

DATA SCIENCE PROJECT REPORT

Subject title and code: Global Economic Environment (AF2602)

Section 1. Choose ONE of the following series from WDI as the dependent variable:

- Select “Current account balance (BoP, current US\$)” as dependent variable.

Section 2. Choose ANY FOUR series from WDI as independent variables.

1. 'Exports of goods and services (BoP, current US\$)',
2. 'Imports of goods, services and primary income (BoP, current US\$)',
3. 'Transport services (% of commercial service exports)',
4. 'Net trade in goods and services (BoP, current US\$)'

Section 3. Collect the data on the dependent and independent variables of at least 15 countries over a sample period of 10 years. The sample size should be at least 100 country-year observations.

In a table, provide a list of the sample countries, the sample period, the sample size, the sample mean, and the sample standard deviation. (3 marks)

	Year		Current account balance (BoP, current US\$)		Exports of goods and services (BoP, current US\$)		Imports of goods, services and primary income (BoP, current US\$)		Transport services (% of commercial service exports)		Net trade in goods and services (BoP, current US\$)	
	sample period	sample size	mean	std	mean	std	mean	std	mean	std	mean	std
Country Name												
Afghanistan	[2008 [YR2008] 2009 [YR2009] 2010 [YR2010] 2011 [YR2011] 2012 [YR2012] 2013 [YR2013] 2014 [YR2014] 2015 [YR2015] 2016 [YR2016] 2017 [YR2017] 2018 [YR2018] 2019 [YR2019] 2020 [YR2020]]	13	-2888041844	1755311896	80175302214	1.68071E+11	22355277719	28423692917	14.39242468	9.935731458	5983552579	20985061365
Albania	[2008 [YR2008] 2007 [YR2007] 2008 [YR2008] 2009 [YR2009] 2010 [YR2010] 2011 [YR2011] 2012 [YR2012] 2013 [YR2013] 2014 [YR2014] 2015 [YR2015] 2016 [YR2016] 2017 [YR2017] 2018 [YR2018] 2019 [YR2019] 2020 [YR2020]]	15	-1265718761	362235607.4	82919999586	1.49836E+11	2.71807E+11	4.74224E+11	17.16924292	13.52390346	6921329172	18058746878
Algeria	[2008 [YR2008] 2007 [YR2007] 2008 [YR2008] 2009 [YR2009] 2010 [YR2010] 2011 [YR2011] 2012 [YR2012] 2013 [YR2013] 2014 [YR2014] 2015 [YR2015] 2016 [YR2016] 2017 [YR2017] 2018 [YR2018] 2019 [YR2019] 2020 [YR2020]]	14	1314760889	21590294647	1.35058E+11	2.82293E+11	5.63345E+11	1.41847E+12	17.03988049	14.22572041	-23084795402	1.68441E+11
Angola	[2008 [YR2008] 2007 [YR2007] 2008 [YR2008] 2009 [YR2009] 2010 [YR2010] 2011 [YR2011] 2012 [YR2012] 2013 [YR2013] 2014 [YR2014] 2015 [YR2015] 2016 [YR2016] 2017 [YR2017] 2018 [YR2018] 2019 [YR2019] 2020 [YR2020]]	15	3944390552	7554095020	46885025165	1.19938E+11	1.37201E+11	2.45543E+11	21.34063625	11.48218838	-2973269832	9438754396
Antigua and Barbuda	[2008 [YR2008] 2007 [YR2007] 2008 [YR2008] 2009 [YR2009] 2010 [YR2010] 2011 [YR2011] 2012 [YR2012] 2013 [YR2013] 2014 [YR2014] 2015 [YR2015] 2016 [YR2016] 2017 [YR2017] 2018 [YR2018] 2019 [YR2019] 2020 [YR2020]]	13	-162055289.6	126839659.9	99086217243	2.19796E+11	1.44506E+11	2.30375E+11	23.85821599	26.45859983	8007628321	31723420053
Argentina	[2008 [YR2008] 2007 [YR2007] 2008 [YR2008] 2009 [YR2009] 2010 [YR2010] 2011 [YR2011] 2012 [YR2012] 2013 [YR2013] 2014 [YR2014] 2015 [YR2015] 2016 [YR2016] 2017 [YR2017] 2018 [YR2018] 2019 [YR2019] 2020 [YR2020]]	15	-6541421067	12179743468	1.01561E+11	2.39092E+11	5.06296E+11	1.44783E+12	19.23033636	14.82055724	653754634.4	12035934948
Armenia	[2008 [YR2008] 2007 [YR2007] 2008 [YR2008] 2009 [YR2009] 2010 [YR2010] 2011 [YR2011] 2012 [YR2012] 2013 [YR2013] 2014 [YR2014] 2015 [YR2015] 2016 [YR2016] 2017 [YR2017] 2018 [YR2018] 2019 [YR2019] 2020 [YR2020]]	15	-787769107.8	482365381.3	49714059236	1.31563E+11	2.75935E+11	4.41334E+11	19.21595991	13.16088405	-303514313	5327046532
Aruba	[2008 [YR2008] 2007 [YR2007] 2008 [YR2008] 2009 [YR2009] 2010 [YR2010] 2011 [YR2011] 2012 [YR2012] 2013 [YR2013] 2014 [YR2014] 2015 [YR2015] 2016 [YR2016] 2017 [YR2017] 2018 [YR2018] 2019 [YR2019] 2020 [YR2020]]	15	-22271687.02	230735832.7	71796009740	1.71393E+11	1.15104E+11	1.81437E+11	28.13684665	20.73504559	-4410155958	17972659528
Australia	[2008 [YR2008] 2007 [YR2007] 2008 [YR2008] 2009 [YR2009] 2010 [YR2010] 2011 [YR2011] 2012 [YR2012] 2013 [YR2013] 2014 [YR2014] 2015 [YR2015] 2016 [YR2016] 2017 [YR2017] 2018 [YR2018] 2019 [YR2019] 2020 [YR2020]]	15	-38484517089	26303153275	6105807761	7098275049	5.57212E+11	1.7863E+12	18.77054574	16.07849357	6783299015	50509140990
Austria	[2008 [YR2008] 2007 [YR2007] 2008 [YR2008] 2009 [YR2009] 2010 [YR2010] 2011 [YR2011] 2012 [YR2012] 2013 [YR2013] 2014 [YR2014] 2015 [YR2015] 2016 [YR2016] 2017 [YR2017] 2018 [YR2018] 2019 [YR2019] 2020 [YR2020]]	15	10081486289	3731252474	72932127090	99758517684	77551135602	1.78409E+11	21.01040183	15.883546	8960028722	22751596619
Azerbaijan	[2008 [YR2008] 2007 [YR2007] 2008 [YR2008] 2009 [YR2009] 2010 [YR2010] 2011 [YR2011] 2012 [YR2012] 2013 [YR2013] 2014 [YR2014] 2015 [YR2015] 2016 [YR2016] 2017 [YR2017] 2018 [YR2018] 2019 [YR2019] 2020 [YR2020]]	15	7949541601	6437200759	74886437829	1.93259E+11	1.89979E+11	3.46452E+11	25.60347226	19.62192156	-570757990.8	2127177627
Bahamas, The	[2008 [YR2008] 2007 [YR2007] 2008 [YR2008] 2009 [YR2009] 2010 [YR2010] 2011 [YR2011] 2012 [YR2012] 2013 [YR2013] 2014 [YR2014] 2015 [YR2015] 2016 [YR2016] 2017 [YR2017] 2018 [YR2018] 2019 [YR2019] 2020 [YR2020]]	15	-1186234801	604642558.8	1.68259E+11	4.78698E+11	1.23719E+11	1.80342E+11	17.0299346	13.5393756	-3612687785	33040329025
Bahrain	[2008 [YR2008] 2007 [YR2007] 2008 [YR2008] 2009 [YR2009] 2010 [YR2010] 2011 [YR2011] 2012 [YR2012] 2013 [YR2013] 2014 [YR2014] 2015 [YR2015] 2016 [YR2016] 2017 [YR2017] 2018 [YR2018] 2019 [YR2019] 2020 [YR2020]]	13	935383236.9	1924789733	3.92248E+11	9.17262E+11	2.1995E+11	4.25561E+11	17.82832915	7.114915292	-5864988656	21252665310
Bangladesh	[2008 [YR2008] 2007 [YR2007] 2008 [YR2008] 2009 [YR2009] 2010 [YR2010] 2011 [YR2011] 2012 [YR2012] 2013 [YR2013] 2014 [YR2014] 2015 [YR2015] 2016 [YR2016] 2017 [YR2017] 2018 [YR2018] 2019 [YR2019] 2020 [YR2020]]	15	162368776	3102235454	1.06309E+11	1.99164E+11	46935229660	1.00788E+11	27.99639906	16.68363675	59354106924	1.32621E+11
Barbados	[2008 [YR2008] 2007 [YR2007] 2008 [YR2008] 2009 [YR2009] 2010 [YR2010] 2011 [YR2011] 2012 [YR2012] 2013 [YR2013] 2014 [YR2014] 2015 [YR2015] 2016 [YR2016] 2017 [YR2017] 2018 [YR2018] 2019 [YR2019] 2020 [YR2020]]	11	-358570860.5	152427418.9	68841083528	88627308925	1.11234E+11	1.68178E+11	17.17765919	12.78574558	-4112475604	29769686564

Section 4. Set a hypothesis for the effect of each independent variable on the dependent variable (i.e., a total of four hypotheses). Explanations / Theories / Intuitions should be provided to justify each hypothesis. Sources of references should be cited. (20 marks)

Dependent Variable	Independent Variable	Hypothesis for the effect of each independent variable on the dependent variable	Reference
Current account balance (BoP, current US\$)	1. 'Exports of goods and services (BoP, current US\$)',	Positive, when export increase, current account balance will increase.	<p>The Formula for Current Account Balance:</p> $CAB=(X-M)+(NY+NCT)$ <p>where:</p> <p>X=Exports of goods and services</p> <p>M=Imports of goods and services</p> <p>NY=Net income abroad</p> <p>NCT=Net current transfers</p> <p>https://www.investopedia.com/insights/exploring-current-account-in-balance-of-payments/</p>
Current account balance (BoP, current US\$)	2. 'Imports of goods, services and primary income (BoP, current US\$)',	Negative, when import increase, current account balance will decrease.	
Current account balance (BoP, current US\$)	3. 'Transport services (% of commercial service exports)',	Positive, when export increase, current account balance will increase.	
Current account balance (BoP, current US\$)	4. 'Net trade in goods and services (BoP, current US\$)'	Positive, when net trade increase, current account balance will increase.	

Section 5. Using the data collected, estimate a fixed-effect model by a Python program. Report the main findings in a table. Provide the Python program in an appendix. (5 marks)

PanelOLS Estimation Summary

Dep. Variable:

CAB

Estimator:

PanelOLS

No. Observations:

214

Date:

Sat, Nov 13 2021

Time:

02:47:53

Cov. Estimator:

Unadjusted

R-squared:

0.0157

R-squared (Between):

0.0232

R-squared (Within):

0.0157

R-squared (Overall):

0.0201

Log-likelihood

-5220.2

F-statistic:

0.7796

P-value

0.5397

Distribution:

F(4,195)

F-statistic (robust):

0.7796

P-value

0.5397

Distribution:

F(4,195)

Entities:

15

Avg Obs:

14.267

Min Obs:

11.000

Max Obs:

15.000

Time periods:

15

Avg Obs:

14.267

Min Obs:

11.000

Max Obs:

15.000

Parameter Estimates

Parameter

Std. Err.

T-stat

P-value

Lower CI

Upper CI

EGS

-0.0007

0.0013

-0.5352

0.5931

-0.0032

0.0019

IGS

5.699e-05

0.0014

0.0410

0.9673

-0.0027

0.0028

TS

-3.458e+07

4.036e+07

-0.8568

0.3926

-1.142e+08

4.502e+07

NT

0.0252

0.0182

1.3835

0.1681

-0.0107

0.0611

- **R-squared = 0.0157 which is low, it is not a good fit model.**

Section 6. Based on the findings, test for the hypotheses one by one. For each hypothesis, intuitively explain why it is / is not supported by the findings. (12 marks)

Independent Variable (Full Name)	Independent Variable	Hypothesis	Hypothesis Conclusions
1. 'Exports of goods and services (BoP, current US\$)',	EGS	has a significantly negative effect on "Current account balance" (Beta1 = -0.0007)	p value (0.5931) > 0.05, one cannot reject the null hypothesis of Beta = 0 (at least at the 5% level of significance)
2. 'Imports of goods, services and primary income (BoP, current US\$)',	IGS	has a significantly postive effect on "Current account balance" (Beta2 =5.699e-05)	p value (0.9673) > 0.05, one cannot reject the null hypothesis of Beta = 0 (at least at the 5% level of significance)
3. 'Transport services (% of commercial service exports)',	TS	has a significantly negative effect on "Current account balance" (Beta3 = -3.458e+07)	p value (0.3926) > 0.05, one cannot reject the null hypothesis of Beta = 0 (at least at the 5% level of significance)
4. 'Net trade in goods and services (BoP, current US\$)'	NT	has a significantly postive effect on "Current account balance" (Beta4 = 0.0252)	p value (0.1681) > 0.05, one cannot reject the null hypothesis of Beta = 0 (at least at the 5% level of significance)

Reference

Current Account Balance, Heakal, <https://www.investopedia.com/insights/exploring-current-account-in-balance-of-payments/>

Appendix

```
from linearmodels import PanelOLS
import statsmodels.api as sm

def Session4(df):

    df = df.copy()

    df.rename(columns={'Current account balance (BoP, current US$)': 'CAB',
                       'Exports of goods and services (BoP, current US$)': 'EGS',
                       'Imports of goods, services and primary income (BoP, current US$)': 'IGS',
                       'Transport services (% of commercial service exports)': 'TS',
                       'Net trade in goods and services (BoP, current US$)': 'NT',},
              inplace=True)

    print(df.columns)

    df['Year'] = df['Year'].str[0:4].astype(int)
    print(df['Year'].head())

    df = df.set_index(['Country Code', 'Year'])

    mod = PanelOLS(df['CAB'], df[['EGS', 'IGS', 'TS', 'NT']], entity_effects=True)
    res = mod.fit()

    print(res)

    return res

s4 = Session4(df)
```