**Mathematical Modeling Practice**

**“Measuring the leverage of FX rates and financial, econometrical indices onto the grain prices based on the major grain importer countries”**

For data collection first I located countries with the largest amount of grain import using TradeMap.org. I used the first 5 match, namely turkey, Indonesia, china, Italy and Egypt. For locating the largest grain importers I used the grain import volume in 2023.

Then from Bloomberg I downloaded the main financial and economic indices that I thought to have the largest impact on grain prices. This was namely fx rates, money supply, fx reserves, cpi, ppi, gdp, equity indices, 10 year yields and other sentiment indices where they were available.

For the initial analysis I used monthly data from 2010.01.31 to 2024.09.31. This was the latest available date where all data was available.

I checked PCA for individual countries, there money supply was one of the greatest driver of variance. Then I checked PCA for th aggregate data where the first 9 components explain more than 90 percent of variance. The first PC’s largest loading is china’s money supply, then Indonesia money supply, fx rates of EGP/USD and USD/TRY. I think fx rates and money supply can explain a lot about the purchasing power of an importing country which can be a driver of international commodity prices.

Then I checked the PCA for the whole dataset on a yearly basis, showing how PCs changed by time. In 8 years out of the 14 years analysed, an indicator of the Chinese economy – gdp, cpi equity or confidence index – were the largest contributor in the 1st PCs. I think this is understandable due to china's large – and growing – role in global demand. Also, fitting a yearly PCA resulted in fewer, 3-4 components explaining 90 percent of variance. I think this might be an overfit, since we only have 12 data points for each year which is quite few.

China’s money supply has strong -above 70 - correlations with most equity indices (except Italy). It’s correlation with wheat prices is weak – 0.11 with Chicago wheat and 0.4 with paris wheat.

I checked for stationarity in wheat prices with ADF and KPSS test and neither indices were stationary. However, the paris wheat price was non-stationary according to ADF and stationary according to KPSS which can mean that it is a trend-stationary process. Both prices are highly auto-correlated.

**Further analysis**

Later, I would like to see how well wheat prices can be predicted by the economic indices used in the analysis. For that I will need to make the time series stationary.

Using mixed frequency data for later analysis – using daily data where available and also nowcasting prices with available daily data ussing Kalman filter.

**Main research question:** Which indices can be the best predictors for Chicago and Paris wheat prices?

**Hypothesis**: A few indices are enough for predicting wheat prices