Global Trade Reallocation and Welfare Implications of the Russia-Ukraine War for Cereal Grains and Oilseeds

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- **Ukrainian grains appear to exhibit a lower degree of substitutability** compared to Ukrainian oilseeds.

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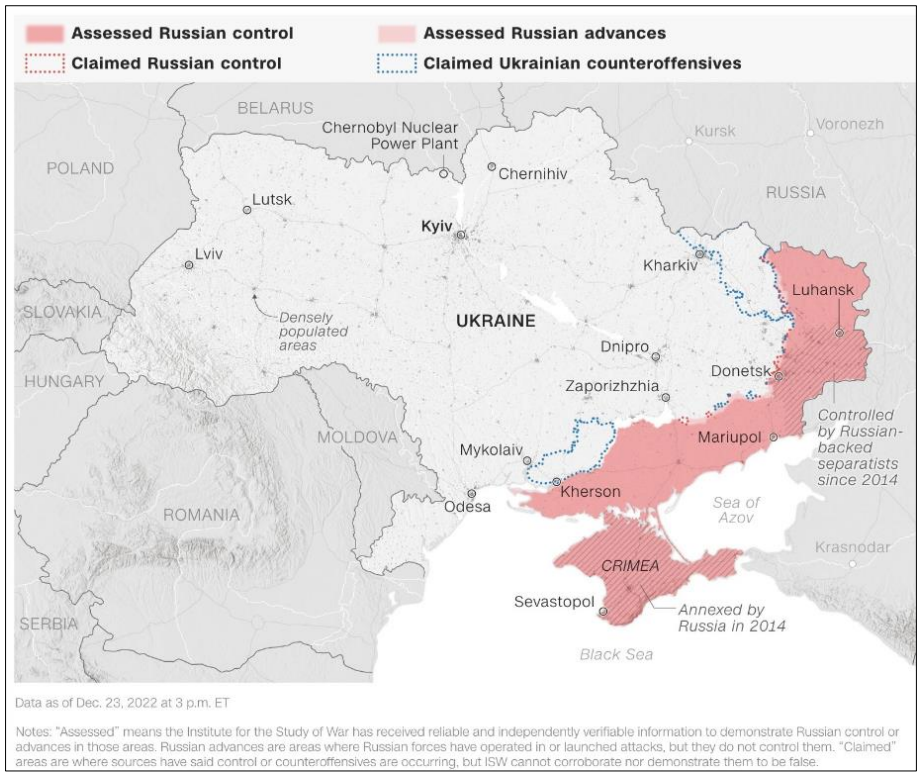
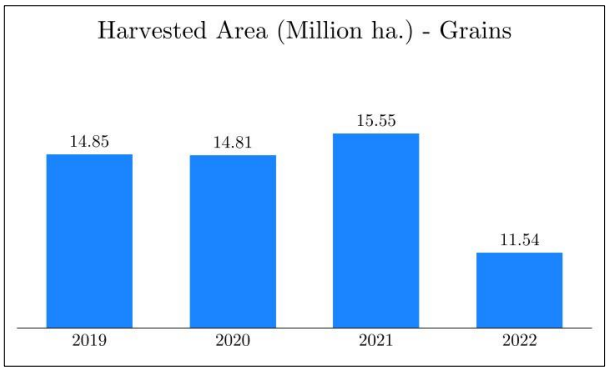
- **More than 55% of Ukraine's land area is arable land**, and agriculture provides employment for 14% of its population (USDA 2022).





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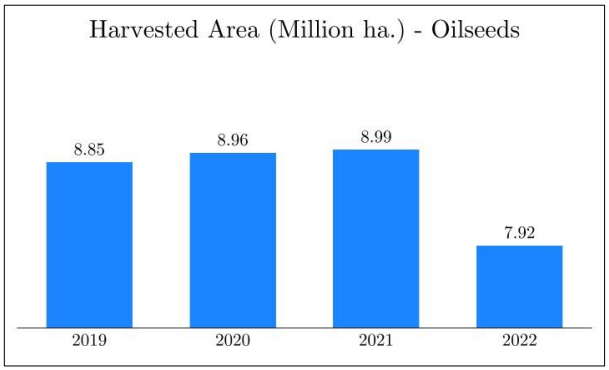

11-12% lower in 2023

Note. The map of Ukranian land controlled by Russia is taken from CNN (2023). Harvested area statistics is taken from FAO (2024). Grains include: Barley, Buckwheat, Maize (corn), Oats, Rice, Rye, Sorghum, and Wheat. Oilseeds include: Flax, raw or retted, Rape or colza seed, Soya beans, and Sunflower seed

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1. What are the **implications of the Russia-Ukraine war on the global international market for grains and oilseeds**?
2. **Who are the winners and losers** resulting from the adjustments in the global international market due to the Russia-Ukraine war? - (*Welfare analysis pending*)

Contribution

- A growing body of literature explores the economic **consequences of the Russia-Ukraine war.**

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- **Ahn, Kim, and Steinbach (2023) use a commodity-level empirical model** to assess the counterfactual trade effects and evaluate trade reallocation effects of the conflict.
- We assess the implications of the Russia-Ukraine conflict on the global markets of grains and oilseeds, **focusing on major importers and exporters.**
- We employ a gravity framework as outlined by Ridley and Devadoss (2023), which, in turn, builds upon the **General Equilibrium PPML (GEPPML) estimator** developed by Anderson, Larch, and Yotov (2018).

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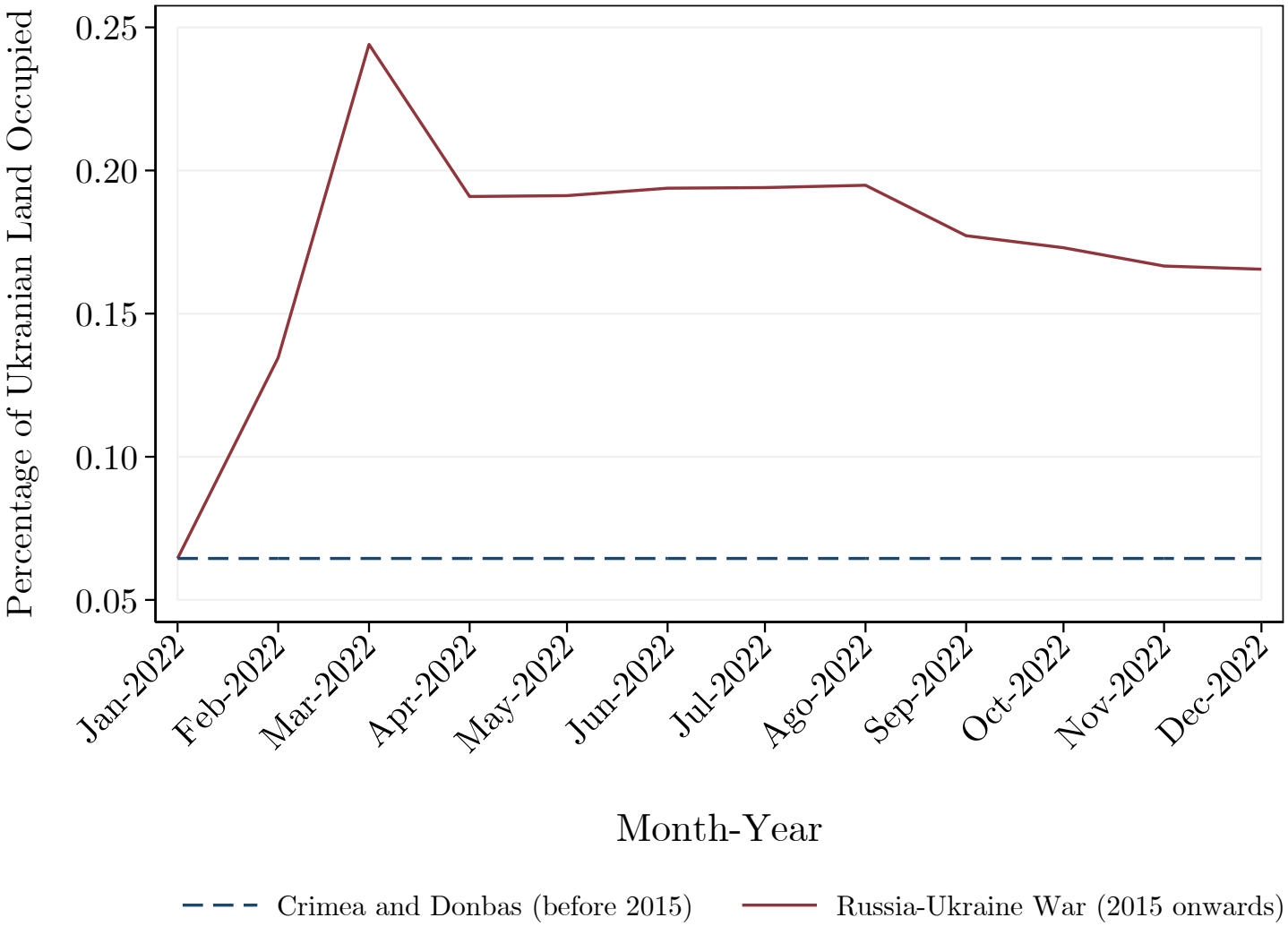
- We use the classification of food imports from the USDA ERS (2023) to identify two groups of goods: **Grains**, and **Oilseeds**.
- We also obtain the **monthly area of Ukranian land occupied by Russia in 2022** (excluding Crimea and the Donbas) from the French Newspaper Le Monde (2023).

◂ Details

Percentage of Ukranian Land Occupied by Russia



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Gravity Framework

- Following Anderson and Wincoop (2003) and Olivero and Yotov (2012), we depict trade flows from exporter i to importer j in month t like:

$$X_{ijt} = \frac{Y_{it}E_{jt}}{Y_t}\left(\frac{\varphi_{ijt}}{\Pi_{it}P_{jt}}\right)^{1-\sigma} \tag{1}$$

  where X_{ijt} is an import flow measured in million tonnes (t).

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- Π_{it} and P_{jt} are the multilateral resistance terms, and $\sigma > 1$ is the elasticity of substitution.

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Following Ridley and Devadoss (2023), we propose a three-way structural gravity model

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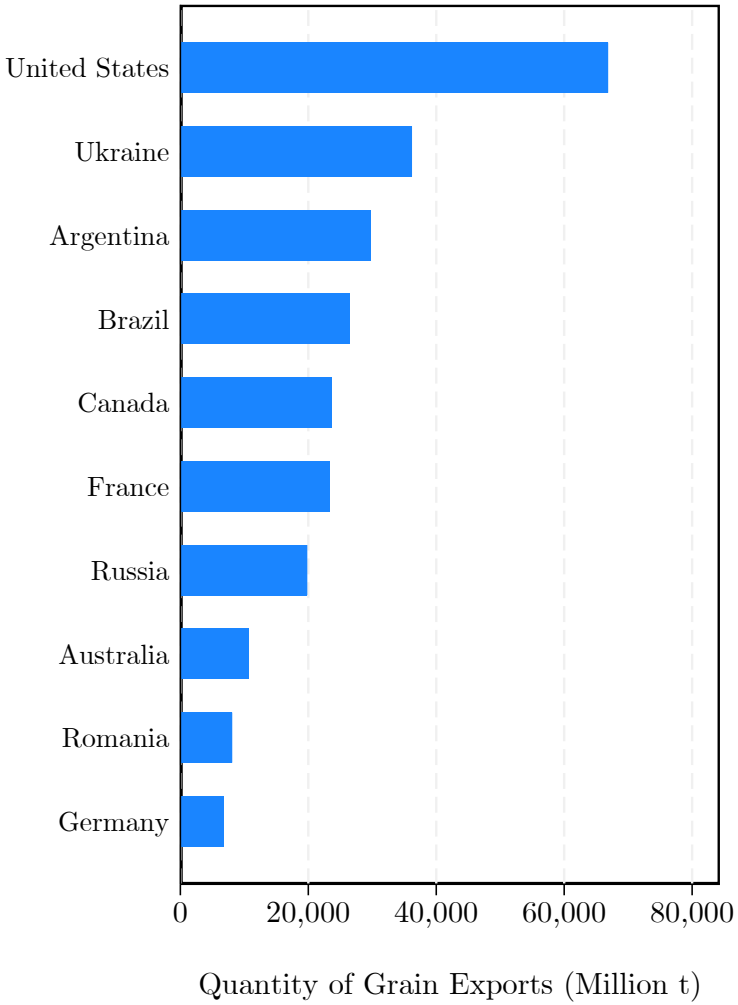
- We repeat the interactions for **eight additional exporters.**

Major Exporters and Importers of Grains in 2019



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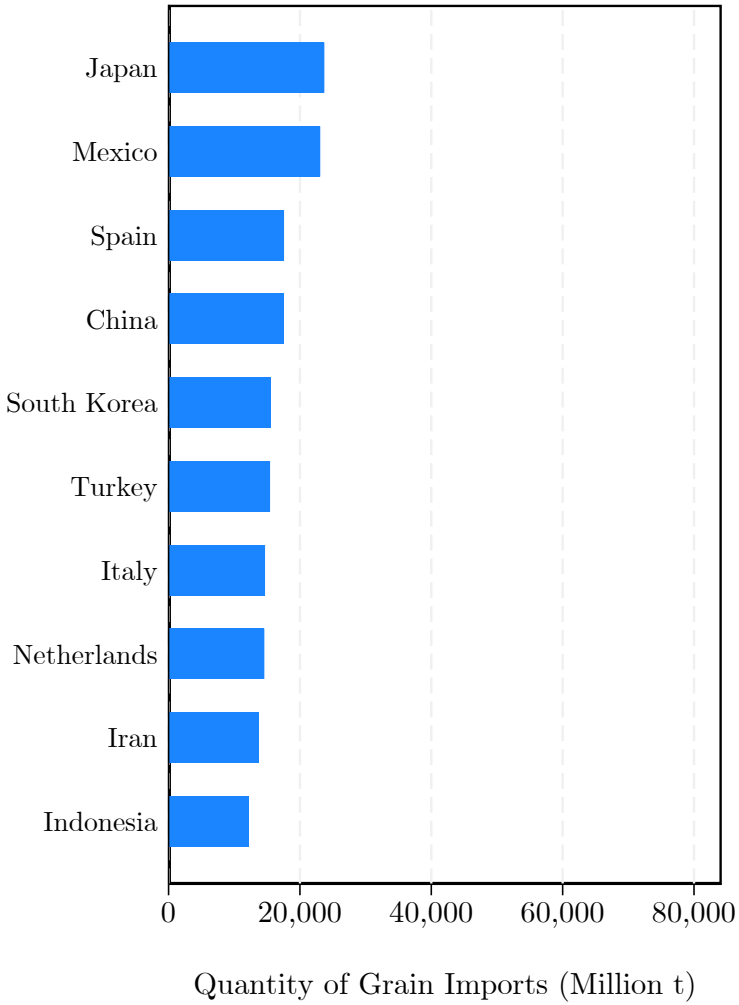
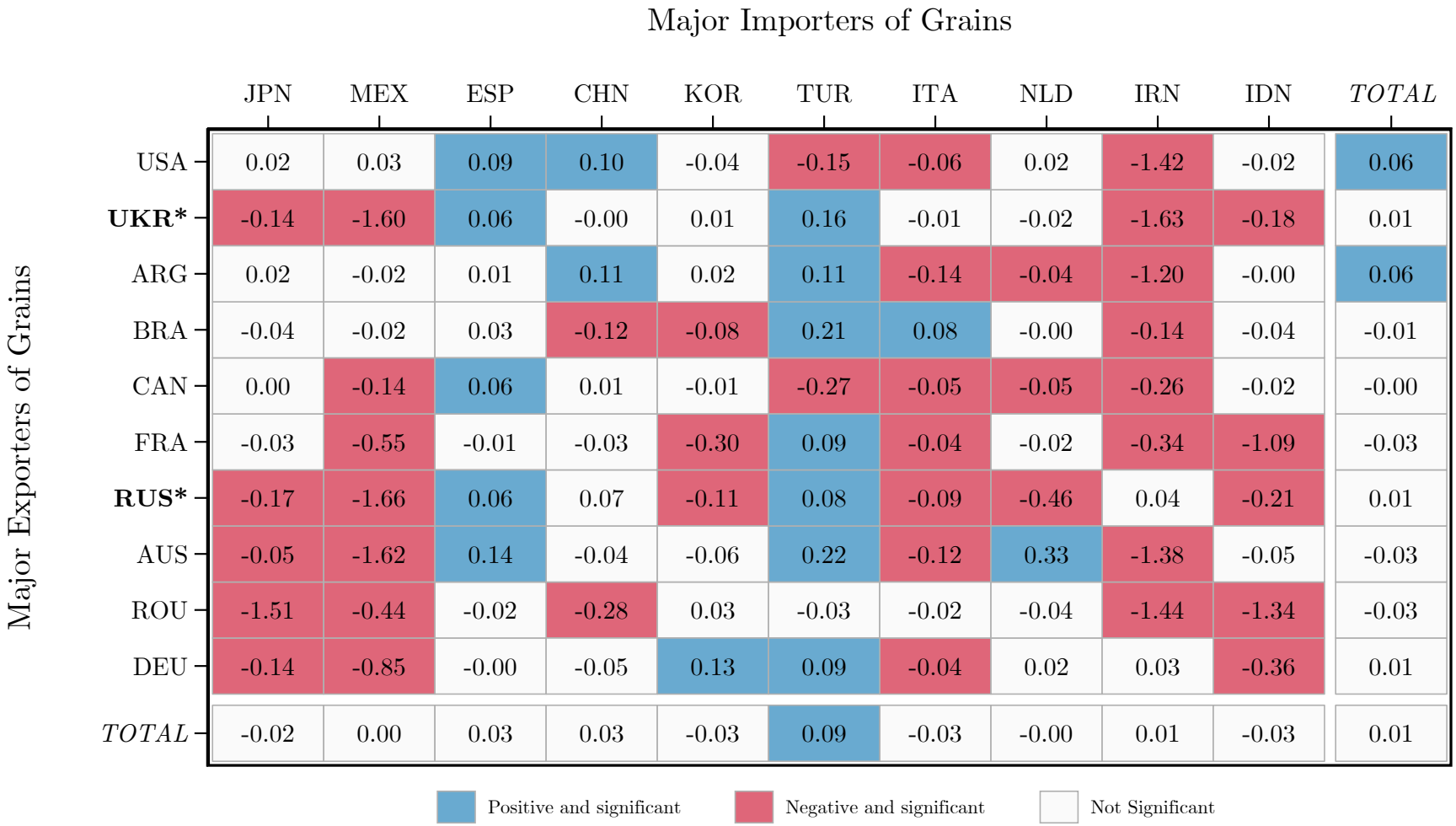


(b) Major Importers of Grains.

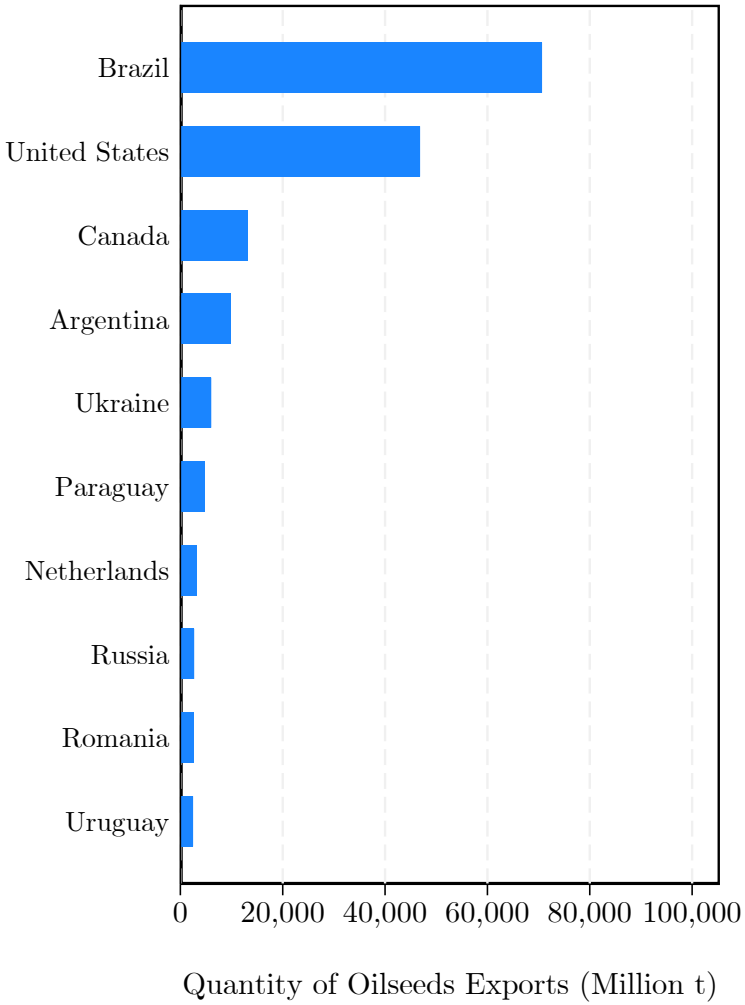
Note. The values are expressed in millions of tonnes (t).

PPML Gravity Regression Coefficient Estimates - Grains



Note. Major exporters and exporters importers are picked based on 2019 data. Cells contain the values of the estimated gravity regression coefficients of the interaction between the exporter and importer indicators and the log of the Ukranian land occupied by Russia. Regression results are derived from 656,371 observations, with an R^2 of 0.918. * Marked to highlight.

Major Exporters and Importers of Oilseeds in 2019



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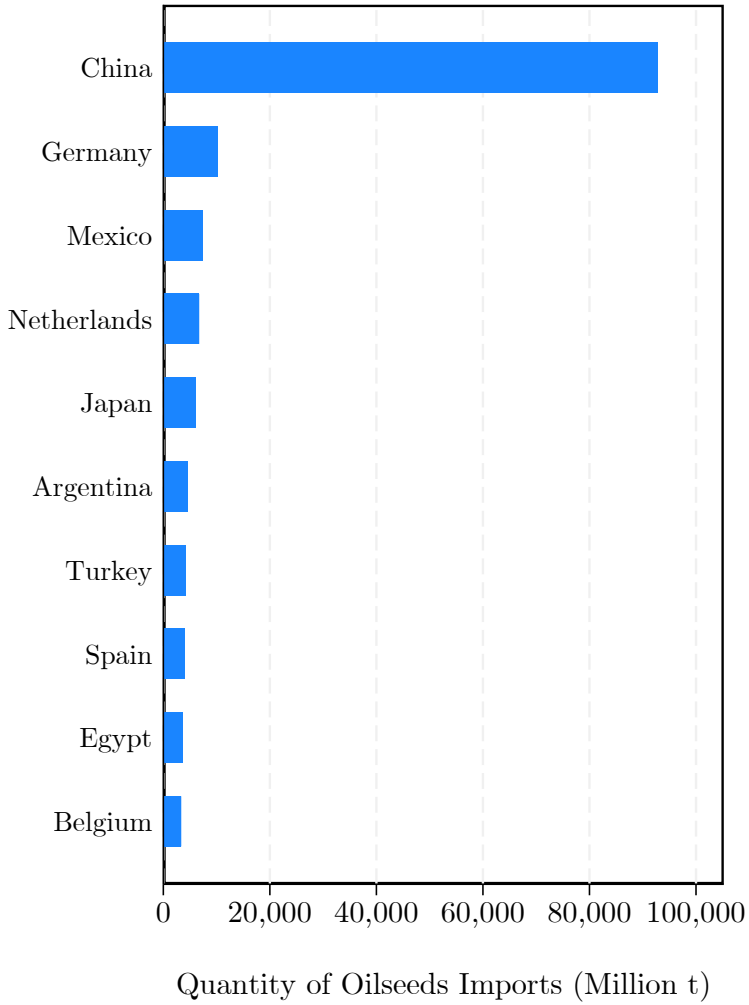

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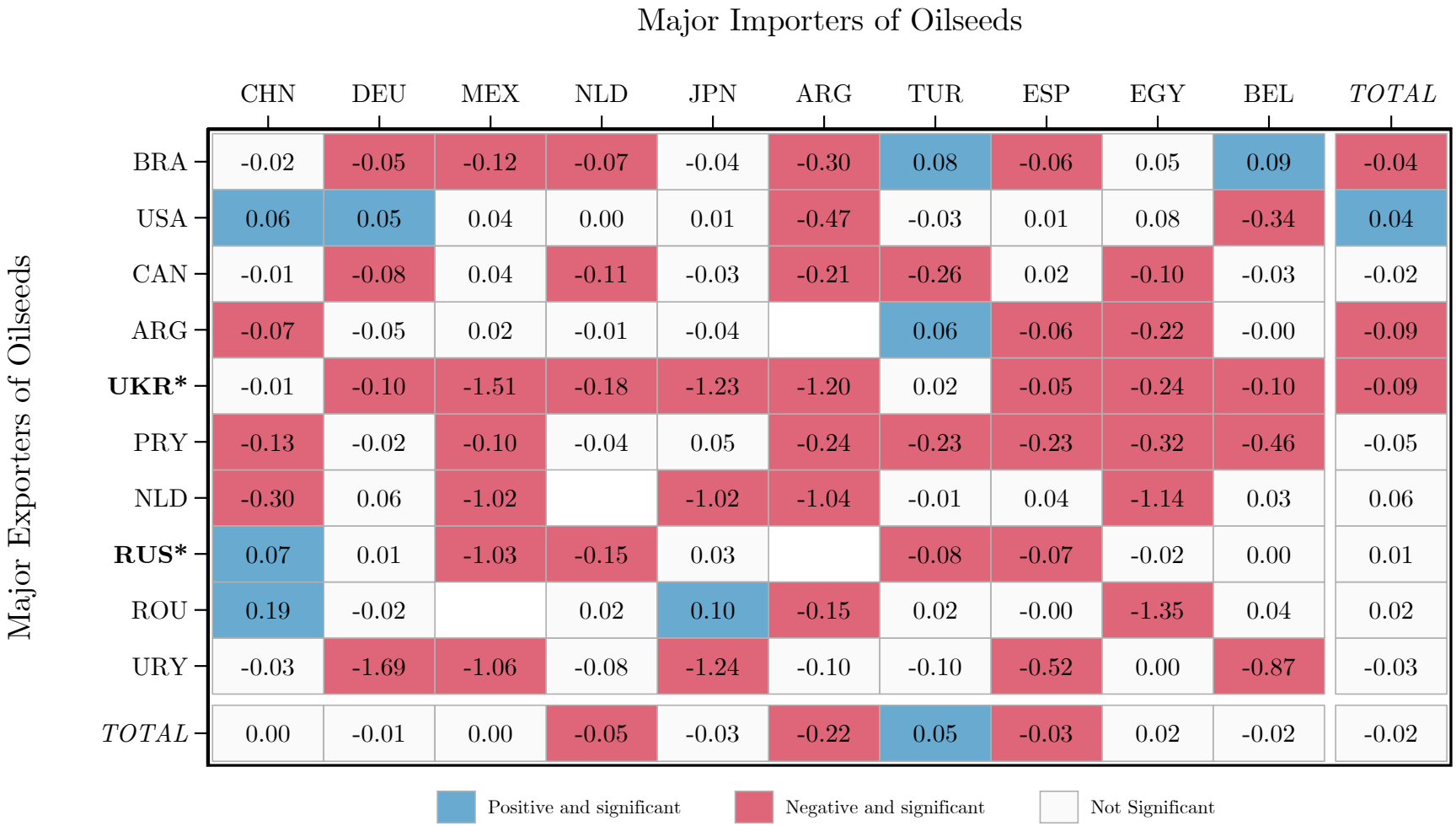

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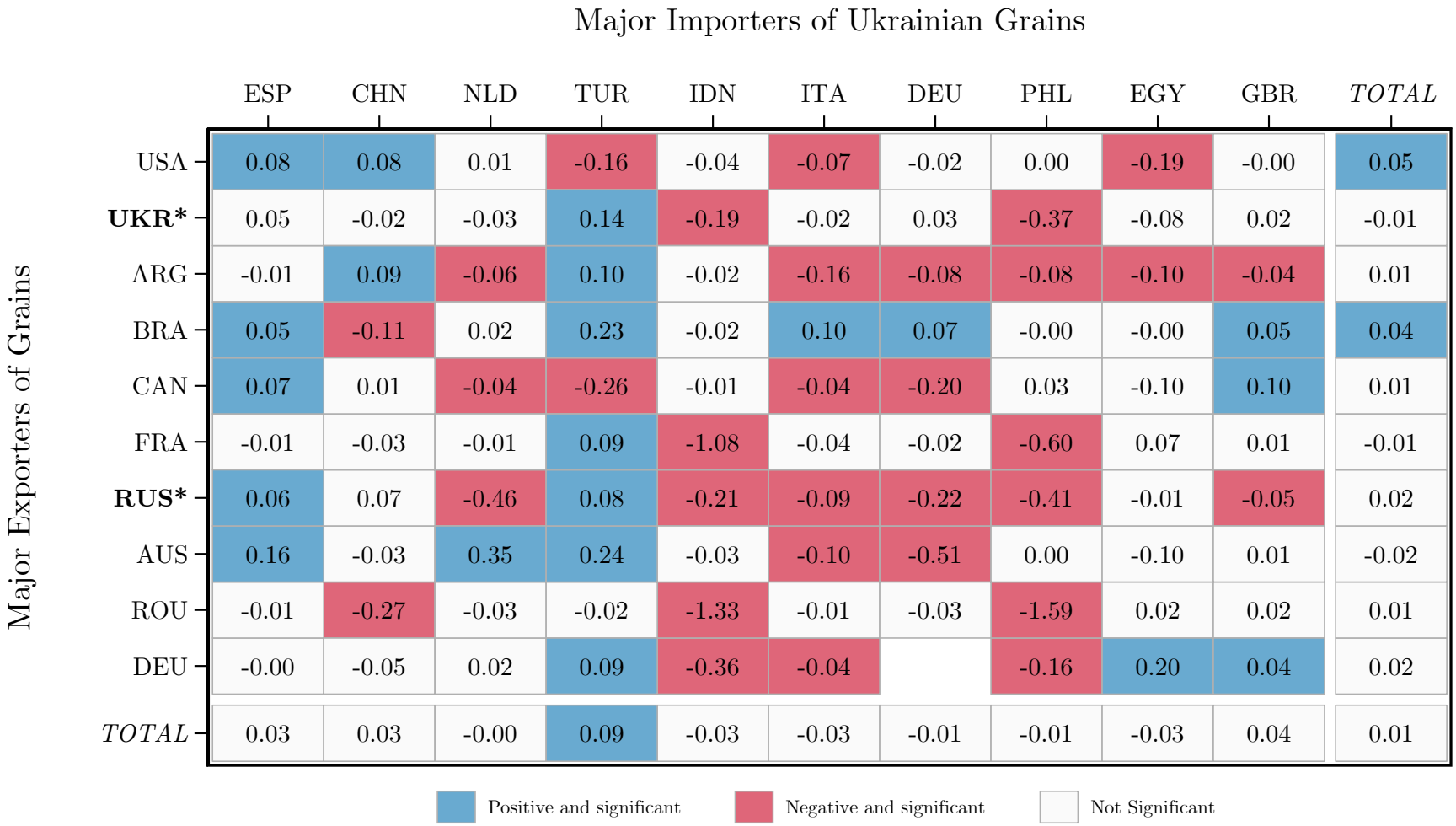

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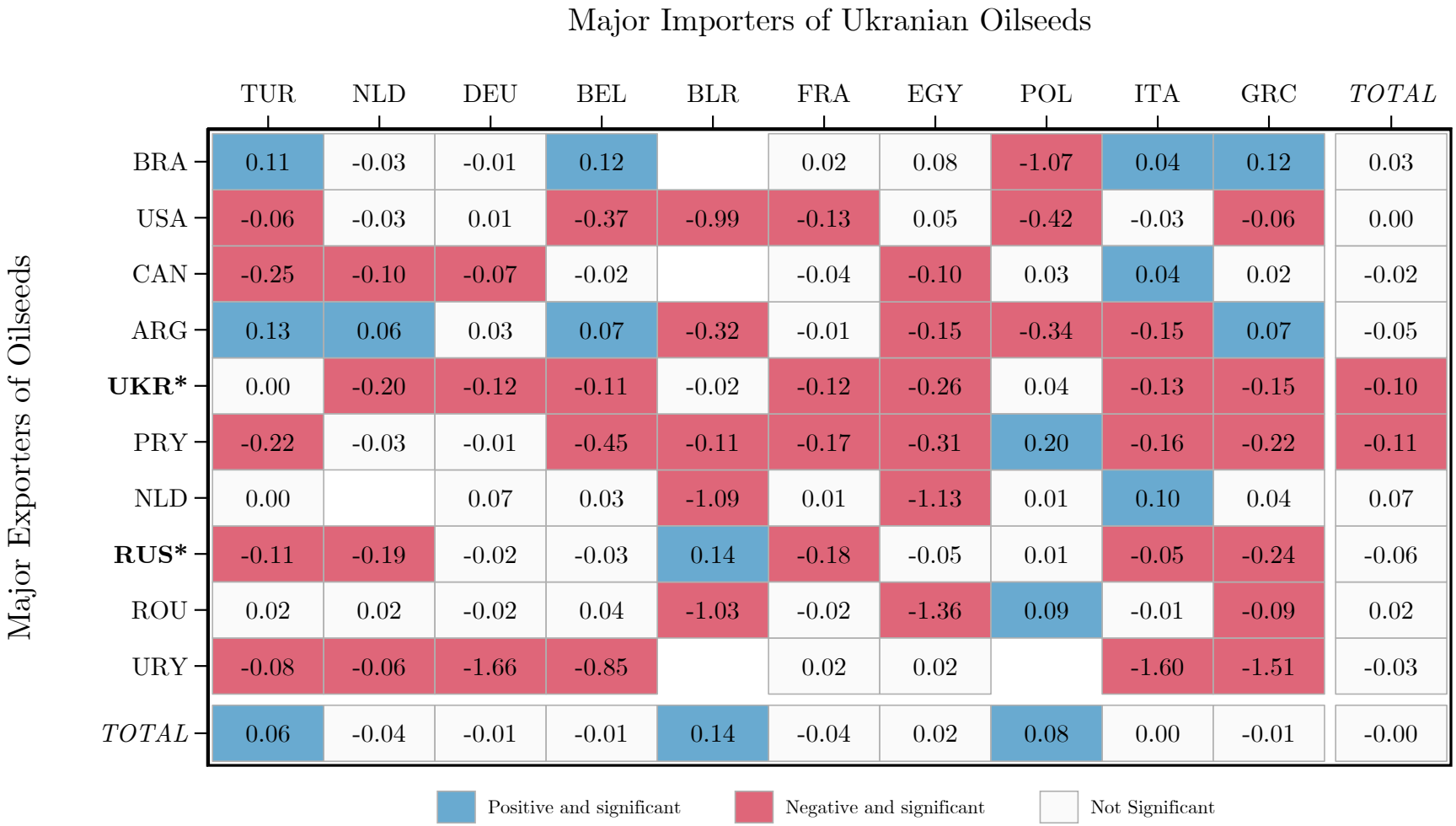

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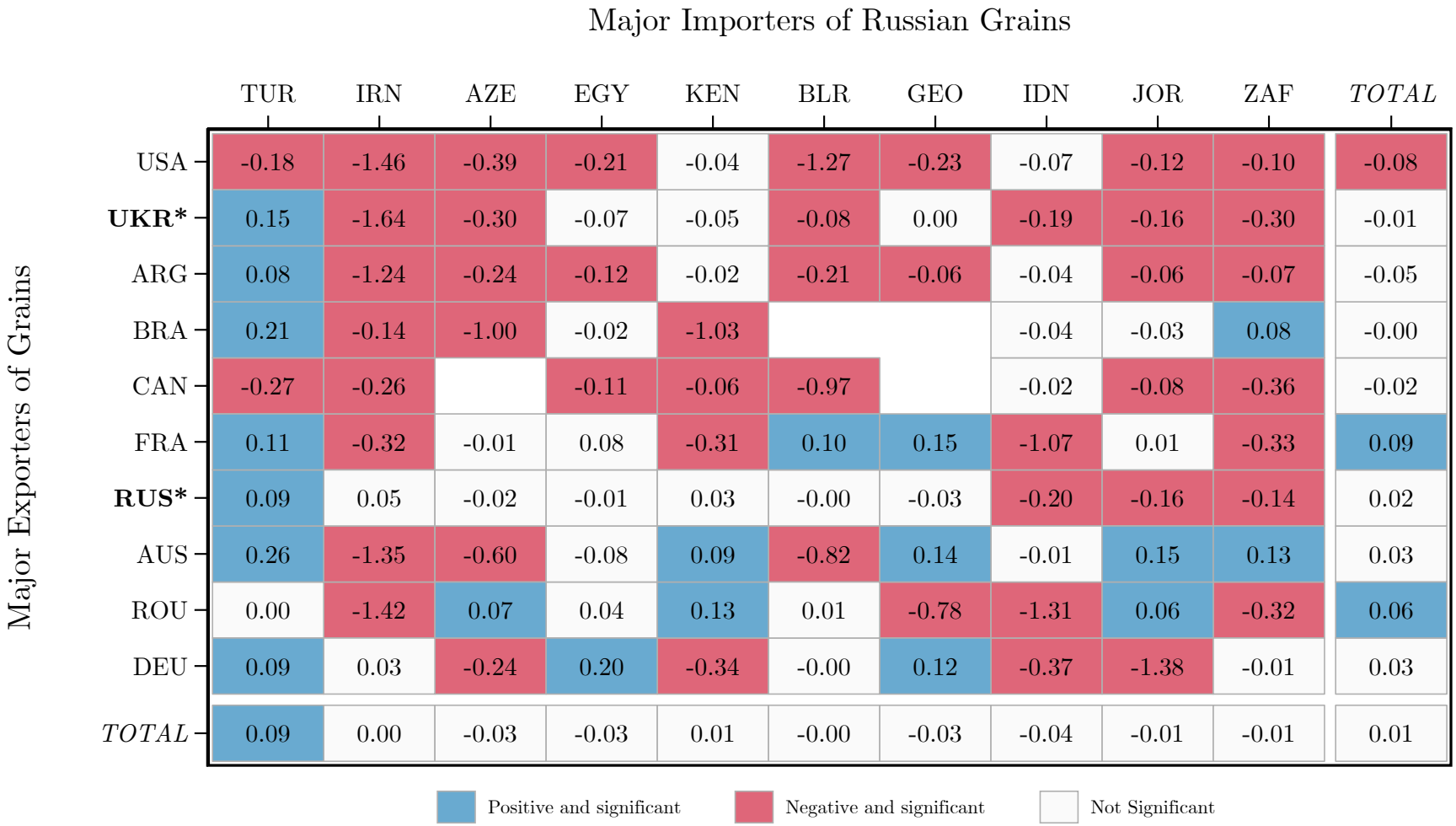

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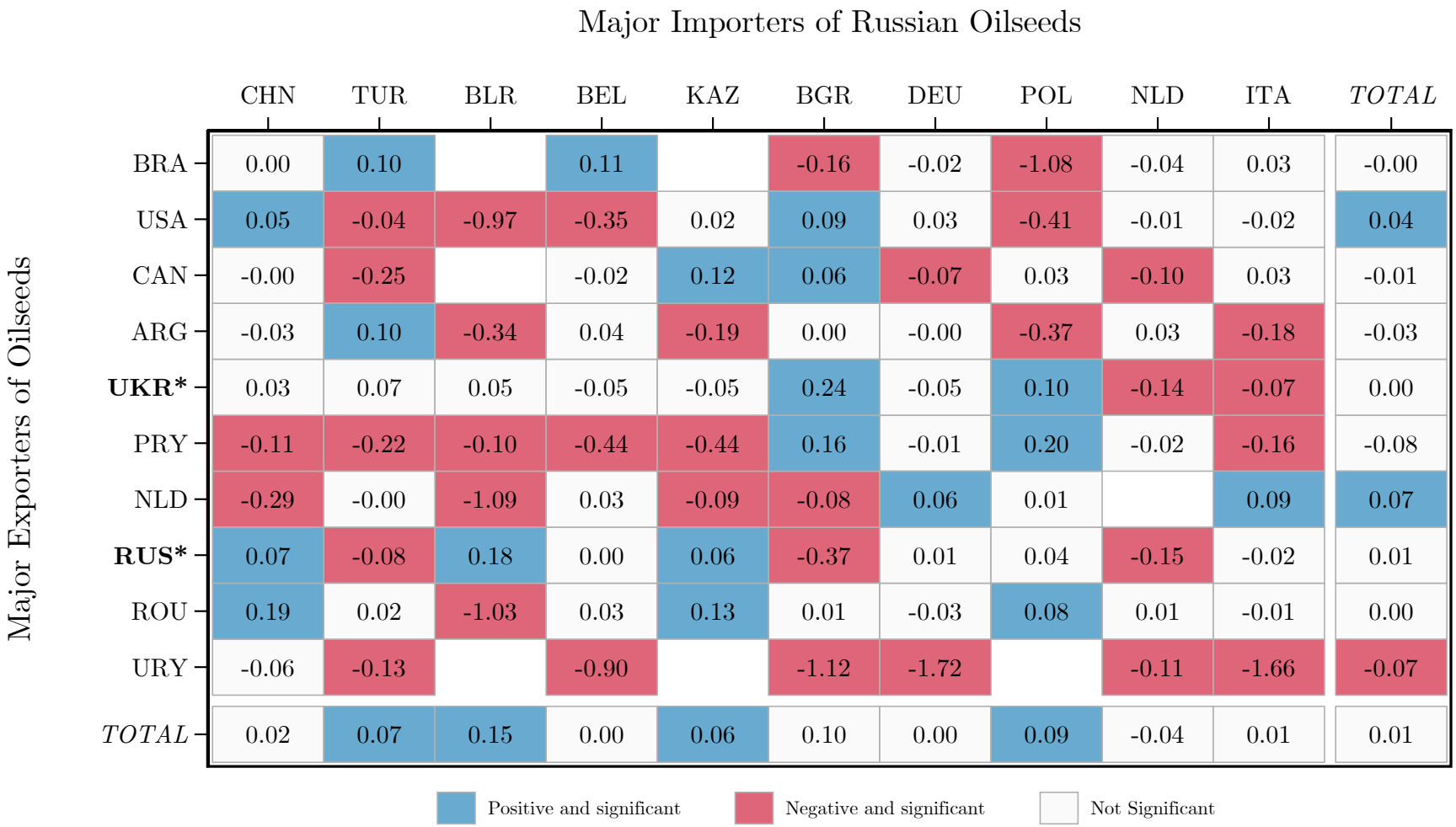

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- These shifts in import patterns suggest dynamic changes in *individual* market, with **Ukrainian grain demonstrating limited substitutability.**

Conclusions ii

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- **Oilseeds from Ukraine have a higher degree of substitutability.** Russian seems to have increased exports to its allies.

◂ Details

Outlook

- **Gravity Regressions** needs to control for other bilateral trade cost variables, such as tariffs.
- Use **export data** instead of import data, but filling out the missing export flows from Ukraine using available import data following a similar approach as Gaulier and Zignago (2010).
- **Calculate welfare implications** using the analysis from Larch and Yotov (2016).
- Disaggregate the analysis by **product type.**

Thank you!

Questions and comments are highly appreciated

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Carlos Zurita: carlos.zurita@ndsu.edu

References I

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References II

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Appendix - Contribution with Citations

- ...Including international trade (Grant et al. 2023), economic growth (Mahlstein et al. 2022), stock market performance (Boungou and Yatié 2022), commodity markets (Fang and Shao 2022), and food security (Behnassi and Haiba 2022; Carriquiry, Dumortier, and Elobeid 2022)

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Appendix - Grains and Oilseeds

- Grains include HS4 codes:
  - 1001: Wheat and meslin.
  - 1002: Rye.
  - 1003: Barley.
  - 1004: Oats.
  - 1005: Corn (maize).
  - 1006: Rice.
  - 1007: Grain sorghum.
  - 1008: Buckwheat, millet and canary seeds; other cereals (including wild rice).
- Oilseeds include HS4 codes:
  - 1201: Soybeans, whether or not broken.
  - 1203: Copra.
  - 1204: Flaxseed (linseed), whether or not broken.
  - 1205: Rape or colza seeds, whether or not broken.
  - 1206: Sunflower seeds, whether or not broken.
  - 1207: Other oil seeds and oleaginous fruits, whether or not broken.
  - 1208: Flours and meals of oil seeds or oleaginous fruits, other than those of mustard.

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Appendix - Gravity Framework

- PTA_{ijt} is an indicator that i and j have a PTA at month t
- $Y_{it} = \sum_j X_{ijt}$ is total export supply and includes intra-national trade
- $E_{jt} = \sum_i X_{ijt}$ is total expenditures from the importer, and it also includes intra-national trade.
- $Y_t = \sum_i Y_{it} = \sum_j E_{jt}$ is Total world production.
- α_0, is an intercept term.
- $\zeta_{it} = -(1-\sigma)\ln(\Pi_{it}) + \ln(Y_{it})$ and $\eta_{jt} = -(1-\sigma)\ln(P_{it}) + \ln(E_{jt})$ are exporter-time and importer-time fixed effects, respectively.
- $\theta_{ij} = (1-\sigma)\lambda_{ij}$ is a country-pair fixed effect that controls for several time-invariant unobservables.
- ε_{ijt} is a mean-zero error term.

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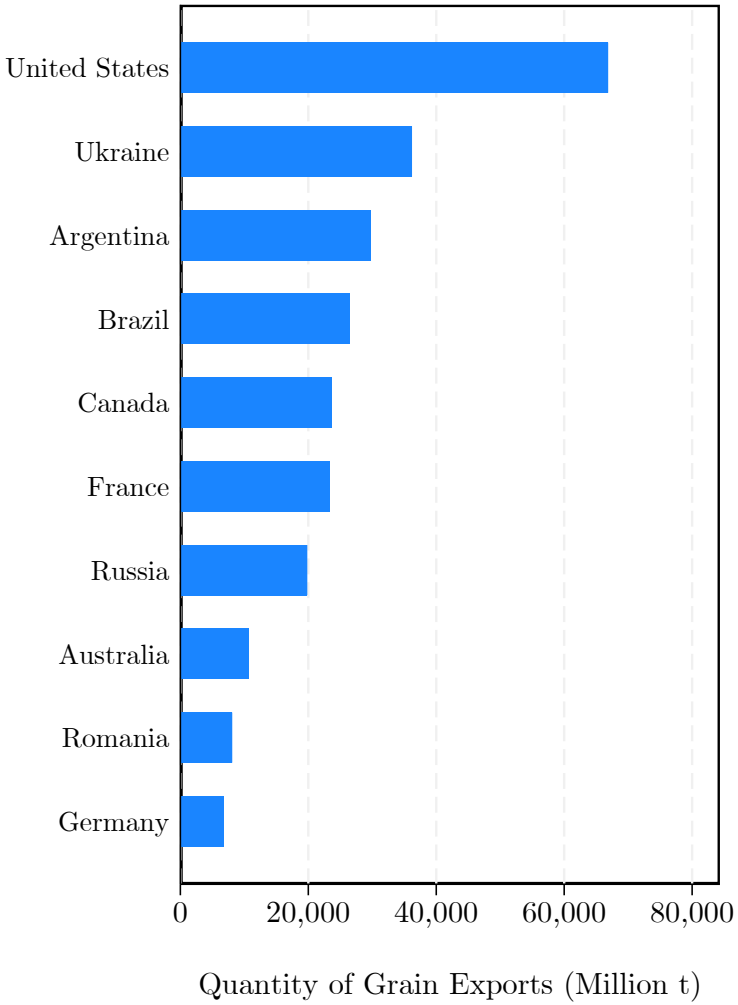
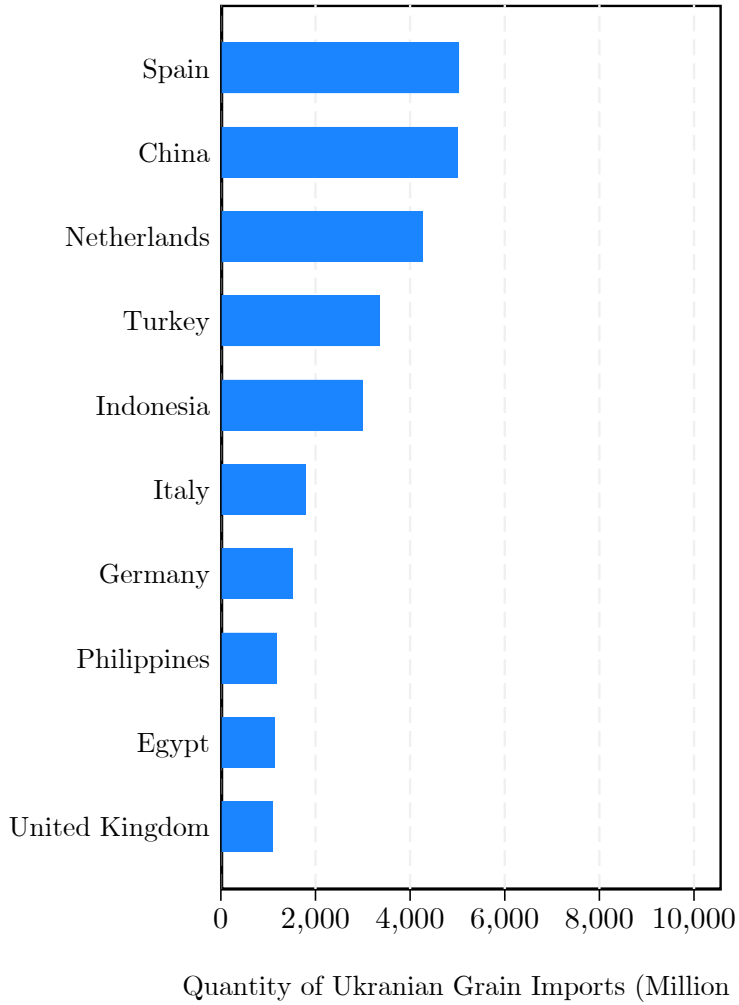
Appendix - Major Importers of Ukranian Grains in 2019



(a) Major Exporters of Grains.



(b) Major Importers of Ukranian Grains.

Note. The values are expressed in millions of tonnes (t).

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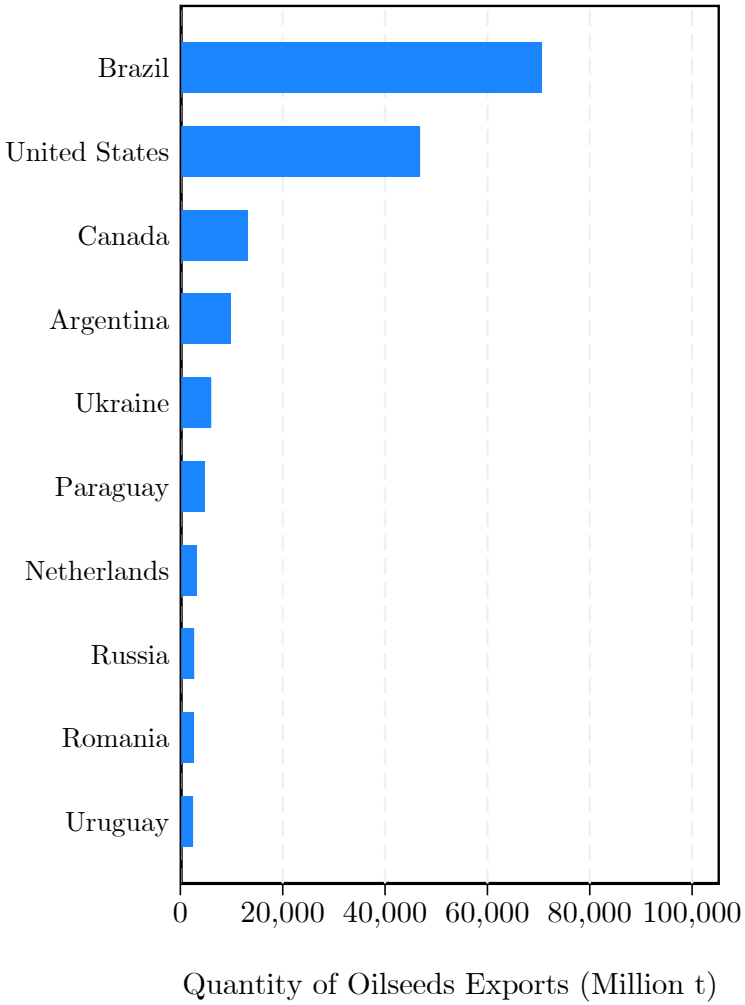
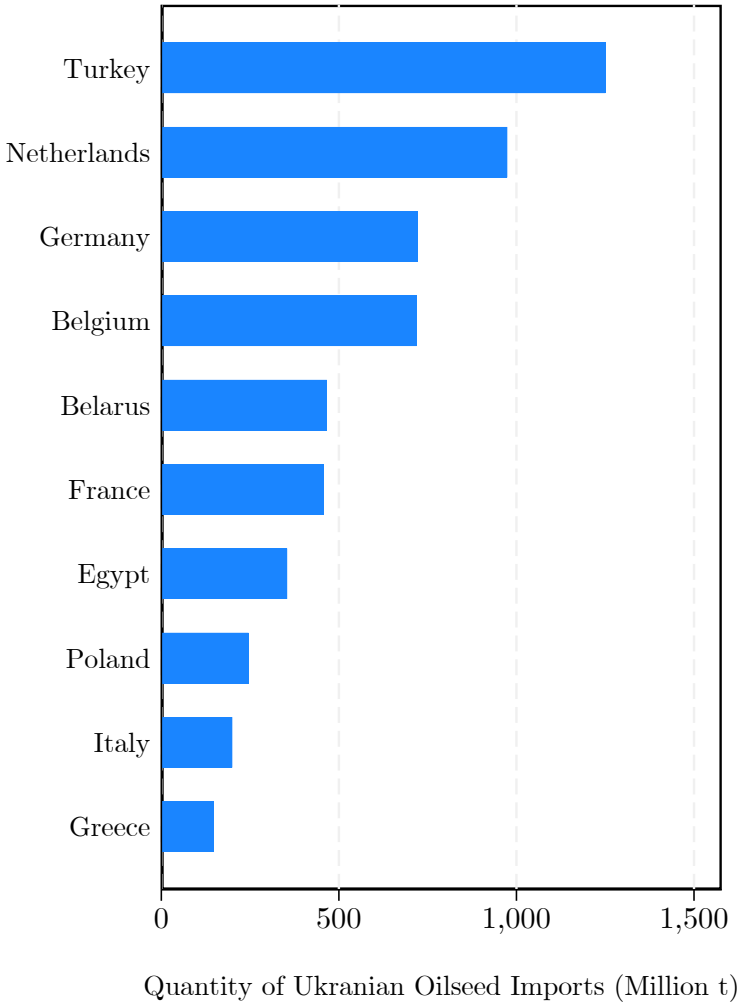
Appendix - Major Importers of Ukranian Oilseeds in 2019



(a) Major Exporters of Grains.

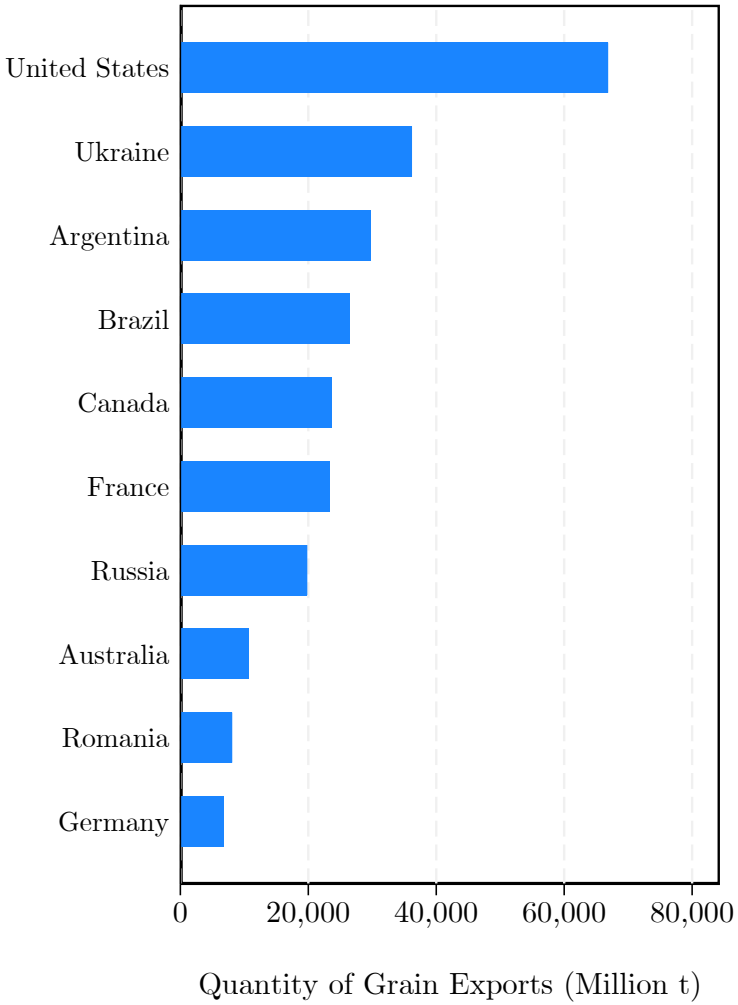


(b) Major Importers of Ukranian Oilseeds.

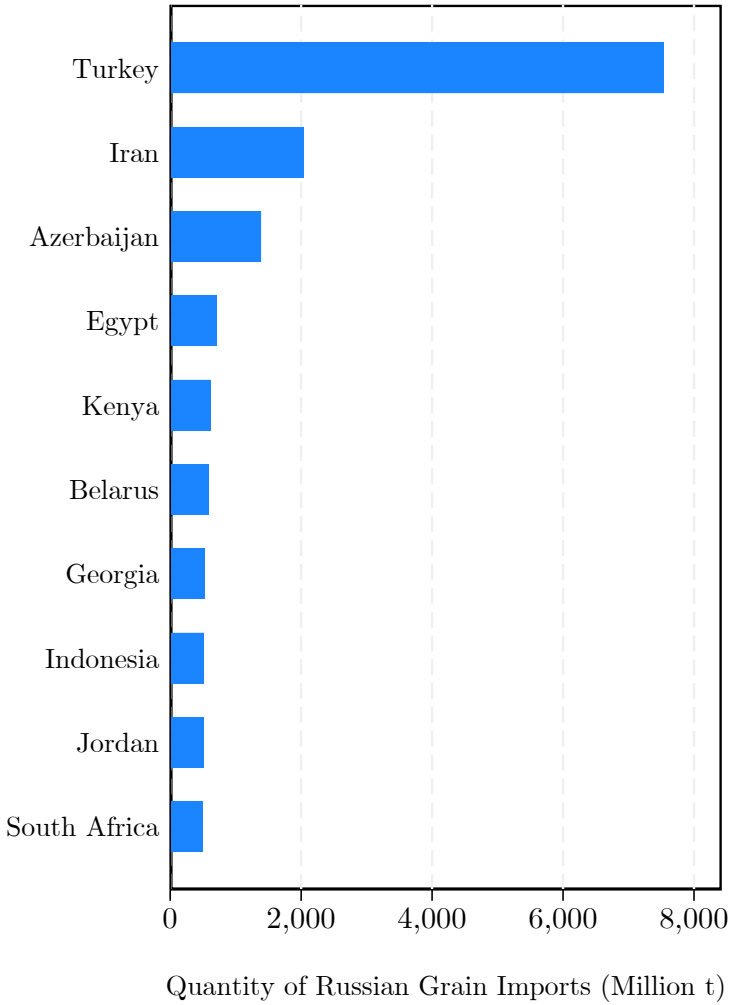
Note. The values are expressed in millions of tonnes (t).

◂ Return

Appendix - Major Importers of Russian Grains in 2019



(a) Major Exporters of Grains.



(b) Major Importers of Russian Grains.

Note. The values are expressed in millions of tonnes (t).

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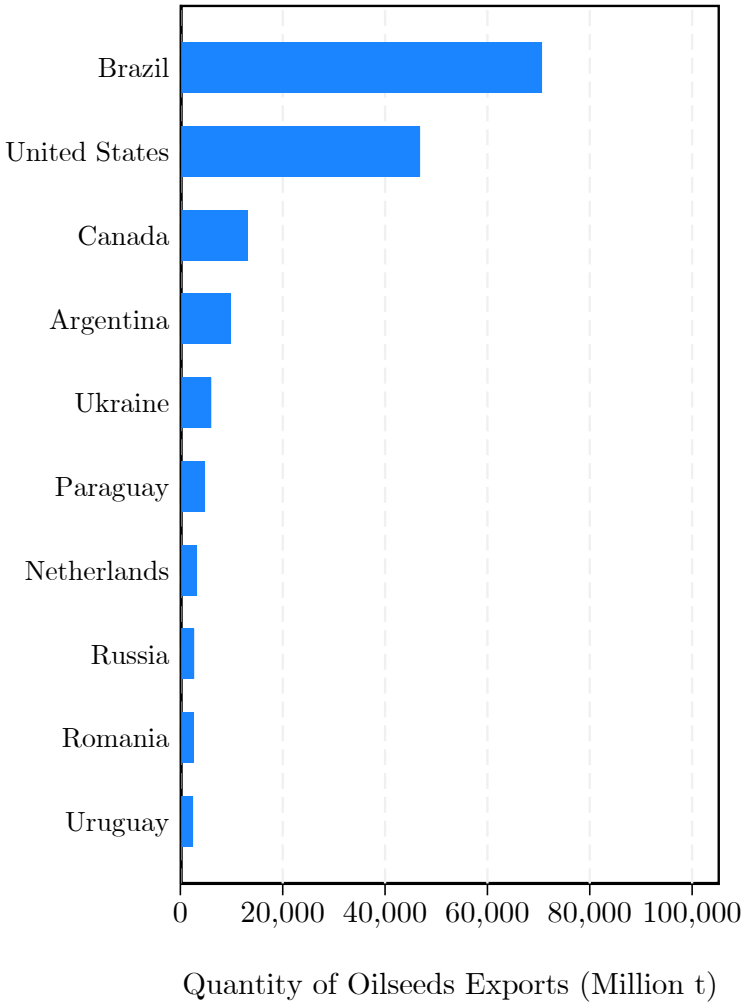
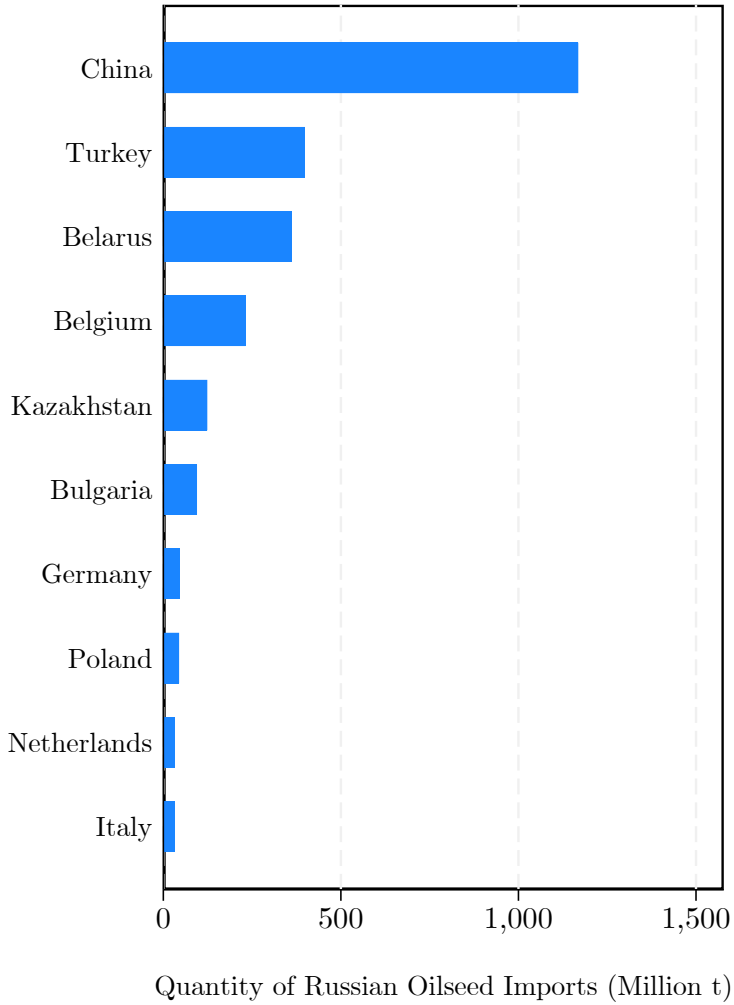
Appendix - Major Importers of Russian Oilseeds in 2019



(a) Major Exporters of Oilseeds.



(b) Major Importers of Russian Oilseeds.

Note. The values are expressed in millions of tonnes (t).

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Appendix - PTA

- Overall Grains: The coefficient for PTA_{ijt} is 0.039 (s.e. $=$ 0.018).
- Overall Oilseeds: The coefficient for PTA_{ijt} is 0.304 (s.e. $=$ 0.106).
- Ukrainian grains: The coefficient for PTA_{ijt} is 0.060 (s.e. $=$ 0.017).
- Ukrainian oilseeds: The coefficient for PTA_{ijt} is 0.308 (s.e. $=$ 0.103).
- Russian grains: The coefficient for PTA_{ijt} is 0.041 (s.e. $=$ 0.147).
- Russian oilseeds: The coefficient for PTA_{ijt} is 0.282 (s.e. $=$ 0.107).

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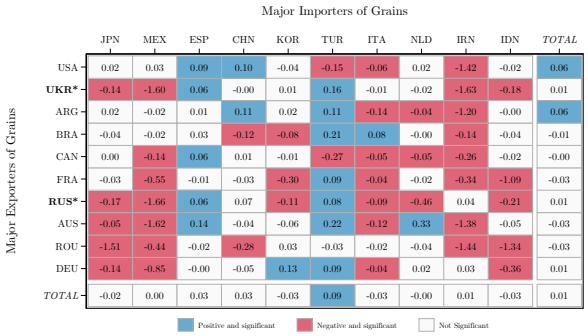
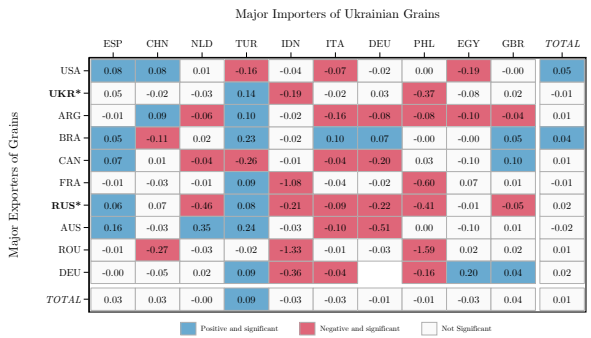
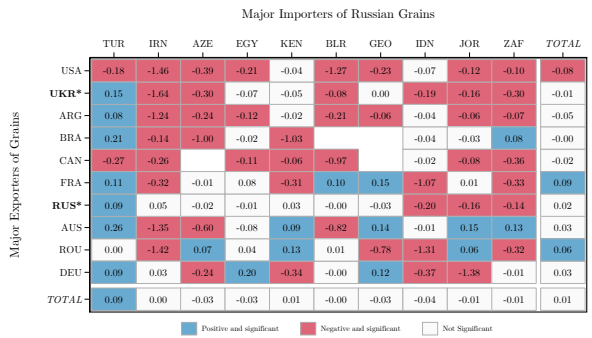
Appendix - Comparison of Results: Grains



(a) Major Importers of Grains from all Origins.



(b) Major Importers of Ukranian Grains.



(c) Major Importers of Russian Grains.

Note. The figure shows estimated coefficients of a three-way structural gravity regression. Major exporters and importers of grains and oilseeds are based on data from the year 2019. Major exporters are the same in all panels.

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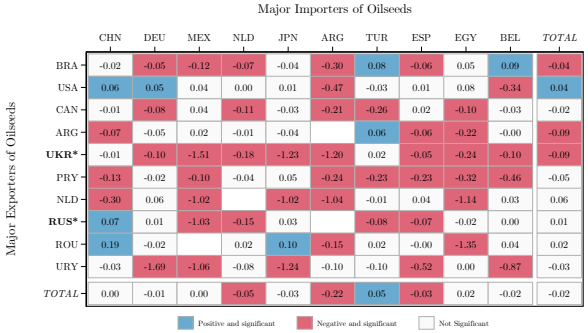
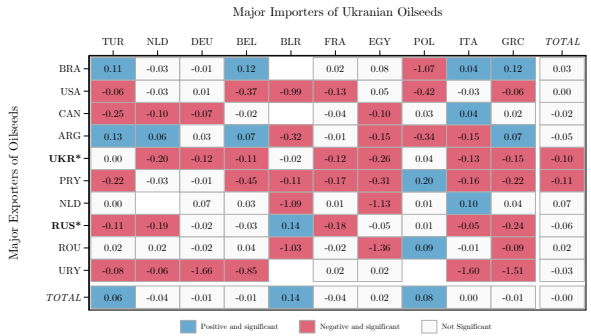
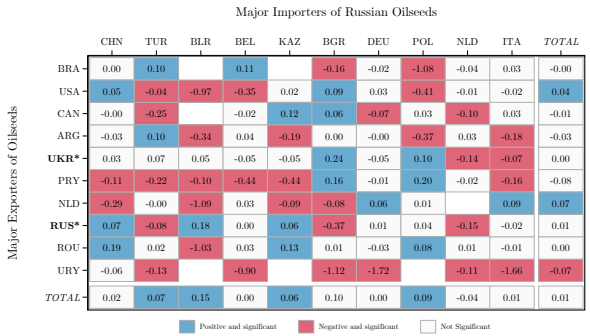
Appendix - Comparison of Results: Oilseeds



(a) Major Importers of Oilseeds from all Origins.



(b) Major Importers of Ukranian Oilseeds.



(c) Major Importers of Russian Oilseeds.

Note. The figure shows estimated coefficients of a three-way structural gravity regression. Major exporters and importers of grains and oilseeds are based on data from the year 2019. Major exporters are the same in all panels.

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