

## Environmental and Socioeconomic Determinants of Grain Virtual Water Trade: An Empirical Analysis using Decomposition and Decoupling Model

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### Abstract

The world's sustainable growth is being severely hampered by the inefficient use of water resources. Despite the widely acknowledged importance of trade in global and regional water and food security, societal reliance on local production as well as international trade remains inadequately assessed. Therefore, using South Korea as a case study, this study fills in this research gap by applying the virtual water concept, the logarithmic mean division index (LMDI) method, and the Tapio decoupling model. The virtual water concept was used to estimate South Korea's net virtual water trade for major grain crops from 1992 to 2017. Then, the LMDI method was utilized to assess the driving factors causing changes in net virtual water trade. Lastly, the Tapio decoupling model was used to investigate the decoupling relationships between economic growth and the driving factors of net virtual water trade. Results showed that South Korea remains a net importer of virtual water flows with respect to grain crops, with an average import of 16,559.24 million m<sup>3</sup> over the study period. In addition, the change in net virtual water trade could be attributed to water intensity effect, product structure effect, economic effect, and population effect. However, water intensity and economic effects were the major decisive factors for decrease and increase in net virtual water trade respectively, while the population and product structure effects had minor positive influences on the net virtual water trade. Furthermore, water intensity and economic growth showed a strong decoupling in most periods, while the decoupling state between product structure and economic growth was observed as expansive negative decoupling. Likewise, population size and economic growth showed a weak decoupling in most periods. The results reveal South Korea's status as it concerns the virtual water trade of grain crops, thus providing valuable insights into the sustainability of trade activities for the management of local water resources.

**Keywords:** Virtual water trade; Water resources; Decomposition and Decoupling Model; Food security; South Korea

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