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Analysis of Factors Determining Global Payment Imbalances in 2000-2019

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Abstract:

Purpose: *The aim of the paper is to identify and assess the impact of the determinants of global payment imbalances in 2000-2019.*
Design/Methodology/Approach: *The study used the desk research method, including critical analysis of the recent literature and econometric methods of data analysis. The assessment of the evolution of global payment imbalances was carried out using the index of global payment imbalances (GI), while regression analysis based on panel data was used to assess the impact of factors influencing payment imbalances.*
Findings: *The research proves that the factors significantly influenced the current account balances (CAB) in the analyzed countries were, real effective exchange rate, GDP growth, household consumption and government consumption, investment, government budget balance, terms of trade, and crude oil trade balance.*
Practical Implications: *The conducted analyses allowed to formulate several recommendations for economic policy. China's exchange rate policy ceased to be the key factor generating global payment imbalances. Moreover, the change in China's economic model of reducing the role of external drivers of economic growth (export demand) and increasing the role of internal drivers (domestic demand) contributes to reducing China's external imbalances. Whereas, the sources of the U.S. current account deficit are particularly internal factors (domestic absorption). The government budget balance is one of the most important factors determining the CAB. Reducing government spending, can become an effective instrument to improve the current account balance. In addition, the balance of crude oil trade is a factor that has a large impact on the CAB. The energy transition of countries towards renewable sources can reduce global payment imbalances.*
Originality/value: *The results contribute to the discussion on the determinants of the global payment imbalances. In this approach, a comprehensive assessment for all countries and by group is possible.*

Keywords: *Global imbalances, current account, panel data, consumer demand, investment, REER, economic growth, twin deficits, United States, China.*

JEL classification: *C11, C33, F32, F34, F41, O52.*

Paper Type: *Research Paper.*

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1. Introduction

Global payment imbalances have been one of the key problems of the contemporary world economy since the beginning of the 21st century. Its essence is the occurrence of chronic current account deficits and surpluses of systemically important countries. After the 2008-2009 financial crisis, global payment imbalances began to decline, with these changes occurring on the side of surplus countries, particularly China, while the United States still has a large deficit.

Previously, China's economic growth strategy was based on external demand (export-led growth staretegy) supported by an active exchange rate policy. The importance of China's exchange rate policy for the creation of global imbalances was related to the maintenance of an undervalued yuan for years through significant, systematic and unidirectional interventions of the People's Bank of China in the foreign exchange market. However, the stricter trade policy by the United States and the global economic downturn caused by the COVID-19 pandemic have limited the effectiveness of this strategy. In addition, for several years now, China has been carrying out reforms to make the exchange rate regime more flexible and trying to support domestic demand as an alternative source of economic driving force. The new development model is based on a 'dual circulation' strategy (Hong, 2020). Diversifying the sources of economic growth aims to achieve more balanced and sustainable economic growth. It should also lead to the reduction of internal and external imbalances (Kowalski and Lesher, 2010).

After the crisis, the share of the United States in the creation of global payment imbalances increased, which may suggest that in the case of this country cyclical factors are relatively less important, and other factors, including internal ones, such as high consumption in relation to savings, demographic changes, weak trade competitiveness or changes in the exchange rate contribute more to the increase in the current account deficit.

According to the International Monetary Fund, in 2019 about 40% of the payment imbalances in the global economy were excessive imbalances (IMF, 2020). This indicates the high level of risks and costs associated with global imbalances, both at the level of individual countries and the global economy as a whole. Permanent external imbalances of systemically important countries in the absence of an effective adjustment mechanism create the risk of rebalancing through crisis (disorderly rebalancing/adjustment) (Eichengreen and Park, 2006), hence it is important to identify the most important determinants of payment imbalances, which will allow to indicate the desired directions of changes in the economic policies pursued by countries.

The purpose of the paper is to assess the impact of factors influencing global payment imbalances in 2000 - 2019. The research conducted in the paper is aimed at answering the following research questions:

1) Have the 2008-2009 financial and economic crisis and prolonged economic weakness been a key factor in reducing global payment imbalances?
2) Is the U.S. trade deficit driven more by internal factors (high domestic demand) or external factors, including policies of surplus countries?
3) Has China's exchange rate flexibility and gradual appreciation of the yuan reduced China's trade surplus?
4) Will the COVID-19 crisis reduce global payment imbalances by depressing U.S. demand amid a weakening economy or magnify them by strengthening China's position in international trade due to China's rapid progress in digitizing and digitizing its economy?

The research is designed to verify the following research hypotheses:

I. After the 2008-2009 crisis, China's exchange rate policy ceased to be a key factor generating global payment imbalances.
II. The shift in China's economic model to reduce the role of external drivers of economic growth (export demand) and increase the role of internal drivers (domestic demand) contributes to reducing China's external imbalances.
III. The sources of the U.S. current account deficit are particularly internal factors (domestic absorption).
IV. The government budget balance is one of the most important factors determining the current account balance. Reducing government spending, can become an effective instrument to improve the current account balance (twin deficits hypothesis).
V. The balance of crude oil trade is a factor that has a large impact on the current account balance. The energy transition of countries towards renewable sources can reduce global payment imbalances.

This paper consists of 7 parts. After the introduction, a review of the theoretical literature and empirical studies important for the analysis are presented. Section 3 presents an assessment of the evolution of global payment imbalances in the world economy from 2000 to 2019. Section 4 characterizes the data used and the methodology of the study, while Section 5 presents the results of the empirical study. The paper ends with a discussion of the results and conclusions.

2. Literature Review

2.1 Theoretical Background of the Current Account Balance Analysis

Among the theoretical approaches to the analysis of factors influencing the current account balance, four main approaches can be highlighted, elasticity, absorption, monetary and intertemporal (Czarny and Śledziewska, 2013). According to the elasticity approach, the adjustment of the current account balance occurs by revaluation or devaluation of the national currency. The main determinants of the

current account balance are the volume of domestic and foreign production, as well as the exchange rate (Robinson, 1937).

According to the absorption approach, the current account balance is the difference between domestic revenues and domestic expenditures (domestic absorption). This relationship can also be formulated as the difference between domestic savings and domestic investments (Alexander, 1952). Whereas the monetary approach is based on Hume's concept of international adjustment mechanism. This approach uses the quantitative theory of money in an open economy. According to this approach, the size of the money stock, rather than real flows, is crucial. The causes of current account imbalances are seen in the imbalance between demand and supply of money (Berdell, 1995).

The intertemporal approach refers to M. Friedman's concept of permanent income, according to which decisions to increase or decrease consumption are determined by expectations of future income. During periods of long-term economic growth, foreign borrowing occurs, and as a result, a current account deficit emerges. According to this approach, the current account balance is equal to the difference between the savings rate and the domestic investment rate, which in turn are determined by expectations of future income and interest rates (Friedman, 1957).

The authors of the discussed theoretical concepts and the main factors influencing CAB according to these theories, as well as the relationship to the research hypothesis are presented in Table 1.

Table 1. *Theoretical approaches to the factors of current account imbalances*

Approach	**Main factors influencing CAB**	**Author**	**Hypothesis to be verified**
elasticity approach	– exchange rate – volume of domestic and foreign production	J. Robinson (1937)	I
absorption approach	– country's GDP – state of the national budget – domestic expenditures: consumption, investment	S. Alexander (1952)	II, III, IV, V
monetary approach	– demand for money changes – domestic money supply changes	F. Berdell (1995)	-
intertemporal approach	– the gap between the savings rate and the domestic investment rate	M. Friedman (1957)	II, III

Source: *Own compilation.*

2.1 Factors of Global Payment Imbalances - A Review of Empirical Studies

The literature on empirical analysis of factors influencing global payment imbalances is very rich. Table 2 presents an overview of the selected literature, summarizing the time frame and geographical scope of the study, the method used, and the main conclusions regarding the influence of the factors analyzed.

Table 2. *Main factors affecting the current account balance in empirical studies*

	Author	Year of publication	Analysed period	Countries analysed	Method	Determinants
1	E. Czarny, K. Śledziewska	2013	1995-2011	100 countries	Regression of panel data (static and dynamic model)	Population age structure: people over 65 as % of the working population (+), unemployment rate (-), terms of trade (+), oil trade (+); in the euro area, the impact of government budget balances and public debt on external balances has not been confirmed
2	J.B. Gosse, F. Serranito	2014	1974-2009	OECD countries		Exchange rate (-), credit level (-), Real GDP (-), oil balance (+), terms of trade (+), labour productivity (+)
3	D. Romelli, C. Terra, E.X. Vasconcelos	2018	1970-2011	World (181 countries)	Regression of panel data	Openness (+), exchange rate (+)
4	A. Możdzież	2018	2002-2016	Central and Eastern European countries (Bulgaria, Czech Republic, Poland, Slovakia, Hungary)	Single equation dynamic error correction models and correlation analysis	Results vary by country: Poland: growth of savings in the economy (+), growth of investment in the economy (-), growth of GG sector spending (-), growth of consumer spending (-)
5	Y.-W. Cheung, S. Steinkamp, F. Westermann	2020	1982-2016	China, Germany	Regression of panel data	Current account balances of China and Germany are quite well explained by currency misalignment, common economic factors, and country-specific factors.
6	M.A. Nasir, K. Jackson	2019	Q1 2000-Q1 2016	Germany, China, Japan, Russia and KSA (major trade surplus) and USA, UK, France, India and Turkey (major trade deficit countries)	Structural Vector Autoregressive (SVAR) Model	Impact of exchange rate misalignment on CAB were very mild and transitory
7	M.A. Nasir, M. Leung	2020	Q1 1994 – Q1 2018	the United States	A non-linear autoregressive distributed lag (NARDL)	Exchange rate (-), domestic inflation (GDP deflator) (-), productivity (+ in short-term, - in long term), domestic savings (+) and fiscal discipline (+)

8	M. Rajković, P. Bjelić, D. Jaćimović, M. Verbič	2020	1990-2016	the Western Balkan (WB) and Central and Eastern European (CEE) countries (18 countries)	Regression of panel data	Real exchange rate (-), but during the global economic crisis, the balance of payments deficit is not impacted significantly by the exchange rate; more significant: government spending (-), foreign demand (+) and direct investments (-).
9	A. Silva, X. Ordenana, P. VeraGilc	2021	1984-2014	49 advanced and emerging economies	Regression model, generalised Least Squares	Quality of institutions (-), financial development (-), FDI (+), financial crises episodes (+)

Notes: *It is a not exhaustive review of the literature. Some of the previous findings are exposed, those are represented with "+" for a positive relationship and "-" for a negative relationship.*
Source: *Own compilation.*

3. Assessment of the Evolution of Global Payment Imbalances in the World Economy in 2000-2019

The global payment imbalance can be assessed using the index of global payment imbalances (*GI*), which is an aggregate measure of the current account imbalances of all countries. This index is calculated as the ratio of the sum of the absolute values of the current account balances of individual countries to world GDP according to the formula (Bracke *et al.*, 2008):

$$GI = \frac{\sum_{i=1}^{n} |CAB_i|}{GDP_W} \tag{1}$$

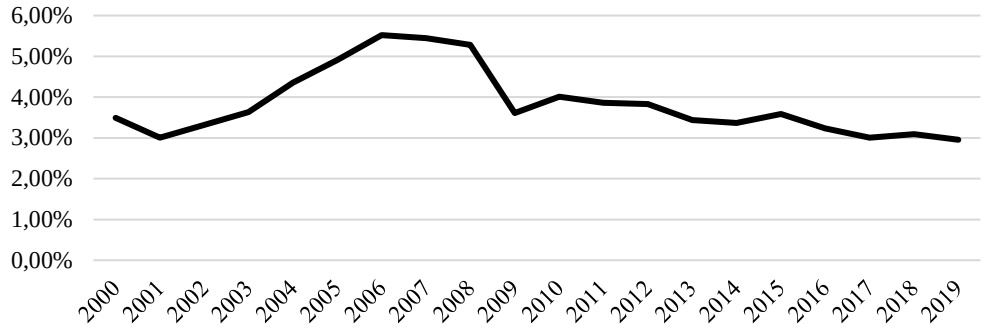
where:
GI - index of global payment imbalances,
CAB_i - value of the current account balance of the *i*-th country,
GDP_W - value of world GDP.

The index calculated in this way indicates the size of current account imbalances relative to global GDP. Analysis of the data presented in fig. 1 indicates that the global payment imbalances grew rapidly in the first decade of the 21st century. In 2001, the global payment imbalances index was 3.01%, and rose to 5.52% in 2006.

The upward trend was halted with the outbreak of the global financial crisis in 2008. In 2009, the GI fell to 3.61%, mainly due to the recession and the collapse in international trade. With the slow economic recovery since 2010, the index increased to 4.01% and has been declining slightly since 2011 reaching 2.95% in 2019.[3]

[3]*Own calculations based on UNCTAD (2021).*

***Figure 1**. Index of global payment imbalances in 2000-2019*



***Source:** Own calculations based on UNCTAD (2021).*

An index calculated according to the formula was used to identify the countries participating most in the creation of global payment imbalances (Bracke *et al.*, 2008):

$$GI_i = \frac{|CAB_i|}{\sum_{i=1}^{n}|CAB_i|} \tag{2}$$

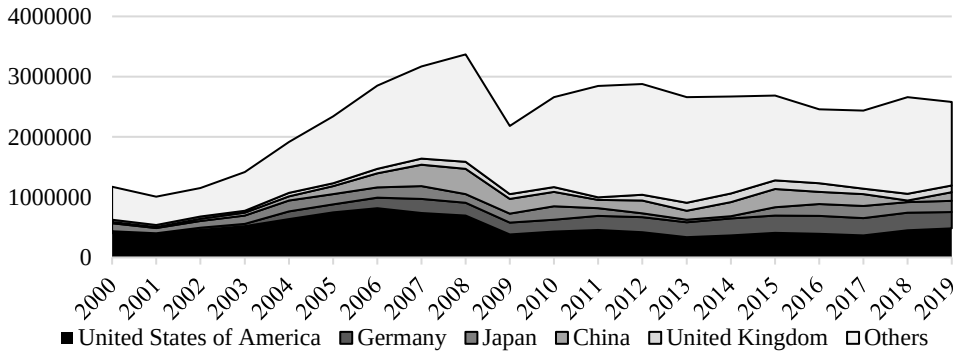
where:
GI_i - *i*-th country's contribution to global payment imbalances,
CAB_i - value of the current account balance of the *i*-th country.

The indicators calculated according to this formula show the shares of countries in the creation of global payment imbalances. The biggest contribution to the creation of global payment imbalances in 2000 came from, United States of America (34.2%), Japan (11.1%), Russian Federation (3.9%), United Kingdom (3.2%), Germany (2.9%).[4] Among this group, surplus countries were Japan and Russian Federation, and deficit countries were: United States, United Kingdom and Germany. In 2019, the largest contribution to global payment imbalances came from the United States of America (18.6%), Germany (10.6%), Japan (7.1%), China (5.5), and United Kingdom (4.4%), with the US and UK in deficit and Germany, Japan and China in surplus (Figures 2 and 3).

The U.S. share in the creation of global payment imbalances over the whole analyzed period was the highest among all countries, although it decreased from 34.2% to 18.6%. The second country with a large current account deficit over the whole analyzed period was the United Kingdom and its share increased from 3.2% to 4.4%. Germany was a deficit country in 2000 and has had surpluses every year since 2002. Japan, Russian Federation and China were also among the countries with large surpluses. Japan's share was 11.1% in 2000, then declined to 1.4% in 2014 and from 2015 increased to 7.1% in 2019.

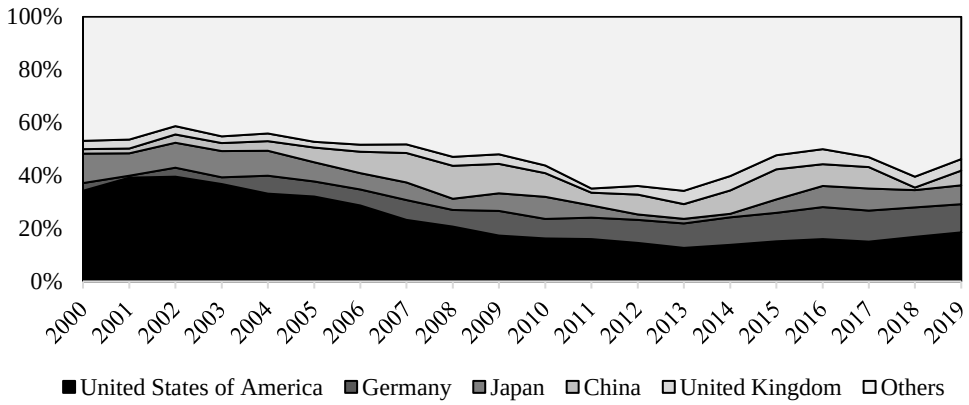
[4]*Own calculations based on UNCTAD (2021).*

Figure 2. *Shares in accumulated global payment imbalances in 2000-2019 (millions USD)*



Source: *Own calculations based on UNCTAD (2021).*

Figure 3. *Shares in accumulated global payment imbalances in 2000-2019 (in %)*



Source: *Own calculations based on UNCTAD (2021).*

The share of the Russian Federation fluctuated in the analyzed period between 1.0% and 4.3%, which was largely related to changes in the prices of oil and gas and other raw materials. China had a large impact on the shaping of the global payment imbalances in the analyzed period, although its share varied over time. In the first decade of the 21st century, the share of China's surplus in the global payment imbalances has been increasing, which was largely due to China's accession to the World Trade Organization in 2001.

China reached its maximum share of 12.5% in 2008. In subsequent years, China's share fluctuated, although a downward trend prevailed. China's external rebalancing was the most important trend in the post-crisis period in the group of surplus countries. Both the collapse in global trade, the evolution of the yuan's exchange rate, as well as the change in strategy in China's economic policy have had a major impact on this.

4. Research Methodology

Further analysis to identify and assess the factors influencing the global payment imbalance was based on panel data modeling for 178 countries over the period 2000-2019. On the basis of substantive rationale derived from the literature review, as well as own knowledge and research experience, and availability and comparability of data, a set of potential explanatory variables that could influence current account balances was generated. A detailed description of the variables adopted for the models, along with an indication of the data sources and the expected direction of impact, is provided in Table 3.

Table 3. *Variables used in the model and sources of statistical data*

Variables	Code	Description	Source	Expected direction of impact
Explained variable				
CAB	[1]	Current account balance (% GDP)	UNCTAD	Explained variable
Explanatory variables				
REER	[2]	Real effective exchange rate index (CPI based, 2005=100)	UNCTAD	-/+
GDP	[3]	Real gross domestic product (Annual average growth rate in %)	UNCTAD	-
Cons_H	[4]	Household consumption expenditure (% GDP)	UNCTAD	-
Cons_G	[5]	General government final consumption expenditure (% GDP)	UNCTAD	+/-
Invest	[6]	Gross fixed capital formation (% GDP)	UNCTAD	-
Deficit	[7]	General government net lending/borrowing (% GDP)	IMF (WEO)	+
TOT	[8]	Terms of trade index (2015=100)	UNCTAD	+
OIL	[9]	Crude oil trade balance (Petroleum, petroleum products and related materials, % GDP)	UNCTAD	+

Source: *Own compilation.*

It was assumed that the following variables could affect the current account balance:

- real effective exchange rate index (CPI based, 2005=100) – the impact of the REER on CAB is not clear-cut, the appreciation of the real exchange rate leads to a deterioration in export competitiveness and consequently a decline in exports, at the same time causing an increase in demand for imports, which worsens the trade balance and CAB, however, if the appreciation of the REER causes an increase in domestic investment abroad, the consequence will be an improvement in CAB in the medium and long term (Jayasooriya, 2020),
- real gross domestic product growth – the better the economic situation measured by GDP growth, the better the expectations for the future, and therefore the higher the propensity to consume and invest, i.e. domestic absorption, which may lead to

an increase in imports and a deterioration in CAB, hence a negative sign is expected (Das, 2016),

- household consumption expenditure as a share of GDP – an increase in consumption and its share in GDP leads to an increase in imports and a decrease in domestic savings, and consequently a deterioration in CAB, so a negative impact on CAB is expected,
- general government final consumption expenditure as a share of GDP – an increase in government spending can lead to an increase in savings (according to Ricardian equivalence) and an improvement in the current account balance (Nickel and Vansteenkiste, 2008), on the other hand, government consumption contributes to the increase in domestic absorption affecting the deterioration of CAB,
- investments (gross fixed capital formation) as a share of GDP - in the short term, an increase in investment and its share in GDP leads to an increase in demand for imported goods; moreover, higher wealth expectations cause an intertemporal adjustment that results in a current account deficit (Olivei, 2000); in the future current investment should lead to productivity gains and higher production capacity, which could improve the current account balance. Nevertheless, the expected sign of the relationship in the short term is negative,
- general government net lending/borrowing as percent of GDP showing fiscal balance – most theoretical models point to a positive relationship between government budget balances and current accounts, especially over the medium term. Government budget defcits tend to induce current account defcits by redistributing income from future to present generations (overlapping generations models). This relationship is in line with the twin defcits idea (Zezza, 2009). Exceptions are the models based on Ricardian equivalence (Ca'Zorzi *et. al.*, 2012),
- terms of trade index – An improvement in terms of trade means that the purchasing power of a domestic entity increases, i.e. for the same amount of exported goods they can purchase a greater amount of imported goods. In addition, with high price elasticity of demand, an improvement in terms of trade may reduce external demand for exported goods, as these goods will be replaced by their substitutes (Rodriguez, 1976, Backus *et. al*, 1994),
- crude oil trade balance as percent of GDP – current account balances of oil-importing countries are highly sensitive to changes in oil prices (Ca'Zorzi *et. al.*, 2012), and many of these countries have balance of payments problems as a result. Consequently, a positive sign is expected.

The analysis was conducted for a group of 178 countries (model 1), and then, due to the fact that there are differences between countries at different levels of economic development, as well as countries with a permanent deficit and surplus, separate models were built for the following groups of countries: advanced economies - 36 countries (model 2), emerging market and developing economies - 142 countries (model 3), deficit countries - 92 (model 4), surplus countries - 35 countries (model 5) and balance countries - 57 countries (model 6). The classification of the International Monetary Fund was used to divide countries according to the level of economic

development, while the average current account balance in the period 2000-2019 was used as the criterion for dividing countries into deficit countries, surplus countries and countries with relative external balance. Countries for which the average current account deficit exceeded 3% of GDP were in the deficit countries group, and countries whose average current account balance was positive and exceeded 3% of GDP were in the surplus countries group. Countries for which the average current account balance was between -3% GDP and 3% GDP were considered to be in relative balance (these thresholds are based on the authors' subjective opinion).

The analyses were conducted using the linear regression method for panel data. The advantage of panel data is the possibility to analyze the phenomenon simultaneously in time and in cross-sectional or spatial dimension. The nature of panel data makes it possible to extract individual specifics of particular objects and the influence of unobservable variables or effects. The use of panel data also allows for greater heterogeneity, i.e., variation in the units of study, provides a greater number of degrees of freedom, and increases estimation efficiency. The regression equations were created using the following formula:

$$Y_{it} = \propto_i + \sum_i^n \beta_i X_{it} + \nu_{it} \tag{3}$$

where:

Y_{it} – explained variable, which is the current account balance in relation to GDP (CAB),

X_{it} – explanatory variables: REER, GDP, Cons_H, Cons_G, Invest, Deficit, TOT, OIL,

$\propto_i$ – constant,

β_i – coefficients on explanatory variables,

ν_{it} – the total random error, consisting of the purely random part ε_{it} and the individual effect u_i relating to the specific *i*-th unit of the panel, $\nu_{it} = \varepsilon_{it} + u_i$.

In the first step of the analysis, each model was built using the classical least squares method. The initial form of the regression models then underwent *a posteriori* selection procedure. This procedure involves removing at each step one non-significant process for which the modulus of the parameter significance test statistic (T-Student's statistic) was the smallest, and re-estimating the model until a set of statistically significant processes is obtained (Kufel, 2002).

5. Research Results

The estimation results of panel data regression models are presented below. The first model verifies whether in the group of 178 analyzed countries the selected factors significantly affected the current account balances. In the case of the first model (for all 178 countries), the *a posteriori* selection procedure showed no need to remove any of the factors. The model was created and then subjected to panel diagnostic tests,

which allowed for the final selection of the model form and a set of explanatory variables (appendix 2). Using the Breusch-Pagan test, the hypothesis of the existence of individual effects was verified.The results of the Breusch-Pagan test ordered to reject the null hypothesis in favor of the alternative one (p-value = 0), which indicates the necessity of introducing individual effects and the impossibility of applying the classical method of least squares (CLS). In the next step, the selection of the model with individual effects was made using the Hausman test. The time-constant variables test statistic indicates the justified use of panel model estimation with fixed effects. The estimated model parameters are presented in Table 4 (column M1:All), the detailed results of the panel model estimation with fixed effects are presented in Appendix 1 and the diagnostic tests of the model in Appendix 2.

The second model verifies whether the selected factors significantly affected current account balances in the group of 36 analyzed developed countries. On the basis of *a posteriori* selection, the REER variable was removed. Diagnostic tests of the model (Breusch-Pagan test, Hausman test) showed that it is appropriate to use panel model estimation with fixed effects. The estimated model parameters are presented in Table 4 (column M2: Advanced), and the detailed results of the panel model estimation with fixed effects are presented in Appendix 3 and the diagnostic tests of the model in Appendix 4.

The third model evaluates the effect of the selected factors on CAB in a sample of 142 developing countries. The *a posteriori* selection procedure showed no need to remove any of the factors. Diagnostic tests of the model (Breusch-Pagan test, Hausman test) indicated that panel model estimation with fixed effects should be used. The estimated parameters of the model are presented in Table 4 (column M3: Developing), the detailed estimation results of the panel model with fixed effects are presented in Appendix 5, and the diagnostic tests of the model are presented in Appendix 6.

The next three models include a country division by average current account balance. The fourth model verifies that in the group of 92 analyzed countries with an average current account deficit exceeding 3% of GDP in 2000-2019, the selected factors significantly affected the current account balance. Based on *a posteriori* selection, the variables Deficit (fiscal balance) and GDP (economic growth) were removed. Model diagnostic tests (Breusch-Pagan test, Hausman test) showed that panel model estimation with fixed effects should be used. The estimated model parameters are presented in Table 4 (column M4: Deficit countries), detailed results of panel model estimation with fixed effects are presented in Appendix 7, and diagnostic tests of the model in Appendix 8.

The fifth model evaluates the impact of the analyzed factors on CAB in a group of 35 countries with an average surplus on CAB. The *a posteriori* selection procedure revealed the need to remove the TOT variable. Diagnostic tests of the model (Breusch-Pagan test, Hausman test) showed that it is legitimate to use panel model estimation with fixed effects. The estimated model parameters are presented in Table 4 (column

M5: Surplus countries), the detailed results of the panel model estimation with fixed effects are presented in Appendix 9, and the model diagnostic tests are presented in Appendix 10.

The sixth model verifies that among the 57 countries analyzed with relative balance on the CAB, the selected factors significantly affected current account balances. Based on *a posteriori* selection, the variables REER, GDP and TOT were removed. Diagnostic tests of the model (Breusch-Pagan test, Hausman test) showed that it is reasonable to use panel model estimation with fixed effects. The estimated model parameters are presented in Table 4 (column M6: Balance countries), and the detailed estimation results of the panel model with fixed effects are presented in Appendix 11, and the diagnostic tests of the model in Appendix 12.

Table 4. *Estimation results of current account balance determinants*

Variable	**M1: All**	**M2: Advanced**	**M3: Developing**	**M4: Deficit countries**	**M5: Surplus countries**	**M6: Balance countries**
REER	0.00820006 (0.00279817)***	Removed on the basis of *a posteriori* selection (Step 1)	0.00822772 (0.00312001)***	−0.00846586 (0.00959879)	0.0174416 (0.00331493)***	Removed on the basis of *a posteriori* selection (Step 1)
GDP	0.0373261 (0.0178598)**	−0.00832642 (0.0279802)	0.0417490 (0.0204177)**	Removed on the basis of *a posteriori* selection (Step 2)	0.0843873 (0.0327479)**	Removed on the basis of *a posteriori* selection (Step 2)
Cons_H	−0.350490 (0.0213916)***	−0.520936 (0.0368939)***	−0.342317 (0.0242885)***	−0.398183 (0.0300486)***	−0.490096 (0.0499076)***	−0.0606691 (0.0300624)**
Cons_G	−0.202792 (0.0381314)***	−0.494131 (0.103104)***	−0.197251 (0.0425470)***	−0.201972 (0.0632818)***	0.0697974 (0.0545503)	−1.01388 (0.0931276)***
Invest	−0.609106 (0.0237067)***	−0.976705 (0.0293085)***	−0.566492 (0.0275261)***	−0.698897 (0.0325837)***	−0.333789 (0.0506923)***	−0.570380 (0.0360180)***
Deficit	0.222088 (0.0198654)***	0.109281 (0.0367259)***	0.232503 (0.0225900)***	Removed on the basis of *a posteriori* selection (Step 1)	0.352450 (0.0312045)***	0.138617 (0.0489895)***
TOT	0.0150941 (0.00665711)**	0.0319612 (0.00971770)***	0.0153525 (0.00763391)**	0.00559058 (0.0119272)	Removed on the basis of a posteriori selection (Step 1)	Removed on the basis of *a posteriori* selection (Step 3)
OIL	0.215784 (0.0248959)***	0.160881 (0.0661227)**	0.222381 (0.0279366)***	0.234277 (0.0469937)***	0.326816 (0.0584412)***	0.155489 (0.0276466)***
Const	35.4339 (1.88085)***	58.2531 (2.84408)***	3.4857 (2.21348)***	40.6999 (3.37231)***	31.9639 (3.06494)***	32.8359 (2.90994)***
Number of	2746	717	2144	1367	553	1127

observations						
Number of countries	178	36	142	92	35	57

Note: *Standard error in brackets,* ****** p < 0.01; ** p < 0.05; * p < 0.1***
Source: *Own compilation.*

The analysis conducted for a group of 178 countries (model 1: All countries) indicates that the factors that significantly affected current account balances and were positively correlated with it (i.e., an increase in the value of the factor resulted in changes towards a surplus on the CAB, and a decrease in the value of the factor resulted in changes towards a deficit on the CAB) were: real effective exchange rate, GDP growth, government budget balance, terms of trade and crude oil trade balance. Conversely, the following factors were negatively correlated, household consumption, government consumption and investment. An increase in the value of these factors resulted in changes towards the current account deficit. However, for the analyzed groups of countries there are differences in the significance of individual factors, as well as the directions of their impact.

The real effective exchange rate turned out to be significant for the current account balance in the group of 178 analyzed countries, in developing economies and in economies with a current account surplus. However, it is worth noting that the sign of the impact for these countries is positive, which contradicts the theoretical assumption that REER appreciation worsens export competitiveness, thus worsening the current account balance. REER negatively affects the current account balance in deficit countries, but in this group this factor turned out to be insignificant. This allows for positive verification of hypothesis I, that China's exchange rate policy ceased to be a key factor generating global payment imbalances.

The economic prosperity determinant adopted for the model is GDP growth. This factor is found to be significant in the group of all countries analyzed, in developing economies and in surplus economies. In contrast, it is insignificant in highly developed economies, in countries with a persistent deficit and in countries with a relative current account balance.

The factors that turned out to be significant in most of the analyzed groups of countries were household consumption, government consumption, and investment (only in the group of surplus countries did government consumption turn out to be statistically insignificant). These factors negatively affect the current account balance, which means that an increase in the share of consumption in GDP causes a deterioration of the CAB (a decrease in the surplus or an increase in the deficit). The same relationship applies to investment.

Thus, an increase in domestic absorption leads to a reduction in the current account surplus. This has important implications for the economic policies of both China,

which has a large surplus, and the United States, which is a deficit country. Increasing domestic absorption in China may lead to a reduction in surpluses, while decreasing domestic absorption in the U.S. will reduce current account deficits of this country. These observations allow for positive verification of hypothesis II, which states that the shift in China's economic model to reduce the role of external drivers of economic growth (export demand) and increase the role of internal drivers (domestic demand) contributes to reducing China's external imbalances. As well as hypothesis III: the sources of the U.S. current account deficit are particularly internal factors (domestic absorption).

The carried out research indicates a significant positive impact of the state budget balance on the external balance in the analyzed groups of countries (only in one group: deficit countries this factor turned out to be statistically insignificant). This means that an improvement in the government budget balance improves the current account balance, while a deterioration in the government budget balance affects the generation of a deficit on the CAB. Moreover, taking into account the negative impact of government consumption (increase in government spending affects the generation of deficit on the CAB) allows to positively verify hypothesis IV: the government budget balance is one of the most important factors determining the current account balance. Reducing government spending, can become an effective instrument to improve the current account balance (twin deficits hypothesis).

Terms of trade proved to be a statistically significant factor in the group of all countries analyzed, as well as in highly developed and developing economies. An improvement in terms of trade increased the current account surplus/decrease in the current account deficit, while a deterioration in terms of trade increased the current account deficit.

The crude oil trade balance proved to be an important factor affecting the current account balance. This factor is significant in all analyzed groups of countries. Oil trade deficit had an effect towards deficit on CAB and oil trade surplus interacted towards surplus on CAB. The results obtained support hypothesis V, that the balance of crude oil trade is a factor that has a large impact on the current account balance. The energy transition of countries towards renewable sources can reduce global payment imbalances. This is because renewable energy sources are more evenly distributed among countries, so oil-importing countries will be able to reduce imports.

Furthermore, promoted for environmental concerns the use of biofuels leading to a rise in the price of agricultural commodities utilized in their production. It has major effects on the economy of emerging and developing countries whose activity is highly dependent on agricultural commodities involved in biofuel production (Gomes *et al*., 2018). Thus, the energy transition will change the historical relationships between energy producers and consumers increasing the energy security of countries (Hache, 2018).

6. Discussion

The obtained results of the research are in line with the main conclusions of the theoretical considerations, as well as with the results of studies conducted by other researchers. Similar conclusions concerning the impact of REER on the foreign trade imbalances were reached by Rajković *et al.* (2020). Results of their research show that during the global economic crisis, the balance of payments deficit is not impacted significantly by the exchange rate and those countries that use their own currency cannot substantially adjust their trade deficit by depreciating their currency. In such cases, other factors play a more significant role, like as government spending, followed by foreign demand and direct investments.

Their research included developing countries. While, Cheung *et al.* (2020) analyzed the factors affecting the current account surplus in two surplus countries: China and Germany. Their empirical analyses show that the current account balances of these two countries are quite well explained by currency misalignment, common economic factors, and country-specific factors. They observed that for these two countries, there is a remarkable reversal in the patterns of exchange rate misalignment since the 2008-2009 global financial crisis. China's currency has turned from being undervalued to overvalued, Germany's currency has erased its level of overvaluation and become undervalued. While China has been gradually reducing its current account surplus, Germany's surplus has continued to increase throughout and after the crisis.

The impact of REER and competitive devaluation on trade imbalance was also studied by Nasir and Jackson (2019) employing a SVAR model for selected major trade surplus (Germany, China, Japan, Russia and Kingdom of Saudi Arabia) and major trade deficit countries (USA, UK, France, India and Turkey). Their findings suggest that exchange rate misalignment from equilibrium may have some implications for the current account balance for the surplus and deficit countries. However, according to their findings, the exchange rate misalignments shall not be seen as the sole responsible factor in the debate on global trade imbalances.

Furthermore, Nasir and Leung (2020) investigated the determinants of US trade balance in a framework, which does account for the asymmetric and non-linear effects of exchange rate dynamics for the US trade balance. The findings of this study shows that the trade balance improvement cannot be attributed to one single macroeconomic factor. Nevertheless, the depreciation can be beneficial to the US trade balance, which implies that the US trade deficit is related to the exchange rate pass-through to which the US has more influence. Empirical results show that the domestic inflation (GDP deflator), productivity, domestic savings and fiscal discipline are crucial for US trade balance in the short to long term.

An interesting research is presented by the work of Silva *et al.* (2021). They examine the role of the quality of institutions, financial development and FDI in addition to standard determinants of the current account. The main findings are that the larger the

better the quality of institutions and the greater the financial development, the larger are current account deficits. FDI, however, contributes to boost current account balances. Furthermore, financial crisis episodes tend to improve current account balances. This is particularly the case in countries that are highly open to trade and to receive FDI, like advanced economies and East Asian countries.

Nevertheless, Ca'Zorzi *et. al.* (2012) indicate that different models point to different predictions on the relevant current account determinants. They have shown that there are potentially thousands (or even million) of plausible current account models, depending on the choice of fundamentals. Conclusions of their research provide evidence of current account imbalances in major economies such as US, UK, China and Japan before the financial crisis. However, the vast majority of models suggest that prior to the financial crisis 2008-2009, current account positions of major economies such as the US, UK, Japan and China could not be easily reconciled with the evolution of economic fundamentals.

7. Conclusions

The questions of why some countries run persistent current account surpluses and why do others run deficits, often over decades, leading to enduring global imbalances have occupied an important place in the deliberations of economists around the world for years (Manger and Sattler, 2019). U.S. trade policy tightening at the end of the second decade of the 21st century, China's changing economic policy strategy, and the downturn associated with the COVID-19 pandemic have led to a revival of the empirical literature on current account imbalances.

This paper contributes to that literature by investigating the importance of factors affecting CAB on a large sample of countries (178) and by country group (highly developed, developing, deficit, surplus, and with relative balance). This problem is extremely important, because such persistent imbalances are the root cause of many financial crises and a major source of international economic conflict. The main conclusions of the conducted research are also the answers to the research questions posed in the introduction.

Have the 2008-2009 financial and economic crisis and prolonged economic weakness been a key factor in reducing global payment imbalances? After the 2008-2009 financial crisis, there was a reduction in global payment imbalances under weak economic conditions. The results of model estimation indicate that the GDP growth variable turned out to be significant in most cases, but the direction of the impact differed depending on the analyzed group of countries. This gives grounds to conclude that GDP growth was not the only key factor.

Moreover, the reduction in global imbalances was mainly based on the reduction of the surplus in China, which suggests that important factors in this case were a change in China's economic strategy to base economic growth more on domestic demand, as

well as the implementation of a more flexible exchange rate policy. In addition, the development of social security policies in China leads to reduced savings and increased consumption. Similarly, moving away from the one-child policy and allowing up to three children will drive consumption. Also driving domestic absorption in China is investment demand, which apart from demand for raw materials also consists of demand for machinery, equipment, etc., associated with investments such as The New Silk Road Project (Belt and Road Initiative). However, the realization of these projects may increase China's exports in the long run.

Is the U.S. trade deficit driven more by internal factors (high domestic demand) or external factors, including policies of surplus countries? It seems extremely difficult to give a conclusive answer to this question, however it can be noted that the factors generating domestic demand, i.e., private consumption, government consumption and investment were significantly influencing the current account balance in all analysed models, including the group of developed countries. In addition, many studies (e.g., (Nasir and Leung, 2020) indicate that in the case of the United States, domestic factors are important; however, the policies of trading partners, mainly China, are not insignificant in shaping the U.S. trade balance.

Has China's exchange rate flexibility and gradual appreciation of the yuan reduced China's trade surplus? The exchange rate has been an important factor determining the current account balance, particularly in developing economies as well as in economies with a current account surplus. However, the direction of the impact of exchange rate movements is not clear. Thus, it gives reason to conclude that other factors have been crucial in reducing China's trade surplus.

Will the COVID-19 crisis reduce global payment imbalances by depressing U.S. demand amid a weakening economy or magnify them by strengthening China's position in international trade due to China's rapid progress in digitizing and digitizing its economy? The economic shock of the COVID-19 crisis appears to be temporary, so it is rather unlikely to expect lasting effects from a balance of payments perspective. Nevertheless, the experience of previous economic crises allows to anticipate that weaker economic conditions during the lockdown period may be reflected in a temporary improvement in the balance of payments. Moreover, the future effects of accelerated digitalization of economies are difficult to assess at the current stage. China is very active in this area, promoting, among others, the idea of issuing a digital yuan, which would increase the chances of strengthening the position of the Chinese currency in international payments.

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Appendices:

Appendix 1. MODEL 1. *Estimation results of the panel model with fixed effects (FE) for all countries using 2746 observations (included 178 cross-sectional units, time-series length: minimum 1, maximum 18), dependent variable (Y): CAB*

Variable	*Coefficient*	*Std. Error*	*t-ratio*	*p-value*	*significance*
const	35.4339	1.88085	18.84	<0.0001	***
REER	0.0082	0.002798	2.931	0.0034	***
GDP	0.037326	0.01786	2.09	0.0367	**
Cons_H	−0.350490	0.021392	−16.38	<0.0001	***
Cons_G	−0.202792	0.038131	−5.318	<0.0001	***
Invest	−0.609106	0.023707	−25.69	<0.0001	***
Deficit	0.222088	0.019865	11.18	<0.0001	***
TOT	0.015094	0.006657	2.267	0.0235	**
OIL	0.215784	0.024896	8.667	<0.0001	***
Mean dependent var		−2.134525	S.D. dependent var		11.58619
Sum squared resid		85960.78	S.E. of regression		5.794690
LSDV R-squared		0.766720	Within R-squared		0.405022
LSDV F(185, 2560)		45.48081	P-value(F)		0.000000
Log-likelihood		−8624.668	Akaike criterion		17621.34
Schwarz criterion		18722.07	Hannan-Quinn		18019.05

rho	0.484663	Durbin-Watson	0.946255

Note: ** p < 0.1, ** p < 0.05, *** p < 0.01*
Source: *Own compilation.*

Appendix 2. *Diagnostic tests of the model 1*

	Test	Test statistic	Interpretation
1	Joint significance of differing group means	F(177, 2560) = 19.3541 with p-value 0	A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.
2	Breusch-Pagan test statistic	LM = 4556.13 with p-value = prob(chi-square(1)>4556.13) = 0	A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.
3	Hausman test statistic	H = 53.4951 with p-value =prob(chi-square(8)> 53.4951) = 8.6486e-009	A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.

Source: *Own compilation.*

Appendix 3. MODEL 2. *Estimation results of the panel model with fixed effects (FE) for advanced economies using 717 observations (included 36 cross-sectional units, time-series length: minimum 18, maximum 20), dependent variable (Y): CAB*

Variable	*Coefficient*	*Std. Error*	*t-ratio*	*p-value*	*significance*
const	58.2531	2.84408	20.48	<0.0001	***
GDP	−0.00832642	0.0279802	−0.2976	0.7661	
Cons_H	−0.520936	0.0368939	−14.12	<0.0001	***
Cons_G	−0.494131	0.103104	−4.793	<0.0001	***
Invest	−0.976705	0.0293085	−33.33	<0.0001	***
Deficit	0.109281	0.0367259	2.976	0.0030	***
TOT	0.0319612	0.00971770	3.289	0.0011	***
OIL	0.160881	0.0661227	2.433	0.0152	**
Mean dependent var	1.704427		S.D. dependent var		8.229279
Sum squared resid	3590.265		S.E. of regression		2.307987
LSDV R-squared	0.925956		Within R-squared		0.673025
LSDV F(42, 674)	200.6832		P-value(F)		0.000000
Log-likelihood	−1594.889		Akaike criterion		3275.777
Schwarz criterion	3472.505		Hannan-Quinn		3351.740
rho	0.596393		Durbin-Watson		0.753352

Note: ** p < 0.1, ** p < 0.05, *** p < 0.01.*
Source: *Own compilation.*

Appendix 4. *Diagnostic tests of the model 2*

	Test	Test statistic	Interpretation
1	Joint significance of differing group means	F(35, 674) = 48.9588 with p-value 2.98948e-160	A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.
2	Breusch-Pagan test statistic	LM = 2757.86 with p-value = prob(chi-square(1)>2757.86) = 0	A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.

3	Hausman test statistic	H = 22.7541 with p-value =prob(chi-square(7)> 22.7541) = 0.00188101	A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.

Source: *Own compilation.*

Appendix 5. MODEL 3. *Estimation results of the panel model with fixed effects (FE) for emerging market and developing economies using 2144 observations (included 142 cross-sectional units, time-series length: minimum 1, maximum 18), dependent variable (Y): CAB*

Variable	*Coefficient*	*Std. Error*	*t-ratio*	*p-value*	*significance*
const	33.4857	2.21348	15.13	<0.0001	***
REER	0.00822772	0.00312001	2.637	0.0084	***
GDP	0.0417490	0.0204177	2.045	0.0410	**
Cons_H	−0.342317	0.0242885	−14.09	<0.0001	***
Cons_G	−0.197251	0.0425470	−4.636	<0.0001	***
Invest	−0.566492	0.0275261	−20.58	<0.0001	***
Deficit	0.232503	0.0225900	10.29	<0.0001	***
TOT	0.0153525	0.00763391	2.011	0.0444	**
OIL	0.222381	0.0279366	7.960	<0.0001	***
Mean dependent var	−3.192515		S.D. dependent var		12.11040
Sum squared resid	81990.10		S.E. of regression		6.412363
LSDV R-squared	0.739131		Within R-squared		0.395189
LSDV F(149, 1994)	37.91739		P-value(F)		0.000000
Log-likelihood	−6948.492		Akaike criterion		14196.98
Schwarz criterion	15047.55		Hannan-Quinn		14508.20
rho	0.477167		Durbin-Watson		0.959348

Note: ** p < 0.1, ** p < 0.05, *** p < 0.01*

Source: *Own compilation.*

Appendix 6. *Diagnostic tests of the model 3*

	Test	Test statistic	Interpretation
1	Joint significance of differing group means	F(141, 1994) = 16.8616 with p-value 1.1454e-248	A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.
2	Breusch-Pagan test statistic	LM = 3007.87 with p-value = prob(chi-square(1)>3007.87) = 0	A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.
3	Hausman test statistic	H = 52.5183 with p-value =prob(chi-square(8)> 52.5183) = 1.33654e-008	A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.

Source: *Own compilation.*

Appendix 7. MODEL 4. *Estimation results of the panel model with fixed effects (FE) for deficit countries using 1367 observations (included 92 cross-sectional units, time-series length: minimum 1, maximum 17), dependent variable (Y): CAB*

Variable	*Coefficient*	*Std. Error*	*t-ratio*	*p-value*	*significance*
const	40.6999	3.37231	12.07	<0.0001	***
REER	−0.00846586	0.00959879	−0.8820	0.3780	
Cons_H	−0.398183	0.0300486	−13.25	<0.0001	***

Cons_G	−0.201972	0.0632818	−3.192	0.0014	***
Invest	−0.698897	0.0325837	−21.45	<0.0001	***
TOT	0.00559058	0.0119272	0.4687	0.6393	
OIL	0.234277	0.0469937	4.985	<0.0001	***
Mean dependent var		−8.963741	S.D. dependent var		9.239099
Sum squared resid		46016.66	S.E. of regression		6.021806
LSDV R-squared		0.605356	Within R-squared		0.368363
LSDV F(97, 1269)		20.06762	P-value(F)		1.2e-193
Log-likelihood		−4343.138	Akaike criterion		8882.276
Schwarz criterion		9393.873	Hannan-Quinn		9073.750
rho		0.414502	Durbin-Watson		1.089530

Note: ** p < 0.1, ** p < 0.05, *** p < 0.01*
Source: *Own compilation.*

Appendix 8. *Diagnostic tests of the model 4*

	Test	Test statistic	Interpretation
1	Joint significance of differing group means	F(90, 1269) = 10.1829 with p-value 1.53982e-097	A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.
2	Breusch-Pagan test statistic	LM = 758.487 with p-value = prob(chi-square(1)>758.487) = 5.72845e-167	A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.
3	Hausman test statistic	H = 47.2556 with p-value =prob(chi-square(6)> 47.2556) = 1.66384e-008	A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.

Source: *Own compilation.*

Appendix 9. MODEL 5. *Estimation results of the panel model with fixed effects (FE) for surplus countries using 553 observations (included 35 cross-sectional units, time-series length: minimum 7, maximum 18), dependent variable (Y): CAB*

Variable	*Coefficient*	*Std. Error*	*t-ratio*	*p-value*	*significance*
const	31.9639	3.06494	10.43	<0.0001	***
REER	0.0174416	0.00331493	5.262	<0.0001	***
GDP	0.0843873	0.0327479	2.577	0.0102	**
Cons_H	−0.490096	0.0499076	−9.820	<0.0001	***
Cons_G	0.0697974	0.0545503	1.280	0.2013	
Invest	−0.333789	0.0506923	−6.585	<0.0001	***
Deficit	0.352450	0.0312045	11.29	<0.0001	***
OIL	0.326816	0.0584412	5.592	<0.0001	***
Mean dependent var		10.49753	S.D. dependent var		12.42492
Sum squared resid		17166.19	S.E. of regression		5.795975
LSDV R-squared		0.798559	Within R-squared		0.637534
LSDV F(41, 511)		49.40794	P-value(F)		7.2e-151
Log-likelihood		−1734.544	Akaike criterion		3553.088
Schwarz criterion		3734.334	Hannan-Quinn		3623.899
rho		0.519847	Durbin-Watson		0.847783

Note: ** p < 0.1, ** p < 0.05, *** p < 0.01.*
Source: *Own compilation.*

Appendix 10. *Diagnostic tests of the model 5*

	Test	Test statistic	Interpretation
1	Joint significance of differing group means	F(34,511) = 19.705 with p-value 3.55233e-072	A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.
2	Breusch-Pagan test statistic	LM = 676.408 with p-value = prob(chi-square(1) > 676.408) = 4.03735e-149	A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.
3	Hausman test statistic	H = 71.4132 with p-value =prob(chi-square(7)> 71.4132) = 7.651e-013	A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.

Source: *Own compilation.*

Appendix 11. MODEL 6. *Estimation results of the panel model with fixed effects (FE) for balance countries using 1127 observations (included 57 cross-sectional units, time-series length: minimum 17, maximum 20), dependent variable (Y): CAB*

Variable	*Coefficient*	*Std. Error*	*t-ratio*	*p-value*	*significance*
const	32.8359	2.90994	11.28	<0.0001	***
Cons_H	−0.0606691	0.0300624	−2.018	0.0438	**
Cons_G	−1.01388	0.0931276	−10.89	<0.0001	***
Invest	−0.570380	0.0360180	−15.84	<0.0001	***
Deficit	0.138617	0.0489895	2.830	0.0047	***
OIL	0.155489	0.0276466	5.624	<0.0001	***
Mean dependent var	−0.488412		S.D. dependent var	6.291885	
Sum squared resid	27976.86		S.E. of regression	5.125363	
LSDV R-squared	0.372377		Within R-squared	0.320775	
LSDV F(61, 1065)	10.35865		P-value(F)	5.81e-72	
Log-likelihood	−3409.003		Akaike criterion	6942.007	
Schwarz criterion	7253.700		Hannan-Quinn	7059.783	
rho	0.541348		Durbin-Watson	0.873470	

Note: ** p < 0.1, ** p < 0.05, *** p < 0.01*
Source: *Own compilation.*

Appendix 12. *Diagnostic tests of the model 6*

	Test	Test statistic	Interpretation
1	Joint significance of differing group means	F(55, 1065) = 7.35708 with p-value 9.14228e-045	A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.
2	Breusch-Pagan test statistic	LM = 83.7786 with p-value = prob(chi-square(1)> 83.7786) = 5.53409e-020	A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.
3	Hausman test statistic	H = 226.84 with p-value =prob(chi-square(5)> 226.84) = 5.08581e-047	A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.

Source: *Own compilation.*