Annex

TRADE MODEL

The model is trained on data from all Eastern European countries and Turkey from 1991 to 2023 where data was available. This allows the model to learn how EU membership impacted those who gained accession compared with those who did not. Turkey was included in an exploratory analysis in order to model how special trading relationships with the EU impact trade, using the Customs Union in force since 1995.

A linear mixed-effects model is used; a regression model that groups observations in this instance by country. The model predicts trade between 2024 and 2040, with two scenarios – one where Ukraine joins the EU in 2030 and another where it does not, predicting for both imports and exports. The model uses trade with all members of the EU in a given year as its dependent variable.

DATA SOURCES

- **Trade flows**: UNCOMTRADE API.
- **GDP**: IMF, including projections until 2029.
- **Population**: IMF API, including projections until 2029.
- **Years as member:** this is a manually coded variable which counts the number of years a given country has been a member.
- **Number of members:** the number of members of the EU in a given year.
- **Free-trade agreements**: manually collected based on Europa. This was originally included in the model, but was not significant and therefore removed. Data on Turkey was subsequently removed.

For the modelling component, population and GDP were forecast from 2030 to 2040.

- **GDP**: the IMF predicts significant GDP growth until 2029. Based on IMF forecasts, this model begins with a predicted 4 per cent increase in GDP growth in 2030, with a reduction of 0.15 per cent in growth each year.
- **Population**: due to declining population trends, Ukraine's population growth is set at a constant -0.5 per cent.

RESULTS

The regression model is detailed below. The model performs extremely well on existing data, with a pseudo-R squared, assessed during five-fold cross-validation, as above 0.98 for all models (maximum R squared is 1).

	Dependent Variable	
	Imports from EU	Exports to EU
Previous year's trade with EU	0.598***	0.875***
	(0.030)	(0.019)
Year	-0.084	-0.122*
	(0.061)	(0.065)

Population (millions)	-0.103	-0.112**
	(0.070)	(0.053)
GDP (billions USD)	0.113***	0.067***
	(0.009)	(0.008)
Years as EU member	0.385***	0.156**
	(0.077)	(0.078)
Number of EU members	0.154**	0.070
	(0.072)	(0.079)
Constant	165.446	242.633*
	(121.765)	(129.602)

Observations	481	478
Log Likelihood	-1,445.964	-1,474.450
Akaike Information Criterion	2,909.929	2,966.899
Bayesian Information Criterion	2,947.511	3,004.426
Note	*p<0.1; **p<0.05; ***p<0.01	