           |
| Germany        | 376         | 84.84           |
| Greece         | 97          | 85.83           |
| Indonesia      | 535         | 81.34           |
| Ireland        | 8           | 6.60            |
| Italy          | 289         | 66.76           |
| Japan          | 3,405       | 90.93           |
| Latvia         | 7           | 90.04           |
| Lithuania      | 22          | 82.20           |
| Luxembourg     | 3           | 45.38           |
| Poland         | 334         | 86.09           |
| South Korea    | 1,820       | 81.75           |
| Spain          | 200         | 66.28           |
| Switzerland    | 157         | 85.14           |
| United Kingdom | 884         | 70.40           |
| United States  | 4,000       | 88.09           |
| Total          | 19,974      | 19,974          |

Notes: The table shows the distribution of firms included in the sample across countries. Column (2) presents the share of sales by stock-listed firms covered in the sample relative to all stock-listed firms in Orbis.

Table A.2: Aggregate trade dependence on Russia and Ukraine by country

| Country        | Trade Dependence on Russia <sub>c</sub> | Trade Dependence on Ukraine <sub>c</sub> |
|----------------|-----------------------------------------|------------------------------------------|
| Australia      | 0.12                                    | 0.01                                     |
| Austria        | 1.38                                    | 0.28                                     |
| Belgium        | 1.71                                    | 0.23                                     |
| Brazil         | 0.24                                    | 0.01                                     |
| Bulgaria       | 4.77                                    | 1.37                                     |
| Canada         | 0.10                                    | 0.01                                     |
| China          | 0.76                                    | 0.09                                     |
| Croatia        | 2.70                                    | 0.14                                     |
| Cyprus         | 3.05                                    | 0.26                                     |
| Czech Republic | 3.33                                    | 0.82                                     |
| Denmark        | 1.26                                    | 0.15                                     |
| Estonia        | 9.44                                    | 0.92                                     |
| Finland        | 5.04                                    | 0.12                                     |
| France         | 0.55                                    | 0.08                                     |
| Germany        | 1.37                                    | 0.21                                     |
| Greece         | 2.03                                    | 0.28                                     |
| Indonesia      | 0.22                                    | 0.10                                     |
| Ireland        | 0.51                                    | 0.08                                     |
| Italy          | 1.25                                    | 0.22                                     |
| Japan          | 0.39                                    | 0.02                                     |
| Latvia         | 15.83                                   | 1.36                                     |
| Lithuania      | 7.42                                    | 2.84                                     |
| Luxembourg     | 0.34                                    | 0.11                                     |
| Poland         | 2.92                                    | 1.24                                     |
| South Korea    | 1.47                                    | 0.04                                     |
| Spain          | 0.42                                    | 0.17                                     |
| Switzerland    | 0.92                                    | 0.24                                     |
| United Kingdom | 0.60                                    | 0.05                                     |
| United States  | 0.12                                    | 0.01                                     |
| Average        | 2.42                                    | 0.40                                     |

Notes: The table shows the share of exports plus imports to Russia and Ukraine as a percentage of GDP in 2019 expressed in percentage points. The last row shows the average in the shares across countries. The country-level trade data come from the International Monetary Fund and the GDP data from the World Bank.

Table A.3: Top 10 industries in the EU by trade dependence on Russia

| Industry                                                  | Trade Dependence on Russia |
|-----------------------------------------------------------|----------------------------|
| Manufacture of coke and refined petroleum products        | 14.64                      |
| Printing and reproduction of recorded media               | 8.06                       |
| Fishing and aquaculture                                   | 3.61                       |
| Manufacture of motor vehicles, trailers and semi-trailers | 3.54                       |
| Manufacture of basic metals                               | 3.51                       |
| Manufacture of chemicals and chemical products            | 3.41                       |
| Electricity, gas, steam, and air conditioning supply      | 2.91                       |
| Manufacture of other non-metallic mineral products        | 2.36                       |
| Manufacture of machinery and equipment n.e.c.             | 2.21                       |
| Mining of coal and lignite                                | 2.17                       |

Notes: The table shows the average trade dependence on Russia across firms in the EU for the ten industries with the highest dependence.

Table A.4: Cumulative returns and international linkages to Russia and Ukraine

| Outcome                                                             | (1)<br>CR(t-14, t+14)  | (2)<br>CR(t-14, t+14)  | (3)<br>CR(t-14, t+14)  | (4)<br>CR(t-14, t+14)  |
|---------------------------------------------------------------------|------------------------|------------------------|------------------------|------------------------|
| $\mathbb{1}(\text{Trade Dependence on Russia in top decile}_{jc})$  | -0.0168***<br>(0.0059) | -0.0168***<br>(0.0058) | -0.0175***<br>(0.0060) | -0.0174***<br>(0.0060) |
| $\mathbb{1}(\text{Trade Dependence on Ukraine in top decile}_{jc})$ | 0.0061<br>(0.0066)     | 0.0063<br>(0.0064)     | 0.0070<br>(0.0062)     | 0.0074<br>(0.0063)     |
| $\mathbb{1}(\text{Affiliate in Russia}_i)$                          | -0.0241***<br>(0.0066) | -0.0242***<br>(0.0066) | -0.0259***<br>(0.0067) | -0.0261***<br>(0.0066) |
| $\mathbb{1}(\text{Affiliate in Ukraine}_i)$                         | -0.0013<br>(0.0107)    | -0.0014<br>(0.0108)    | -0.0022<br>(0.0107)    | -0.0022<br>(0.0107)    |
| $\mathbb{1}(\text{Affiliate in Region}_i)$                          | -0.0091*<br>(0.0049)   | -0.0093*<br>(0.0049)   | -0.0122**<br>(0.0052)  | -0.0117**<br>(0.0051)  |
| Controls                                                            | Yes                    | Yes                    | Yes                    | Yes                    |
| $R^2$                                                               | 0.119                  | 0.119                  | 0.124                  | 0.129                  |
| Number of firms                                                     | 19,774                 | 19,774                 | 19,774                 | 19,774                 |

Notes: Estimates of equation (2). The outcome variable in all columns is the cumulative return for a time window of four weeks centered around the start of the war. The regression controls for the top decile of trade dependence on Russia and Ukraine, based on data from the OECD ICIO Tables for 2019. The other regressors are explained in Table 2. All regressions control for country and industry fixed effects. The standard errors are clustered at the industry-level.

Table A.5: Cumulative returns and international linkages to Russia - heterogeneity

| Outcome                                                                                                                             | (1)<br>CR(t-14, t+14)  | (2)<br>CR(t-14, t+14)  |
|-------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------|
| $\mathbb{1}(\text{Trade Dependence on Russia in top decile}_{jc})$                                                                  | -0.0219**<br>(0.0099)  | -0.0159<br>(0.0096)    |
| $\mathbb{1}(\text{Trade Dependence on Russia in top decile}_{jc})$<br>$\times \mathbb{1}(\text{Affiliate in Russia}_i)$             | -0.0206**<br>(0.0095)  |                        |
| $\mathbb{1}(\text{Trade Dependence on Russia in top decile}_{jc})$<br>$\times \mathbb{1}(\text{Total assets in second quartile}_i)$ |                        | -0.0081<br>(0.0090)    |
| $\mathbb{1}(\text{Trade Dependence on Russia in top decile}_{jc})$<br>$\times \mathbb{1}(\text{Total assets in third quartile}_i)$  |                        | -0.0005<br>(0.0094)    |
| $\mathbb{1}(\text{Trade Dependence on Russia in top decile}_{jc})$<br>$\times \mathbb{1}(\text{Total assets in top quartile}_i)$    |                        | -0.0216**<br>(0.0104)  |
| $\mathbb{1}(\text{Affiliate in Russia}_i)$                                                                                          | -0.0212***<br>(0.0062) | -0.0206***<br>(0.0067) |
| $\mathbb{1}(\text{Affiliate in Ukraine}_i)$                                                                                         | -0.0024<br>(0.0103)    | 0.0033<br>(0.0106)     |
| $\mathbb{1}(\text{Affiliate in Region}_i)$                                                                                          | -0.0174***<br>(0.0048) | -0.0113**<br>(0.0050)  |
| Controls                                                                                                                            | Yes                    | Yes                    |
| $R^2$                                                                                                                               | 0.106                  | 0.131                  |
| Number of firms                                                                                                                     | 19,774                 | 19,774                 |

Notes: Estimates of equation (2). The outcome variable in all columns is the cumulative return for a time window of four weeks centered around the start of the war. In column (1) trade dependence is interacted with a dummy capturing whether the firm owns an affiliate in Russia. In column (2) trade dependence is interacted with dummies capturing the firm' position in the distribution of total assets defined based on quartiles. The omitted category is the first quartile in the firms' total assets distribution. The other regressors are explained in Table 2. All regressions control for country and industry fixed effects. The standard errors are clustered at the industry-level.

Table A.6: Cumulative returns and international linkages to Russia - non-linearity

| Outcome                                                              | (1)                          | (2)                       | (3)                       |
|----------------------------------------------------------------------|------------------------------|---------------------------|---------------------------|
|                                                                      | CR(t-14, t+14)<br>Linear Dep | CR(t-14, t+14)<br>P50 Dep | CR(t-14, t+14)<br>P75 Dep |
| Total Dependence on Russia <sub>jc</sub>                             | -0.2283<br>(0.1622)          |                           |                           |
| $\mathbb{1}(\text{Trade Dependence on Russia in top half}_{jc})$     |                              | -0.0036<br>(0.0070)       |                           |
| $\mathbb{1}(\text{Trade Dependence on Russia in top quartile}_{jc})$ |                              |                           | -0.0126*<br>(0.0066)      |
| $\mathbb{1}(\text{Affiliate in Russia}_i)$                           | -0.0265***<br>(0.0066)       | -0.0265***<br>(0.0066)    | -0.0263***<br>(0.0066)    |
| $\mathbb{1}(\text{Affiliate in Ukraine}_i)$                          | -0.0020<br>(0.0105)          | -0.0020<br>(0.0106)       | -0.0015<br>(0.0107)       |
| $\mathbb{1}(\text{Affiliate in Region}_i)$                           | -0.0120**<br>(0.0052)        | -0.0119**<br>(0.0051)     | -0.0122**<br>(0.0053)     |
| Controls                                                             | Yes                          | Yes                       | Yes                       |
| $R^2$                                                                | 0.128                        | 0.128                     | 0.129                     |
| Number of firms                                                      | 19,774                       | 19,774                    | 19,774                    |

Notes: Estimates of equation (2). The outcome variable in all columns is the cumulative return for a time window of four weeks centered around the start of the war. The three columns only differ in the measure of trade dependence used. In column (1), trade dependence on Russia enters as a continuous measure. Columns (2) and (3) present alternative definitions of the trade dependence dummy: in column (2) the median is used as the cut-off and in column (3) p75 is used as the cut-off. The other regressors are explained in Table 2. All regressions control for country and industry fixed effects. The standard errors are clustered at the industry-level.

Table A.7: Cumulative returns and international linkages to Russia - alternative measurement multinationals

| Outcome                                                            | (1)<br>CR(t-14, t+14)  | (2)<br>CR(t-14, t+14)  |
|--------------------------------------------------------------------|------------------------|------------------------|
| $\mathbb{1}(\text{Trade Dependence on Russia in top decile}_{jc})$ | -0.0227***<br>(0.0056) | -0.0221***<br>(0.0057) |
| Sales share Russia <sub>i</sub> (std.)                             | -0.0037*<br>(0.0022)   |                        |
| $\mathbb{1}(\text{Affiliate in Ukraine}_i)$                        | -0.0122<br>(0.0101)    |                        |
| $\mathbb{1}(\text{Affiliate in Region}_i)$                         | -0.0149**<br>(0.0057)  |                        |
| Share affiliates in Russia <sub>i</sub>                            |                        | -0.1455***<br>(0.0348) |
| Share affiliates in Ukraine <sub>i</sub>                           |                        | -0.0026<br>(0.0589)    |
| Share affiliates in Region <sub>i</sub>                            |                        | -0.0234***<br>(0.0088) |
| $\ln(\text{number affiliates}_i + 1)$                              |                        | -0.0018<br>(0.0011)    |
| Controls                                                           | Yes                    | Yes                    |
| $R^2$                                                              | 0.130                  | 0.130                  |
| Number of firms                                                    | 19,613                 | 19,774                 |

Notes: Estimates of equation (2). The outcome variable in all columns is the cumulative return for a time window of four weeks centered around the start of the war. Column (1) provides estimates based on the standardized sales share of Russian affiliates relative to the firms' sales. Column (2) presents estimates where affiliate presence is proxied by the share of affiliates in each region relative to the overall number of affiliates and also includes the log of the number of foreign affiliates of a firm. The regressors other are explained in Table 2. All regressions control for country and industry fixed effects. The standard errors are clustered at the industry-level.

Table A.8: Cumulative returns and international linkages to Russia - further robustness checks

| Outcome                                                            | (1)<br>CR(t-14, t+14)<br>Baseline | (2)<br>CR(t-14, t+14)<br>Core Industry Dep | (3)<br>CR(t-14, t+14)<br>Asian firms |
|--------------------------------------------------------------------|-----------------------------------|--------------------------------------------|--------------------------------------|
| $\mathbb{1}(\text{Trade Dependence on Russia in top decile}_{jc})$ | -0.0220***<br>(0.0057)            | -0.0199***<br>(0.0061)                     | -0.0297***<br>(0.0071)               |
| Affiliate in Russia <sub>i</sub>                                   | -0.0258***<br>(0.0066)            | -0.0259***<br>(0.0066)                     | -0.0340***<br>(0.0086)               |
| Affiliate in Ukraine <sub>i</sub>                                  | -0.0007<br>(0.0106)               | -0.0009<br>(0.0106)                        | -0.0014<br>(0.0110)                  |
| Affiliate in Region <sub>i</sub>                                   | -0.0125**<br>(0.0053)             | -0.0125**<br>(0.0053)                      | -0.0102*<br>(0.0059)                 |
| Controls                                                           | Yes                               | Yes                                        | Yes                                  |
| $R^2$                                                              | 0.130                             | 0.129                                      | 0.177                                |
| Number of firms                                                    | 19,774                            | 19,774                                     | 10,219                               |

Notes: Estimates of equation (2). The outcome variable in all columns is the cumulative return for a time window of four weeks centered around the start of the war. Column (1) presents the results of our preferred baseline specification. In column (2), the dummy for trade dependence on Russia is defined for firms operating in multiple industries based on the value of trade dependence of the core industry in which the firm operates in its headquarters location instead of the average value across all industries in which they operate. The core industry of the firm is defined in Orbis as core business activity of a company. Column (3) presents the results of our baseline specification excluding Asian firms from the sample. The other regressors are explained in Table 2. All regressions control for country and industry fixed effects. The standard errors are clustered at the industry-level.

Table A.9: Cumulative returns and international linkages to Russia - time windows

| Outcome                                                            | (1)<br>CR(t-1, t+7)    | (2)<br>CR(t-7, t+7)    | (3)<br>CR(t-1, t+14)   | (4)<br>CR(t-1, t+28)   | (5)<br>CR(t-28, t+28)  | (6)<br>CR(t-1, t+84)  |
|--------------------------------------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|-----------------------|
| $\mathbb{1}(\text{Trade Dependence on Russia in top decile}_{jc})$ | -0.0052*<br>(0.0027)   | -0.0119***<br>(0.0030) | -0.0100***<br>(0.0037) | -0.0090<br>(0.0064)    | -0.0181***<br>(0.0061) | -0.0229**<br>(0.0097) |
| $\mathbb{1}(\text{Affiliate in Russia}_i)$                         | -0.0211***<br>(0.0042) | -0.0172***<br>(0.0051) | -0.0276***<br>(0.0053) | -0.0264***<br>(0.0054) | -0.0347***<br>(0.0071) | -0.0131<br>(0.0096)   |
| $\mathbb{1}(\text{Affiliate in Ukraine}_i)$                        | -0.0079<br>(0.0063)    | -0.0056<br>(0.0076)    | -0.0045<br>(0.0080)    | -0.0059<br>(0.0074)    | 0.0002<br>(0.0097)     | 0.0087<br>(0.0120)    |
| $\mathbb{1}(\text{Affiliate in Region}_i)$                         | -0.0046*<br>(0.0026)   | -0.0071**<br>(0.0032)  | -0.0109***<br>(0.0038) | -0.0054<br>(0.0042)    | -0.0071<br>(0.0064)    | 0.0075<br>(0.0065)    |
| Controls                                                           | Yes                    | Yes                    | Yes                    | Yes                    | Yes                    | Yes                   |
| $R^2$                                                              | 0.122                  | 0.165                  | 0.127                  | 0.130                  | 0.114                  | 0.152                 |
| Number of firms                                                    | 19,774                 | 19,774                 | 19,774                 | 19,774                 | 19,774                 | 13,685                |

Notes: Estimates of equation (2). The outcome variable in columns (1) to (6) is the cumulative return for different time windows increasing in length from column (1) to column (6) around the Russian invasion into Ukraine. While in columns (2) and (5) the time windows are centered around the start of the war and respectively consider a two-week and eight-week window, the windows in columns (1), (3), (4) and (6) all start 1 day prior to the start of the war and consider respectively 7, 14, 28, and 84 days after the start of the war. The regressors are explained in Table 2. All regressions control for country and industry fixed effects. The standard errors are clustered at the industry-level.