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ORIGINAL ARTICLE

The interactive effect of geopolitical risk and natural resource rent on political instability: Evidence from Ghana

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Abstract

Background: According to economists, political instability is regarded as a serious malaise harmful to economic development, which results in frequent switches of policies, creating instability to impede economic performance. The widespread political instability in many developing countries, along with its harmful effects on social welfare and economic performance, has heightened the interest of policymakers and economists in understanding the factors that contribute to political instability to inform better policy formulation. It is therefore imperative to examine the interactive effect of geopolitical risk and natural resource rent on political instability to provide strong empirical grounds for policy implementation.

Objectives: This study employs a long time series dating from the period of 1824–2020 to examine how natural resource rent and geopolitical risk influence political instability in Ghana. First, we examine long-run effects using linear methods. Second, we employ nonparametric methods to investigate the nonlinear link between natural resource rent and political instability as well as between geopolitical risk and political instability.

Methods: The study applied linear methods and nonparametric methods to historical time series data dating from the period of 1824–2020.

Results: The results from the linear methods show that the interaction of natural resource rent and geopolitical risk exerts a positive and larger impact on political instability compared to their separate effects. The results from the nonparametric methods show a weak nonlinear link between these variables (i.e., natural resource rent, geopolitical risk, and political instability),

although consistent with the linear long-run results, the links are positive.

Conclusion: Overall, the results demonstrate that the observed positive relationship between natural resource rent and political instability is not just a recent phenomenon but holds for over more than 100 years in Ghana. Therefore, to attain a stable political environment, both long- and short-term policies on political stability should be formulated.

KEYWORDS
geopolitical risk, natural resource rent, political instability

Political instability defined as a crisis within a country caused by a variety of factors including government incompetence, cultural heterogeneity, low regime legitimacy, economic problems, high crime rates, and others (Ake 1973; Campos and Nugent 2002) poses a huge threat to economic development. Political instability is also regarded by economists as a serious malaise harmful to economic development, which results in frequent switches of policies, creating instability to impede economic performance (Aisen and Veiga 2013; Purcell, Heitmeier, and Van Wyhe 2017). The widespread political instability in many developing countries and its damaging repercussions on social welfare, and economic performance have increased the interest of policymakers, and economists to seek a better understanding of what influences political instability for policy formulation. This has led to a growing body of literature examining the factors that influence political instability. To this point, studies in this strand of the literature have shown that factors including natural resource extraction (Wang et al. 2021a), corruption (Nur-Tegin and Czap 2012), nature of political regime (Miljkovic and Rimal 2008), income growth rate (Alesina and Perotti 1996), investment (Cumming, Rui, and Wu 2016), foreign aid (Steinwand 2015), and ethnic diversity (Repkine 2014) influence political instability. The interaction of geopolitical risk and natural resource rent, and in particular their joint effects on political instability, has not been analyzed. In this study, we attempt to bridge this gap in the literature.

Geopolitical risk defined as the risk linked with wars, terrorist acts, and tensions between states does not only possess a significant threat to human life but also disturbs political stability (Dogan, Majeed, and Luni 2021). The term that has been used synonymously refers to other related events such as regional instability, political copes, political violence, and terrestrial disputes (Emmers 2009; Khan, Su, and Rizvi 2022; Wang, Su, and Umar 2021b) and also has a direct link to natural resource extraction that is likely to influence political stability. For example, previous studies have demonstrated that natural resource extraction breeds conflicts, tribal disputes, political violence, wars, and authoritarianism (Conrad et al. 2019; Hinkkainen Elliott and Kreutz 2019; Johnson 2019; Sini, Abdul-Rahim, and Sulaiman 2021), all of which have implications for a stable political environment.

Using very long historical data for Ghana covering the period of 1824–2020, we examine the interactive effect of geopolitical risk and natural resource rent on political instability. Using very long historical data is important given that these data allow us to track the evolution of both pre- and postcolonial disputes, wars, and conflicts associated with Ghana's natural resources, especially gold extraction. Thus, there is a need to capture periods before 1957 when there was a high rate of wars and tribal conflicts between the British colonist and several tribes in Ghana due to the struggle for power over substantial deposits of gold in the soil (Busia 2018). For instance, the Anglo-Ashanti wars, which occurred between the period of 1824 and 1900, were fought between the Ashanti (Asante) and the British over a piece of land rich in gold (Butcher 2019; Wasserman 1961). The war was fought for over 50 years before the Asantes gave up sovereignty over their southern possessions of land rich in gold. Also, very long-run time series data give room for high observations that increase precision and facilitate more accurate results for how natural resources influence the link between geopolitical risk and political instability (Nunn 2009).

The purpose of this study is in threefold. First, we examine the impact of geopolitical risk on political instability. Second, we also examine the impact of natural resource rent on political instability. Third, we examine the influential role of natural resource rent on the relationship between geopolitical risk and political instability. To do this, we first employ parametric methods to examine long-run impacts. We find a positive link between geopolitical risk and political instability as well as a positive relationship between natural resources and geopolitical risk. Also, the interactive effect of geopolitical risk and natural resource rent on political instability is negative but statistically higher than the direct effects. Also, we employ nonparametric approaches to examine nonlinear properties given that such long-run time series data contain structural shifts. The nonparametric estimates suggest a positive long-run relationship between geopolitical risk and political instability. Additionally, the combined effect of natural resource rent and geopolitical risk on political instability is relatively higher than the direct effects. In essence, both parametric and nonparametric estimates suggest that natural resource rent and geopolitical risk exacerbate political instability.

In examining this issue, we make several contributions to literature. First, we contribute to the literature that seeks to understand the root causes of political instability (Cumming, Rui, and Wu 2016; Nur-Tegin and Czap 2012; Steinwand 2015; Wang et al. 2021a). In particular, we contribute to the literature that has examined how natural resource extraction influences political instability (Asiedu 2006; Wang et al. 2021a; Zeeshan et al. 2022). These studies have improved our understanding of how natural resources influence a stable political environment and thus have been useful in influencing policy implementations. However, this study differs from these studies given that we focus on the interactive effect of natural resource rent and geopolitical risk on political instability. Understanding the interactive effect of geopolitical risk and natural resource rent on political instability is vital given that it provides a new perspective worth considering in the drive to attain a stable political environment. Our findings suggest that besides the factors discovered by the literature, geopolitical risk influences political instability, and thus policymakers should consider this factor when devising policies aimed at ensuring a stable political environment.

Second, we also contribute to the literature on the effect of geopolitical risk on macroeconomic instability, which has so far focused on a wide range of instability in several macroeconomic variables including oil prices, investment, stock market uncertainty, and crude oil security (Anser, Syed, and Apergis 2021; Antonakakis et al. 2017; Wang, Su, and Umar 2021b). By focusing on political instability, we extend this strand of the literature and provide further insight into the implications of geopolitical risk. Also, this study fills a significant gap in the literature given the lack of studies on the effect of geopolitical risk on political instability. Specifically, we produce the first findings from a study that examines the combined effect of geopolitical instability and natural resource on political instability. The implicit inspiration for our study is that by producing strong empirical results, we can provide a sound empirical basis for policy implementation and allow targeted policy interventions to resolve political instability in developing countries.

Our focus on Ghana is important for several reasons. First, Ghana is one of the African countries with tremendous natural resources including gold, iron ore, cocoa, bauxite, diamond, and others, which attracted a lot of outside interest and thus led to British invasion in 1902 (Miller, Vandome, and Mcbrewster 2009). Second, in 2005, a huge deposit of crude oil was discovered in the western part of Ghana (Adabor, Buabeng, and Dunyo 2022; Marbuah 2017). The country produced its first crude oil constituting about 24 million barrels, and the production rose to 28 million barrels in the fourth quarter of 2018 (Adabor 2022; Dramani and Frimpong 2020). To date, Ghana produces an average of 179.43 thousand barrels per day, and it is expected that the country will become the leading net exporter of gas and crude oil in Africa by 2030 (Anyars and Adabor 2023; Oteng-Abayie et al. 2023). This makes Ghana more susceptible to geopolitical risk because several studies have demonstrated that natural resource extraction is associated with geopolitical events such as disputes, wars and others (Hinkkainen Elliott and Kreutz 2019; Johnson 2019). Third, Ghana has experienced series of geopolitical events in the past, especially before Ghana attained independence. The first Europeans who colonized Ghana are the Portuguese who, on their arrival in Ghana, had encounters with different African kingdoms that controlled substantial deposits of gold (Apoh 2013). Their aim was to gain sovereignty over lands rich in gold held by tribes in Ghana. This led to a struggle for power over Ghana's natural resources between the Portuguese and a variety of kingdoms

in Ghana, especially a substantial deposit of gold they found between the rivers of Ankobra and Volta, and they named the area as "da Mina," meaning "The Mine" (Donkor 2005). Intuitively, there were series of conflicts between the Portuguese and many tribes in Ghana. In the history of Ghana, the British were the most impactful invaders who colonized Ghana from 1902 to 1957. When the British first arrived in Ghana, they seized privately held land along the coast, and this led to conflicts between the British and Ghanaian kingdoms in coastal areas. These kingdoms also fought with the African company of merchants to eliminate them and take over the interest of these merchants. The British also attacked the Asante over a piece of land rich in gold, and this led to five conflicts, which are popularly known as the "Anglo-Asante Wars," between the British Empire and the Asante Empire (Leimkugel et al. 2007). To capture these periods characterized with series of geopolitical events, we utilize very long time series data to capture pre- and postcolonial eras.

The rest of the study is organized as follows: the section that follows reviews previous studies. Data sets and variables are described in the third section, whereas results are reported in the fourth section. The fifth section provides a robustness check and conclusion.

LITERATURE REVIEW

In this section, we summarize relevant and recent studies conducted on geopolitical risk, natural resource rent, and political instability in two distinct parts. First, we review studies on the nexuses between geopolitical risk and natural resources rent. Second, we review studies on natural resource rent and political instability. Given the absence of studies on geopolitical risk and political instability, we are unable to present a literature review on that. Hence, this study fills an important literature gap on the connection between geopolitical risk and political instability.

Geopolitical risk and natural resources rent

Studies revolving around this area of research can be grouped into three categories. The first strand of the literature finds an adverse effect of natural resource rents on geopolitical risk (Barkoulas, Hu, and Santos 2008; Olanipekun and Alola 2020). For instance, Cunado et al. (2020) examine the impact of geopolitical risk on oil returns and reported that geopolitical risk causes a decline in oil returns. A study by Barkoulas, Hu, and Santos (2008) reported a similar outcome for return from both gold and oil. In the Persian Gulf, Olanipekun and Alola (2020) examine the link between geopolitical risk and oil production and reported that geopolitical risk decreases the production of oil. Thus, a shock from any form of geopolitical event decreases the production of oil.

The second category of this strand of the literature posits that the impact of geopolitical risk on natural resource rents is positive (Antonakakis et al. 2017; Bouoiyour et al. 2019; Omar, Wisniewski, and Nolte 2017). For example, findings from Omar, Wisniewski, and Nolte (2017) suggested that oil acts as a haven in periods of high geopolitical risk because geopolitical events such as wars and crises that influence the oil market increase oil prices leading to higher returns from oil sales. Consistently, Antonakakis et al. (2017) find that the return from oil increases owing to the impact of geopolitical tension on the oil market. Concurrently, Noguera-Santaella (2016) finds a positive effect of higher oil prices with increasing geopolitical events before 2000 but finds a moderate effect after 2000.

The third category of this strand of the literature posits that there is no association between natural resource rent and geopolitical risk (Antonakakis et al. 2017; Joëts, Mignon, and Razafindrabe 2017). For example, Joëts, Mignon, and Razafindrabe (2017) find no relationship between oil price volatility and uncertainty geopolitical events, whereas Antonakakis et al. (2017) reported that there is no association between geopolitical threats and oil prices.

The above literature survey reveals that there is a newly emerging area of research that focuses on the link between natural resource rent and geopolitical events. Although these studies are scanty, the

evidence presented is mixed. Also, these studies tend to focus on the link between geopolitical risk and oil returns. There is a need to explore the interaction of geopolitical risk and natural resource rent since several studies have shown that natural resource extraction leads to geopolitical events including wars, disputes, tribal wars, political violence, and authoritarianism (Johnson 2019; Sini, Abdul-Rahim, and Sulaiman 2021). Thus, some geopolitical events emerge out of natural resource extraction.

Natural resource rent and political instability

The relationship between natural resource rent and political instability has been well documented in the literature. This strand of the literature argues that natural resource rent leads to an unfavorable political environment via four main channels, namely (1) access to honeypots, (2) secessionists movements, (3) financing of rebel groups, and (4) isolation of governments from their electorates (Collier 2003; Collier and Hoeffler 2005).

Different groups may fight resulting in valuable honeypots linked to natural resource extraction, which disturbs a stable political environment (Ajide, Adenuga, and Raheem 2020; Fearon and Laitin 2003; Farzanegan, Lessmann, and Markwardt 2018). For example, Fearon and Laitin (2003) suggested that natural resources are intrinsically linked with a prize value-capturing state that increases gains to rent-seeking activities, and this is likely to breed conflicts or wars among different groups. Similarly, Farzanegan, Lessmann, and Markwardt (2018) find evidence of a positive relationship between natural resource rent and internally generated conflict risk for a panel of more than 90 countries covering the period of 1984–2004. In essence, natural resource abundance may induce excessive rent-seeking and thus increase the risk of internal conflict.

Secessionist movements often emerge out of the unequal distribution of natural resources. Regions that are well endowed with natural resources often seek political and economic independence to have absolute control or power over their natural resources. This leads to misunderstandings or conflicts between endowed regions and less endowed regions, and this is one of the main sources of conflicts or political instability (Le Billon 2001; Wennmann 2007).

One of the major sources of financing wars or conflicts is natural resources. Thus, revenue made from natural resource extraction is often used to finance conflicts and wars. Most rebels do not have access to government budgets to finance their political and economic activities. They sometimes resort to revenues from trading natural commodities to finance their economic and political ambitions (Le Billon 2001). Although there are several sources of finance for rebels including diversion of foreign aid, kidnapping, protection rackets, and diaspora remittances, reliance on revenue from natural resources outweighs the other sources of finance. This is because access to natural resource rent provides sufficient revenues to rebels that allow them to get access to the tools, machinery, and other resources that they need to carry out their activities. For example, Ross (2004) argues that rebel groups always lose their incentive to reach a peace settlement when they have access to lootable resource because lootable resources make the conflict more profitable.

Natural resources can also separate the government from its electorate. A significant proportion of state revenue comes from taxation. Thus, the representative government funds most of its developmental projects through the revenue made from taxation (Ishiyama, Martinez, and Ozsut 2018; Robinson and Acemoglu 1969). However, resource rent is nontaxable, and this reduces government revenue and accountability. When accountability reduces, it lowers citizens' interest and participation in government activities, which ultimately leads to tensions or conflicts between the government and the citizens. In essence, natural resource rent breeds internal conflicts between electorates and representative government because it reduces government accountability.

The literature review above consistently supports the hypothesis that natural resource rent is linked with internal conflicts. Thus, there is a potential correlation between natural resource extraction and geopolitical events such as conflicts. However, when natural resources are used for developmental projects that bridge the social and economic inequality gap between the rich and the poor, it can reduce the risk of

internal conflicts and thus promote economic growth and development (Adabor, Buabeng, and Dunyo 2022; Besley and Persson 2010). This is not the case in many developing countries rich in abundant natural resources due to the lack of strong state and private institutions that oversee the utilization of revenue made from natural resources (Adabor 2022).

DATA AND EMPIRICAL MODEL

The dependent variable is political instability, which captures the perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism. This variable was sourced from the World Government Indicator (WGI) for the period of 1996–2020. The key independent variables of interest are natural resource rent (NR) and geopolitical risk (GPR). Natural resource rent is measured as the difference between the cost of extracting natural resources and revenue made from the sale of natural resources as a percentage of gross domestic product (GDP), following the World Bank's standards. Natural resource rent can also be viewed as the gross profits of natural resource firms as a percentage of GDP. Data on natural resource rent were obtained from the WGI from 1970 to 2020. To measure geopolitical risk, we utilized the historical geopolitical risk index approach developed by Caldara and Iacoviello (2022). This approach is based on an electronic text search of 11 international newspapers from the archives fetched from articles containing words or a set of terms such as geopolitical tension, geopolitical uncertainty, war, nuclear threats, nuclear war, fear of war, and terrorism among others. For each time, the number of such articles depicts a share of the total new articles. Here, a geopolitical risk index is constracted, and the yearly annual average indices for each year are computed. To capture colonial periods in Ghana, which are characterized by geopolitical events such as a frequent dispute over a piece of land rich in gold, we utilized linear interpolation to backdate the data to the period of 1824.

Recent studies by Ajide, Adenuga, and Raheem (2020), Conrad et al. (2019), and Sini, Abdul-Rahim, and Sulaiman (2021) have demonstrated that natural resource rent (NR) is intrinsically linked to geopolitical events such as fear of war, tribal dispute, political violence, and terrorism. The findings from these studies suggest that geopolitical events are inherent in the extraction of natural resources. Building on the aforementioned studies, we formulate an empirical model to include the interaction of natural resource rent and geopolitical risk. The empirical model is formulated as follows:

$$ln\,\mathrm{PI}_t = \beta_0 + \beta_1 ln\mathrm{NR}_t + \beta_2 ln\mathrm{GPR}_t + \beta_4(\mathrm{GPR}_t * \mathrm{NR}_t) + \beta_i ln\mathrm{V}_t + \mu_t, \quad (1)$$

where PI, NR, and GPR depict political instability, natural resource rent, and geopolitical risk, respectively. The subscription t and μ represent year and the error term, respectively. The term V captures control variables including the GDP per capita growth rate (GDP), youth unemployment (UM), population growth, government spending, and human capital. We control for the GDP per capita growth rate because several studies have reported a strong linkage between economic growth and political instability (Asteriou and Price 2001; Dalyop 2019; Jong-A-Pin 2009). For example, Aisen and Veiga (2013) show that political instability is one of the causes of a low rate of economic growth. To capture the effect of overpopulation, we include annual population as a control variable since rapid population growth strains political institutions, increases pressure on social amenities, and increases the likelihood of forming rebels and pressure groups, all of which have implications for political stability (Al-Shammari and Willoughby 2019; Lehmijoki and Palokangas 2006). Unemployment is correlated with political instability in several African countries including Ghana, and thus we control for youth unemployment (Fomba Kamga, Talla Fokam, and Ningaye 2022; Hailu Demeke 2022). Government spending and human capital were also included in the empirical model as control variables because previous studies have demonstrated that an increase in human capital and government spending tends to increase political stability (Annett 2001; Gyimah-Brempong and De Camacho 1998; Outreville 1999). Table A1 in the Supporting Information Appendix provides a brief description of all the variables utilized in the study.

TABLE 1 Bayer and Hanck combined co-integration test estimates.

	Fisher statistics			
Model	**EG-JOH**	**EG-JOH-BO-BDM**	**Lower bound**	**Upper bound**
(1a)F_{PI}(PI | GPR, NR, GPR*NR, V)	59.011***	63.410***	12.082	18.019
(2a)F_{PI}(PI | GPR,V)	57.660***	73.342***	13.072	19.098
(3a)F_{PI}(PI | NR, V)	64.99***	83.751***	13.082	19.099

Note: The upper bound and lower bound denote critical values for EG-JOH and EG-JOH-BO-BDM, respectively.
***Denotes statistical significance at the 1 percent level.

MAIN RESULTS

Parametric results

Most time series analyses begin with a unit root test to examine the stationarity properties of the data. This is important because utilizing time series data that are not stationary can lead to biased estimates. Therefore, we first implement standard unit root tests to examine the stationarity properties of our variables. Specifically, we utilized the Phillips and Perron (1988), and the augmented Dickey–Fuller (Dickey and Fuller 1979) unit root tests. The results for each of these unit root tests are reported in Table A3 (see the Supporting Information Appendix). The unit root test results suggest that all the variables are either stationary at their level or first difference.

Next, we examine the cointegrating relationship among the series by utilizing the Bayer and Hanck (2013) combined co-integration approach. Table 1 reports the results of the Bayer and Hanck (2013) co-integration test. The results suggest that the null hypothesis of no co-integration should be rejected since the Fisher statistics for EG-JOH and EG-JOH-BO-BDM are greater than all the critical values (upper and lower bound) at a 1 percent level of significance. In essence, the results suggest the presence of co-integration among all the variables, which is consistent across the three models.

After establishing a long-run co-integration among all the variables, we estimate the long-run interactive effect of geopolitical risk and natural resource rent on political instability utilizing the Dynamic Ordinary Least Square approach (DOLS) developed by Stock and Watson (1993). The DOLS estimator is suitable because it considers some specific econometric issues such as serial correlation and endogeneity. We cannot rule out the endogeneity issue in our analysis given that we cannot control for all myriads of factors that influence political instability. Thus, one major source of endogeneity in our analysis is omitted variable bias. Another source of endogeneity is measurement errors in measuring the variables, particularly for human capital prior to 1957. Also, another source of endogeneity resulting from measurement errors is the linear interpolation used to backdate all the variables. This is because linear interpolation beyond the available data range is more likely to ignore data patterns or fluctuations, sensitivity to data distribution, and the propagation of uncertainty and errors through the interpolation process. Intuitively, the interpolated values may deviate from their true values leading to endogeneity. Fortunately, the DOLS accounts for endogeneity (Stock and Watson 1993) and thus can resolve the endogeneity problem from all sources in our analysis.

Table 2 reports the results for the DOLS. Column 1 reports the direct effect of geopolitical risk on political instability, whereas column 2 reports the effect of natural resource rent on political instability. Column 3 reports the interactive effect of NR and geopolitical risk on political instability. The results presented in column 1 show that a 1 percent increase in geopolitical risk generates (*lnGPR*) an approximately 0.099 increase in political instability, ceteris paribus. In column 2, we find that a 1 percent increase in natural resource rent (*lnNR*) causes about a 0.195 increase in political instability, suggesting a positive link between NR and PI. The positive effect of NR on PI is consistent with findings from Bouoiyour et al. (2019) and Antonakakis et al. (2017). In column 3, it is observed that the interaction of geopolitical

TABLE 2 Dynamic Ordinary Least Square approach (DOLS) long-run estimates.

Variable	(1)	(2)	(3)
lnGPR	0.099**		0.189**
	(0.017)		(0.027)
lnNR		0.195**	0.095**
		(0.049)	(0.013)
lnGPR lnNR*			0.590***
			(0.059)
lnUM	0.091**	0.199**	0.219**
	(0.019)	(0.026)	(0.039)
lnPG	0.118**	0.261**	0.098**
	(0.029)	(0.019)	(0.015)
lnGS	−0.213**	−0.189**	−0.094**
	(0.027)	(0.034)	(0.015)
lnHC	−0.139**	−0.213**	−0.139**
	(0.023)	(0.025)	(0.022)
lnGDP	−0.239**	−0.209**	−0.198*
	(0.039)	(0.038)	(0.024)
Intercept	0.211**	0.199**	0.135**
	(0.033)	(0.049)	(0.035)
Observations	196	196	196

Note: Dependent variable is political instability.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.
Source: Authors' estimations.

risk and natural resource rent (*lnGPR*lnNR*) exerts a positive impact on political instability at a 1 percent level of significance. Specifically, the coefficient of the interaction of term (*lnGPR*lnNR*) in column 3 of Table 2 shows that political instability would increase by approximately 0.590 when a 1 percent increase in natural resource rent is complimented with geopolitical risk, all things being equal. The interacted effect is higher than both individual effects, suggesting that the combined effect of natural resource rent and geopolitical risk is likely to worsen a stable political environment. The interactive effect also provides a suggestive piece of evidence that natural resource extraction leads to geopolitical events as argued by previous studies (Ajide, Adenuga, and Raheem 2020; Farzanegan, Lessmann, and Markwardt 2018) since their combined effect is higher and stronger than their individual effects. Overall, the results across columns 1–3 suggest that both natural resource rent and political instability increase political instability; however, their combined effect worsens a stable political environment.

Regarding the covariates, all of them remain consistent throughout the three alternative models in terms of their relationship with political instability. Specifically, the results in Table 2 reveal that unemployment and population growth exert a positive effect on political instability, whereas GDP per capita growth rate, government spending, and human capital exert a negative effect on political instability. For example, the results in column 1 show that a 1 percent increase in unemployment leads to about a 0.091 increase in political instability, whereas a 1 percent increase in population growth leads to nearly 0.118. Also, in the same column, we find that a 1 percent increase in government spending generates about a 0.213 decrease in political instability, whereas a 1 percent increase in human capital leads to about a 0.139 increase in political instability, ceteris paribus. The coefficient of GDP per capita growth rate (*lnGDP*) in column 1 suggests that a 1 percent increase in GDP per capita growth rate causes about a 0.239 decrease in political instability (results in columns 2 and 3 are interpreted in the same manner). It can be inferred from these

TABLE 3 Sub-sampling analysis using Dynamic Ordinary Least Square approach (DOLS).

	1824–1889			1890–1956			1957–2020		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variable									
lnGPR	0.309**		0.235**	0.209**		0.215**	0.159**		0.145**
	(0.047)		(0.049)	(0.039)		(0.023)	(0.023)		(0.029)
lnNR		0.365**	0.145**		0.299**	0.254**		0.089**	0.135**
		(0.039)	(0.031)		(0.041)	(0.034)		(0.015)	(0.029)
lnGPR∗ lnNR			0.409**			0.319**			0.209**
			(0.049)			(0.049)			(0.034)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	65	65	65	66	66	66	63	63	63

Note: Dependent variable is political instability.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.
Source: Authors' estimations.

results that unemployment and population growth are not conducive to a stable political environment, whereas government spending, human capital, and GDP growth per capita promote a stable political environment.

Robustness check and extension

In this section, our main goal is to undertake two robustness checks to ensure that our baseline estimates from DOLS are robust. Precisely, we examine the robustness of our results to different samples and a nonparametric method.

Sub-sampling analysis

Table 3 reports the results for the combined effect of NR and geopolitical risk on political instability for different periods. Specifically, we focus on periods before and after Ghana's independence (i.e., 1824–1889, 1890–1956, and 1957–2020). This is important because before Ghana attained independence, the British colonist and several tribes in Ghana, especially the Asante, fought over gold and other natural resources. Thus, before 1957, there was a high incidence of geopolitical events compared to years after independence. The results for *lnGPR∗lnNR* reported in column 3 suggest that before the period of 1889, political instability would increase by about 0.409, a 1 percent increase in natural resource rent is complemented with 1 percent increase in geopolitical risk. This point estimate is relatively higher than the periods of 1890–1956 and 1957–2020 but closer to the population estimate in Table 2 (0.590), depicting that regardless of the period or the sample, the combined impact of natural resource rent and the geopolitical event is positive. Regarding the individual effect of natural resource rent and geopolitical risk, both exert a positive effect on political instability for all the different periods and thus conform to the full sample long-run estimates in Table 2.

Nonparametric results

The data utilized in this study span for more than a hundred years. Therefore, there is a higher likelihood that such long data may contain nonlinear properties, time-varying volatility, and structural breaks and

TABLE 4 Nonlinear co-integration test results.

Model	F-$_{statistics}$	*p*-value	*K* = 5
(1a)F_{PI}(PI | GPR, NR, GPR*NR, V)	18.694	0.001	
(2a)F_{PI}(PI | GPR,V)	15.995	0.002	
(3a)F_{PI}(PI | NR, V)	17.915	0.004	
Critical value		Lower bound	Upper bound
1%		5.112	6.012
5%		7.394	10.381

Note:*K* denotes the number of regressors in the equation.
Source: Authors' estimates.

shifts. Specifically, there is a potential nonlinear association among natural resource rent, geopolitical risk, and political instability. As a result, we conduct a nonlinear analysis in this section. First, we employed the Zivot and Andrews (2002) test to examine the unit root properties and to test for structural breaks in the series. The results for the Zivot and Andrews (2002) test reported in Table A4 (see Supporting Information Appendix) show that all the variables are either stationary at their level or first difference. At the same time, Table A4 confirms the presence of structural breaks for all the variables although the breaks for natural resource rent, geopolitical risk, and political instability were not strong since these variables were significant at a 10 percent level of significance.

Having detected the presence of nonlinear unit root properties in the series, we then employ the Shin, Yu, and Greenwood-Nimmo (2014) nonlinear co-integration test to examine the nonlinear co-integration among the variables. The Shin, Yu, and Greenwood-Nimmo (2014) nonlinear co-integration is similar to the linear ARDL model. Thus, the F-statistics estimated from the bound test approach are compared to the upper bond to determine the presence or absence of co-integration. Table 4 reports Shin, Yu, and Greenwood-Nimmo (2014) nonlinear co-integration test results. The results suggest that the F-statistics of 18.694, 15.995, and 17.915 for all the alternating models is greater than the upper bound of 6.012 and 10.381 at 1 percent and 5 percent levels of significance, respectively. This result suggests the presence of nonlinear co-integration among the variables.

Having established nonlinear co-integration among the variables, we applied the NARDL model to estimate both the long-run and short-run interactive effect of natural resource rent and geopolitical risk on political instability. The long-run results are reported in Table 5, whereas the short-run results are reported in Table 6. The results in Table 6 show that positive changes (increase) in both NR and geopolitical risk increase political instability, whereas negative changes in both NR and geopolitical risk decrease political instability but are not statistically significant. For instance, in column 1, a 1 percent increase in $lnGPR^{+}$ leads to about a 0.109 increase in political instability, whereas a 1 percent increase in $lnGPR^{-}$ leads to about a 0.109 decrease in political instability. However, the effect of $lnGPR^{-}$ is not statically significant, suggesting that the nonlinear relation among natural resource rent, geopolitical instability, and political instability is not statistically strong. Therefore, applying a parametric or linear model will produce accurate and reliable estimates. Also, the interactive effect of $lnGPR^{+} * lnNR^{+}$ on political instability is statistically significant, whereas the interactive impact of $lnGPR^{-} * lnNR^{-}$ on political instability is not statistically significant, suggesting that a decrease in both natural resource rent and geopolitical risk may not lead to a decrease in political instability as expected. Overall, the results in Table 5 are consistent with the DOLS estimates in Table 2 since only the positive changes (increase) exert a significant positive impact on political instability.

Table 6 reports the short-run combined effect of natural resource rent and geopolitical risk on political instability. From the statistics displayed in Table 6, it is observed that an increase in both $lnGPR^{+}$ and $lnNR^{+}$ increases political instability, whereas an increase in both $lnGPR^{-}$ and $lnNR^{-}$ decreases political instability in columns 1 and 2, respectively. However, the effect of both $lnGPR^{-}$ and $lnNR^{-}$ is not

TABLE 5 Nonliner Autoregressive Distributed Lag (NARDL) long-run estimates.

Variable	(1)	(2)	(3)
$lnGPR^{-}$	−0.109		−0.249
	(0.117)		(0.217)
$lnGPR^{+}$	0.109**		0.079**
	(0.029)		(0.013)
$lnNR^{-}$		−0.095	−0.195
		(0.089)	(0.099)
$lnNR^{+}$		0.251**	0.085**
		(0.039)	(0.012)
$lnGPR^{+} * lnNR^{+}$			0.295**
			(0.049)
$lnGPR^{-} * lnNR^{-}$			0.195
			(0.159)
Covariates	Yes	Yes	Yes
Observations	196	196	196

Note: Dependent variable is political instability.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.
Source: Authors' estimations.

statistically significant, suggesting that negative changes in both natural resource rent and geopolitical risk cannot result in a substantial decrease in political instability. The short-run estimates also confirm the presence of a weak asymmetrical relationship among these variables since $lnGPR^{-}$ and $lnNR^{-}$ were not statistically significant. Also, the Durbin-Watson test rejects the null hypothesis of no long-run weak asymmetrical relationship in the model, implying there is a weak asymmetrical relationship between these variables in the short run. These results conform to both the long-run and the DOLS estimates in Table 2 since only the positive changes (increase) exert a positive significant impact on political instability, whereas the negative changes (decrease) are not significant.

DISCUSSION AND CONCLUSION

The extraction of natural resources such as coal, oil, gas, and minerals is growing expeditiously worldwide, with a yearly international investment of about $1 trillion (Barma, Kaiser, and Le 2012). Globally, the use and extraction of primary natural resources exceed 100 billion tons per year and expected to reach between 170 billion and 184 billion by the end of 2050 as reported by the International Resource Panel (Preston, Wellesley, and Lehne 2019). The increasing extraction of natural resources poses a threat to a stable political environment since its extraction has been shown to lead to geopolitical events such as political violence, territorial dispute, wars, conflicts, and tribal dispute (Ajide, Adenuga, and Raheem 2020; Farzanegan, Lessmann, and Markwardt 2018). Thus, natural resource extraction is a factor that can give rise to geopolitical risk, which, in turn, influences political stability. Although an increasing amount of work tends to analyze and examine the determinants of political instability, the role of geopolitical risk and natural resource rent remains unexplored.

This study fills an important gap in the literature by examining how natural resources and geopolitical risk influence political instability. Specifically, we examine the combined impact of geopolitical risk and natural resource rent on political instability utilizing both parametric and nonparametric approaches. Also, we considered a long time series of data covering the period of 1824–2020 given that we want to capture

TABLE 6 Nonliner Autoregressive Distributed Lag (NARDL) Short-run estimates.

Variable	(1)	(2)	(3)
$lnGPR^{-}$	−0.129		−0.230
	(0.117)		(0.213)
$lnGPR^{+}$	0.089**		−0.099**
	(0.013)		(0.015)
$lnNR^{-}$		−0.289	−0.155
		(0.199)	(0.135)
$lnNR^{+}$		0.089**	−0.111**
		(0.019)	(0.025)
$lnGPR^{+} * lnNR^{+}$			0.230**
			(0.025)
$lnGPR^{-} * lnNR^{-}$			−0.133
			(0.125)
Covariates	Yes	Yes	Yes
Observations	196	196	196
ECM (−)	−0.123	−0.213	−0.124
R^2	0.378	0.401	0.302
Adjusted R^2	0.213	0.200	0.211
Durbin-Watson test	2.121	2.111	2.011
F-statistic	73.779	56.123	65.213
Prob (F-statistics)	0.001	0.002	0.003

Note: Dependent variable is political instability.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.
Source: Authors' estimations.

colonial periods characterized by geopolitical events such as Anglo-Ashanti wars, which were fought between the Ashanti (Asante) and the British over a piece of land rich in gold. The following findings emerge from our study. First, natural resource rent is positively related to political instability, and geopolitical risk exerts a positive impact on political instability. Also, the interaction of both natural resource rent and geopolitical risk exerts a positive effect on political instability, which is relatively larger than their individual effects. A second result is that there is evidence of a weak asymmetrical relationship among natural resource rent, geopolitical risk, and political instability, which is not surprising given that the period under study spans over 100 years. However, after allowing for nonlinearity in the data, we still found evidence of both natural resource rent and geopolitical risk instability exerting a positive impact on political instability.

Given the lack of studies on how natural resource rent and geopolitical risk influence political instability, this study extends the literature that has examined the implications of natural resource extraction. Thus, studies closer to the present study are those that have examined the impact of natural resource rent on several outcomes. Generally, these studies find that natural resource extraction results in political instability via four main channels including (1) access to honeypots, (2) secessionists movements, (3) financing of rebel groups, and (4) isolation of governments from their electorates (Collier 2003; Collier and Hoeffler 2005). However, our study differs and extends this strand of the literature by considering the role of geopolitical risk, which is argued to emerge out of natural resource extraction. In essence, the findings from this study extend our understanding of how natural resource rent and geopolitical risk interact to influence political instability. Also, our result extended the antecedent of political instability and how to address it. Most of the studies on the antecedent of political instability have largely focused on the role

of natural resource extraction, corruption, nature of the political regime, income growth rate, foreign aid, and ethnic diversity (Nur-Tegin and Czap 2012; Repkine 2014; Steinwand 2015; Miljkovic and Rimal 2008; Wang et al. 2021a). However, there is a higher likelihood that geopolitical risk would interact with natural resource rent to influence political instability given that evidence in the literature demonstrates that natural resource extraction is associated with geopolitical events such as conflicts, disputes, wars, and others (Barkoulas, Hu, and Santos 2008; Olanipekun and Alola 2020). Additionally, the findings from this study also have important policy implications.

First, the results from this study are consistent with findings from the strand of the literature that has demonstrated that natural resource extraction is one of the major sources of geopolitical events such as wars, political violence, terrestrial disputes, and others, all of which have implications for economic growth and development. Intuitively, the results are consistent with existing that used data over more recent shorter periods and find that natural resource extraction causes political instability via several pathways (Ajide, Adenuga, and Raheem 2020; Farzanegan, Lessmann, and Markwardt 2018). However, given that our data span over 100 years demonstrates that the observed relationship between natural resource rent and political instability is not just a recent phenomenon but holds for over more than 100 years in Ghana. Therefore, to attain a stable political environment, both long- and short-term policies on political stability should be formulated because our study has demonstrated that the positive relationship between natural resource rent and political instability occurs in both long and short periods.

Second, the finding of this study contributes to our understanding of the long-term drivers of political instability throughout history. Specifically, we show that natural resource rent and geopolitical risk are long-term drivers of political instability, which is consistent with the increased recognition being given to natural resource extraction and geopolitical events in explaining historical political instability in Ghana, in particular neo-colonialism (Price 1984).

Third, it is important to stress that after interacting natural resource rent with geopolitical risk, their positive impact on political instability was relatively larger than the individual positive impact on political instability. This suggests that mitigating political instability via implementing policies to guide the extraction of natural resources to reduce geopolitical risk may be more challenging because these two factors driving political instability are deeply entrenched and persistent over time.

Although this study has produced some interesting findings that are vital for policy implantation, it is important to stress that this study also encountered some limitations. Given the long nature of the data that span over 100 years, there are certainly potential measurement errors in natural resource rent, geopolitical risk, and political instability. Although we cannot completely wipe out all the measurement errors, we utilized estimations strategies that resolve these measurement errors in the data. Thus, the dynamic ordinary least square method and the nonlinear autoregressive distributed lag model can minimize measurement and potential endogeneity. This study takes Ghana as a case study, and thus the finding of this study may be limited. It is therefore important that future studies carry out cross-country studies using panel data. This is very important given the lack of panel studies on this issue and the important insights that might emerge from different countries.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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