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The Impact of Economic Sanctions on Oil Industry: A Case Study of Libya Using the Synthetic Control Method

*Basem Ertimi, Basem Oqab

Faculty of Economics, University of Zawia, Libya

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ABSTRACT

This study assesses the impact of economic sanctions on oil exports and economic growth through case studies of Libya. By setting up a synthetic group method that reproduces the oil exports and economic growth of the case study before the imposition of economic sanctions, we compare the oil exports and the economic growth of the Synthetic and the actual for each period. We address a crucial gap in the literature of sanction in a petrostate case study using the synthetic control approach. Our analysis found that both petroleum exports and economic growth were lower with economic sanctions. This research is integrated into the comparative and international landscape of international influence relations with the domestic economy. Economic sanctions, the results show, are the key driver in fluctuations in oil exports and economic growth that might be represented in the oil curse. We believe that our empirical research can contribute to domestic and international policy formation by sanctioned countries. Overall, the findings confirm that sanctions may be imposed on Libya as another channel of the resource curse from the global and foreign policy perspectives.

تأثير العقوبات الاقتصادية على صناعة النفط: دراسة حالة لليبيا باستخدام أسلوب (Synthetic Control Method)

*باسم الرتيمي و باسم عقاب

كلية الاقتصاد ،جامعة الزاوية، ليبيا

الكلمات المفتاحية:
العقوبات الاقتصادية
الدولة البترولية
لعنة النفط
منهجية طريقة التحكم الاصطناعية

الملخص

تقيّم هذه الدراسة تأثير العقوبات الاقتصادية على صادرات النفط والنمو الاقتصادي من خلال دراسات حالة لليبيا. من خلال إنشاء طريقة المجموعة التركيبية التي تعيد إنتاج صادرات النفط والنمو الاقتصادي لدراسة الحالة قبل فرض العقوبات الاقتصادية، فإننا نقارن صادرات النفط والنمو الاقتصادي للنفط الصناعي والفعلي لكل فترة. نعالج فجوة حاسمة في أدبيات العقوبات في دراسة حالة بتروستاتية باستخدام نهج التحكم التركيبي. وجد تحليلنا أن كلاً من الصادرات البترولية والنمو الاقتصادي كانا أقل بسبب العقوبات الاقتصادية. تم دمج هذا البحث في المشهد المقارن والدولي لعلاقات التأثير الدولي مع الاقتصاد المحلي. وأظهرت النتائج أن العقوبات الاقتصادية هي المحرك الرئيسي لتقلبات صادرات النفط والنمو الاقتصادي الذي قد يتمثل في لعنة النفط. نعتقد أن أبحاثنا التجريبية يمكن أن تسهم في تشكيل السياسات المحلية والدولية من قبل البلدان الخاضعة للعقوبات. بشكل عام، تؤكد النتائج أن العقوبات قد تُفرض على ليبيا كقناة أخرى لعنة الموارد من منظور السياسة العالمية والخارجية.

Introduction

The economic impact of imposed sanctions has been at the centre of several discussions in politics and international affairs throughout the years. With increased international attention being paid to petrostates and their foreign policy implications and interests in the global energy transition and resource curse phenomena, little study has been conducted on the economic effects of sanctions on specific country segments. Nonetheless, given the growing number of nations classified as Petro-states, the influence of economic sanctions operating within the context of the resource curse theory should not be neglected (Ertimi, Sarmidi, Khalid, & Ali, 2022) [1]. We argue that sanctions imposed for later reasons affect the resource curse mechanism in Petro-state economies. Economic sanctions will first result in a significant reduction in exports and imports (Gary Clyde Hufbauer, Schott, & Elliott, 2008) [2]; Additionally, a decline in

*Corresponding author:
E-mail addresses: b.ertimi.zu.edu.ly, (B. Oqab) b.oqap@zu.edu.ly

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foreign investment would negatively affect the target nation's economic development (Neuenkirch & Neumeier, 2015) [3]. The detrimental impact of sanctions on GDP development and other key macroeconomic indicators is therefore firmly established. Governments are indeed more susceptible to the resource curse (Ertimi, Sarmidi, Khalid, and Helmi Ali (2021) [4]. The implementation of sanctions will therefore be one manifestation of the phenomenon of the oil curse.

This study looks at the influence of economic sanctions on oil exports and the growth rate of GDP. The resource-dependent economic basis of the petro-state enables social benefits to be distributed in times of boom. High dependency on oil exports does, however, generate a fragile economy that might collapse as a result of sanctions. So, we believe that economic sanctions can contribute to the deprivation of economic resources and the decrease in revenue, leading to more cursing. We suggest that economic sanctions can also be seen as an additional oil curse channel. Using the synthetic control approach, we attempt to assess the impact of economic sanctions on oil exports in Libya.

Thus, the purpose of this study is to ascertain the effect of economic sanctions on Libya's oil exports and GDP growth rate. The research depicts the "should-be" amount of oil exports and economic growth without economic sanctions. This article will demonstrate that oil economic sanctions have a detrimental effect on the Libyan economy, which is unorthodox for petroleum-dependent nations; economic sanctions only exacerbate the oil curse.

1. Literature review

1.1. Economic Sanctions and Petrostates: A Transmission Channel

Punitive measures to conflict generated by oil are typically found in the petrostate's governance. It encourages the petrostate to engage in a conflict and increases the likelihood that nations or international communities will impose economic sanctions. Economic sanctions are used to exert pressure on the ruling regime to reform (Bellin, 2004; J. Colgan, 2011; J. D. Colgan, 2010) [5], [6], [7].

The present literature outlines sanctions as foreign policy tools for sender nations to change the behaviour of target governments unilaterally or multilaterally. Sanctions are expected to put economic consequences on their target to influence the behaviour of the state (Drezner & Drezner, 1999) [8]. Similarly, the current research examines the factors that contribute to the efficacy of economic sanctions. A straightforward observation is that sanctions are more effective when they impose higher aggregate economic costs on the target country (Bapat, Heinrich, Kobayashi, & Morgan, 2013) [9]. Due to the intensive use of sanctions, the 1990s was described as the" sanctions decade" (Cortright & Lopez, 2000) [10]. Economic sanctions have since been gaining momentum and investigated from many viewpoints. Studies show that sanctions have a substantial adverse impact on the GDP of the target countries (Allen, 2008) [11]. It has a negative effect and is more severe for the impoverished (Afesorgbor & Mahadevan, 2016) [12]. When this occurs, it endangers financial stability while also provoking foreign exchange crises (Peksen & Son, 2015) [13]. It harms the economic growth of the targeted country (Neuenkirch & Neumeier, 2015) [3]. Researchers looked into how and when economic sanctions were implemented (Hovi, Huseby, & Sprinz, 2005; Marinov, 2005) [14], [15], why they did not work (Pape, 1997) [16]. As well as whether or if the effects may be made to improve (Hufbauer et al., 2008) [2], What were the humanitarian ramifications that emerged? (Moret, 2015) [17], as well as the link between the economic sanctions and law (Alexander, 2009) [18].

Sanctions also have serious health consequences (Allen & Lektzian, 2013; Gibbons & Garfield, 1999) [19] [20]. It has a considerable detrimental effect on trade in the target nations (Yang, Askari, Forrer, & Zhu, 2009) [21]. It produces negative externalities by undermining the targeted state's human rights and civil liberties and significantly decreasing the target country's democratic freedoms (Peksen & Drury, 2010) [22].

2.1.1. Cross-Country Studies

Multiple cross-country studies examine various elements of the economic and social costs of economic sanctions. Generally speaking, the majority of sanctions research is qualitative in nature. Hufbauer et al. (1990) [23], examined 115 case studies of sanctions imposed during World War I, Lam (1990) [24] used the Probit estimation approach. Hufbauer et al. (1990) [23], demonstrated that sanctions are more effective when directed against relatively small, impacted nations with relatively sound foreign policy objectives, a weak economy, and a fragile target country policy.

In comparison, most studies focused on the influence on trade relations of international sanctions. Using the Gravity Model method, Caruso (2003) [25] addressed the influence on international trade of economic sanctions. Figures agree on the hypothesis of significant adverse consequences of international economic sanctions on trade flows. A subsequent study (Caruso, 2005) [26], using the same methodology, quantifies the impact of sanctions on international trade. Using the US and 49 target countries, find that sanctions have a detrimental effect on bilateral trade. Yang et al. (2009) [21] analyse the effect of US trade with the EU and target countries and find that trade diversion performance differs significantly from that of countries hit by US trade sanctions.

Another literature section focuses on additional sanctions consequences. Ebrahimi et al. (2015) [27] conduct comparative and instructive research on the effect of international sanctions on the human rights situation in Iraq and Iran. They noted that sanctions impede human rights in various ways, including education, health, and development. Wen et al. (2020) [28] examine the effect of sanctions on energy security by utilising panel data from target countries from 1996 to 2014 and a fixed-effects model. According to the research, international sanctions can have a significant adverse effect on the energy stability of target economies in some situations. This indicates that international sanctions might reduce energy efficiency, therefore degrading the quality of the environment. In another line, Peksen and Drury (2010) [29] employed a vector decomposition model for cross-national data from 1972 to 2000. Comprehensive sanctions negatively damage freedom and democracy. Kamali et al. (2016) [30] established a relationship between economic sanctions and government corruption in target nations after conducting a 1995–2012 research of 73 sanctioned and 60 non-sanctioned countries over that time period. The findings reveal that corruption is more severe in sanctioned nations than in non-sanctioned countries, according to the research.

2.1.2. Libya Case Study

The US sanctions have harmed Libya but, in particular, Libyan oil output from pre-managed oil resources owing to a lack of access to replacement parts and knowledge as US companies shut down their activities in Libya (O'Sullivan, 2004) [31]. Additionally, Vandewalle (2016) [32] asserts that US sanctions have exacerbated the overall challenges in Libya's oil industry, resulting in increased instability. In 1992, the UN imposed further sanctions. These included an air embargo and a prohibition on the export of arms to Libya. When Libya refused to cooperate, the air embargo was intensified, Libyans' foreign assets were blocked, and oil-related supplies to Libya were prohibited. In 1996, the Iran-Libya Sanctions Act extended the trade and investment ban against Iran to Libya. Sanctions resulted in 50% inflation, severe unemployment, housing shortages, and a loss of $18 billion in oil earnings (Collins, 2004) [33]. Abughalia et al. (2012) [34] observe the trend in Libya's sanctions on exports and imports (1978-2010). It was discovered that total exports and imports and GDP per capita were lower during the sanction era. Yahia and Saleh (2008) [35] examined the relationships between economic sanctions and employment in the Libyan economy using a multiple regression model and the Johansen technique to co-integration. They contended that economic sanctions had a significant influence on both Libyan and international workers. Economic sanctions between 1990 and 2003 had a severe impact on skilled labour mobility.

Additionally, it has a detrimental effect on many other sectors in the country, including oil production and industry. Cevik and Rahmati (2020) [36] examine the impact of foreign sanctions imposed on Libya between 1983 and 1999. They employed both the OLS and VAR methods. Sanctions have a significant adverse influence on economic growth, as demonstrated by the findings.

Except for the research above, we employ a panel dataset and generate counterfactuals for Libya using SCM to perform data-driven comparative case studies. Recently, the SCM was used in three sanction studies examines data from 1970 to 2010 to assess the impact of sanctions on FDI in several sanctioned nations over that period (Mirkina, 2018) [37]. Gharehgozli (2017) [38] examines the effect of increased sanctions on Iran's GDP between 2011 and 2014. Rodríguez (2019) [39] takes into account the impact of sanctions on Venezuela's industry. Also, Barseghyan (2019) [40] examined the macroeconomic consequences of the 2014 Western sanctions on Russia.

Given the nature of the sanctions in our sample, we focus on the spectrum of sanctions' effects on Libyan oil exports and economic growth. The country is highly reliant on oil, which significantly impacts and affects the whole economy. In general, there has been little research on the resource curse from the perspective of economic sanctions as a possible transmission channel. A synthetic control approach will be used in the process. Another method by which the resource curse is influenced is suggested in this study, as opposed to others that use evidence from a case study and economic sanctions.

3. Synthetic Control Method (SCM)

To evaluate the effect of economic sanctions on oil exports and economic growth rate, the synthetic control method will be used, introduced by Abadie and Gardeazabal (2003) [41] with further developments in Abadie, Diamond, and Hainmueller (2010) [42] and Abadie et al. (2015) [43]. According to Athey and Imbens (2016) [44], it represents the leading innovation in the effect assessment literature since 2003. The approach is particularly well-suited for conducting case studies with small samples and only one or a few treated units. Previously, the synthetic control approach was used to assess the effect of resource discovery on Gross Domestic Product (Smith, 2015) [45], the influence of economic sanctions imposed on foreign direct investment(Mirkina, 2018) [37], Additionally, the impact of economic sanctions on Iran's GDP per capita is examined (Gharehgozli, 2017) [38] real exchange rates (El-Shagi, Lindner, & Von Schweinitz, 2016) [46], and the impact of covid-19 on the GDP (Ertimi, Sarmidi, Khalid, & Ali, 2022) [47].

We build a synthetic case of Libya that approaches the values of a set of control variables that can predict oil exports using this method. Our covariates set includes oil production, oil consumption, GDP growth, energy use, and foreign direct investment. Hence, the objective is to evaluate the effect of economic sanctions on oil exports by applying the synthetic control group.

Table 1 shows the weights that produce the best synthetic sanctioned countries from the collection of countries provided in the donor pool, based on the weights that generate the best synthetic sanctioned countries. To develop the synthetic unit, the weights are chosen to best suit the oil exports and GDP growth rate before treatment, and the set of predictor variables used to forecast oil exports for both the synthetic and the treatment units. Synthetic Libya is created by employing data mechanics to obtain all of the weights, and the economic characteristics of the country are listed in Table 1.

Table 1: Country weight in Synthetic Libya

Libya	
Country	Weight
Algeria	0
Angola	0
Colombia	0
Ecuador	0
Kuwait	.154
Nigeria	.088
Norway	0
Oman	.669
Qatar	0
Saudi Aribia	.088
United Arab Emirates	0

Source: Authors' calculations

3.1. Data and Sample selection

Annual panel data for the period 1980-2018 are used for the empirical study. Since economic sanctions were applied at various points throughout the research, the pre-intervention period is not identical. Our donor pool comprises Algeria, Ecuador, Colombia, Kuwait, Nigeria, Qatar, Bahrain, Saudi Arabia, Oman, Norway, and the United Arab Emirates. Libya, a sanctioned state, is defined as the treated country in our data collection.

3.2. Empirical results

The donor countries are included in Table 1 and their contribution to the construction of Libya's counterfactual. Oman, Kuwait, Nigeria, and Saudi Arabia are the best producers of synthetic Libya. Synthetic's pre-sanction match for each case is compared to a population-weighted average of the donor in Table 1.

3.2.1. The case of Libya

Libya was sanctioned economically in 1992. The trajectory of oil exports from actual and synthetic Libya is depicted in Figure 1. Synthetic Libya almost perfectly replicates Libya's oil exports before the imposition of sanctions (1992). Then actual Libya demonstrates a drop in oil exports with the imposition of economic sanctions. As a result, our findings suggest that economic sanctions have a detrimental effect on Libya's oil exports.

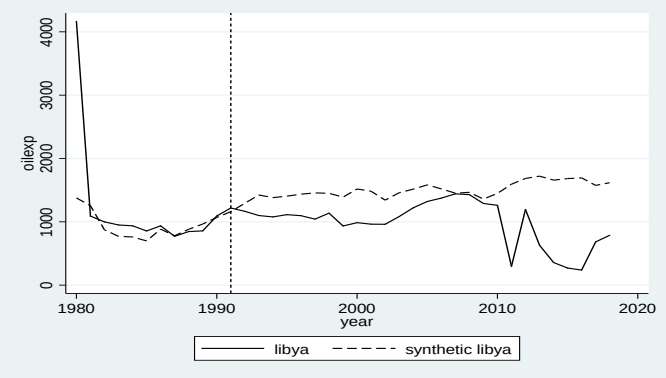

Fig. 1: Trends in oil exports: Libya versus Synthetic Libya
Note: The vertical dashed line is the year of imposing sanctions.

Libya exported 1098.78 million barrels of oil in 1993, approximately 349 million barrels less than the value would have been had economic sanctions not been implemented during 1992. Libya's oil exports decreased by 24% in the first year following the sanctions, compared to the Synthetic Libya baseline. According to the SCM study, if economic sanctions had not been implemented, oil sales would have been 1447 barrels higher in 1992.

3.2.2. Placebo Study (Placebo Libya)

Once again, we conduct placebo tests to determine the validity of our estimations. By comparing the estimated impact of economic sanctions on Libya to the distribution of placebo effects for other countries, we can compare the estimated influence of economic sanctions on Libya to the distribution of placebo effects for other countries. It will be inferred that economic sanctions substantially impact Libya if Libya's estimated effect is significantly significant compared to the distribution of placebo effects.

The result of our placebo research is depicted in Figure 2. The synthetic Libya well matches the actual pattern of oil exports during the pre-sanction's placebo era. Nonetheless, observe the considerable difference between the synthetic and actual oil exports trajectory, implying that the placebo economic sanctions have a sizable influence on oil exports that might possibly equal the actual.

Generally, we argue that if there are enough placebo treatment effects in placebo studies higher than those anticipated in Libya, there is no statistically substantial evidence of the impacts of economic sanctions in Libya. Suppose placebo studies show that the estimated Libyan treatment impact is remarkably high compared with the

effects of placebo treatment on countries not subject to economic sanctions via our sample time frame. In that case, we argue there is statistically significant evidence of the impact in Libya of economic sanctions. Once we estimate the placebo effect, the estimated sanctions' impact does not appear exceptionally large compared to the estimated placebo effects.

Figure 2 shows the gap plots for all of the control units in the pool. Libya is, as can be demonstrated, an outlier in the distribution of placebo effects. The adverse impact of the sanctions is anticipated to be substantially lower. We are thus convinced that the enforcement of sanctions will reduce oil exports.

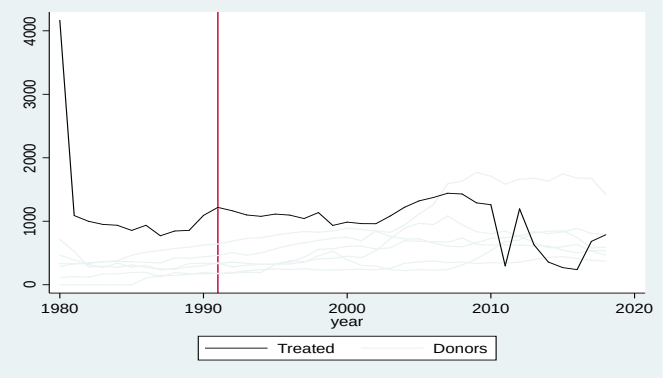

Fig. 2: Placebo effect of oil exports Libya vs. Synthetic Libya

Note: While the grey lines indicate the estimated placebo effect of each country, the black line indicates the estimated effect on Libya of economic sanctions.

3.2.3. Robustness Check

Again, in the context of the removal of a single country from the study along the lines of

Again, in conjunction with the exclusion from Abadie et al. (2015) [43], we have checked the sensitivity of our findings with regard to changes in synthetic country weights. Table 1 demonstrates that synthetic Libya is built by an average of 11 nations. We reevaluate our approach to building synthetic Libya, except for one of the countries in Table 1. We aim to discover to what extent each country leads to our results. In the first iteration, following this update, Kuwait was deleted from the donor pool based on its weight unit in Table 1. We run the model in the donor pool, and we discover that Nigeria has gotten the highest unit weight. We then drop Algeria for the following edition apart from Nigeria.

Figure 2 shows the impact on the solid black line, synthetic Libyan oil exports on the 11 weighting countries, and grey lines represent the leave-one-out figures. The average synthetic departing statistics (grey lines) for pre-sanctions are lower than actual Libyan exports (solid black line). It suggests that the one-out estimates are appropriate. The synthetic control unit values produce an average difference similar to our initial predicted gap. This shows that the figures for the elimination of states are strong.

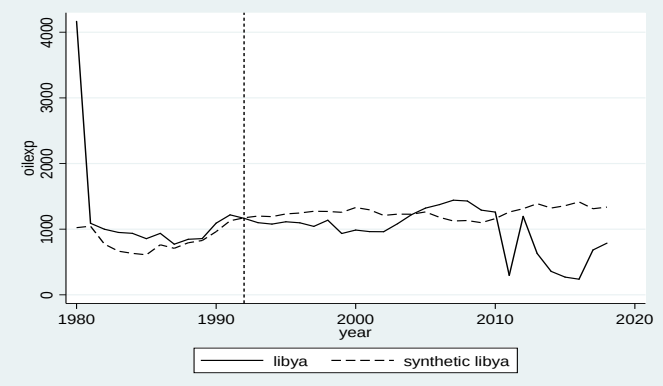

Fig. 3: Leave-one-out synthetic control distribution for Libya

Libya was also subjected to unilateral sanctions imposed by the US in 1986. Figure 4 shows current and synthetic Libya trajectories of oil exports. Synthetic Libya reproduces pretty accurately oil exports to Libya during the era before sanctions (1986). Then actual Libya displays a decrease in oil export sales after the imposition of economic sanctions. Consequently, our finding suggests that economic sanctions have a detrimental effect on Libya's oil exports due to economic sanctions. The size of the gap between actual and synthetic sanctions is nonetheless lesser than in 1992.

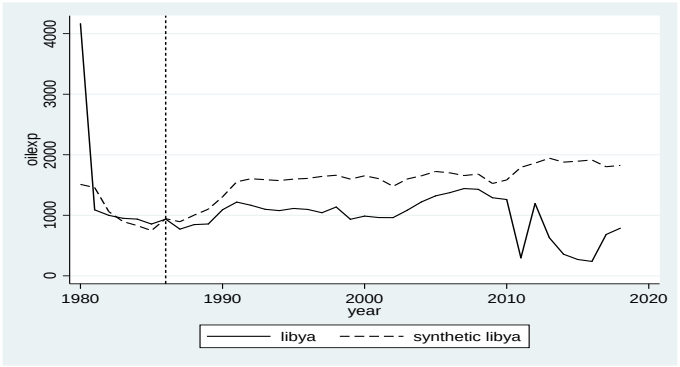

Fig. 4: Trends in oil exports: Libya versus Synthetic Libya (US sanctions1986)

3.2.4. Synthetic Libya and the Effect on GDP growth

Figure 4 shows the trajectory to Libya's and Synthetic Libya's real GDP growth rate from 1980 to 2018. In the pre-sanction period, Synthetic Libya roughly approaches Libya's GDP growth rate. The difference in GDP growth in Libya and Synthetic Libya from 1980 to 2018 is our assessment of the effect of the economic sanctions implemented in 1992. The difference between the two after 1992 indicates a significant negative impact on the country's GDP growth rate due to economic sanctions.

Figure 5 shows that while Synthetic Libya's GDP growth has been constant, Libya's real GDP has declined significantly since 1992 with the difference between the two widenings. In other words, throughout nine years of economic sanctions, the actual GDP growth rate has declined.

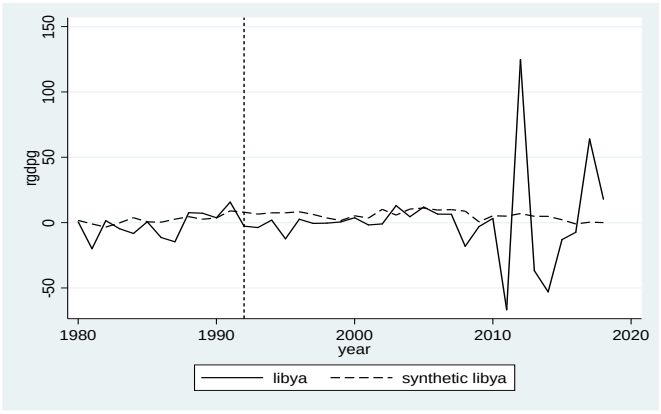

Fig. 5: Trends in GDP growth rate: Libya versus Synthetic Libya

4. Conclusion and policy implications

Many previous studies have investigated in the sanctioned countries the impact of economic sanctions on many aspects. However, in the context of the resource curse, no study has addressed the effect of economic sanctions. In the previous four decades of economic sanctions, multiple studies explored the varied elements of the resource curse.

Our technique differs from literature by highlighting the causal influence of economic sanctions and drawing attention towards another channel leading to the oil curse, reflecting the international dimension of Libya's oil curse.

This study has shown that economic sanctions have harmful effects on oil exports. We have used the synthetic control approach to create an appropriate control group to estimate a significant detrimental effect after sanctions. In the instance of Libya, we are using country panel data for oil exports to isolate the economic impact of economic sanctions. In this respect, we have introduced the synthetic control technique to determine how oil exports would have done without

sanctions. We discover that economic sanctions have harmed Libya and that decreased exports would not have occurred in the absence of economic sanctions. We have established that our estimated effect is caused by economic sanctions using placebo experiments and 'leaving-one-out' testing; accordingly, our estimate is robust. We demonstrate that economic sanctions may be used as an additional channel in Libya's resource curse context.

There is sufficient evidence that governments used oil income inefficiently and wastefully and argued that sanctions hurt the economy. Thus, the removal of sanctions is likely to have a large influence on macroeconomic policy, as oil accounts for at least 90% of the country's export revenues. The case study validates many of the economic sanction's findings. Firstly, sanctions are generally isolated from other strategies such as constructive engagement and diplomacy. This has restricted their choices to succeed since sanctions have severely damaged them. Secondly, while the actual causal mechanism is challenging to point out, sanctions have been imposed alongside strengthening the authoritarianism anticipated in the literature. These instances, nonetheless, offer the literature with unique insights on the effects of sanctions. Since the country relies significantly on one industry and is primarily Governmental-controlled, targeted state sanctions can have more profound impacts.

Based on the conclusions of the previous empirical research, policy implications may be proposed. First, our findings imply that a target state facing economic sanctions should reduce its reliance on the sender market and diversify its export and import markets to limit the harm imposed by any restrictions. Second, the country should exercise prudence regarding economic sanctions since they are the most likely to face them given their foreign policy behaviour and sensitivity to them, which may be viewed as another channel of the oil curse. Thus, our research fills a gap in the literature on economic sanctions in the context of the resource curse and has important implications for related scholars working in this field of study.

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