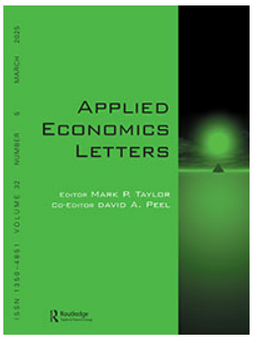

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Testing the twin deficit hypothesis for resource-rich economies in the era of climate change

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ABSTRACT

Burning fossil fuels emits greenhouse gases, the primary culprit of human-induced global warming and climate change. It is appropriate to revisit the twin deficit hypothesis with an extended data set and increasing evidence on the gravity of climate change. This study tests the twin deficit hypothesis for 18 resource-rich countries by employing annual data from 1991 to 2020. Employing panel unit-root tests, specifically, using an extension of the Granger causality test for heterogeneous panels, the findings of this study show that causality runs from the current account balance to the fiscal balance for 18 resource-rich countries. However, the sequential panel selection approach (SPSM) indicates that the stationarity of the current account balance (or budget balance) in a select few countries, including Equatorial Guinea, Kuwait, Iran, and the United Arab Emirates, is the only reason why the unit root null was rejected. We have discovered a bidirectional link for these four resource-rich nations, partially confirming our main hypothesis. This prompts us to test each of the four countries separately, and only the United Arab Emirates concurs with our primary claim. This unidirectional causality from the current account deficit to the budget deficit has policy implications for the United Arab Emirates.

KEYWORDS

Twin deficit hypothesis; current account balance; fiscal balance; panel unit-root tests

JEL CLASSIFICATION

C87; F43; H62

I. Introduction

Many resource-rich countries experience export-led growth as long as a relatively higher price of oil and natural gas persists in the global commodity markets. However, this kind of growth trend creates implicit fiscal vulnerability by increasing the dependency of state budget revenues on commodity prices. Once oil and natural gas prices decline in the international markets, economic growth's driving force disappears.

Furthermore, resource-rich economies keep growing without generating a current account deficit. In this regard, accelerating climate change means that resource-rich countries will likely lose their advantage of having persistent current account surpluses and retaining fiscal sustainability in government revenues (CTI 2021).

The increasing evidence confirming the role of burning fossil fuels in increasing global average temperatures towards 1.5 degrees Celsius, the more likely the prices of fossil fuels and earnings of resource-rich countries will come under scrutiny. This trend poses considerable challenge for resource-rich countries with huge potential of evaporating sizable current account surpluses (Appendix 1).

Considering existing literature on the twin deficit hypothesis, we can mainly mention about three different strands which provided mixed evidence for this topic. As a result, subsequent empirical works have examined why causality running from a budget deficit to a current account deficit (Akalpler and Panshak 2019; Banday and Aneja 2019; Dey and Tareque 2022), shows a bidirectional relationship between these two variables (Eregha, Aworinde, and Vo 2022; Karras 2013), or supports causality running from a current account deficit to a budget deficit (Ahmad and Aworinde 2020; Helmy 2018).

Transfers from oil funds to state budgets are common in resource-rich countries. In this manner, as per Kouassi et al (2004), budget deficit cannot be treated as a fully controlled policy variable. That is, the current account balance as an

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exogenous variable will have budgetary implications. Considering the background mentioned above, the gravity of the twin deficits for resource-rich countries is gaining importance. Due to climate change, the twin deficit hypothesis must be revisited for the resource-rich countries to provide more conclusive and comprehensive scientific evidence.

The following section provides comprehensive information on the data and methodology of this study. The third section presents the estimation results. The last section concludes the study.

II. Data and methodology

The data used in this paper has been gathered from IMF (2023). All observations are annual and cover the period from 1991 to 2020. Our sample consists of 18 countries. Appendix 2 has a list of the countries. The highest number of observations was used to choose the samples in Appendix 2. As a result, we have chosen the years 1991 through 2020. The main variables of interest in the empirical analysis are the budget balance as a percent (%) of gross domestic product (GDP) and the current account balance measured as a percent (%) of GDP. Table 1 shows descriptive statistics for the variables used.

This section presents the importance of employing panel unit-root tests to achieve more reliable and robust results. Otherwise, ignoring tests of the stationary of the main variables of interest can lead to spurious regression problems. To examine the non-stationarity of the model variables, the Cross-sectionally Augmented IPS (CIPS) panel unit root test developed by Pesaran (2007) was utilized in our paper.

The null hypothesis is a unit root for all time series in the panel. It is important to note that the null hypothesis of non-stationarity may be rejected even if just one of the panel's budget balances (or current account balances) is stationary (Aslanidis and Fountas 2014). We cannot thus assume that all individual budget balance (or current account balance) series are stationary under the alternative. To address this problem, Chortareas and Kapetanios (2009) suggest using the sequential panel selection method (SPSM) approach to segregate the several stationary budget balance (or current account balance) series inside the panel.

To examine the causal association, we use the extension of the Granger causality test for heterogenous panels developed by Dumitrescu and Hurlin (2012) by presenting the following model:

$$y_{i,t} = \alpha_i + \sum_{k=1}^{K} \gamma_{ik} y_{i,t-k} + \sum_{k=1}^{K} \beta_{ik} x_{i,t-k} + \varepsilon_{i,t} \; with \; i = 1, \ldots, N \; and \; t = 1, \ldots, T \quad (1)$$

where, $x_{i,t}$ and $y_{i,t}$ correspond to the two stationary variables for individual i in period t. The null hypothesis of the test assumes that there is no existence of Granger causality between the variables. Therefore, we test the null hypothesis $H_0 : \beta_{i1} = \cdots = \beta_{iK} = 0, \quad _i$ (the absence of causality) against the alternative $H_1 : \beta_{i1} = \cdots = \beta_{iK} = 0, \quad _i$, which states that there may be a causal relationship for certain individuals, but not necessarily for all.

III. Results

Before running Granger causality between the budget balance and the current account balance, there should be time series properties of the data used in the empirical tests. We only present results with one lag since the data are annual, and one lag is sufficient to capture the autoregressive dynamics in the series. We find strong evidence of cross-sectional dependence using the CIPS test. Table 2's Panel A and Panel B contain the CIPS test results. As can be observed, in both cases, the statistic value is below the threshold at the 1% significance level for the current account balance and the budget balance, respectively. This second-generation test thus disproves the unit-root process null hypothesis for both the current account balance and the budget balance.

Table 1. Descriptive statistics.

variables	N	M	SD	min	max
CAB	540	3.92	20.18	−242.18	60.20
BB	540	−1.53	38.13	−557.49	43.30

Source: Authors` own elaboration.

Table 2. Pesaran's unit-root test (CIPS) results.

Panel A: Intercept only			
	CIPS Test	CV (5%)	CV (1%)
CAB	−3.15**	−2.20	−2.38
BD	−3.03 **	−2.20	−2.38
Panel B: Intercept and Trend			
CAB	−3.49**	−2.72	−2.88
BD	−3.62 **	−2.72	−2.88

Source: Own elaboration.
**, and * denote rejection of the null hypothesis at the 1% and 5% significance levels, respectively.

The Granger causality test results in Table 3 show unidirectional causation running from the current account balance to the budget balance of resource-rich countries. This causation has been found for the lag lengths between 1 and 8.

Robustness

A series of tests were conducted to assess the robustness of our findings. In Table 4, before running the Granger causality test, we split our sample into countries characterized by stationary and non-stationary. The findings from the SPSM (Chortareas and Kapetanios 2009) applied to the Pesaran test are shown in Table 4 to generate results for stationarity that are particular to a specific country. The SPSM suggests that just four common out of a total of 18 series are stationary in both variables across the whole sample period. These include Equatorial Guinea, Kuwait, Iran, and the United Arab Emirates.

Table 5 provides the results for the four stationary countries. We have discovered a bidirectional link for these four resource-rich countries, partially confirming our main hypothesis.

Table 6 examines our basic theory using four stationary countries individually. This allows us to analyse heterogeneity, and it would be instructive to find out which causes, or lack of causes, are present in particular countries. Only in the United Arab Emirates does the relationship between the current account balance and the budget balance support the key findings; in Equatorial Guinea, the causation was shown to be in reverse.

IV. Conclusion

Accelerating climate change requires revisiting possible causality running between a fiscal deficit and a current account deficit to provide new insights. This paper investigates the causal linkage between the current account and fiscal deficits with a sample of 18 oil and gas-rich countries. In line with the existing literature on this topic, such as Kouassi et al. (2004), Helmy (2018), Ahmad and Aworinde (2020), our study concludes that a unidirectional relationship runs from the current account deficit to the budget

Table 3. The results of Granger causality tests: full sample.

Granger causality	Optimal number of lags (BIC)	W-bar	Z-bar	*p*-value
CAB → BD	1 (lags tested: 1 to 8)	4.175	9.527 **	0.003
BD → CAB	1 (lags tested: 1 to 8)	1.006	0.020	0.984

***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. The symbol "→" shows the direction of Granger causality. *p-values computed using 1,000 bootstrap replications.

Table 4. Stationary series (all countries).

	CIPS test	
Sample period	Current Account Balance	Budget Balance
1991–2020	COG, EGN, IRN, KWT, SR, UAE	EGN, GAB, IRN, KWT, MEX UAE,

Sequential panel selection method (SPSMP) based on CIPS test.
COG: Congo, Rep., EGN: Equatorial Guinea, GAB: Gabon, IRN: Iran, KWT: Kuwait, MEX: Mexico NGA: Nigeria, SUR: Suriname, UAE: United Arab Emirate.

Table 5. The results of Granger causality tests: four stationary countries.

Granger causality	Optimal number of lags (BIC)	W-bar	Z-bar	*p*-value
(a) Most vulnerable countries				
CAB → BD	8 (lags tested: 1 to 8)	14.850	3.425***	0.000
BD → CAB	8 (lags tested: 1 to 8)	12.768	2.384**	0.017

***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. The symbol "→" shows the direction of Granger causality. *p-values computed using 1,000 bootstrap replications.

Table 6. The results of Granger causality tests: four stationary countries individually.

Granger causality	Optimal number of lags (BIC)	W-bar	Z-bar	*p*-value
(a) Equatorial Guinea				
CAB → BD	1 (lags tested: 1 to 8)	0.013	−0.697	0.220
BD → CAB	**6 (lags tested: 1 to 8)**	**81.217**	**21.713*****	**0.000**
(b) Kuwait				
CAB → BD	1 (lags tested: 1 to 8)	1.724	0.512	0.540
BD → CAB	8 (lags tested: 1 to 8)	28.258	5.064	0.130
(c) Iran				
CAB → BD	1 (lags tested: 1 to 8)	0.553	−0.316	0.810
BD → CAB	1 (lags tested: 1 to 8)	0.866	−0.094	0.940
(d) UAE				
CAB → BD	**7 (lags tested: 1 to 8)**	**48.184**	**11.007****	**0.010**
BD → CAB	2 (lags tested: 1 to 8)	0.551	−0.724	0.480

***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. The symbol "→" shows the direction of Granger causality. *p-values computed using 1000 bootstrap replications.

deficit. When we include 18 countries, this finding is well supported. However, as demonstrated by the use of the sequential panel selection approach, such evidence should be viewed with caution because it is driven mainly by the stationarity of variables in a small number of countries. We discovered a bidirectional association when we tested our primary hypothesis for four stationary resource-rich countries. This prompts us to test each of the four countries separately, and only the United Arab Emirates (UAE) concurs with our primary claim. The findings of this study suggest that implicit fiscal vulnerability will gradually evolve into an explicit fiscal vulnerability for United Arab Emirates.

IMF forecasts show that thanks to relatively higher oil prices in the international markets, the current account surplus is almost 12% of GDP of the UAE. Also, the budget surplus is expected to reach 9% of the GDP (IMF 2023). As we found, unidirectional causality runs from the current account balance to the fiscal balance. During the upcoming seven years, policymakers in this country may lose this flexibility. It would be prudent to accelerate economic and export diversification in the country, along with energy transition. 95 of the primary energy consumption of the UAE comes from fossil fuels (EI 2023), and the energy sector is the largest emitter of CO2 in the country (IMF 2023). UAE plans to invest 150 billion USD in the oil and natural gas sector between 2023–2028 (Bearak 2023). Findings of our study suggest a unidirectional relationship running from the current account balance to budget balance for UAE case. With a dwindling current account surplus, the economy of the UAE could become more fiscally vulnerable as the global energy demand for fossil fuels shifts away.

Future research on this causality could extend this relationship by including the loss in economic growth due to climate change as an additional variable. Additionally, our findings demonstrate the significance of taking cross-sectional dependency into account in the panel, an element that is lacking in the body of research. Before applying Granger causality to panel data in future studies, stationary problems should be appropriately considered.

Disclosure statement

No potential conflict of interest was reported by the authors.

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References

Ahmad, A. H., and O. B. Aworinde. 2020. "Revisiting the Twin Deficits Hypothesis: New Evidence from Nonlinear Tests." *Applied Economics Letters* 27 (19): 1602–1606. https://doi.org/10.1080/13504851.2019.1707473.

Akalpler, E., and Y. Panshak. 2019. "Dynamic Relationship Between Budget Deficit and Current Account Deficit in the Light of Nigerian Empirical Application." *Evolutionary and Institutional Economics Review* 16 (1): 159–179. https://doi.org/10.1007/s40844-019-00122-8.

Aslanidis, N., and S. Fountas. 2014. "Is Real GDP Stationary? Evidence from a Panel Unit Root Test with Cross-Sectional Dependence and Historical Data." *Empirical Economics* 46 (1): 101–108. https://doi.org/10.1007/s00181-012-0668-z.

Banday, U. J., and R. Aneja. 2019. "Twin Deficit Hypothesis and Reverse Causality: A Case Study of China." *Palgrave Communications* 5 (93): 1–10. https://doi.org/10.1057/s41599-019-0304-z.

Bearak, M. 2023. "To understand clean energy challenges, we went to Uzbekistan." New York Times, Accessed September 20, 2023. https://www.nytimes.com/2023/09/14/climate/to-understand-clean-energy-challenges-we-went-to-uzbekistan.html.

Chortareas, G., and G. Kapetanios. 2009. "Getting PPP Right: Identifying Mean-Reverting Real Exchange Rates in Panels." *Journal of Banking & Finance* 33 (2): 390–404. https://doi.org/10.1016/j.jbankfin.2008.08.010.

CTI (Carbon Tracker Initiative). 2021. "Beyond Petrostates: The Burning Need to Cut Oil Dependence in the Energy Transition." Accessed October 13, 2022. https://carbontracker.org/reports/petrostates-energy-transition-report/.

Dey, S. R., and M. Tareque. 2022. "Twin Deficits Hypothesis in Bangladesh: An Empirical Investigation." *International Journal of Emerging Markets* 17 (9): 2350–2379. https://doi.org/10.1108/IJOEM-06-2020-0628.

Dumitrescu, E. I., and C. Hurlin. 2012. "Testing for Granger non-causality in heterogeneous panels." *Economic Modelling* 29 (4): 1450–1460. https://doi.org/10.1016/j.econmod.2012.02.014.

EI (Energy Institute). 2023. "Statistical Review of World Energy." Accessed August 18, 2023. https://www.energyinst.org/statistical-review.

Eregha, P. B., O. B. Aworinde, and X. V. Vo. 2022. "Modeling Twin Deficit Hypothesis with Oil Price Volatility in African Oil-Producing Countries." *Resources Policy* 75:102512. https://doi.org/10.1016/j.resourpol.2021.102512.

Helmy, H. E. 2018. "The Twin Deficit Hypothesis in Egypt." *Journal of Policy Modeling* 40 (2): 328–349. https://doi.org/10.1016/j.jpolmod.2018.01.009.

IMF (International Monetary Fund). 2023. "United Arab Emirates: 2022 Article IV Consultation-Press Release; and Staff Report." Accessed August 18, 2023. https://www.imf.org/en/Publications/CR/Issues/2023/06/22/United-Arab-Emirates-2022-Article-IV-Consultation-Press-Release-and-Staff-Report-535073.

Karras, G. 2013. "Are "Twin deficits" Asymmetric? Evidence on Government Budget and Current Account." *International Economics* 158:12–24. https://doi.org/10.1016/j.inteco.2019.02.001.

Kouassi, E., M. Mougoué, and K. Kymn. 2004. "Causality Tests of the Relationship Between the Twin Deficits." *Empirical Economics* 29 (3): 503–525. https://doi.org/10.1007/s00181-003-0181-5.

Pesaran, M. H. 2007. "A Simple Panel Unit Root Test in the Presence of Cross-Section Dependence." *Journal of Applied Econometrics* 22 (2): 265–312. https://doi.org/10.1002/jae.951.

Appendix

Appendix 1. Implications of 1.5 degrees Celsius global warming

1.5 degrees of warming is considered a key tipping point, beyond which the likelihood of extreme flooding, drought, wildfires, and food shortages could increase strikingly. During the next five years, between 2023 and 2027, global temperature will likely increase by 1.5 degrees Celsius, an increase of 10 percent to 66 percent (WMO, 2023). This increase will breach what 196 countries pledged in the Paris Climate Agreement. IPCC (2023) estimates that existing and planned fossil fuel investments increase the likelihood of warming beyond 1.5 degrees Celsius. In tandem with this imperative, IEA (2023) heralds that for 2023, the ratio of clean to fossil fuels energy investments will be 1.7. Five years ago, this ratio was 1:1.

Source

World Meteorological Organization (WMO), 2023. 'WMO Global Annual to Decadal Climate Update (Target years: 2023–2027)', https://library.wmo.int/index.php?lvl=notice_display&id=22272 (27.06.2023).

Intergovernmental Panel on Climate Change (IPCC). 2023. 'Climate Change 2023: Synthesis Report. Summary for policy-makers' https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf (27.06.2023).

International Energy Agency (IEA). 2023. World Energy Investment 2023. https://www.iea.org/reports/world-energy-investment-2023 (27.06.2023).

Appendix 2. The list of the countries

id	country	starts	ends	(1991–2020 sample)	(2004–2020 sample)	(2011–2020 sample)
1	Timor Leste	2001	2020		✓	✓
2	Angola	1996	2020		✓	✓
3	Bahrain	1990	2020	✓	✓	✓
4	Azerbaijan	1994	2020		✓	✓
5	South Sudan	2011	2020			✓
6	Equatorial Guinea	1990	2020	✓	✓	✓
7	Oman	1990	2020	✓	✓	✓
8	Suriname	1990	2020	✓	✓	✓
9	Gabon	1990	2020	✓	✓	✓
10	Chad	1995	2020		✓	✓
11	Algeria	1990	2020	✓	✓	✓
12	Nigeria	1990	2020	✓	✓	✓
13	Congo (Rep. of)	1990	2020	✓	✓	✓
14	Brunei	1990	2020	✓	✓	✓
15	Saudi Arabia	1991	2020	✓	✓	✓
16	Libya	1990	2020	✓	✓	✓
17	Kuwait	1990	2020	✓	✓	✓
18	Iraq	2004	2020		✓	✓
19	Russia	1998	2020		✓	✓
20	Kazakhstan	2002	2020		✓	✓
21	Iran	1990	2020	✓	✓	✓
22	Qatar	1990	2020	✓	✓	✓
23	UAE	1990	2020	✓	✓	✓
24	Mexico	1990	2020	✓	✓	✓
25	Ecuador	1995	2020	✓	✓	✓
26	Norway	1990	2020	✓	✓	✓
27	Malaysia	1990	2020	✓	✓	✓
	Number of Countries			18	26	27
	Total observations			540	442	270