



# Sanctions and economic growth: Do sanction diversity and level of development matter?

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## ABSTRACT

The application of economic and political sanctions becomes a vital tool of international politics to facilitate peaceful coexistence among the nations. However, the issue of the effectiveness of sanctions in creating adequate disutility to ensure compliance remains contentious. Therefore, this study assesses the effect of sanctions on the economic growth of the target states. It captures the diversity of sanctions using system Generalized Method of Moments (GMM) with extensive dataset for the period 1970–2018. The findings reveal that extensive, multilateral sanctions, and export restriction are the only sanction categories that are effective in creating disutility and reducing the real income per capita growth when targeted at the developed countries. On the other hand, limited sanctions (partial embargo) – sanctions that are targeted at specific sectors, groups, and issues such as withdrawal of foreign aid, as well as import restrictions can effectively reduce income per capita growth when imposed on developing countries while all other categories of sanctions have a positive effect on income growth in targeted developing economy. Therefore, we, conclude that the sanctions diversity, development level of the target country and sender identity play vital roles concerning the sanctions-economic growth nexus. These attributes should be considered in the application and analyses of sanctions to ensure their effectiveness. The study provided several interesting policy insights.

## 1. Introduction

International economics literature stressed the need for strong political and economic relations among countries. It is believed that interactions between the countries enhance the adaptive capacity of the countries in overcoming economic challenges such as unemployment, hyperinflation, and recessions. This encourages the interdependence of economies around the world. Hence, geopolitics occupies a significant position in growth economics. Consequent to the current wave of globalization and the network of interdependences among countries, the application of economic and political sanctions becomes a vital tool of international politics to

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facilitate peaceful coexistence among the nations. Sanctions are considered flexible, nonviolent, more humanitarian and more liberal than the use of military might in the settlement of international disputes. However, the detrimental effects of sanctions on the socioeconomic and political lives of the people in the target state(s) have been widely reported in the extant literature. It is argued that sanctions adversely affect food security and the availability of potable water, thwart access to healthcare and medical services [1,2], worsen infant mortality and reduce life expectancy [3,4]. Moreover, economic sanctions undermine the democracy of the targeted nations and promote civil strife and political instability [5–8], deteriorates their respect for human right and in most cases failed to achieve the desired objective of the imposition of the sanctions [9].

Nonetheless, most of these studies are qualitative and focused on the devastating humanitarian and political consequences of the sanctions. There is a dearth of studies on the economic impact of economic and political sanctions. Meanwhile, the effectiveness of sanctions depends on their ability to inflict substantial economic damage that will compel compliance. Thus, sanctions have a potentially adverse effect on the economic growth of the target state. The few empirical research on the economic consequences of sanctions argued that the imposition of sanctions adversely affects trade flows [10,11], prompts currency crises [12] widens income inequality and poverty gap [13,14] and hinders economic growth [14,15]. Also, some recent studies also focused on the effects of sanctions for individual countries such as Iran [16–18], Russia [19], and China [20]. These studies focused on individual countries and their findings may not fit for generalization to other countries.

However, extant literature did not adequately explore the effect of sanctions on economic growth. The study [14], which considered sanctions and economic growth suffers some defects. The study focuses on the general effect of UN and SU sanctions on economic growth. Similarly [15], considered the effect of sanctions on economic growth but focused on the issue of endogeneity. The previous studies failed to capture the heterogeneity of the target and origin countries, sanction's episodes and the potential effects of political and economic institutions of the target state. The novelty of this study hinges on capturing the heterogeneity of the countries based on income levels, the diversities of the sanctions, and the incorporation of the role of political and economic institutions in shaping the sanctions-growth nexus. Considering the sanctions generally will becloud the policymakers' understanding of the cost and effectiveness of sanctions. Probably, this caused the contentious debate on the effectiveness of sanctions over time. The diversity of the sanctions lies in several folds (purpose, types, commitment, sender and instruments). For instance, Variety obnoxious economic, political and environmental policies elicit the imposition sanctions on a state. Hence, the sanctions could serve as punitive, demonstrative or proactive measures to ensure compliance on the part of the target state. Moreover, they are initiated by individual state (unilaterally) or international organization (multilaterally) and implemented using instruments such as asset freeze, embargoes, export, and import restrictions, travel bans, economic agreement suspension, blockage and termination of foreign aid [21]. Furthermore, sender states applied sanctions to countries at various levels of political and economic development over the years. Then, sanctions are unique, diverse and heterogeneous. Accounting for the heterogeneity in the sanction-economic growth nexus becomes imperative. Moreover, the effectiveness of sanctions largely depends on the income classification of the countries. Sanctions are likely to damage the economies of the poor nations more than the rich countries due to the heavy dependence of the former on the later. Thus, the impact of sanctions on economic growth could vary largely by the income classification of the targeted states. Besides, the quality of economic and political institutions are fundamental determinants of economic growth [22]. So, the impact or effectiveness of sanctions could largely depend on the institutions. For instance, democracies are more likely to accede to sanctions than the autocracies [23].

Therefore, this current study made several contributions to the sanctions-economic growth literature. First, using a global sample, this study captures the heterogeneity the countries by considering the sender identity and the income levels of the target and sender countries. Second, the study considered the diversity of sanctions and evaluates their idiosyncratic effects on economic growth. Third, this study accounted for the role of institutions in shaping the impact of the different episodes of sanctions on economic growth. Succinctly, this study contributes to the literature by evaluating the impact of political and economic sanctions on economic growth, calibrates the heterogeneity of the sanctions and the impact by income classification of the targeted countries. Also, this study includes the economic and political institutions as control variables for the association between sanctions and economic growth.

The findings show that sanctions significantly affect the income per capita growth of the target countries. However, the nature and magnitude of the effects varies by sanction categories, sender identity and the income levels of the target and sender countries. We find that sanctions are highly effective for developing countries but do not have a significant impact on the income per capita of the developed countries. Further, some categories of sanctions have a positive effect on income growth while others have a negative association with the growth of income of the target countries. Another striking finding is that sanctions without prior threat episodes have the highest adverse effect on economic growth.

## 2. Literature review

The literature on sanctions is divided into the studies that examine the effectiveness of sanctions in ensuring compliance and those that consider the economic and humanitarian impacts of sanctions. The assessment of the success of sanctions generated vigorous debate and attracted a great deal of attention from researchers and policymakers. Earlier studies were qualitative due to the lack of quantitative measures of sanctions. Therefore, the measurement of the success of the rate of sanctions constitutes the early concerns of the scholars. In their study [24] led the debate by developing an index that considers both the policy change resulting from the sanctions and the contribution of the sanctions to the outcome. The first part of the index measures the policy outcome on the scale of 1–4 implying failure, unclear, partial success, and complete success respectively. The second part of the index categorized the contributions of the sanctions into negative, no contribution, substantial and decisive. The two parts were manipulated and harmonized to compose an index scaled from 1 to 16 with scores above 9 denoting successful sanctions episodes. The study concludes that, at least,

partial success connotes the effectiveness of the sanctions. However, several empirical studies have reported the ineffectiveness of sanctions [24–27]. The substantial report of the low success rate of the sanctions raised skepticism and necessitated the need for further investigation on the determinants of the effectiveness of sanctions. Accordingly [28,29], recognized the relevance of the political system in determining the effectiveness of sanctions. These studies provided evidence that democratic governments are less likely to comply with sanctions than autocratic leaders. The democratic government of the target states enjoys greater legitimacy and can easily garner the support of the citizenry to defend the domestic regime against the sender's demands. This is regarded this as a rally-around-the-flag effect. As a result, democratic regimes are found to be more resilient to sanctions. Contrarily [23,25,30], argue sanctions are more effective when the target state operates democracy rather than autocracy. The need for public accountability and the fear of political cost compels democracies to concede to the demands of the sender state. More so, the authoritarian regime can repress public revolt and compel rally-around-the flag support. Similarly, several authors have submitted that domestic political instability and economic hardship often lead to compliance with the demands of the sender [31–33].

Another factor considers the effectiveness of sanctions is the structure of the economy of the target state. Although the implications are ambiguous, it is observed that trade openness and the level of integration of the target state to the world economy substantially determine the success of sanctions. Accordingly [34,35], found that extensive trade linkages between the sender and the target states facilitate the effectiveness of the sanctions. The logic behind the success is that large initial trade volumes cause huge welfare damages due to embargo on trade or the suspension of preferential of regional trade agreements and thus compel compliance. On the other hand, greater trade openness could provide the target state the opportunity to divert the trade loss from the sender to other countries and therefore compensate for the income lost from the sender's trade blockage. This reduces the success of sanctions.

Furthermore, the characteristics of the sanctions determine their success rate. For instance Ref. [36], suggest that multilateral sanctions inflict greater harm and reduces the possibility of the substitutions of economic sources for the target state and hence, induces compliance. Meanwhile, the effectiveness of the sanctions might be less due to the difficulty of maintaining a stable coalition [37,38]. Type of the measures adopted for sanctions also received attention. Sanctions that inflict maximum harm on the ruling elites are likely to be more successful [26]. Similarly [39], financial sanctions targeted at freezing the asset of elites do prompt compliance. Moreover [40], find a positive relationship between cost and the success of sanctions. The higher the cost incurred by the target state due to the sanctions, the higher the chance of the effectiveness of the sanctions. Also, the duration of sanction episodes has been considered as a determinant of the success of the sanctions [30,34,35].

Moreover, empirical studies identified the humanitarian and health impacts of sanctions considering child mortality, life expectancy, food security, and access to healthcare services. In this regard [3,4], examine the impact of UN sanctions on child mortality in Iraq. Both studies found that sanctions drastically increased infant and child mortality in the country. Specifically [4], find that sanctions led to the increase in infant mortality from 47 to 108 per 1000 births while under-5 mortality rose from 56 to 131 per 1000 births. Similarly, studies have argued that sanctions have a significant detrimental effect on life expectancy, availability of food and potable water as well as healthcare and medical services in the target state [1,41].

Few studies have considered the economic effects of sanctions. The effectiveness of sanctions is dependent on their potential damage to the economy of the target state. It is, therefore, reasonable to expect that sanctions will have a detrimental impact on economic growth. Meanwhile, empirical studies have identified a decline in trade flows, fall in foreign direct investment and withdrawal foreign aid and financial grants as the most obvious channels through which maximum welfare damage is inflicted on the target economy due to sanctions. Therefore, previous studies on the effects of sanctions focused on these areas. For example [10,11], report the trade-decreasing effect of sanctions. The main argument is that sanctions increase the risk and transaction cost of international trade leading to a reduction in profitability. This ultimately results in to decline in trade flow between the target and sender states. Sanctions also create trade diversion between the states [42]. Similarly [43], found a negative effect of sanctions on foreign direct investment in the short and long run. Considering the effect of sanctions on inequality [13], found robust evidence of the adverse effect of the imposition of sanctions on income inequality. The study submits that the effect differs by types of the sanctions and is more severe for long sanctions that span longer duration. Other studies submit that the imposition of sanctions prompt currency crises [12], worsen inflation [44] and promote regional inequality [45]. But less attention is given to the effect of sanctions on economic growth.

However, Sanctions threaten the political stability of the target state and raise uncertainty. The uncertainty would have harmful effects on the trade, investment and financial relations of the target country. Besides, sanction episodes create political instability [6–8] which in turn negatively affect savings, investment and economic growth [46,47]. Similarly, uncertainty implies a higher cost of investment in the target state. This negatively affects the economic growth of the target state. Moreover [27,48], find that the imposition of sanctions leads to the increase in illicit economic activities and the expansion of the underground economy which in turn negatively affects economic growth. The imposition of sanctions increases smuggling which may even be supported by the government to evade sanction measures, generate funds, get supplies and strengthen their political power [49]. Sanctions could also increase corruption by undermining the authority of the target state and weakening its capacity to enforce the rule of law. Consequently, economic growth will be adversely affected due to more unproductive used of resources and an increase in transaction costs. The political elites of the target state may even deliberately aggravate the damage on the target economy and the sufferings of the people to minimize public revolt and compel the citizens to support the government against the sender's demands [50].

Also, the effect of the sanctions on economic activities could largely depend on the type, commitment, cost and other characteristics of the sanctions. Equally, the effect could differ significantly by the level of development of the target state. Finally, the quality of the economic and political institutions is fundamental in shaping economic activities of the target state and thus could matter in the sanctions-growth nexus. All these are scarcely considered in the previous studies. Therefore, this study evaluates the impact of sanctions on economic growth accounting for institutional quality and the heterogeneity of sanction.

### 3. Data and methods

This study examines the impact of sanctions on economic growth. To achieve the objectives, the study used a panel data of 168 countries over the period 1970–2018. The countries are selected based on data availability. However, the period considered witnessing a significant rise in the number of sanctions globally. The data on sanctions are obtained from the 4th edition of the Threat and Imposition of Economic Sanctions (TIES) dataset provided by Ref. [21]. This dataset provides extensive and up-to-date information on diverse aspects of the sanctions. This is particularly important for capturing the heterogeneity of the effects of sanctions on economic growth. The components of sanctions including extensive, limited, unilateral, and multilateral and US sanctions are used. Other sanctions characteristics incorporated in the analysis are sanction duration, export, and import restrictions as well as asset freeze. Following the extant literature on economic growth, real Gross Domestic Product (GDP) per capita serves as the dependent variable in this study while gross capital formation, government consumption, trade openness, and human capital development index are included as the control variables. The data on the real GDP per capita and the control variables are sourced from the World Bank's World Development Indicators.

Adopting the framework of the augmented Solow growth model to find out the impact of sanctions on economic growth, the model used in the study is specified as follows;

$$\lnrgdppc_{it} = \alpha_i + \theta SAN_{it} + \gamma CONT_{it} + \varepsilon_{it} \quad (1)$$

where  $\lnrgdppc$  stands for the natural logarithm of the real GDP per capita which serves as the dependent variable (economic growth).  $SAN$  denotes a vector of the sanctions categories while  $CONT$  represents a vector of the control variables (gross capital formation, government consumption, human capital development, trade openness, political and economic institutions). The control variables are included following existing literature on the determinants of economic growth [47,51,52]. The logarithm of the gross capital formation, and government consumption are used to harmonize the unit of measurement. However, human capital development, trade openness, political and economic institutions are not logged because categorical variables and variables that are measured in percentages are not supposed to be logged. It is important to note that the index of political institutions was developed from the World Governance Indicators (WGI) which are measured on values ranging from  $-2.5$  to  $2.5$ . while the economic institutions were measured in percentage. All the sanction variables are dummy variables which assume value 1 and 0.

The subscript 'i' represents country  $i$  ( $i = 1, 2, \dots, 168$ ) and 't' refers to the time  $t$  ( $t = 1970, 1971, \dots, 2018$ ). The country-specific constant and the composite stochastic error term are represented by  $\alpha_i$  and  $\varepsilon_{it}$  respectively. Similarly, the coefficients of the sanctions categories and the control variables are denoted by  $\theta$  and  $\gamma$  respectively. Specifying equation (1) to capture the dynamic interactions between the variables gives.

$$\lnrgdppc_{it} = \alpha_i + \phi \lnrgdppc_{it-k} + \theta SAN_{it-1} + \gamma CONT_{it-1} + \varepsilon_{it} \quad (2)$$

where  $k$  and  $\phi$  specify the number of lags of the dependent variable and its parameter respectively. The lagged dependent variable also represents the initial income level which accounts for conditional convergence of economic growth [52].

The common econometric problems generally associated with panel data are heteroscedasticity and endogeneity. The problems render the estimates of the Ordinary Least Square (OLS) biased and inconsistent [53]. To solve these problems [54], performed the first difference transformation of the level model, equation (1) to develop the Generalized Method of Moments (GMM) estimator. Applying the first differenced GMM, equation (2) becomes.

$$\Delta \lnrgdppc_{it} = \alpha_i + \phi \Delta \lnrgdppc_{it-k} + \theta \Delta SAN_{it-1} + \gamma \Delta CONT_{it-1} + (\varepsilon_{it} - \varepsilon_{it-1}) \quad (3)$$

The difference operator is indicated by  $\Delta$  in equation (3). In addition to the first-differenced independent variables, the first difference GMM uses the higher-order lagged values of the dependent variables as instruments to solve the problem of endogeneity. However [55–57], find that the first difference GMM estimator is susceptible to large downward finite sample bias and very low precision. Thus, the studies recommend the system GMM estimator. The system GMM applies a combination of the level and first-differenced equations, (2) and (2), to produce two-step system-GMM estimates. The advantages of the system GMM technique over the first difference GMM estimator is that the system GMM estimator employs many internal instruments and thus expected to be more efficient than the first-differenced GMM estimator in handling the problems of heteroscedasticity, endogeneity, and finite sample bias especially where the number of cross-sections is greater the time. In short, system GMM techniques can efficiently handle the problems of unobserved heterogeneity, simultaneity, and dynamic endogeneity [55,58–60].

Therefore, we employ the two-step system-GMM estimator for the estimation of all the models in this study. The choice of this method is based on the panel data and the nature of the relationship among the explanatory variable. For instance, an autocratic regime that continuously violates human rights, trade agreement or/and environmental laws may attract the application of sanctions. Such a case indicates a potential endogeneity problem between the sanction variables and the indicator of political institutions. This problem might also exist between the other variables in the model. However, due to the use of many instruments, it becomes necessary to test for the validity of instruments and adequacy of the models [55]. Therefore, this study applied the Sargan test for over-identifying restrictions and the Arellano-Bond AR (2) test for higher-order autocorrelation as diagnostic tests in all the models.

### 4. Results and discussion

The analysis begins with the baseline estimates of the system GMM includes only the control variables as explanatory variables. The

results of the entire sample, developed countries, and developing countries are contained in columns 1, 2 and 3 of Table 1 respectively. The estimations are separated to ensure robustness and capture the dynamics of the countries in terms of economic development. The results show that the lag of real GDP per capita assumes positive values in all the different samples. This indicates that the initial level of income positively affects the level of economic growth. The lagged dependent variables also examine the possibility of conditional convergence, which dictates that those poor countries expectedly growth faster than rich countries of similar economic characteristics. The positive values of the lag of real GDP per capita indicate no conditional convergence. This is in line with the findings of [61–64] who find lack of income convergence among different groups of countries around the world. This confirms the claim of [65] that conditional convergence disappears when the sample data covers a period after 2000.

Furthermore, the results confirm the significant positive association between capital formation and economic growth in all the models. This shows that investment promotes economic growth. Similarly, the positive coefficient of trade openness (but insignificant for the developed countries) verifies that the hypothesis that favorable terms of trade promote economic growth and performance. This is because larger volumes of exports relative to imports enhance capital accumulation, which in turn, propels economic growth. In consonance with the *a priori* expectation, human capital has a significant positive relationship with the real GDP per capita. This finding is in line with the submission of [51], which revealed that high level of education and human capital development improves productivity and consequently promote income and growth. Moreover, economic institutions (economic freedom) assumed statistically significant positive coefficients, indicating that good and strong economic institutions propel economic growth.

However, the estimates indicate that the coefficient of polity2 is negative and significant for overall sample but statistically insignificant for the subsample of developed countries while economic institutions remained significant but negative for the developed countries. This shows the importance of political institutions as fundamental determinants of economic growth [47]. However, the negative association in the subsample confirms the proposition of [52] that beyond a certain moderate level, democracy hurts economic growth. Democracy tends to increase the size of government and propensity of corruption and inefficiency, which is inimical to economic growth.

Finally, the baseline results show that huge government spending (consumption) is harmful to economic growth in the developed countries but promotes economic growth in the developing countries. This indicates that large government spending (size) creates inefficiency and imposes an enormous fiscal burden on the developed economies and thus inhibits economic growth. In the case of the developing countries, there is huge infrastructure deficit which can be minimized by large government spending (consumption). Thus, high government consumption promotes economic growth in the developing economies. The same positive impact of government consumption is observed for the overall sample because, there are more developing countries than developed countries in the overall sample.

All the estimates are consistent with extant empirical and theoretical findings vis-à-vis the determinants of economic growth and the Sargan and the Arellano-Bond AR(2) tests show the validity of the instruments and absence of autocorrelation in all the models.

**Table 1**  
System GMM estimates of the Baseline model (only control variables).

Independent Variables	Dependent Variable: real GDP per capita growth		
	(1) All countries	(2) Developed countries	(3) Developing countries
Lagged Real GDP Per Capita	0.987*** (0.000195)	0.961*** (0.0347)	0.983*** (0.000545)
Capital formation	0.000396*** (6.87e-05)	0.0327** (0.0139)	0.000699*** (8.23e-05)
Trade openness	0.000279*** (9.97e-06)	2.17e-05 (0.000139)	0.000339*** (1.82e-05)
Human capital index	0.00343*** (0.000846)	0.00289 (0.0195)	0.00278 (0.00170)
Government consumption	0.00290*** (7.41e-05)	−0.0309** (0.0136)	0.00274*** (0.000137)
Polity2	−0.0241*** (0.000804)	0.000925 (0.0339)	−0.0444*** (0.00299)
Economic institutions	0.0127*** (0.000665)	0.00471** (0.00183)	0.0168*** (0.00124)
Constant	0.0340*** (0.00162)	0.363 (0.280)	0.0591*** (0.00447)
Observations	6528	1104	5424
Number of groups	136	23	113
Number of instruments	170	89	170
<b>Diagnostics</b>			
AR(2)	[0.521]	[0.232]	[0.480]
Sargan test	164.80	64.33	163.46
P-value of Sargan test	[0.424]	[0.668]	[0.453]
Hansen test	130.96	21.10	111.52
P-value of Hansen test	[0.214]	[0.983]	[0.674]

Note: Standard errors in parentheses, [ ], \*\*\*, \*\* and \* denote P-values, 1%, 5% and 10% level of significance respectively.

**Table 2**  
System GMM estimates of the Effects of sanctions on economic growth (all sampled countries).

Independent Variables	Dependent variable: Real GDP per capita growth										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Lagged GDP Per Capita	0.987*** (0.000207)	0.987*** (0.000262)	0.986*** (0.000191)	0.987*** (0.000197)	0.986*** (0.000244)	0.987*** (0.000191)	0.987*** (0.000283)	0.987*** (0.000246)	0.987*** (0.000365)	0.987*** (0.000320)	0.987*** (0.000293)
Capital formation	0.000485*** (7.72e-05)	0.000407*** (6.22e-05)	0.000481*** (5.99e-05)	0.000399*** (6.00e-05)	0.000499*** (6.33e-05)	0.000407*** (7.23e-05)	0.000608*** (8.79e-05)	0.000451*** (6.78e-05)	0.0102*** (0.000144)	0.0104*** (7.85e-05)	0.0107*** (0.000104)
Trade openness	0.000260*** (1.44e-05)	0.000289*** (1.24e-05)	0.000275*** (7.67e-06)	0.000283*** (9.99e-06)	0.000276*** (8.00e-06)	0.000289*** (1.20e-05)	0.000214*** (1.46e-05)	0.000289*** (1.21e-05)	0.000532*** (8.91e-06)	0.000521*** (6.75e-06)	0.000538*** (7.91e-06)
Human capital index	0.00453*** (0.000866)	0.00370*** (0.000729)	-0.00172* (0.000968)	0.00273** (0.00109)	-0.00141 (0.000900)	0.00348*** (0.000849)	0.00611*** (0.00104)	0.00290*** (0.000931)	-0.000558 (0.00120)	-0.00180 (0.00161)	-0.00174 (0.00150)
Government spending	0.00293*** (8.72e-05)	0.00286*** (6.63e-05)	0.00286*** (5.87e-05)	0.00290*** (6.31e-05)	0.00283*** (7.00e-05)	0.00288*** (7.53e-05)	0.00293*** (7.41e-05)	0.00284*** (7.42e-05)	-0.0115*** (0.000128)	-0.0116*** (8.53e-05)	-0.0120*** (0.000111)
Polity2	-0.0222*** (0.00104)	-0.0234*** (0.00110)	-0.0244*** (0.00115)	-0.0249*** (0.00158)	-0.0244*** (0.00131)	-0.0241*** (0.00126)	-0.0215*** (0.00183)	-0.0251*** (0.00108)	0.0700*** (0.00210)	0.0749*** (0.00212)	0.0776*** (0.00187)
Economic institutions	0.0142*** (0.000698)	0.0121*** (0.000584)	0.0118*** (0.000640)	0.0129*** (0.000559)	0.0121*** (0.000529)	0.0123*** (0.000655)	0.0150*** (0.000964)	0.0126*** (0.000585)	0.0122*** (0.000755)	0.0116*** (0.000659)	0.0115*** (0.000815)
Sanctions	0.0396*** (0.00104)										
Imposed sanctions		0.0363*** (0.00188)									
Extensive sanctions			0.575*** (0.108)								
Limited sanctions				-0.0148*** (0.000966)							
Multilateral sanctions					0.551*** (0.138)						
Unilateral sanctions						0.0163*** (0.00124)					
US sanctions							0.0808*** (0.00134)				
Sanctions duration								-0.000267*** (7.34e-05)			
Import Restriction									0.0300*** (0.00368)		
Export Restriction										0.0131*** (0.00206)	
Asset Freeze											0.0322*** (0.00268)
Constant	0.0251*** (0.00159)	0.0317*** (0.00217)	0.0393*** (0.00166)	0.0331*** (0.00188)	0.0388*** (0.00206)	0.0325*** (0.00165)	0.0240*** (0.00233)	0.0334*** (0.00193)	0.0463*** (0.00228)	0.0440*** (0.00260)	0.0426*** (0.00194)
Observations	6528	6528	6528	6528	6528	6528	6528	6528	4055	4055	4055
Number of countries	136	136	136	136	136	136	136	136	134	134	134
Number of instruments	170	170	170	170	170	170	170	170	170	170	170
AR (2) test P-value	0.611	0.516	0.479	0.523	0.475	0.519	0.655	0.510	0.694	0.638	0.641
Hansen test P-value	0.427	0.410	0.478	0.402	0.480	0.405	0.492	0.402	0.978	0.973	0.965
Sargan test P-value	0.933	0.939	0.826	0.948	0.936	0.939	0.940	0.936	0.478	0.613	0.524

Note: Standard errors in parentheses, \*\*\*, \*\* and \* denote 1%, 5% and 10% level of significance respectively.

Table 3

System GMM estimates of the Effects of sanctions on economic growth (only developed countries).

Independent Variables	Dependent variable: Real GDP per capita growth										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Lagged GDP Per Capita	0.967*** (0.0380)	0.967*** (0.0329)	0.974*** (0.0308)	0.974*** (0.0406)	0.974*** (0.0308)	0.979*** (0.0231)	0.973*** (0.0225)	0.943*** (0.0490)	0.601*** (0.175)	0.667*** (0.129)	0.534*** (0.191)
Capital formation	0.0240 (0.0203)	0.0230 (0.0181)	0.0133 (0.0141)	0.0233 (0.0150)	0.0133 (0.0141)	0.0112 (0.0151)	0.0150 (0.0164)	0.00355 (0.0218)	0.133*** (0.0449)	0.158*** (0.0473)	0.140*** (0.0428)
Trade openness	7.22e-05 (0.000129)	7.86e-05 (0.000132)	0.000108 (0.000106)	4.66e-05 (0.000148)	0.000108 (0.000106)	8.13e-05 (0.000156)	6.79e-05 (0.000170)	0.000382 (0.000341)	0.000215 (0.000251)	0.000192 (0.000266)	1.58e-05 (0.000260)
Human capital index	0.0119*** (0.00262)	0.0127*** (0.00322)	0 (0)	0 (0)	0 (0)	0.0108*** (0.00251)	0.0112 (0.0194)	0.00483 (0.0284)	0 (0)	0 (0)	0 (0)
Government spending	-0.0215 (0.0196)	-0.0209 (0.0173)	-0.0134 (0.0157)	-0.0216 (0.0155)	-0.0134 (0.0157)	-0.0121 (0.0156)	-0.0148 (0.0150)	-0.00256 (0.0202)	0.136 (0.102)	0.124 (0.0768)	0.237* (0.128)
Polity2	0.00514 (0.0212)	0.00189 (0.0310)	-0.00567 (0.0292)	0.0163 (0.0223)	-0.00567 (0.0292)	0.00378 (0.0235)	-0.00105 (0.0263)	0.00835 (0.0247)	0.000355 (0.0219)	-0.000503 (0.0230)	0.0183 (0.0231)
Economic institutions	0.00274 (0.00210)	0.00399** (0.00192)	0.00272* (0.00160)	0.00291** (0.00113)	0.00272* (0.00160)	0.00183 (0.00213)	0.00445 (0.00296)	0.00363 (0.00225)	-0.000690 (0.00197)	-0.000499 (0.00136)	0.00226 (0.00241)
Sanctions	-0.0387 (0.0265)										
Extensive sanctions		-0.0640* (0.0341)									
Extensive sanctions			-0.00625 (0.0222)								
Limited sanctions				-0.00942 (0.0144)							
Limited sanctions					-0.00625 (0.0222)						
Multilateral sanctions						-0.207* (0.109)					
Unilateral sanctions							-0.00428 (0.0108)				
Sanctions duration								1.11e-05 (0.00113)			
Import Restriction									0.00492 (0.00637)		
Export Restriction										-0.0257* (0.0155)	
Asset Freeze											0.00866 (0.0210)
Constant	0.285 (0.349)	0.297 (0.252)	0.281 (0.275)	0.218 (0.333)	0.281 (0.275)	0.246 (0.219)	0.274 (0.186)	0.543 (0.374)	-2.548* (1.449)	-3.568** (1.473)	-4.560** (1.960)
Observations	1104	1104	1104	1104	1104	1104	1104	1104	811	811	811
Number of countries	23	23	23	23	23	23	23	23	23	23	23
Number of instruments	170	170	170	170	170	170	170	170	170	170	170
AR (2) test P-value	0.321	0.124	0.421	0.135	0.237	0.535	0.232	0.452	0.257	0.161	0.115
Hansen test P-value	0.326	0.292	0.399	0.430	0.425	0.501	0.612	0.413	0.352	0.296	0.384
Sargan test P-value	0.763	0.619	0.724	0.674	0.826	0.792	0.728	0.802	0.755	0.696	0.712

Note: Standard errors in parentheses, \*\*\*, \*\* and \* denote 1%, 5% and 10% level of significance respectively.

**Table 4**  
System GMM estimates of the Effects of sanctions on economic growth (only Developing countries).

Independent Variables	Dependent variable: Real GDP per capita growth										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Lagged GDP Per Capita	0.983*** (0.000577)	0.984*** (0.000593)	0.983*** (0.000545)	0.983*** (0.000478)	0.983*** (0.000681)	0.984*** (0.000611)	0.983*** (0.000689)	0.983*** (0.000718)	0.988*** (0.000792)	0.987*** (0.000799)	0.988*** (0.000842)
Capital formation	0.000710*** (7.34e-05)	0.000642*** (6.12e-05)	0.000699*** (8.23e-05)	0.000607*** (0.000108)	0.000718*** (7.08e-05)	0.000639*** (6.65e-05)	0.000876*** (9.38e-05)	0.000648*** (9.24e-05)	0.0118*** (0.000236)	0.0115*** (0.000295)	0.0116*** (0.000228)
Trade openness	0.000339*** (1.65e-05)	0.000351*** (1.34e-05)	0.000339*** (1.82e-05)	0.000338*** (1.78e-05)	0.000343*** (1.91e-05)	0.000351*** (1.42e-05)	0.000289*** (2.48e-05)	0.000353*** (2.17e-05)	0.000561*** (1.69e-05)	0.000576*** (1.10e-05)	0.000586*** (1.00e-05)
Human capital index	0.00242 (0.00180)	0.00387*** (0.00136)	0.00278 (0.00170)	0.00225* (0.00119)	0.00255* (0.00144)	0.00395** (0.00181)	0.00430*** (0.00115)	0.00299*** (0.00115)	-0.0151*** (0.00433)	-0.0121** (0.00501)	-0.0188*** (0.00335)
Government spending	0.00271*** (8.21e-05)	0.00280*** (8.91e-05)	0.00274*** (0.000137)	0.00285*** (0.000126)	0.00270*** (0.000142)	0.00281*** (0.000105)	0.00276*** (0.000143)	0.00274*** (0.000107)	-0.0126*** (0.000232)	-0.0126*** (0.000256)	-0.0129*** (0.000212)
Polity2	-0.0429*** (0.00263)	-0.0430*** (0.00234)	-0.0444*** (0.00299)	-0.0446*** (0.00273)	-0.0446*** (0.00297)	-0.0429*** (0.00246)	-0.0387*** (0.00253)	-0.0438*** (0.00274)	0.0823*** (0.00350)	0.0813*** (0.00330)	0.0870*** (0.00450)
Economic institutions	0.0166*** (0.000711)	0.0157*** (0.000791)	0.0168*** (0.00124)	0.0171*** (0.000912)	0.0171*** (0.00126)	0.0157*** (0.000804)	0.0183*** (0.00119)	0.0172*** (0.00114)	0.0223*** (0.000875)	0.0219*** (0.000896)	0.0221*** (0.000959)
Sanctions	0.0111*** (0.00149)										
Imposed sanctions		0.0359*** (0.00202)									
Extensive sanctions											
Limited sanctions				-0.0193*** (0.00116)							
Multilateral sanctions					5.071 (7.569)						
Unilateral sanctions						0.0358*** (0.00205)					
US sanctions							0.0751*** (0.00273)				
Sanctions duration								-0.000109 (9.93e-05)			
Import Restriction									-0.0392*** (0.00785)		
Export Restriction										0.00148 (0.00699)	
Asset Freeze											0.0564*** (0.00865)
Constant	0.0555*** (0.00452)	0.0515*** (0.00412)	0.0591*** (0.00447)	0.0600*** (0.00397)	0.0605*** (0.00478)	0.0514*** (0.00450)	0.0470*** (0.00556)	0.0577*** (0.00547)	0.0101** (0.00476)	0.0148*** (0.00458)	0.00923* (0.00536)
Observations	5424	5424	5424	5424	5424	5424	5424	5424	5424	5424	5424
Number of countries	113	113	113	113	113	113	113	113	113	113	113
Number of instruments	170	170	170	170	170	170	170	170	170	170	170
AR (2) test P-value	0.506	0.477	0.480	0.482	0.477	0.497	0.473	0.457	0.428	0.468	0.493
Hansen test P-value	0.435	0.438	0.453	0.431	0.438	0.688	0.431	0.442	0.452	0.422	0.432
Sargan test P-value	0.999	0.956	0.999	0.999	0.987	0.999	0.999	0.940	0.936	0.996	0.978

Note: Standard errors in parentheses, \*\*\*, \*\* and \* denote 1%, 5% and 10% level of significance respectively.



This validates the results of the baseline and subsequent estimates. Therefore, the results show the adequacy of the sample used in the study for further analysis of the impact of sanctions on economic growth.

Table 2 contains the results of the estimations in which different categories of sanctions are included in addition to the control variables. This is to evaluate the effect of the diverse categories of sanctions episodes. Due to multicollinearity among the sanction's variables, each was included one after the other. The results are contained in columns 1–11 for the respective sanctions. In column 1, the variable representing overall sanctions is included. The results revealed that the coefficients of all the sanction indicators, except limited sanctions and sanction duration, are positive and statistically significant. This implies that it is only the initiation of limited sanctions and the long duration of sanctions that can create substantial disutility which will lead to decline in the growth of per capita GDP. That is, limited sanctions have negative effects on the economic growth of the target economy. The imposition of limited sanctions (partial embargo) – sanctions targeted at specific sectors, groups, or issues such as the withdrawal of aid, suspension of trade agreements and travel ban tend to have a greater adverse effect than complete sanctions on the economy of the target state. Thus, considering the overall sample generally, the limited sanctions are effective in enforcing compliance with a target country to request the demands of the sender. Sanction duration also has significant negative effect on economic growth. This finding conforms to the findings of [14].

The estimates predict that all other categories of sanctions (overall sanctions, imposed, extensive multilateral, unilateral, US sanctions as well as Import Restriction, Export Restriction and asset freeze) have significant positive effects on the economic growth of the target economy. The plausible explanation for the positive effect is that the imposition of extensive sanctions or total embargo leads to an increase in smuggling, which the government may support to evade sanction measures, generate funds, get supplies, strengthen their political power, and ensure greater economic growth [27,48,49]. Desperate actors in both sender and target states contrive a means to transact and sabotage the aim of the sanctions.

The analysis also includes the category of sanctions by sender identity and indicates that the effect of sanctions from a very frequent sanctioner, the US, is ineffective. This finding resonates with the submission of [14] who observed that US sanctions are notably less effective than the UN sanctions. It also verifies the proposition of [39] that frequent imposition of sanctions by a specific country leads to a loss of credibility of the sanctioner and thus undermines the effectiveness of the sanctions. Equally, multilateral sanctions increase the real income per capita growth. The reason for this seemingly contrary finding is not far-fetched. Multinational organizations like WTO, EU, and UN impose sanctions as a means of dispute settlement between members. As such, the disputes are often resolved at the negotiation stage and stability is restored in the target economy. Moreover, multilateral sanctions are preceded by a long period of negotiation during which the target country seeks alternative sources of income and averts the negative effect of the sanctions. The alternative sources could result in greater income per capita.

Regarding specific sanctions, the estimates in columns 9, 10 and 11 indicate that import and export restrictions, and asset freeze result in an increase in income per capita growth. Restrictions on international trade (imports and exports) may insulate the domestic firms in the target economy against international competition and the negative effects of exchange rate instability. Consequently, domestic trade improves and leads to an increase in income growth.

Table 3 reports the results of the different sanction episodes on real income per capita growth of the developed countries. This is to evaluate the diversity of the sanction effects based on the income levels of the target economies. The result predicts that only the coefficients of extensive sanctions ( $\beta = -0.0640$ ,  $P$ -Value  $< 0.1$ ), multilateral sanctions ( $\beta = -0.207$ ,  $P$ -Value  $< 0.1$ ), and export Restriction ( $\beta = -0.0257$ ,  $P$ -Value  $< 0.1$ ) that are negative and statistically significant. These are the sanction episodes that are effective in creating disutility by reducing the real income per capita growth when targeted at the developed countries.

All other sanction types and categories do not have a significant impact on the income per capita growth of the developed economies. The reason for this finding is not far-fetched. The developed economies have strong economic and political structures which enable them to be more resilient to the hardship meted on them via the imposition of sanctions. In other words, the developed countries are characterized by well-structured and strong economic and political institutions. Thus, they offset any income losses that could result from sanction imposition on them. Another reason for the insignificant effect of sanctions is that the developed economies are major players in the global economy and geopolitics. Hence, they are always at an advantage to avert the negative effects of sanctions. Therefore, sanctions are completely ineffective when applied to developed countries. In such a case, it is only the extensive and multilateral sanctions, and Export Restrictions that can be effective because of their serious conditions and the fact that the developed economies depend largely on export trade. This is related to the findings of previous studies such as [14,27,39,48], and [49].

We further considered a sample of only developing countries to examine the effect of sanctions on the economic growth of the target economies. The results reported in Table 4 show that Limited sanctions and Import restriction exert negative consequences on the economic growth of the developing countries. This implies that sanctions that are targeted at specific sectors and withdrawal of foreign aid, as well as import restrictions are effective when targeted at the developing countries. This is because the developing countries depend heavily on foreign aid and importation of goods and services for their development. Also, such sanctions can easily be enforced.

However, all other sanction categories are positively related to economic growth in the developing economies. This could be because of the existence of a large informal sector and underground economic activities in most of the developing economies. These exist due to the weak structure of the developing economies. But when sanctions are imposed, the informal sector and the underground economic activities receive the support of the government of the target country. Hence, the negative consequences of the sanctions may be neutralized, leading to an increase in economic activities and income of the target economy.

Therefore, with the imposition of sanctions the developing economies build resilience via the activities of the informal sector and smuggling to forestall the negative consequences of sanctions. Thus, the negative impact of the sanctions becomes less severe when imposed on the developing economies. Alternatively, the developing countries comply easily with the demands of the sender state(s).

Also, the multinational organizations only permit the imposition of moderate sanctions on developing countries and even handle disputes between developing countries with greater compassion or at least less stringency. This reduces the negative effects of the sanctions. This finding corroborates the position of [14], who submitted that although both UN and US sanctions are effective in reducing the economic growth of the target states, the effect of US sanctions is much smaller and tends to be less effective for some target state.

In a nutshell, the results show that the effects of sanctions differ by the level of economic development of the sender and target countries.

## 5. Conclusion and policy remarks

The study assesses the effect of sanctions on the economic growth of the target states. It considered the different categories of sanctions to capture the heterogeneous and diverse effects of sanctions on the target economy. The findings reveal that sanctions significantly affect the income per capita growth of the target countries. However, the nature and magnitude of the effects differ by sanction categories and the income levels of the target and sender countries. Some categories of sanctions have a positive effect on income growth while others have a negative association with the growth of income of the target countries. Moreover, the findings revealed that only extensive, multilateral sanctions, and export restriction are the only sanction categories that are effective in creating disutility by reducing the real income per capita growth when targeted at the developed countries. On the other hand, limited sanctions (partial embargo) – sanctions that are targeted at specific sectors, groups and issues such as withdrawal of foreign aid, as well as import restrictions are effective when imposed on developing countries.

We conclude that the characteristics of the sanctions, income level of the target country and the identity of the sender play vital roles concerning the sanctions-economic growth nexus. Therefore, to ensure the effectiveness of sanctions, policies decisions concerning sanctions should always incorporate the diversity of the sanctions heterogeneity of the target countries by income classification, the sender identity, and the quality economic and political institutions of the target and sender countries.

The limitation of the study is that it does not consider regional heterogeneity of the countries. Also, the different components of the institutional quality were not considered. Since most countries align with their regional partners on issues of geopolitics, and the different dimensions of institutional framework can affect the sanctions-economic growth nexus in diverse ways, it is imperative for further studies in this area to consider regional and institutional diversities of target and origin countries or organizations.

## Author contribution statement

Abdulkareem Alhassan: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Anoush Shabani Sabzehmeidani: Conceived and designed the experiments; Performed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Amjad Issa Taha; Murat Ismet Haseki: Contributed reagents, materials, analysis tools or data; Wrote the paper.

## Data availability statement

Data will be made available on request.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix

**Table A1**

Summary statistics of the variables used for estimation.

Variables	(1) observations	(2) Mean	(3) Standard deviation	(4) Minimum	(5) Maximum
Real_GDP Per Capita	6283	10,727	15,813	134.0	111,968
Government spending	4648	4.769e+10	1.208e+11	730,983	1.200e+12
Human capital index	6283	0.0118	0.0839	0	0.884
Capital formation	4591	5.916e+10	1.602e+11	-3.700e+07	2.700e+12
Trade openness	6283	78.35	48.93	0.0210	437.3
Economic institutions	5504	1.719	0.960	1	3
Polity2	5504	0.457	0.498	0	1

(continued on next page)

Table A1 (continued)

Variables	(1) observations	(2) Mean	(3) Standard deviation	(4) Minimum	(5) Maximum
Sanctions	6283	0.0470	0.212	0	1
Imposed sanctions	6283	0.0126	0.111	0	1
Extensive sanctions	6283	0.00350	0.0591	0	1
Limited sanctions	5504	0.0285	0.166	0	1
Multilateral sanctions	5504	0.00418	0.0645	0	1
Unilateral sanctions	5504	0.0102	0.100	0	1
Unilateral sanctions	5504	0.0832	0.276	0	1
Import Restriction	3766	0.0831	0.276	0	1
Export Restriction	3766	0.0364	0.187	0	1
Asset Freeze	3766	0.0292	0.168	0	1
Sanctions duration	4743	1.055	3.720	0	42
Government spending (log)	6283	16.72	10.09	0	27.81
Capital formation (log)	6283	17.31	10.05	0	29.20
Real GDP Per Capita (log)	6283	8.283	1.493	4.898	11.63

Note: The log of Real GDP Per Capita, Capital formation, and Government spending are used for the estimations.

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