

Global Fertilizer Value-Chain Risks for Austria

Asjad Naqvi, Philipp Warum, and Franz Sinabell

Austrian Institute of Economic Research (WIFO), Arsenal Object 20, 1030 Vienna, Austria

Contact: franz.sinabell@wifo.ac.at



Abstract

Global value chain risks in the agriculture sector have significantly increased in recent years. Utilizing a global database of homogenized bilateral trade flows, we evaluate fertilizer import risks for Austria using newer measures for analysing complex networks. We show that global fertilizer trade continues to depend on high-risk countries, Austria has reduced its trade diversification in fertilizers over the years, importing at higher prices than EU27 countries, and as a result, faces higher risks from value chain disruptions. This affects competitiveness of the agricultural sector in an adverse manner.

Introduction

Recent events, such as COVID-19 and the Russian invasion of Ukraine, have revealed the susceptibility of Global value chains (GVCs) to exogenous shocks. In addition to trade disruptions, climate change impacts, reduced gas supply, and rising energy prices have put certain sectors at risk. This is especially evident in the agriculture sector in Austria, which recently experienced a record increase in the prices of key imported inputs such as fertilizers, exemplifying the vulnerability of Austria's food supply to risks emanating abroad (Barbieri et al., 2022). To assess these trade risks for Austria, in this paper we analyse the global fertilizer network and lay the groundwork for a more in-depth analysis.

Data

The main data source for our analysis is COMTRADE-BACI (Gaulier & Zignago, 2010), a homogenized database for bilateral country-country trade flows. We use the Harmonized System classification, version 1996 (H1), and select data for the 2000-2021 timeframe. We aggregate the five main four-digit groupings for Fertilizers: 3101 (Animals or Vegetables), 3102 Nitrogen (N), 3103 Phosphorous (P), 3104 Kalium (K), and 3105 Mixed (NPK), into a broad Fertilizer (310) category. The BACI database also provides us with the quantity in tonnes and values in nominal USD. The nominal values are converted to EUR using average annual exchange rates. For comparison across years, price deflators from Eurostat are used.

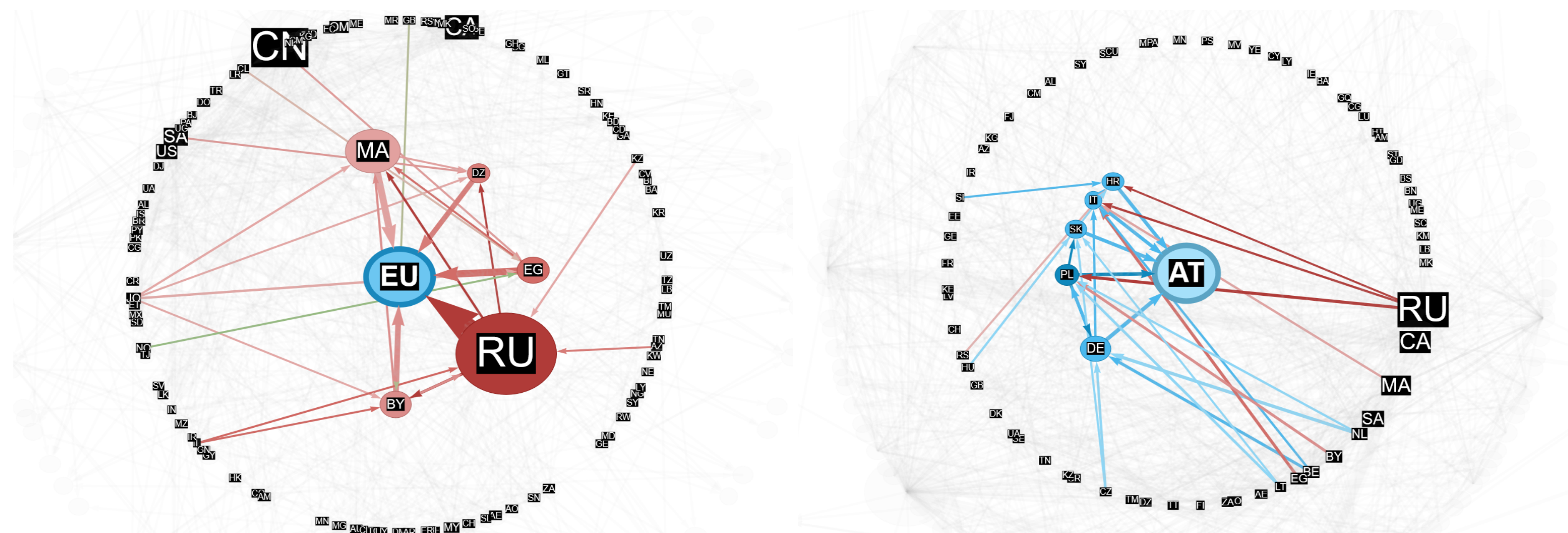
Referenzen

- Alves, L. G., Mangioni, G., Rodrigues, F. A., Panzarasa, P., & Moreno, Y. (2022). The rise and fall of countries in the global value chains. *Scientific Reports*, 12(1), 9086.
- Barbieri, P., MacDonald, G. K., Bernard de Raymond, A., & Nesme, T. (2022). Food system resilience to phosphorus shortages on a telecoupled planet. *Nature Sustainability*, 5(2), 114–122.
- Brin, S., & Page, L. (1998). The anatomy of a large-scale hypertextual web search engine. *Computer networks and ISDN systems*, 30(1-7), 107–117.
- Gaulier, G., & Zignago, S. (2010). Baci: International trade database at the product-level (the 1994-2007 version). *CEPII Working Paper 2010-23*.
- John, K. (1998). Authoritative sources in a hyperlinked environment. *Proceedings of 9th ACM-SIAM Symposium on Discrete Algorithms*, 1998.
- Xing, W., & Ghorbani, A. (2004). Weighted pagerank algorithm. *Proceedings. Second Annual Conference on Communication Networks and Services Research*, 2004., 305–314.

Methods

In our study, we employ advanced network analysis methods to assess value chain risks in global product trade networks, using two key metrics: PageRank and HITS. PageRank evaluates node importance by considering both the quantity and quality of flows (Brin & Page, 1998), while HITS distinguishes between hubs and authorities (John, 1998). We make two data adjustments: calculating flow weights based on bilateral trade value and reversing import-export directions to capture node importance accurately.

Figures 1 & 2: Global fertilizer trade network of Top 5 import destinations 2021, EU and Austria



Results

Figure 3 shows the importance of the top ten exporters of Fertilizers between 2000 and 2021 using our weighted PageRank. Russia maintains its top spot across the years, with a relatively high importance. Belarus takes the second spot, while Ukraine, that was on the third place in 2000, drops to levels lower than Austria in 2021. Next to the U.S., Canada and several EU countries, China also ranks highly on the graph. Therefore, global trade is highly dependent on countries that might be considered high risk as geo-political tensions might realign new trade agreements.

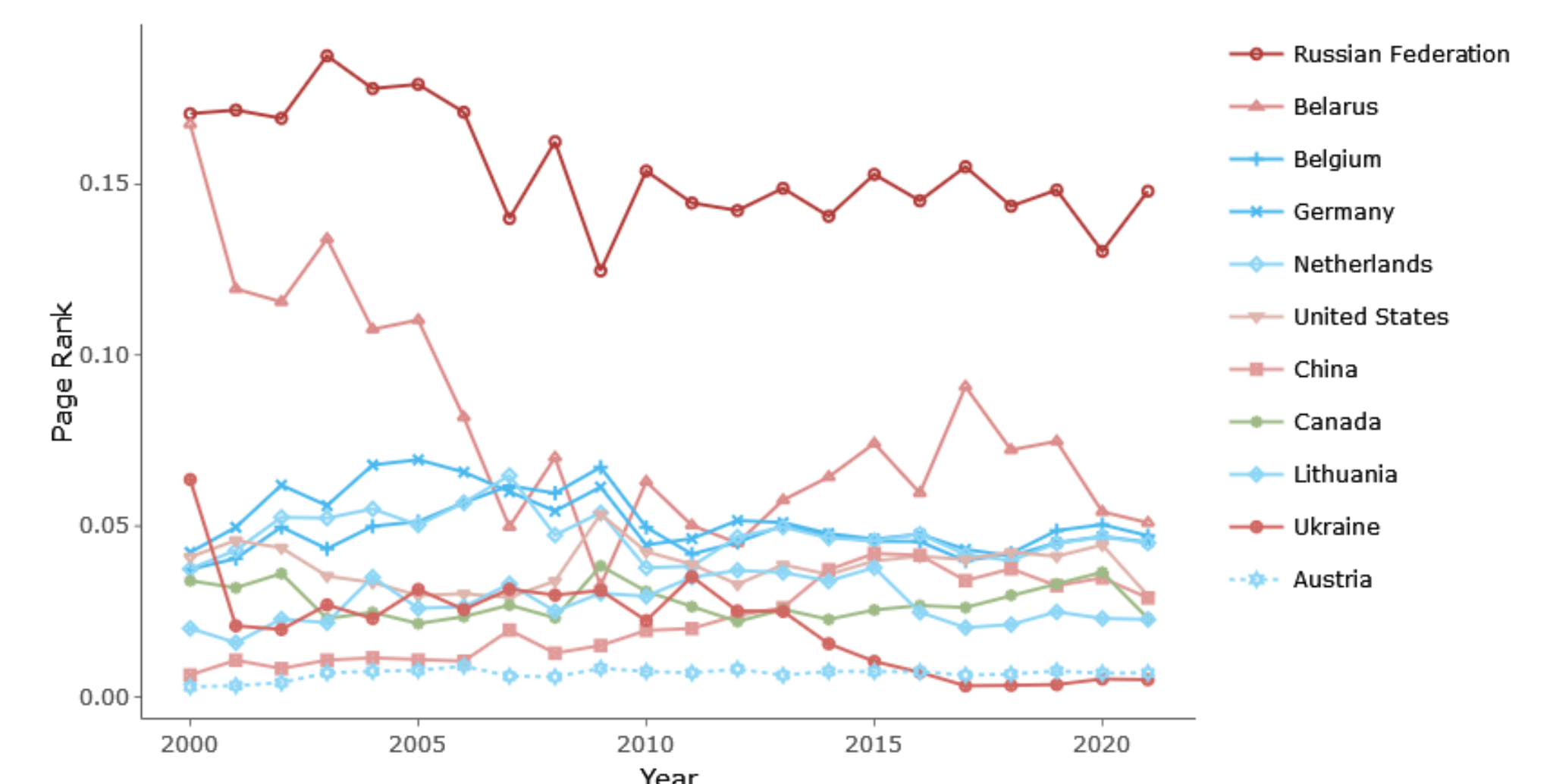


Figure 4 compares the Hub score of Austria's fertilizer imports with the EU27 countries. The area fill shows the 25-75th percentile. While Austria was trending in line with the EU27 average, we observe that after 2007, its Hub score fell to the lower end of the distribution, implying a decline in import diversification, indicating fewer trading partners as compared to the EU median.

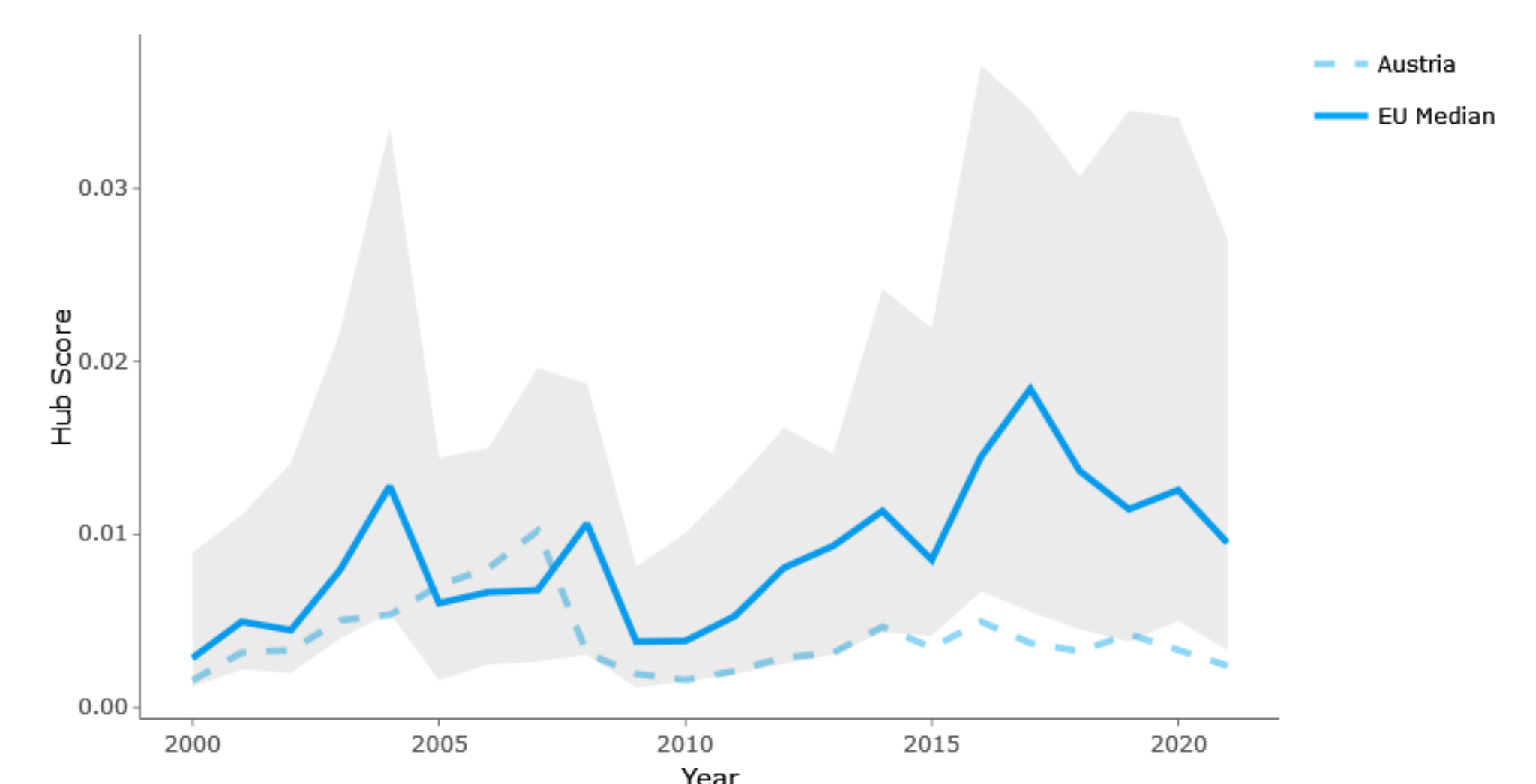
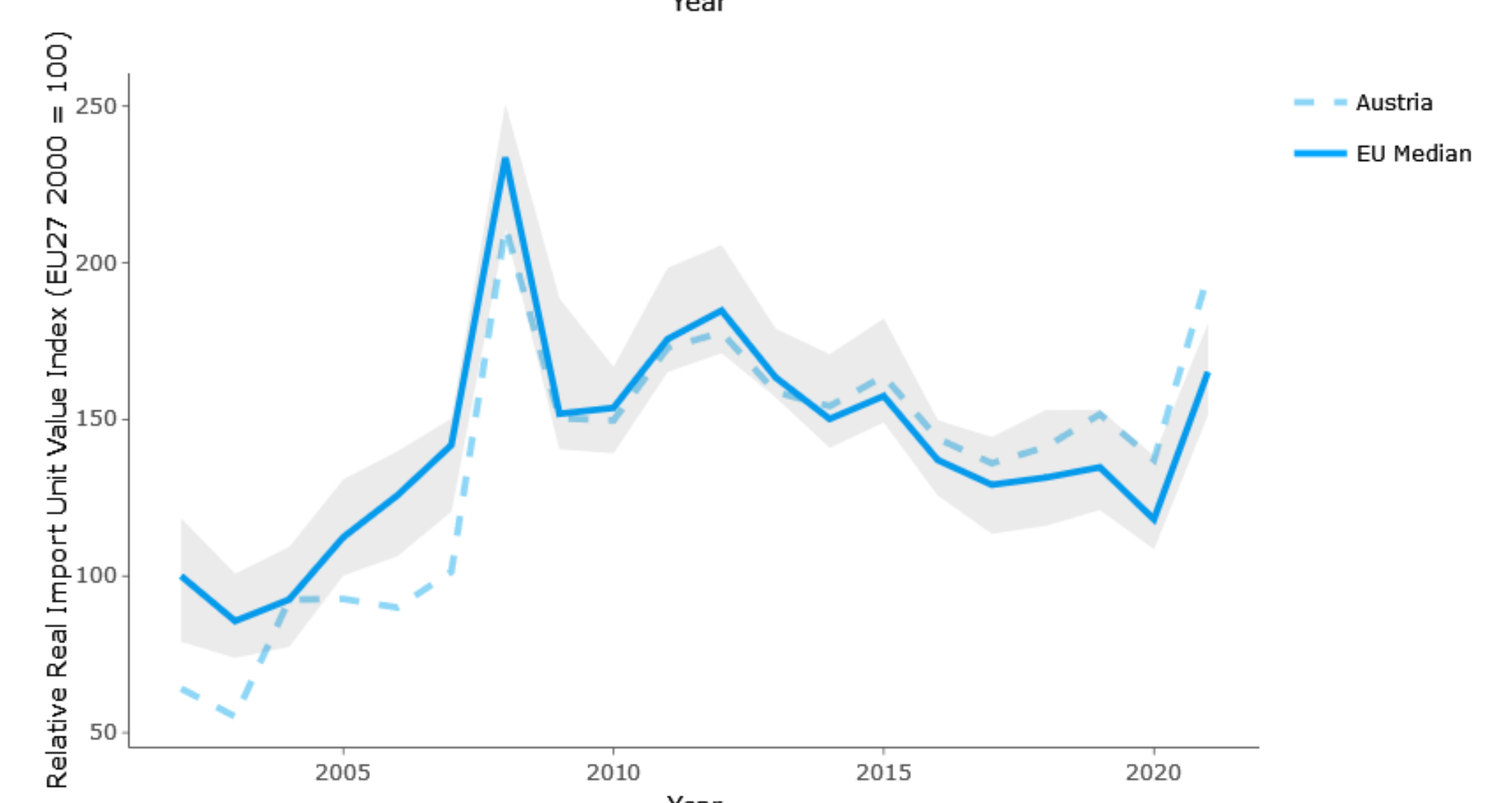


Figure 5 shows the real price development of Fertilizer imports to Austria and compares it with the distribution in EU27. Fertilizer price developments reflect macro instability caused by the 2007-08 financial crisis and the COVID-19 lockdowns that are now followed by the Russian invasion in Ukraine.



Conclusions

Our preliminary results provide several important insights, namely, the continuing dependence on geo-politically risky countries, lower trade diversification in Austria, and higher-than-average import prices. All of these point towards a continuously increasing risk to the stability of supplies of fertilizer to Austria, that can be mitigated through potential trade diversification.