Macroeconometrics - UK variables report

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Preliminaries

In this project, we aim to analyze the development of the Gross Domestic Product (GDP), exchange rates, and trade balance of the United Kingdom (UK). We collect our data from the OECD open data portal. We use data on a quarterly basis, starting latest in 1997. This period covers important financial events such as the Global Financial Crisis (GFC) in 2007, the Brexit referendum in 2016 and UK's final EU leave in 2020 as well as the COVID-19 pandemic from 2020-2022.

Exercise 1

Part 1: Analyzing the time series in levels

Looking at the plain time series data and analyzing the plots, we get the following results:

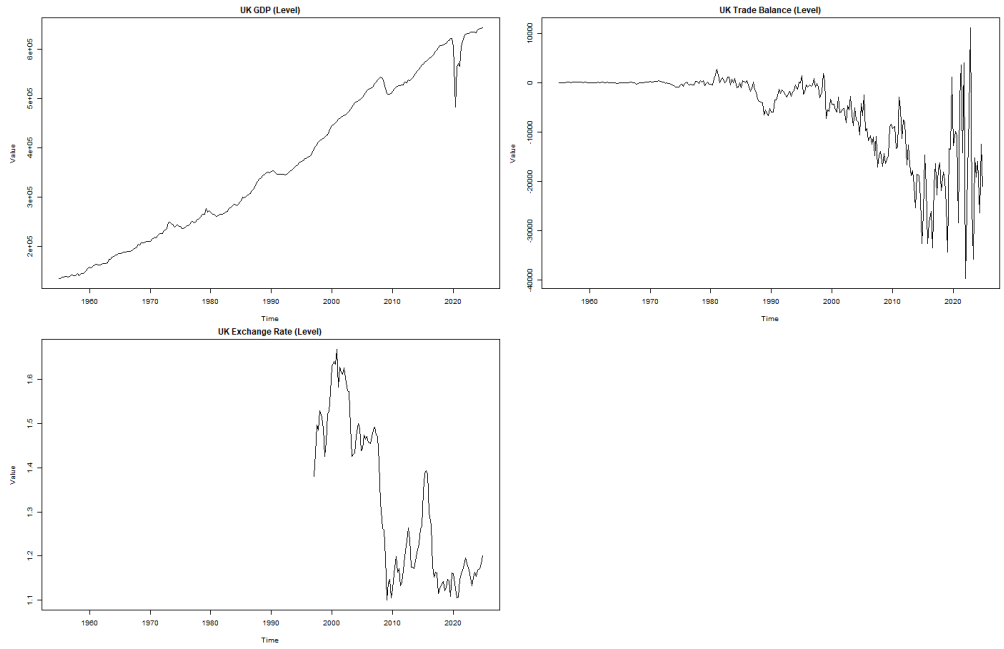

Figure 1: Residual diagnostics from ARIMA(1,0,4).

GDP: Data on UK's GDP is available on a quarterly basis starting in 1955. GDP exhibits a clear, upwards trend with only a few shocks (such as the 2020 COVID-19 oandemic or the 2007 financial crisis) interrupting

the general trend. Hence, the GDP of the UK is clearly not stationary. However, the trend seems to be linear, suggesting that the first-differences time series of the GDP might be stationary. \

Trade Balance: As GDP, data on the trade balance is available on a quarterly basis starting in 1955. We see that the trade balance fluctuates around 0 until the 1990s where a negative trend seems to set in continueing until the 2010s, when trade balance starts fluctuating around a low, negative value. However, since the observed spikes are getting much bigger over time, we also see an increase in fluctuation around the respective stationary mean. Hence, the data seems to be stationary in the beginning and in the end with a negative trend being observed between the 1990s and the 2010s. \

Exchange Rate: Data on the exchange rate is available since 1997 on a quarterly basis. It exhibits stationarity between 1997 and 2007, as well as from 2007 onwards. In 2007, a shock seems to have shifted the mean of the stationary process downwards.

Part 2: Conducting unit roots and stationarity tests

In this section, we aim to formally conduct stationarity tests for the series. As explained in the last section, we have reason to doubt that our series are entirely stationary. However, for our analysis, we are relying on stationarity properties of the series. Hence, after identifying the non-stationary series formally, we will conduct the first-difference transformation to obtain stationary series for our analysis.\

Starting with the non-transformed series, we run a series of tests for each time series separately (Explain the type of tests here!) \

GDP:

	ADF		KPSS		
test	statistic	p.value	crit_10pct	crit_5pct	crit_1pct
ADF	-2.530635	0.3525184	NA	NA	NA
KPSS	4.731673	0.0100000	NA	NA	NA
ERS DF-GLS	3.073724	NA	-1.62	-1.94	-2.57
PP	-21.532938	0.0483211	NA	NA	NA

Table 1: Unit-root and stationarity tests for UK GDP

Trade Balance:

	ADF		KPSS		
test	statistic	p.value	crit_10pct	crit_5pct	crit_1pct
ADF	-2.2250155	0.4812789	NA	NA	NA
KPSS	3.3948515	0.0100000	NA	NA	NA
ERS DF-GLS	-0.6723293	NA	-1.62	-1.94	-2.57
PP	-157.4146465	0.0100000	NA	NA	NA

Table 2: Unit-root and stationarity tests for UK GDP

Exchange Rate:

	ADF		KPSS		
test	statistic	p.value	crit_10pct	crit_5pct	crit_1pct
ADF	-2.382354	0.4179499	NA	NA	NA
KPSS	1.754143	0.0100000	NA	NA	NA
ERS DF-GLS	-1.414941	NA	-1.62	-1.94	-2.58
PP	-13.157562	0.3539359	NA	NA	NA

Table 3: Unit-root and stationarity tests for UK GDP

\ Interprete these results! \

Now, let us turn to the first-difference transformations of the time series. \

GDP:

	ADF		KPSS		
test	statistic	p.value	crit_10pct	crit_5pct	crit_1pct
ADF	-8.0195142	0.01	NA	NA	NA
KPSS	0.0864308	0.10	NA	NA	NA
ERS DF-GLS	-7.9411516	NA	-1.62	-1.94	-2.57
PP	-321.6127812	0.01	NA	NA	NA

Table 4: Unit-root and stationarity tests for UK GDP

Trade Balance:

	ADF		KPSS		
test	statistic	p.value	crit_10pct	crit_5pct	crit_1pct
ADF	-8.1714448	0.01	NA	NA	NA
KPSS	0.0349289	0.10	NA	NA	NA
ERS DF-GLS	-12.9115650	NA	-1.62	-1.94	-2.57
PP	-300.0884288	0.01	NA	NA	NA

Table 5: Unit-root and stationarity tests for UK GDP

Exchange Rate:

	ADF		KPSS		
test	statistic	p.value	crit_10pct	crit_5pct	crit_1pct
ADF	-5.0408902	0.01	NA	NA	NA
KPSS	0.0837118	0.10	NA	NA	NA
ERS DF-GLS	-2.1882524	NA	-1.62	-1.94	-2.58
PP	-82.8852407	0.01	NA	NA	NA

Table 6: Unit-root and stationarity tests for UK GDP