Externalities in Military Spending and Growth: The Role of Natural Resources as a Channel through Conflict

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Abstract

This analysis re-examines the relationship between military spending and economic growth using recent advances in panel estimation methods and a large panel dataset. The investigation is able to reproduce many of results of the existing literature and to provide a new analysis on the relationship between conflict, corruption, natural resources and military expenditure and their direct and indirect effects on economic growth. The analysis finds that the impact of military expenditure on growth is generally negative as in the literature, but that it is not significantly detrimental for countries facing either higher internal or external threats and for countries with large natural resource wealth once corruption levels are accounted for.

Keywords: Military expenditure; Economic Growth; Conflict; Natural Resources, Corruption
JEL classification: H56; O11; Q34

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1. Introduction

The economic effects of military spending continue to be the subject of considerable debate in the literature where the impact of military expenditure is frequently found either to be non-significant or negative.[1] How do these effects vary across economies? And what factors drive the heterogeneity of military spending effects? These questions continue to be an important focus for research as it is an expenditure by governments that has influence beyond the resources it takes up, especially when countries need some level of security to deal with internal and external threats inducing positive externalities for the military spending and growth relationship.

This analysis reproduces many of results of the existing literature using recent advances in panel estimation methods and a large panel dataset which employs unique data on military spending and variety of conflict measures. The investigation shows that the differential impact of military expenditure is increasing and significant not only for external threat levels, but also internal threat levels. In addition, extending the concept of the resource-conflict link, the analysis contributes to the defence literature by showing that the impact of military expenditure on growth is less detrimental for countries with large natural resource wealth once corruption levels are accounted for. The analysis also addresses the concerns from the resource-conflict literature regarding endogenous behaviour of natural resources, with findings that suggest a significant positive impact of natural resource wealth on conflict.

Theoretical literature has allowed the identification of a number of channels through which military spending can impact the economy – such as labour, capital, technology, external relations, socio-political effects, debt and conflicts (see Dunne and Uye, 2009). The relative importance and sign of these effects, as well as the overall impact on growth can only be ascertained by empirical analysis.

An important issue distinguished in empirical literature is the identification problem that results from the feature that security threats may influence observed changes in both military spending and economic growth. Aizenman and Glick (2006) explain the presence of these non-linearities showing that while growth falls with higher levels of military spending, its impact is positive in the presence of external threats.

[1] For surveys of the military spending and growth literature see Chan (1987), Dunne (1996, chap. 23), Smith (2000), Ram (2003), Smaldone (2006), Dunne and Uye (2009).

Another feature that has emerged in the conflict literature is the role of natural resources.[2] Collier and Hoeffler (1998) offered a pioneering empirical contribution finding that resource wealth has a positive impact on possibility of conflict, with the main results robust to employing alternative measures of resource wealth (notably a measure of resource rents, see Collier and Hoeffler, 2005).

Although the resource-conflict link is increasingly viewed as a stylized fact in economics and political science (see e.g., Ross 2004a; Ron, 2005), the explanations of this evidence are mixed. Focussing on the economic roots of conflict, De Soysa (2002), Fearon (2005), Ross (2006), De Soysa and Neumayer (2007), and Lujala (2009) highlight the role of (legal) oil and mineral resource trading. Probability of foreign intervention (Rosser, 2006) and the probability of suffering from economic shocks (Collier and Hoeffler, 2005) are other explanations as to why resources might be linked to conflict.

Other explanations of the resource-conflict link arise around political (state-strength) perspectives of (potential) rebels as key decision-makers (e.g., Auty, 2004; Dunning, 2005; Humpreys, 2005; Snyder and Bhavnani, 2005). According to this view, resource-rich economies tend to suffer from weak state and unaccountable leadership, which is unable or unwilling to diversify the economy in order to deliver key public goods. Alternatively, resource riches may encourage oppressive regimes, leading to genuine grievances amongst a share of the population.[3]

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[2] The literature has distinguished between no less than three different dimensions of the "resource curse": resources are associated with (i) slower economic growth, (ii) violent civil conflict, (iii) undemocratic regime types. Selected contributions include the following works: On economic growth, refer to Sachs and Warner (1995), Mehlum *et al.* (2006), Brunnschweiler and Bulte (2008) and etc. With respect to conflict, refer to Collier and Hoeffler (1998, 2004), Ross (2004[a,b]), De Soysa and Neumayer (2007), Collier *et al*. (2009), Lujala (2009). Considering regime type (and institutions more broadly), refer to Ross (2001), Leite and Weidmann (2002), Jensen and Wantchekon (2004), Bulte *et al*. (2005) and Caselli and Tesei (2011). Overview articles include Rosser (2006), Dixon (2009) and van der Ploeg (2009).

[3] Standard explanations of civil war advanced by economists and political scientists are greed and grievance. The rational choice concept regards civil war as a special form of non-cooperative behaviour. The greed motive simply reflects a chance for rebels to enrich themselves; grievance, however, is explained in a behavioural context, and underlines relative deprivation, social discrimination and inequality (e.g., due to ethnic and religious segregations, see Regan, 2003). Ballantine (2003) has emphasized that the mix of greed and grievance can be particularly effective and relevant as an explanation of the onset of war. Ross (2004b) investigates these

Therefore there are many reasons to believe that high levels of resource wealth may generate high demand for military protection since the military performs as a premium guard against the internal and external risk that a country may face with. In addition, having natural resources can also reduce the opportunity costs of increasing military spending and building up the military–industrial complex facilitating to strengthen the ability of the military to protect the national security and natural resources (Ali *et al.*, 2013; Dunne and Tian, 2013).

Hence, it is not always easy to distinguish between the various mechanisms connecting resources to conflict. On one hand, while the income from resource abundance may serve as an incentive for rebellion activity, one may also argue that it proxies for the "effectiveness of the state" (e.g., Fearon and Laitin, 2003). Along with these complications, there is a literature that involves resource scarcity, rather than abundance, as a driver of violent conflict (Homer-Dixon, 1999; Brunnschweiler and Bulte, 2009). Another concern in the literature is that resource rents, as in Collier and Hoeffler (2005) and De Soysa and Neumayer (2007) may be endogenous with respect to conflict.

The remainder of the paper is organized as follows. The methodology and data employed are described in Section 2. Section 3 presents the estimation results and Section 4 concludes.

2.1. Empirical Methodology

The analysis employs the system GMM dynamic panel data estimator developed in Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). This approach has advantage to address the issues of potential biases induced by country specific effects, and of joint endogeneity of all explanatory variables in a dynamic formulation which is especially important here because of the link between military spending and conflict, i.e. if military expenditure is reacting to an increased threat of conflict, then the ultimate cause of the reduced growth might be the threat of conflict itself rather than the observed military expenditure.[4] Moreover, to ensure that the estimated effect is not driven by the number of

motives, along with other potential conflict triggers. The theoretical foundation of these perspectives may be traced back to Grossman (1991) and Hirschleifer (1995).

[4] Along with coefficient estimates obtained using GMM system estimator, the tables also report three tests of the validity of identifying assumptions they entail: Hansen's (1982) J test of over-identification; and Arellano and Bond's (1991) AR(1) and AR(2) tests in first differences. AR (1) test is of the null hypothesis of no first-order serial correlation, which can be rejected under the identifying assumption that error term is not serially

instruments, the analysis employs the "1 lag restriction" technique introduced by Roodman (2009) that uses only certain lags instead of all available lags as instruments. The treatment of each regressor according to their exogeneity levels is based on upper and lower bound conditions (Roodman, 2006).

The benchmark analysis follows a similar specification used by Aizenman and Glick (2006) which provides evidence of a non-linear growth effect of military expenditure, which allows the presence of threats to security.[5] Starting from this benchmark, the analysis confirms the presence of conflict risks and government performance as potential sources of positive externalities for military spending and growth relationship, and then looks at the interaction between military expenditure and natural resources as a channel through conflict, also accounting for the potential adverse effect that might be generated by poor governance, namely by rent-seeking or corruption activities.

Letting the subscripts *i* and *t* represent country and time period respectively, the estimated model can be written as

$$y_{it} - y_{i(t-1)} = \alpha\, y_{i(t-1)} + \theta_1 mil_{it} + \theta_2 mil_{it} {*} X_{it} + \varphi' X_{it} + \beta' Z_{it} + \mu_t + \xi_i + \varepsilon_{it} \qquad (1)$$

where y is log of real per capita income, mil_{it} is military spending, X_{it} is the vector of variables interacted with military spending expressed as either threat, corruption or natural resource wealth, Z_{it} is a vector of additional control variables, μ_t is a period-specific constant, ξ_i is an unobserved country-specific effect, and ε_{it} is an error term.

The hypothesis is that $\theta_1 < 0$ and $\theta_2 > 0$ implying that the impact of military expenditure $\theta_1 + \theta_2 {*} X_{it}$ is less negative at high levels of threat, government performance and natural resource wealth. Moreover, as θ_1 and θ_2 have opposite signs, a threshold effect arises:

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correlated; and AR (2) test is of the null hypothesis of no second-order serial correlation, which should not be rejected. In addition, to deal with heteroskedasticity, the Windmeijer (2005) small-sample correction is applied.

[5] Dunne *et al.* (2005) in their critical review paper compare theoretical models mainly employed by defence economists. They conclude that the Feder-Ram model should be avoided within the defence economics literature, since it is prone to theoretical misinterpretation. The augmented Solow model used by Knight *et al.* (1996) has fewer theoretical weaknesses, but it is too narrow given the range of variables that have been found significant determinants of growth. The reformulation of the Barro model used by Aizenman and Glick (2006), which allows for security effects on output is more promising and has the comparative advantage to explain both military expenditures and output.

$$\frac{\delta(y_{it}-y_{i(t-1)})}{\delta\, mil_{it}} = \theta_1 + \theta_2 * X_{it} > 0 \quad \xrightarrow{yields} \quad X_{it} > \quad \tilde{X} := -\frac{\theta 1}{\theta 2}$$

The standard errors of the respective threshold levels are computed using the delta method. However it is of note that in small samples, the delta method is known to result in excessively large standard errors.

As an additional robustness check, outliers are singled out using a strategy advocated by Belsley *et al.* (1980) that involves the application of the DFITS statistic to identify the countries associated with high combinations of residual and leverage statistics.

2.2. Data and Descriptive Statistics

The initial analysis is based on a balanced dynamic panel dataset consisting of 89 countries over the 1970-2010 period.[6] To construct the panel dataset, non-overlapping five year intervals are used. This filters out short-run cyclical fluctuations, so that the analysis can focus on long-run growth effects (Aghion *et al.*, 2009). The dependent variable, logged per capita real (Laspeyres) GDP growth, is constructed using data from the Penn World Tables (PWT 7.1). Log of initial income per capita is used as regressor.

Military spending is measured as the average ratio of military expenditures to GDP, using data collected from the SIPRI (Stockholm International Peace Research Institute) Yearbooks. As online data tables relate only to the period from 1988 onwards, military expenditure shares for the previous periods are collected and inputted directly from the SIPRI Yearbooks in order to extend the time horizon.[7]

The degree of threat measure employed is twofold: internal and external. To measure the internal threat level, the analysis employs two alternative proxies: internal conflict onset and internal conflict incidence. The former is measured as the fitted values of civil conflict onset from Fearon and Laitin (2003). The projection of probabilities for onset is realized according

[6] See Appendix Tables B and C for the list of countries and descriptive statistics.

[7] Data on military spending was initially collected for 173 countries starting from the period of 1959 as the PWT data on real GDP per capita is not available for most countries before this date. However, the time horizon was restricted to the period of 1970 and onwards because the measure of natural resources is available only since this date. Moreover, in order to maximise the number of countries for which data on military expenditure and real GDP per capita is available for most years, the balanced sample was limited to 113 countries. Due to lack of the data for other important control variables, the analysis was further constrained to the balanced sample of 89 countries.

to the specification of their original paper.[8] The latter is constructed using UCDP/PRIO Armed Conflicts 2012 Dataset of the International Peace Research Institute's (PRIO) Centre and Uppsala Conflict Data Program (UCDP), and computed by counting the number of internal threat incidences during non-overlapping five year intervals for the period of 1970-2010. A country's external threat level is proxied in two ways. First, war instensity measure is computed in a similiar way as in Aizenman and Glick (2006) by counting the number of wars a country has been involved in conflict for the last half century. Specifically, it is defined as the number of years a country was at war with each of its adversaries during the period from 1960 to 2010 and divided by the sample period. This variable is constructed based on the data of militarized interstate disputes from "Major Episodes of Political Violence, 2008" collected by the University of Maryland's Center for Systematic Peace (CSP). A sensitive issue from the estimation of military expenditure and growth relationship conditional on war intensity measure is that the estimated effect might be driven by the future conflict that a country has not experienced yet at previous time period. Therefore, the analysis also employs an alternative measure of external threat incidence which is constructed using UCDP/PRIO data; and computed by counting the number of wars a country has been involved in conflict during non-overlapping five year intervals for the period of 1970-2010.

The measure of resource wealth is the resource rent provided by Hamilton and Ruta from the World Bank.[9] It includes two categories of natural resources: minerals and energy (oil, gas and coal); and is measured as the product of the quantity of resources extracted and the difference between the resource price and the unit cost of extraction.

Corruption is measured by the control of corruption index extracted from ICRG (International Country Risk Guide) data set.[10] The index has values ranging from a value of 0 (for very high corruption or very poor performance) to 6 (for very low corruption or excellent performance) and hence may be interpreted as an increasing index of government performance.

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[8] More specifically, the predicted values of civil conflict onset from model 2 of Table 1 as in Fearon and Laitin (2003) are used. The projection reflects prior war, income, population, mountains and non-contiguous territory, oil, new states and political instability, polity2, as well as ethnic and religious fraction. Note that employing the civil conflict onset measure restricts the data set to 1970-2000 period.

[9] See also Collier and Hoeffler (2005), De Soysa and Neumayer (2007).

[10] Employing corruption data restricts the sample to 82 countries and the time span to the period of 1985-2010.

To examine the claim of endogenous behaviour of natural resource wealth on conflict, several variables are employed to serve as exogenous instruments. Instrumental variables should be exogenous and correlated with the 1st stage endogenous variables, but not with the error term of the 2nd stage conflict regression. The instruments employed include three geographical variables – distance to major navigable river,[11] percentage of fertile soil (*soil*), and percentage of land area in the tropics (*tropics*).[12] It is evident that biophysical conditions can affect a country's comparative advantage in exporting primary commodities, and hence its resource dependence. Moreover, there is no indication that these instruments invite conflict directly and therefore correlate with the 2nd stage error term.[13]

A further instrument is given by the variable *democracy* constructed by replacing negative values of the variable *polity2* in the Polity IV database (Marshall, 2010) with zero. *Polity2* is widely used in the empirical political-science literature as a measure of the position of a country on a continuum of autocracy-democracy spectrum (e.g., Acemoglu *et al.*, 2008; Persson and Tabellini, 2006, 2009; Besley and Kudamatsu, 2008). Although one might question the exogeneity of regime type for conflict regressions, the analysis clearly demonstrates that this variable may be used as an instrument (see also e.g., Fearon and Laitin, 2003; Vreeland, 2008). There is also little reason to suspect that democratic system of governance leads to more incidents of civil conflict; and more importantly it is questionable whether it has a direct effect on conflict potential.[14]

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[11] This variable is employed from G-Econ data set collected by Yale University. Source: http://gecon.yale.edu/data-and-documentation-g-econ-project

[12] The geographical characteristics on *soil* and *tropics* are obtained from Nunn and Puga (2012). Source: http://diegopuga.org/data/rugged/

[13] The geophysical characteristics most commonly found to influence conflict is the degree of high terrain, which is not directly linked to these geographical instruments.

[14] Using the *polity2* measure that ranges from -10 to 10, Fearon and Laitin (2003) find an insignificant impact of political regime type on civil conflict onset. However they suggest that anocracies, as defined by the middle of the polity index (ranging from -5 to 5) of political regime, are more susceptible to civil conflict than either pure democracies or pure dictatorships. Unpacking the anocracy measure, Vreeland (2008) finds that certain components of the polity index are defined with explicit reference to civil conflict, and when these components are removed from the polity index, the significant relationship between political regime and conflict disappears. To check whether the arguments above alter the results, the analysis also used a dummy for democracy that takes value of 1 if *polity2* is higher than 5 and 0 otherwise as an instrument. The results are qualitatively similar to that presented here. Moreover, Sirimaneetham and Temple (2009) demonstrate that instability itself can form a binding constraint on a country's economy, where for the more stable countries, the measures of institutional

The analysis also employs a standard set of control variables typically used in the empirical growth literature (e.g., Barro and Lee, 1994; Barro and Sala-i-Martin, 1995, Ch. 12), which can be classified as stock and flow variables. Stock variables are measured at the beginning of each half decade and consist of two proxies for human capital: the log of average years of schooling attained by males aged 15 and over, obtained from Barro and Lee data set; and the log of life expectancy, as reported by the United Nations. Flow variables are measured as averages over the half-decade. These feature the population growth rate,[15] real private investment as a percentage of real GDP and degree of economic openness, all as reported in the Penn World Tables (PWT 7.1).

Table 1 provides summary statistics for shares of military expenditure and natural resources, and the cumulative incidence of conflict over the different subsamples. Three features are of note for the analysis. The first is the tendency that countries experience internal threat on average 8 times more frequently than external threat (8.382 vs. 1.112). This supports the claim that the end of proxy-wars and superpower involvement in local wars did not reduce the number of conflicts, but did reduce the intensity of military battles (Kaldor, 1999). There are fewer real military battles than in the past, but attacks on civilians increased showing a dominance of civil or intra-state wars. Furthermore, over 2/3 of the sample never experienced any external threat, while this figure is almost the same for those who have experienced internal conflict. This might affect the economic impact of military expenditure on growth through external and internal conflict. The second facet of these statistics is that conflicts occur more frequently in relatively more resource abundant countries. The average natural resource shares increases when moving from the sample without any conflict experience to the sample with some conflict experience: from 2.391% (4.099%) to 5.608% (5.057%) for internal (external) threat. The third aspect is the obvious tendency that countries facing either external or internal threat tend to spend relatively more on the military sector compared with the sample facing no threat. Average military expenditure share increases when moving from the sample without any conflict experience to the sample with some conflict experience: from 2.479% (2.242%) to 2.980% (4.112%) for internal (external) threat.

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quality have more explanatory power on economic performance, i.e. fundamentals such as good institutions are not strongly associated with economic performance unless stability is also in place.

[15] Growth rate of population employed in the analysis is computed as log of $n + g + \delta$, where n is average population growth rate; g is the rate of technical progress and δ is the rate of depreciation of the stock of physical capital investment and $g + \delta$ is assumed to be equal to 0.05, following Mankiw *et al.* (1992).

3. Empirical Results

Estimation results for the impact of military expenditure conditional on threat levels are presented in Table 2. Table 3 displays estimation results for the relationship between military spending and growth conditional on corruption levels. Tables 4-11 explore the relationship between military spending and growth concentrating on natural resources as a channel through conflict. Table 4 addresses the concerns of potential endogeneity problems in resource-conflict relationship. The results from the non-linear estimation of the relationship between military spending and growth conditional on natural resource wealth are reported in Table 5. The subsequent tables report a number of sensitivity checks on the results from Table 5. In particular, the analysis explores the robustness of the results to: alternative criteria for inclusion of the countries in the sample based on (i) importance of the shares from natural resource rents in the economy; (ii) dropping large commodity producers and (iii) subsets of countries with relatively intense conflict experiences that might potentially be induced by resource abundance; (iv) breaking down the resource wealth by commodity type (energy and oil resources); (v) alternative time windows; (vi) allowance for other non-linearities.

3.1. Military Expenditure and Growth: Threats

Figure 1 illustrates how the impact of military spending on economic growth changes while the level of threat increases. Scatter plots and fitted relationships between the variables of interest are achieved using partial regressions.[16] The plots indicate a significant negative impact of military expenditure on growth for the sample with no experience of conflict, while this effect is positive, albeit insignificant, for the sample with some conflict experience.

Estimation results for the impact of military expenditure conditional on internal threat levels are presented in Table 2.[17] The conjecture of this investigation follows the idea that the

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[16] Partial-regression estimates are obtained in two stages. First, both the dependent variable and the isolated independent variable are projected onto the additional set of regressors under consideration. Next, the fitted dependent variable is regressed against the fitted independent variable. In each case, the residuals of a growth regression on a set of variables are compared with the residuals of military expenditure regression on the same variables. The figures are produced using OLS regressions where growth and military expenditure are related linearly.

[17] An analogous analysis of the relationship between military expenditure and growth conditional on external threat levels is reported in Appendix Table A1. Overall the results confirm the findings from Aizenman and Glick (2006) and demonstrate that this non-linearity is also apparent in a panel setting.

impact of military expenditure on growth is a non-linear function of the effective militarized threat posed by internal and external forces. Alternatively, threats without expenditure for military security reduce growth, military expenditure without threats decreases growth, while impact of military expenditure in the presence of sufficiently large threats would be positive.

The results from the non-linear estimation of these relationships provide support for the conjecture, and indicate that military expenditure has a negative direct effect on growth. The coefficients on the interaction term are significant and positive in all cases, implying a positive marginal impact of military expenditure in the presence of threats. The coefficient estimates on threat measures are mostly negative where significances show sensitivity across different specifications. The threshold analysis for the internal threat measure of civil conflict onset implies that military spending has an overall negative (positive) effect on growth for threat levels below (above) the probability level of 0.032.

As a check on the results, the growth equation is re-estimated according to the threshold levels where the separate linear specifications are estimated for the subsamples below and above the threshold level.[18] The associated quantitative significance of one standard deviation increase in military expenditure from splitting the data set into subsamples is estimated as -0.28 percentage points (significant) among low threat level countries, and -0.01 percentage points (insignificant) among high threat level countries.[19] Thus, these piece-wise linear specifications imply a relationship similar to that found in the specification that includes the interaction term between military expenditure and threat.

The last column in Table 2 employs alternative measure for internal threat levels using UCDP/PRIO data. The results are qualitatively similar and consistent to that found above.

Coefficient estimates of additional explanatory variables enter mostly with the expected signs. Initial income exhibits a negative relationship with growth. Estimated coefficients on life expectancy and the investment ratio are positive, statistically significant, and typically indicate strong quantitative effects. Finally, the estimated effect of population growth, trade openness and schooling is typically insignificant.

[18] The threshold value of 0.021 is used for the analysis of low and high internal threat sample. However note that any threshold value below 0.021 yields qualitatively similar results to that presented in Table 2.

[19] These measures are obtained by multiplying the coefficient estimate by average standard deviation of 2.81, dividing by the time span between income observations (5 years), and then multiplying by 100 to convert to a percentage-point measurement.

As an additional robustness check, the analysis also considered the potential influence of several subsets of countries singled out due to the maintenance of high shares of military expenditure and on the basis of certain unusual aspects of their conflict experiences during the time period spanned by the sample.[20] Results of this exercise are reported in Appendix Tables A2 and A3 where the results provide supportive evidence for the non-linear relationship conditional on threat levels as described above.

Overall, these findings suggest that the negative and significant relationship between military expenditure and growth is only apparent among countries facing low threats, while in the presence of sufficiently high threats military expenditure is not significantly detrimental for growth, illustrating typically an insignificant impact.

3.2. Military Expenditure and Growth: Corruption

Previous studies suggest that the relationship between military expenditure and growth also depends on corruption and rent seeking behaviour (see e.g., Gupta *et al.*, 2001; d'Agostino *et al.*, 2012). In Table 3, this association is examined more formally, where the hypothesis is that military expenditure in the presence of corruption (better government performance) reduces (increases) growth.

The results from the non-linear estimation of this relationship support this hypothesis. Military expenditure and corruption are decreasing economic performance directly, while the interaction term enters positively, all illustrating a significant impact on growth. The associated quantitative significance of one standard deviation increase in military expenditure from splitting the data set into subsamples according to the threshold level is estimated as -0.67 percentage points (significant) among high corruption level countries (those below the corruption level of 4.5), and 0.01 percentage points (insignificant) among low corruption level countries (those above the level of 4.5).

As noted by Delavallade (2005), the existence of corruption leads to a re-allocation of resources from more productive sectors towards less productive ones. As military spending generates more rents, projects in this sector are likely to involve larger amounts of money and may attract more and larger bribes. Overall, the magnitude of these results implies that corruption leads to increases in military spending, worsening the negative impact of the larger military sector on the economy's growth rate.

[20] See Appendix A for description of additional robustness checks.

3.3.1. Military Expenditure and Growth: Natural Resources

The exploration now turns to relationships between military spending and growth concentrating on natural resources as a channel through conflict. As mentioned previously, a large body of the literature identifies natural resource wealth as a major determinant of civil conflict. The dominant causal link is that resources provide finance and motive (the "state prize" model). Others see natural resources as causing "political Dutch disease" or increasing rent-seeking and corruption activities, which in turn weaken state capacity leading to a fail of delivering key public goods and hence increase conflict possibility. If this is the case, the resource-conflict link is expected to impact the military spending and growth relationship. This investigation supposes that if resource wealth is related to a higher risk of conflict, then the impact of military expenditure on growth is a non-linear function of natural resource wealth. In particular, the impact of military expenditure in the presence of a sufficiently large resource wealth would be positive, conditioning that natural resources are not associated with high corruption activities.

Estimation results of the analysis of the resource-conflict link are presented in Table 4. The first two columns of the upper panel derives this relationship using ordinary least squares (OLS) where civil conflict onset linearly responds to initial income, natural resources and the set of control variables as employed in the benchmark analysis. The findings are very similar to those found in the existing literature, where all variables of interest take the expected signs. Specifically, resource wealth leads to a higher probability of conflict, while a negative correlation is apparent for initial income. In both cases, initial income and resource wealth illustrate strong quantitative effects on probability of conflict onset.

In light of the concerns about endogeneity, as argued by Brunnschweiler and Bulte (2009), the next column applies a two-step instrumental variables (IV) model, where initial income and natural resources are estimated in the first stage by a simple linear regression, and the second stage uses an instrumental variable approach to determine the probability of the conflict onset. First-stage regression results, as shown in the lower panel, demonstrate that the instruments are strong. The joint endogeneity test from the linear estimation provide support for the idea that the variables of interest are jointly endogenous, and that instrumenting for these variables is necessary to obtain unbiased estimates of the causal relationship for the onset of conflict.[21] The test statistics for the instruments also confirm that they are appropriate: over-identification tests (Hansen J test) and the tests on the excluded instruments, all performed in linear regressions, show that the instruments are strong and properly exogenous.[22]

The estimation results from the instrumental variables approach imply a qualitatively similar relationship to that found in the OLS specifications. Higher incomes attenuate the risk of conflict, while resource wealth is positively and significantly associated with civil conflict onset. Therefore, returning back to the relationship of military spending and growth conditional on resource wealth, the effect from military expenditure and resource interaction is expected to be positive.

The results from the non-linear estimation of this relationship are reported in Table 5. To deal with problems that might potentially be induced from association of corruption with natural resources and military expenditure, the analysis employs two approaches (see e.g., Leite and Weidmann, 2002; Aizenman and Glick, 2006; d'Agostino *et al.*, 2012). Under the first, as shown in columns (1) and (2), the specification also includes corruption and its interaction with military expenditure in addition to the interaction term between military expenditure and natural resources. Under the second (column 3), the growth equation is estimated by interacting military expenditure with two separate natural resource variables: one for resource wealth for those countries below the corruption level of 4.5 (high corruption), and the other for countries above this level (low corruption).

The estimation results from these alternative approaches provide support for the supposition. While military expenditure has a direct significant and negative effect on growth, the coefficients on the interaction terms with natural resources are positive, implying a positive differential impact of military expenditure. In particular, interaction terms under the first approach are significant and robust to the elimination of outliers. For the second approach, military expenditure is only significant for the case when it is interacted with resource wealth for countries with low corruption levels, and illustrates an insignificant impact for high

[21] Separate endogeneity tests for the variables of interest fail to reject the exogeneity of initial income. However, natural resource wealth still enters endogenously. Therefore, the IV equation is also re-estimated by instrumenting only for natural resources; the results are qualitatively similar to that presented in Table 4.

[22] The joint significance test of the instruments fails to reject the null of no explanatory power on conflict.

corruption levels, confirming the concerns regarding a potential contradictory effect induced by corruption.

In summary, the findings confirm the idea that resource wealth is related with a higher risk of conflict, and show that the impact of military expenditure in the presence of sufficiently large resource wealth is positive once corruption levels are accounted for.

3.3.2. Robustness Checks

Table 6 examines the robustness of the results estimated for the relationship between military spending and growth, conditional on natural resources, to the exclusion of countries whose natural resource wealth accounts for only a small share of GDP. For these countries it is unlikely that the capacity of resources provides finance or motive to induce a potential conflict, so focussing on a smaller sample with significant resource rents share is arguably a better test for sensitivity of the results. Columns 1 and 2 exclude countries in the first decile of the average share distribution (8 countries); columns 3 and 4 exclude countries in the first quartile (18 countries); and columns 5 and 6 exclude all countries below the median average share (39 countries). Results from baseline sample are confirmed and generally reinforced as the threshold to be included in the sample progressively increases. In particular, the point estimates for the interaction term (columns 2, 4 and 6) become more positive as the analysis focuses on more resource dependent countries.

The potential influence on the results of several additional subsets of countries is also considered. The collection of these subsets reflects countries singled out due to their resource dependence and conflict experiences during the time period spanned by the sample. The results of this exercise are illustrated in Tables 7 and 8. For each subset, Tables 7 and 8 report the list of countries, their average shares of natural resource rents, military expenditure and growth rates measured over the entire sample period, and the coefficient estimates obtained for interaction terms of military spending with natural resources as specified above for the first and the second approach.

Table 7 addresses the plausible concern that high stakes from resource rents might incentivise conflict potential and affect motivation for rebels to enrich themselves. The investigation therefore excludes from the sample four subsets of countries: (i) those belonging to OPEC; (ii) big oil and natural gas producers; (iii) large minerals and coal producers; and (iv) the union of these subsets.[23] In all cases, the results remain robust at least at the 10% significance level with coefficient estimates of the variables of interest lying within one standard deviation of the full-sample estimate.

Table 8 checks the sensitivity of the results to the exclusion of countries with relatively intense conflict experiences that might potentially be induced by resource wealth. The results of this exercise are demonstrated for three subsets of countries: (i) countries with high internal threat levels and high natural resource shares specified as those experienced internal threat above the mean of cumulative internal conflict incidence and with natural resource levels above the mean; (ii) countries with high external threat levels and high natural resource shares defined as those experienced external threat more than approximately one standard deviation from the mean of cumulative external conflict incidence and with natural resource levels above the mean; and (iii) the union of these subsets. The coefficient estimates of the interaction terms change very little given the removal of any one of the subsets under consideration. However, statistical significance of interaction term, as specified under the first approach, is somewhat altered in the case when the exclusion of the second and the third subsets are employed. Overall, the general pattern of results reported in Table 5 remains apparent given the exclusion of these countries from the sample.

Table 9 deals with the issue of commodity typology. An important distinction that has been made in the literature is the role of energy and oil trading as a potential driver of conflict (Rosser, 2006; De Soysa and Neumayer, 2007 and etc.), which is believed to induce higher risk of conflict, as they are generally more valuable and easier to control for the ruling elite. Therefore columns 1-2 and 3-4 break down the resource wealth into energy and oil resources respectively. The results from both cases are consistent with findings from Table 5. Furthermore, the point estimates of interaction terms provide support to the belief that energy and oil resources in particular, are the crucial drivers of the impact of the natural resources on the conflict potential as mentioned above.

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[23] The investigation treats Indonesia as an OPEC country, as it belonged to the organisation for more than half of the sample period. It also includes Ecuador who joined the OPEC in 2007. Alternative treatments of these countries do not alter the results. Big commodity producers reflect countries with more than 3% of total world supply, belonging to the list of top 10 biggest producers (according to the latest estimates) in the world by commodity. Data for commodities produced in a country are obtained from the following sources: minerals (bauxite, copper, phosphates, tin, gold, gemstones and etc.) from British Geological Survey 2000-2008; Oil, natural gas and coal from US Energy Information Administration 1980-2009.

Using time effects in all regressions controls for any common factor that could affect all countries in any five-year interval. In addition, the non-linear specification implicitly allows for time and cross-country variation in the effect of military expenditure on economic growth. However, it would be of interest to check if the results hold when different time windows are used for the estimation. The baseline time span in the analysis for natural resource contingency is 1985-2010. Table 10 considers more restrictive information under the first approach available for four successive periods of minimum 15 years: 1985-2000; 1985-2005; 1990-2010; 1995-2010. The result holds significantly, at least at the 10% significance level, suggesting that the findings from non-linear relationship between military expenditure and growth are also robust when the analysis is restricted to different time spans.

A final robustness check explores the sensitivity of the results to the inclusion of additional nonlinearities of military expenditure. Results of this exercise are reported in Table 11 where columns 1 and 2 add the interactions of military expenditure, respectively, with initial logged income and the threat measure of conflict onset into the specification.[24] In all cases, the results remain robust. Moreover, note that all other interactions show a highly significant impact and take the correct sign.[25]

Overall, the findings provide supportive evidence to the general pattern of results reported in Table 5 showing robust relationship between military expenditure and growth conditional on natural resource wealth.

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[24] The design of initial income interaction with military expenditure is an approach to place countries into income categories (see DeJong and Ripoll, 2006). The evidence of a positive significant interaction term effect between military expenditure and initial income arises by differences in the impact of military expenditure on growth across different income groups.

[25] An analogous analysis as in column 2 of Table 11 has been carried by employing military expenditure interaction with external instead of internal threat. The results are qualitatively similar to those reported here. Furthermore, in addition to investigating the internal and external threats separately as potential sources of positive externalities for the non-linear relationship between military spending and growth, the analysis also considered including military spending interactions with both type of threats into the model simultaneously. The results reveal a significant interaction effect of military spending only with internal threats. This is consistent with Kaldor's (1999) argument that the change in the nature of conflicts after the end of Cold-War era led to important changes in the frequency of civil or intra-state wars, illustrating dominance of internal conflicts over external conflicts (see Table 1). However this is not to argue that the role of external threats as a source of positive externality for the military spending and growth relationship should be underestimated.

4. Conclusion

The empirical analysis has confirmed that military expenditure in the presence of high external threats increases economic growth, while military expenditure driven by rent seeking and corruption reduces growth. In addition, the analysis provides evidence that such non-linearity is also apparent when internal threats are considered. Extending the concept of the resource-conflict link, the analysis also contributes to the defence literature showing that military expenditure is less detrimental for countries with large natural resource wealth as long as the resource wealth is not associated with high corruption activities.

The empirical research was constrained by the limited availability of data for some countries (e.g., for Arab Gulf countries, former Soviet Union countries), inducing the analysis to concentrate on relatively limited country sample. Therefore there is no obvious way to deal with the robustness constraints imposed by the limitations of the sample. Hence, the results should be taken as a suggestive of the deeper structure linking military expenditure, conflict, natural resource wealth and growth.

The analysis also suggests a number of paths for future research concerning the effect of military activity on economic growth through natural resource wealth. Various channels by which natural resources can influence the economy have been discussed in the literature. A particularly promising avenue of future research would be to analyze the role of political factors, such as degree of political stability, and the political orientation of the government.

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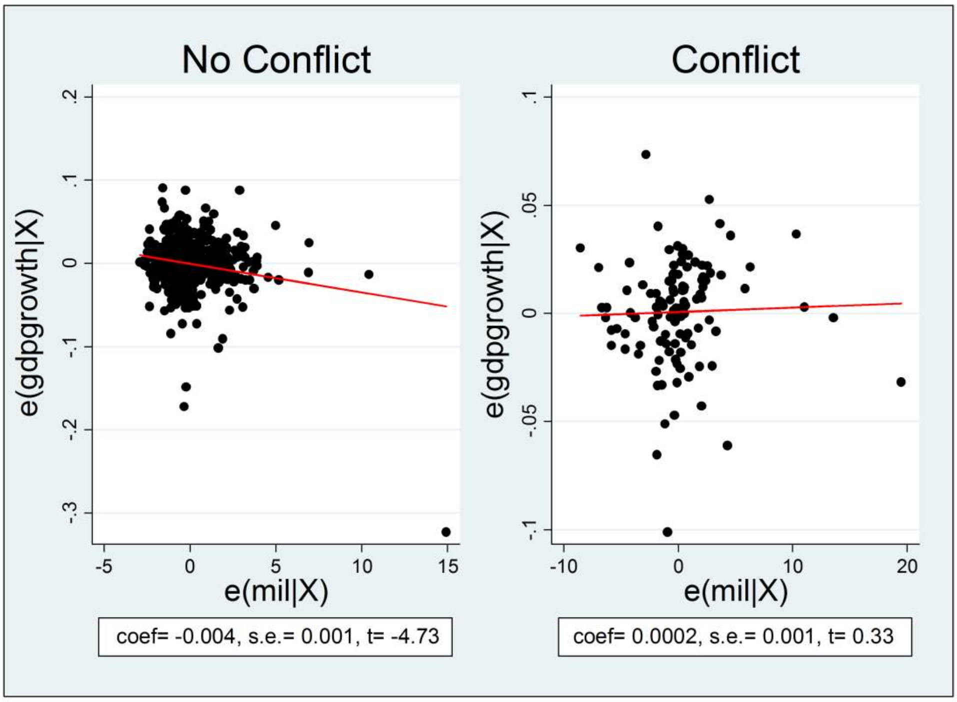
Figure 1: Partial Regression Plots for Military Expenditure and Growth



Note: The set of regressors includes log of initial income, log of population growth, log of life expectancy, investment ratio, log of openness and schooling, and time fixed effects. The figures are produced using OLS panel regressions.

Table 1: Descriptive Statistics for Military Expenditure, Natural Resources and Conflict

Summary Statistics						
Sample split	Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
Full sample	Mil. exp.	89	2.789	2.189	0.281	14.964
	Natural res.	89	4.379	6.946	0	38.969
	Ext. Threat	89	1.112	3.009	0	16
	Int. Threat	89	8.382	11.888	0	45
Internal Threat						
No Conflict	Mil. exp.	34	2.479	1.876	0.281	11.247
	Natural res.	34	2.391	3.897	0	13.827
Conflict	Mil. exp.	55	2.980	2.357	0.549	14.964
	Natural res.	55	5.608	8.082	0	38.969
External Threat						
No Conflict	Mil. exp.	63	2.242	1.132	0.281	4.836
	Natural res.	63	4.099	7.206	0	38.969
Conflict	Mil. exp.	26	4.112	3.334	0.933	14.964
	Natural res.	26	5.057	6.355	0	26.112

Note: All descriptive statistics are based on cross sectional averages for the 1970-2010 period. Internal and external threat measures represent cumulative sum of the conflict incidences over the whole sample constructed using UCDP/PRIO data.

Table 2
Military Expenditure and Internal Threat
Dependent Variable: Logged per capita real (Laspeyres) GDP growth
Estimation: System GMM estimation with Windmeijer (2005) Small Sample Robust Correction

	Internal threat: Onset				**Internal Threat Incidence**
	Main Model	**Outliers Removed**	**Level of Threat**		
			Low	**High**	
	(1)	(2)	(3)	(4)	(5)
Initial GDP p.c. (log)	-0.008**	-0.009**	-0.009**	-0.004	-0.010***
	(0.004)	(0.004)	(0.004)	(0.007)	(0.004)
Mil. exp/GDP	**-0.004***	**-0.006****	**-0.005****	**-0.0002**	**-0.006****
	(0.002)	**(0.003)**	**(0.002)**	**(0.001)**	**(0.003)**
Mil*Threat	**0.130****	**0.205****			**0.0014****
	(0.062)	**(0.097)**			**(0.0006)**
Threat	-0.159	-0.459	0.323	-0.333*	-0.004**
	(0.106)	(0.308)	(0.284)	(0.164)	(0.002)
Pop. growth (log)	-0.009	-0.016	-0.018	-0.017	-0.006
	(0.017)	(0.012)	(0.013)	(0.037)	(0.016)
Life expectancy (log)	0.139***	0.148***	0.148**	0.184***	0.123***
	(0.045)	(0.054)	(0.062)	(0.038)	(0.042)
Investment/GDP	0.152***	0.145***	0.120***	0.072***	0.219***
	(0.034)	(0.037)	(0.041)	(0.017)	(0.049)
Openness (log)	-0.007	-0.011	-0.001	-0.020	-0.020***
	(0.005)	(0.007)	(0.005)	(0.013)	(0.007)
Schooling (log)	-0.011	-0.014	-0.013	-0.015*	-0.007
	(0.008)	(0.009)	(0.012)	(0.008)	(0.008)
Observations	517	478	419	64	665
Threshold Analysis					
Internal Threat	0.027	0.032			4.39
	(0.0004)	(0.001)			(3.35)
SPECIFICATION TESTS (*p* -values)					
(a) Hansen Test:	0.990	0.994	0.700	0.872	0.798
(b) Serial Corr.:					
First-order	0.002	0.003	0.007	0.212	0.000
Second-order	0.916	0.745	0.779	0.247	0.190

Note: Columns 1 and 2 estimate military expenditure and economic growth relationship conditional on the probability of internal conflict onset, respectively, with and without outliers. Columns 3 and 4 apply the alternative approach to estimate the impact of military expenditure for countries with high and low internal threat levels. Column 5 employs UCDP/PRIO data to measure for internal threat incidence instead of conflict onset. All specifications control for time fixed effects. The excluded countries in column 2 are Botswana, China, Egypt, Israel, Mali, Korea Rep. and Singapore; in column 3 are Botswana, Israel, Korea Rep., Mali and Singapore; in column 4 are China and Uganda; and in column 5 are Botswana, China, Egypt and Singapore. The outliers are singled out using OLS regressions. ***, **, * represent significance of estimates, respectively, at 1%, 5% and 10% levels. Standard errors are presented in parentheses.

Table 3
Military Expenditure and Corruption
Dependent Variable: Logged per capita real (Laspeyres) GDP growth
Estimation: System GMM estimation with Windmeijer (2005) Small Sample Robust Correction

	Main Model	**Outliers Removed**	**Level of Corruption**	
			Low	**High**
	(1)	(2)	(3)	(4)
Initial GDP p.c. (log)	-0.011**	-0.008	-0.014*	-0.016**
	(0.004)	(0.005)	(0.008)	(0.007)
Mil. exp/GDP	**-0.018*** **	**-0.017*** **	**0.0002**	**-0.012*** **
	(0.003)	**(0.002)**	**(0.001)**	**(0.003)**
Mil*Corr	**0.004*** **	**0.004*** **		
	(0.001)	**(0.001)**		
Corruption	-0.006**	-0.007**	-0.005**	0.009
	(0.003)	(0.003)	(0.002)	(0.007)
Pop. growth (log)	-0.008	0.001	-0.046**	0.023
	(0.019)	(0.018)	(0.022)	(0.028)
Life expectancy (log)	0.105***	0.099**	0.187*	0.143***
	(0.033)	(0.044)	(0.092)	(0.047)
Investment/GDP	0.260***	0.247***	0.175***	0.355***
	(0.042)	(0.048)	(0.046)	(0.062)
Openness (log)	-0.024***	-0.026***	0.001	-0.043**
	(0.008)	(0.008)	(0.007)	(0.011)
Schooling (log)	-0.003	0.003	0.042**	0.012
	(0.009)	(0.009)	(0.018)	(0.012)
Observations	404	384	72	307
Threshold Analysis				
Corruption (0-6)	4.3	4.5		
	(1.89)	(2.25)		
SPECIFICATION TESTS (*p* -values)				
(a) Hansen Test:	0.654	0.634	0.792	0.824
(b) Serial Corr.:				
First-order	0.001	0.003	0.032	0.004
Second-order	0.546	0.622	0.389	0.741

Note: The excluded countries in column 2 are Botswana, China, Mozambique and Uganda. Eliminated countries from low corruption level sample are Australia and Finland, while from high corruption level sample are China, Mozambique and Uganda. The estimates reported in columns 3 and 4 are achieved using the "1 lag restriction" technique following Roodman (2009). All specifications control for time fixed effects. The outliers are singled out using OLS regressions. ***, **, * represent significance of estimates, respectively, at 1%, 5% and 10% levels. Standard errors are presented in parentheses.

Table 4
Natural Resources and Civil Conflict Onset
Dependent Variable: Probablity of Civil Conflict Onset

	OLS		**IV**
	(1)	(2)	(3)
Initial GDP p.c. (log)	-0.016***	-0.006***	-0.004**
	(0.005)	(0.001)	(0.002)
Natural Res.	0.061**	0.014*	0.063**
	(0.027)	(0.007)	(0.028)
Control Set	Yes	Yes	Yes
Observations	517	506	494
R-squared	0.243	0.343	
Joint exogeneity p			0.044
Instrument overid p			0.892
Exc. inst. F- Initial GDP p.c.			31.07
Exc. inst. F- Nat. Res.			12.53

First stage results for instruments

	(1) Initial GDP p.c. (log)	(2) Natural Res.
Dist. to major river	-0.049***	-0.004*
	(0.018)	(0.002)
Soil	-0.621***	-0.100***
	(0.142)	(0.016)
Tropical	-0.428***	0.019**
	(0.074)	(0.009)
Democracy, lagged	0.046***	-0.002*
	(0.008)	(0.001)

Note: Columns 1 and 2 estimates economic growth specification, respectively, with and without outliers. Column 3 applies instrumental variables approach using the specification as in column 2. In addition to variables of interest reported in the upper panel, all specifications control for military expenditure ratio, log of population growth, log of life expectancy, investment ratio, log of openness and schooling, and time fixed effects. The excluded countries are China and Israel. The outliers are singled out using OLS regressions. ***, **, * represent significance of estimates, respectively, at 1%, 5% and 10% levels. Standard errors are presented in parentheses.

Table 5
Military Expenditure and Natural Resources
Dependent Variable: Logged per capita real (Laspeyres) GDP growth
Estimation: System GMM estimation with Windmeijer (2005) Small Sample Robust Corruption

	Main Model	**Outliers Removed**	**Alternative Model**
	(1)	(2)	(3)
Initial GDP p.c. (log)	-0.013***	-0.011**	-0.014**
	(0.004)	(0.005)	(0.007)
Mil. exp/GDP	**-0.020*** **	**-0.019*** **	**-0.011** **
	(0.003)	**(0.003)**	**(0.005)**
Natural Res.	-0.017	-0.019	
	(0.031)	(0.034)	
Mil*Nat	**0.025** **	**0.027** **	
	(0.012)	**(0.013)**	
Natural Res_{high}			0.014
			(0.066)
Natural Res_{low}			-0.531**
			(0.222)
Mil*Nat_{high}			0.016
			(0.031)
Mil*Nat_{low}			**0.269** **
			(0.133)
Corruption	-0.004	-0.005*	
	(0.003)	(0.003)	
Mil*Corr	0.004***	0.004***	
	(0.001)	(0.001)	
Pop. growth (log)	-0.015	-0.006	0.028
	(0.017)	(0.017)	(0.027)
Life expectancy (log)	0.112***	0.112**	0.159***
	(0.030)	(0.042)	(0.053)
Investment/GDP	0.233***	0.225***	0.316***
	(0.042)	(0.047)	(0.062)
Openness (log)	-0.021***	-0.023***	-0.031***
	(0.008)	(0.008)	(0.009)
Schooling (log)	-0.004	0.001	0.015
	(0.008)	(0.009)	(0.014)
Observations	404	384	389
SPECIFICATION TESTS (*p* -values)			
(a) Hansen Test:	0.978	0.986	0.820
(b) Serial Corr.:			
First-order	0.001	0.004	0.002
Second-order	0.361	0.461	0.985

Note: Columns 1 and 2 report the estimation results, respectively, with and without outliers under the first estimation approach. Column 3 employs the second estimation approach using the "1 lag restriction" technique following Roodman (2009) and removing outliers. All specifications control for time fixed effects. Eliminated countries in column 2 are Botswana, China, Mozambique and Uganda; in column 3 are China, Mozambique and Uganda. The outliers are singled out using OLS regressions. ***, **, * represent significance of estimates, respectively, at 1%, 5% and 10% levels. Standard errors are presented in parentheses.

Table 6
Excluding Low Natural Resource Share Countries
Dependent Variable: Logged per capita real (Laspeyres) GDP growth
Estimation: System GMM estimation with Windmeijer (2005) Small Sample Robust Correction

	Above 1st Decile Share		**Above 1st Quartile Share**		**Above Median Share**	
	(1)	(2)	(3)	(4)	(5)	(6)
Initial GDP p.c. (log)	-0.012**	-0.014**	-0.007*	-0.012*	-0.011**	-0.009
	(0.005)	(0.007)	(0.004)	(0.007)	(0.004)	(0.006)
Mil. exp/GDP	**-0.020*** **	**-0.008**	**-0.021*** **	**-0.008***	**-0.019*** **	**-0.011** **
	(0.003)	**(0.005)**	**(0.003)**	**(0.005)**	**(0.002)**	**(0.005)**
		[0.102]				
Natural Res.	-0.019		-0.050		-0.027	
	(0.040)		(0.032)		(0.027)	
Mil*Nat	**0.029***		**0.031** **		**0.018**	
	(0.016)		**(0.012)**		**(0.011)**	
					[0.112]	
Natural Res_{high}		0.028		0.026		-0.032
		(0.065)		(0.064)		(0.068)
Natural Res_{low}		-0.501**		-0.561**		-0.777**
		(0.208)		(0.222)		(0.292)
Mil*Nat_{high}		0.004		0.001		0.021
		(0.033)		(0.033)		(0.029)
Mil*Nat_{low}		**0.295** **		**0.319** **		**0.409** **
		(0.132)		**(0.140)**		**(0.167)**
Corruption	-0.003		-0.006*		-0.005	
	(0.003)		(0.003)		(0.004)	
Mil*Corr	0.004***		0.005***		0.005***	
	(0.001)		(0.001)		(0.001)	
Control Set	Yes	Yes	Yes	Yes	Yes	Yes
Observations	364	364	314	314	210	210
SPECIFICATION TESTS (*p* -values)						
(a) Hansen Test:	0.846	0.903	0.880	0.984	1.000	0.398
(b) Serial Corr.:						
First-order	0.004	0.002	0.003	0.002	0.003	0.002
Second-order	0.416	0.630	0.515	0.711	0.938	0.570

Note: Columns 1 and 2 exclude the countries below the 1st decile of natural resource rents as a share of GDP (8 countries); columns 3 and 4 exclude countries below the 1st quartile (18 countries); and columns 5 and 6 exclude countries below the median (39 countries). All specifications employ log of population growth, log of life expectancy, investment ratio, log of openness and schooling, and time fixed effects as an additional control set. ***, **, * represent significance of estimates, respectively, at 1%, 5% and 10% levels. Standard errors are presented in parentheses; estimates in square brackets are p-values.

Table 7
Excluding Big Producers
Dependent Variable: Logged per capita real (Laspeyres) GDP growth
Estimation: System GMM estimation with Windmeijer (2005) Small Sample Robust Correction

Country	Average Nat. Resource Share	Average Mil. Exp. Share	Average Growth Rate	Coeff.	S. E.	p value
			Remove OPEC Countries			
Algeria	19.51	2.57	1.28			
Ecuador	13.83	2.19	1.77		**Mil*Nat**	
Indonesia	10.31	2.34	4.19	0.026	0.011	0.024
Iran	26.11	4.69	0.89		**Mil*Nat**$_{low}$	
Venezuela	26.15	1.75	0.50	0.230	0.116	0.051
			Remove Big Oil and Gas Producers			
Brazil	2.02	1.52	2.29			
Canada	3.78	1.78	1.88		**Mil*Nat**	
China	7.34	1.73	6.90	0.022	0.011	0.046
Iran	26.11	4.69	0.89		**Mil*Nat**$_{low}$	
Mexico	6.89	0.55	1.93	0.205	0.103	0.051
United States	1.64	5.37	1.68			
Venezuela	26.15	1.75	0.50			
			Remove Big Minerals and Coal Producers			
Australia	3.87	2.49	2.28			
Bolivia	10.73	2.36	0.44			
Botswana	1.78	3.32	5.75		**Mil*Nat**	
Chile	9.85	4.16	2.29	0.022	0.012	0.064
Jamaica	5.58	0.82	0.66		**Mil*Nat**$_{low}$	
Jordan	0.67	11.25	-0.02	0.267	0.121	0.030
Morocco	1.49	4.11	2.38			
Peru	6.41	3.05	1.28			
Zambia	13.51	2.73	-0.27			
			Remove All Subsets			
Algeria	19.51	2.57	1.28			
Australia	3.87	2.49	2.28			
Bolivia	10.73	2.36	0.44			
Botswana	1.78	3.32	5.75			
Brazil	2.02	1.52	2.29			
Canada	3.78	1.78	1.88			
Chile	9.85	4.16	2.29			
China	7.34	1.73	6.90		**Mil*Nat**	
Ecuador	13.83	2.19	1.77	0.021	0.009	0.037
Indonesia	10.31	2.34	4.19		**Mil*Nat**$_{low}$	
Iran	26.11	4.69	0.89	0.193	0.114	0.094
Jamaica	5.58	0.82	0.66			
Mexico	6.89	0.55	1.93			
Morocco	1.49	4.11	2.38			
Peru	6.41	3.05	1.28			
United States	1.64	5.37	1.68			
Venezuela	26.15	1.75	0.50			
Zambia	13.51	2.73	-0.27			

Note: The estimates are achieved according to specifications under the first and the second estimation approach as in Table 5. Big commodity producers reflect countries with more than 3% of total world supply which belong to the list of top 10 biggest producers in the world by commodity. Data for commodities produced in a country are obtained from the following sources: minerals (bauxite, copper, phosphates, tin, gold, gemstones and etc.) from British Geological Survey 2000-2008; Oil, natural gas and coal from US Energy Information Administration 1980-2009.

Table 8
Exclusion of Countries with Unusual Characteristics
Dependent Variable: Logged per capita real (Laspeyres) GDP growth
Estimation: System GMM estimation with Windmeijer (2005) Small Sample Robust Correction

Country	Average Nat. Resource Share	Average Mil. Exp. Share	Average Growth Rate	Coeff.	S. E.	p value
Remove Countries with High Internal Threat Levels and High Natural Res. Shares						
Algeria	19.51	2.57	1.28			
Colombia	4.97	2.31	2.39		**Mil*Nat**	
Congo Dem. Rep.	7.37	2.24	-3.59	0.026	0.012	0.039
Indonesia	10.31	2.34	4.19		**Mil*Nat$_{low}$**	
Iran	26.11	4.69	0.89	0.218	0.102	0.035
Peru	6.41	3.05	1.28			
Sudan	4.30	3.00	0.99			
Remove Countries with High External Threat Levels and High Natural Res. Shares						
China	7.34	1.73	6.90		**Mil*Nat**	
				0.022	0.014	0.106
Egypt	12.64	8.66	3.04		**Mil*Nat$_{low}$**	
				0.217	0.107	0.046
Iran	26.11	4.69	0.89			
Remove All Subsets						
Algeria	19.51	2.57	1.28			
China	7.34	1.73	6.90			
Colombia	4.97	2.31	2.39			
Congo Dem. Rep.	7.37	2.24	-3.59		**Mil*Nat**	
Egypt	12.64	8.66	3.04	0.022	0.015	0.138
Indonesia	10.31	2.34	4.19		**Mil*Nat$_{low}$**	
Iran	26.11	4.69	0.89	0.217	0.103	0.039
Peru	6.41	3.05	1.28			
Sudan	4.30	3.00	0.99			

Note: The estimates are achieved according to specifications under the first and the second estimation approach as in Table 5. Countries with high internal threat levels and high natural resource shares are specified as those experienced internal threat above the mean of cumulative internal conflict incidence with natural resource levels above the mean. Countries with high external threat levels and high natural resource shares are specified as those experienced external threat more than 1 standard deviation from the mean of cumulative external conflict incidence with natural resource levels above the mean.

Table 9
Typologies of Commodities
Dependent Variable: Logged per capita real (Laspeyres) GDP growth
Estimation: System GMM estimation with Windmeijer (2005) Small Sample Robust Correction

	Energy Resources		**Oil Resources**	
	(1)	(2)	(3)	(4)
Initial GDP p.c. (log)	-0.016**	-0.013**	-0.007	-0.009
	(0.006)	(0.006)	(0.007)	(0.006)
Mil. exp/GDP	**-0.020*** **	**-0.010** **	**-0.009* **	**-0.002**
	(0.002)	**(0.005)**	**(0.005)**	**(0.003)**
Energy res.	-0.073			
	(0.050)			
Oil res.			-0.050	
			(0.056)	
Mil*Energy	**0.051*** **			
	(0.017)			
Mil*Oil			**0.041** **	
			(0.019)	
$Energy_{high}$		-0.145		
		(0.092)		
$Energy_{low}$		-0.714***		
		(0.262)		
Oil_{high}				-0.043
				(0.066)
Oil_{low}				-0.540**
				(0.225)
Mil* $Energy_{high}$		0.068**		
		(0.030)		
Mil* $Energy_{low}$		**0.404** **		
		(0.157)		
Mil* Oil_{high}				0.036
				(0.025)
Mil* Oil_{low}				**0.279** **
				(0.121)
Corruption	-0.002		-0.003	
	(0.004)		(0.004)	
Mil*Corr	0.004***		0.002*	
	(0.001)		(0.001)	
Control Set	Yes	Yes	Yes	Yes
Observations	404	404	365	365
SPECIFICATION TESTS (*p* -values)				
(a) Hansen Test:	0.745	0.699	0.976	0.954
(b) Serial Corr.:				
First-order	0.003	0.003	0.000	0.000
Second-order	0.530	0.583	0.403	0.456

Note: All specifications employ log of population growth, log of life expectancy, investment ratio, log of openness and schooling, and time fixed effects as an additional control set. The estimates are achieved using the "1 lag restriction" technique following Roodman (2009). ***, **, * represent significance of estimates, respectively, at 1%, 5% and 10% levels. Standard errors are presented in parentheses.

Table 10
Different Time Windows
Dependent Variable: Logged per capita real (Laspeyres) GDP growth
Estimation: System GMM estimation with Windmeijer (2005) Small Sample Robust Correction

	1985-2000 (1)	1985-2005 (2)	1990-2010 (3)	1995-2010 (4)
Initial GDP p.c. (log)	-0.012	-0.009**	-0.013***	-0.013***
	(0.008)	(0.004)	(0.004)	(0.005)
Mil. exp/GDP	**-0.024*** **	**-0.022*** **	**-0.020*** **	**-0.020*** **
	(0.003)	**(0.003)**	**(0.003)**	**(0.003)**
Natural Res.	-0.209*	-0.102**	-0.017	-0.013
	(0.124)	(0.048)	(0.031)	(0.034)
Mil*Nat	**0.067** **	**0.047*** **	**0.025** **	**0.025* **
	(0.030)	**(0.014)**	**(0.012)**	**(0.015)**
Corruption	-0.008**	-0.006**	-0.004	-0.003
	(0.004)	(0.003)	(0.003)	(0.003)
Mil*Corr	0.005***	0.005***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Control Set	Yes	Yes	Yes	Yes
Observations	240	322	404	322
SPECIFICATION TESTS (*p* -values)				
(a) Hansen Test:	0.181	0.997	0.978	0.967
(b) Serial Corr.:				
First-order	0.009	0.000	0.002	0.002
Second-order	N/A	0.961	0.371	0.400

Note: All specifications employ log of population growth, log of life expectancy, investment ratio, log of openness and schooling, and time fixed effects as an additional control set. ***, **, * represent significance of estimates, respectively, at 1%, 5% and 10% levels. Standard errors are presented in parentheses.

Table 11
Allowance for Other Non-linearities
Dependent Variable: Logged per capita real (Laspeyres) GDP growth
Estimation: System GMM estimation with Windmeijer (2005) Small Sample Robust Correction

	(1)	(2)
Initial GDP p.c. (log)	-0.011**	-0.015*
	(0.005)	(0.008)
Mil. exp/GDP	-0.037***	-0.052***
	(0.008)	(0.011)
Natural Res.	-0.015	-0.151*
	(0.035)	(0.090)
Mil*Nat	**0.028****	**0.066*****
	(0.014)	**(0.022)**
Corruption	-0.003	-0.004
	(0.003)	(0.005)
Mil*Corr	**0.002*****	**0.003****
	(0.001)	**(0.001)**
Mil*GDP	**0.003****	**0.004****
	(0.001)	**(0.002)**
Threat		-1.276***
		(0.399)
Mil*Threat		**0.439*****
		(0.119)
Control Set	Yes	Yes
Observations	384	222
SPECIFICATION TESTS (*p* -values)		
(a) Hansen Test:	0.985	0.587
(b) Serial Corr.:		
First-order	0.003	0.005
Second-order	0.709	N/A

Note: Both columns are estimated removing outlier countries. Eliminated countries in column 1 are Botswana, China, Mozambique and Uganda; in column 2 are Botswana, China, Mozambique and Sudan. Column 2 employs probability of civil war onset as threat measure. All specifications employ log of population growth, log of life expectancy, investment ratio, log of openness and schooling, and time fixed effects as an additional control set. The outliers are singled out using OLS regressions. ***, **, * represent significance of estimates, respectively, at 1%, 5% and 10% levels. Standard errors are presented in the parentheses.

Appendices

Appendix A: Robustness Checks for Threat Levels Analysis

Beyond the robustness checks described in Tables 2 and A1 for the analysis conditional on threat levels, special attention is paid to the potential influence on the results of several subsets of countries. The collection of these subsets features countries singled out due to the maintenance of high shares of military expenditure and on the basis of certain unusual aspects of their conflict experiences during the time period spanned by the sample. Results of this exercise are reported in Tables A2 and A3 for four subsets of countries: (i) high military expenditure share countries, specified as those which spend more than approximately one standard deviation from the mean in military sector; (ii) countries with high level of threat, defined as those experienced threat more than approximately three standard deviations from the mean of cumulative conflict incidence; (iii) the poorest countries with high military expenditure shares and high levels of threat, stipulated as those are in the bottom of income distribution, which spend more than average in the military sector and experienced an external threat above the mean of cumulative conflict incidence;[26] and (iv) the union of these subsets. For each subset, Table A2 and A3 report the list of countries, the cumulative number of threat incidences during the time period spanned by the sample, their average military expenditure shares and growth rates measured over the entire sample period, and the coefficient estimates obtained for the interaction of military spending with threat given their removal from the sample in addition to outlier countries. For ease of comparison, the estimates obtained given the exclusion of the outlier countries, are also reported.

The coefficient estimates of the interaction term with internal and external threat incidence change very little given the removal of any one of the subsets under consideration; and generally, enter significantly at conventional levels. For both cases, the estimates obtained given the removal of each subsample lie within approximately one standard deviation of the estimate when the potential outliers are removed. Statistical significance in the case when military expenditure is interacted with internal conflict onset also changes very little, indicating strong qualitative effects. What does change somewhat is the magnitude of the

[26] The cut-off level for countries in the bottom of income distribution is taken as in DeJong and Ripoll (2006), where country classifications are obtained by mapping classification thresholds as defined by the World Bank's income measures into the corresponding Penn World income measures. The resulting definition is specified as those with real per capita GDP level less than $2,650.

coefficient estimates of the interaction term when the third and the fourth subsets are excluded. The significance of the coefficient estimates of the interaction term with war intensity also exhibits sensitivity to the exclusion of particular subsets, with the magnitude of estimates lying within approximately two standard deviations of the estimate given the exclusion of potential outliers.

Overall, these findings suggest that the negative and significant relationship is only apparent among countries facing low threats, while in the presence of sufficiently high threats military expenditure is not materially detrimental for growth.

Table A1
Military Expenditure and External Threat
Dependent Variable: Logged per capita real (Laspeyres) GDP growth

	External threat: War intensity			**External Threat Incidence**
	Main Model (1)	**Outliers Removed** (2)	**Alternative Model** (3)	(4)
Initial GDP p.c. (log)	-0.006***	-0.006***	-0.006***	-0.023***
	(0.002)	(0.002)	(0.002)	(0.004)
Mil. exp/GDP	**-0.003*** **	**-0.004*** **		**-0.006*** **
	(0.001)	**(0.001)**		**(0.001)**
Mil*Threat	**0.008***	**0.026*** **		**0.0025***
	(0.004)	**(0.011)**		**(0.0014)**
Mil*High Threat			**-0.001**	
			(0.001)	
Mil*Low Threat			**-0.003*** **	
			(0.001)	
Threat	0.019	-0.062	0.016	-0.013**
	(0.045)	(0.064)	(0.041)	(0.006)
Pop. growth (log)	-0.001	-0.004	-0.001	0.015*
	(0.007)	(0.007)	(0.0067)	(0.008)
Life expectancy (log)	0.088***	0.088***	0.087***	0.044**
	(0.012)	(0.013)	(0.013)	(0.022)
Investment/GDP	0.111***	0.097***	0.099***	0.156***
	(0.013)	(0.013)	(0.013)	(0.021)
Openness (log)	-0.007***	-0.010***	-0.009***	-0.013***
	(0.002)	(0.002)	(0.002)	(0.004)
Schooling (log)	-0.006*	-0.005	-0.006	-0.009
	(0.004)	(0.004)	(0.004)	(0.009)
No. Observations	695	665	665	665
		Threshold Analysis		
Threat	0.376	0.144		2.23
	(0.064)	(0.006)		(2.74)

Note: Columns 1 estimates military expenditure and economic growth relationship conditional on war intensity levels, while column 2 runs the same exercise excluding the potential outlier countries. Column 3 applies the alternative approach to estimate the impact of military expenditure for countries with different threat levels by interacting military expenditure with two separate dummy variables: one for countries facing low threats, and the other for countries with high threat levels where the average threshold value of 0.260 ((0.376+0.144)/2) is used for the analysis. Column 4 employs an alternative external threat incidence measure constructed using UCDP/PRIO data. The analysis of military expenditure and growth relationship conditional on external threat levels using GMM estimator demonstrates marginally insignificant impact for the interaction terms. Therefore column 4 reports Fixed effect estimates for the analysis of non-linear relationship conditional on external threat incidence following the majority of research analyses in the defence literature. Since the external threat measure of war intensity by construction is constant over time within a country, and thus is dropped when FE estimator is used, columns 1-3 employ seemingly unrelated regressions (SUR) estimator instead of FE for the analysis of non-linear relationship conditional on war intensity levels. All specifications control for time fixed effects. Eliminated countries in column 2 are Botswana, China, Israel, and Singapore; in column 3 are Botswana, China, Egypt, and Singapore; and in column 4 are Botswana, China, Egypt, Israel, Korea Rep. and Singapore. The outliers are singled out using OLS regressions. ***, **, * represent significance of estimates, respectively, at 1%, 5% and 10% levels. Standard errors are presented in parentheses.

Table A2
Exclusion of Countries with Unusual Characteristics
Dependent Variable: Logged per capita real (Laspeyres) GDP growth
Estimation: System GMM estimation with Windmeijer (2005) Small Sample Robust Correction

Country	No. of Internal threat Incidence	Average Mil. Exp. Share	Average Growth Rate	Coeff.	S. E.	p value
			Remove Outliers			
Botswana	0	3.32	5.75			
China	0	1.73	6.90		**Mil*Threat (Onset)**	
Egypt	6	8.66	3.04	0.251	0.141	0.078
Israel	45	14.96	2.42		**Mil*Threat (Incidence)**	
Korea Rep.	0	3.85	5.47	0.0019	0.0009	0.043
Mali	5	2.19	1.79			
Singapore	0	4.61	5.27			
			Remove High Military Exp. Share Countries			
Egypt	6	8.66	3.04		**Mil*Threat (Onset)**	
Israel	45	14.96	2.42	0.351	0.147	0.020
Jordan	0	11.25	-0.02		**Mil*Threat (Incidence)**	
Syria	5	9.05	1.48	0.0029	0.0009	0.002
United States	9	5.37	1.68			
			Remove High Internal Threat Level Countries			
Colombia	45	2.31	2.39		**Mil*Threat (Onset)**	
				0.252	0.139	0.075
Israel	45	14.96	2.42		**Mil*Threat (Incidence)**	
				0.0018	0.0009	0.052
Philippines	42	1.66	1.51			
			Remove Poorest Countries with High Military Exp. Shares and High Internal Threat Levels			
					Mil*Threat (Onset)	
Mozambique	16	4.76	1.21	0.493	0.207	0.019
					Mil*Threat (Incidence)	
Pakistan	15	4.99	2.34	0.0023	0.0011	0.060
			Remove All Subsets			
Colombia	45	2.31	2.39			
Egypt	6	8.66	3.04			
Israel	45	14.96	2.42		**Mil*Threat (Onset)**	
Jordan	0	11.25	-0.02	0.603	0.195	0.003
Mozambique	16	4.76	1.21		**Mil*Threat (Incidence)**	
Pakistan	15	4.99	2.34	0.0032	0.0013	0.012
Philippines	42	1.66	1.51			
Syria	5	9.05	1.48			
United States	9	5.37	1.68			

Note: In addition to variables of interest reported above, all specifications control for initial income, internal threat (either onset or incidence measure), log of population growth, log of life expectancy, investment ratio, log of openness and schooling, and time fixed effects. High military expenditure share countries are specified as those which spend more than 1 standard deviation from the mean in military sector. High internal threat level countries are specified as those experienced internal threat more than 3 standard deviations from the mean of cumulative internal conflict incidence. The poorest countries with high military expenditure shares and high external threat levels are specified as those are in the bottom of income distribution (income rank 1) which spend more than 1 standard deviation from the mean in military sector and experienced internal threat above the mean of cumulative internal conflict incidence. The estimation results are achieved using the "1 lag restriction" technique following Roodman (2009).

Table A3
Exclusion of Countries with Unusual Characteristics
Dependent Variable: Logged per capita real (Laspeyres) GDP growth
Estimation: Fixed Effects Estimator

Country	No. of external threat incidence	Average Mil. Exp. Share	Average Growth Rate	Coeff.	S. E.	p value
Remove Outliers						
Botswana	0	3.32	5.75			
China	12	1.73	6.90		**Mil*Threat (Intensity)**	
Egypt	4	8.66	3.04	0.047	0.015	0.002
Israel	4	14.96	2.42		**Mil*Threat (Incidence)**	
Korea Rep.	0	3.85	5.47	0.0025	0.0014	0.078
Singapore	0	4.61	5.27			
Remove High Military Exp. Share Countries						
Egypt	4	8.66	3.04			
Israel	4	14.96	2.42		**Mil*Threat (Intensity)**	
Jordan	1	11.25	-0.02	0.011	0.019	0.596
Syria	2	9.05	1.48		**Mil*Threat (Incidence)**	
United States	3	5.37	1.68	0.0027	0.0015	0.071
Remove High External Threat Level Countries						
China	12	1.73	6.90		**Mil*Threat (Intensity)**	
India	16	2.97	3.48	0.084	0.019	0.000
Iran	10	4.69	0.89		**Mil*Threat (Incidence)**	
Pakistan	15	4.99	2.34	0.0036	0.0019	0.067
Remove Poorest Countries with High Military Exp. Shares and High External Threat Levels						
Egypt	4	8.66	3.04		**Mil*Threat (Intensity)**	
India	16	2.97	3.48	0.035	0.017	0.043
Pakistan	15	4.99	2.34		**Mil*Threat (Incidence)**	
Syria	2	9.05	1.48	0.0035	0.0018	0.050
Remove All Subsets						
China	12	1.73	6.90			
Egypt	4	8.66	3.04			
India	16	2.97	3.48		**Mil*Threat (Intensity)**	
Iran	10	4.69	0.89	0.075	0.136	0.579
Israel	4	14.96	2.42		**Mil*Threat (Incidence)**	
Jordan	1	11.25	-0.02	0.0035	0.0022	0.113
Pakistan	15	4.99	2.34			
Syria	2	9.05	1.48			
United States	3	5.37	1.68			

Note: In addition to variables of interest reported above, all specifications control for initial income, external threat (either intensity or incidence measure), log of population growth, log of life expectancy, investment ratio, log of openness and schooling, and time fixed effects. High military expenditure share countries are specified as those which spend more than 1 standard deviation from the mean in military sector. High external threat level countries are specified as those experienced external threat more than 3 standard deviations from the mean of cumulative external conflict incidence. The poorest countries with high military expenditure shares and high external threat levels are specified as those are in the bottom of income distribution (income rank 1) which spend more than average in military sector and experienced external threat above the mean of cumulative external conflict incidence.

Appendix B: List of Countries

Code	Country	Code	Country	Code	Country
1	Algeria	31	Greece	61	Pakistan
2	Argentina	32	Guatemala	62	Panama
3	Australia	33	Guyana	63	Papua New Guinea
4	Austria	34	Honduras	64	Paraguay
5	Bangladesh	35	Hungary	65	Peru
6	Belgium	36	India	66	Philippines
7	Bolivia	37	Indonesia	67	Portugal
8	Botswana	38	Iran	68	Rwanda $_c$
9	Brazil	39	Ireland	69	Senegal
10	Burundi $_c$	40	Israel	70	Sierra Leone
11	Cameroon	41	Italy	71	Singapore
12	Canada	42	Jamaica	72	South Africa
13	Central African Rep. $_c$	43	Jordan	73	Spain
14	Chile	44	Kenya	74	Sri Lanka
15	China	45	Korea, Rep. of	75	Sudan
16	Colombia	46	Liberia	76	Sweden
17	Congo, Dem. Rep.	47	Malawi	77	Switzerland
18	Congo, Rep. of	48	Malaysia	78	Syria
19	Costa Rica	49	Mali	79	Thailand
20	Cote d'Ivoire	50	Mauritania $_c$	80	Togo
21	Cyprus	51	Mauritius $_c$	81	Tunisia
22	Ecuador	52	Mexico	82	Turkey
23	Egypt	53	Morocco	83	Uganda
24	El Salvador	54	Mozambique	84	United Kingdom
25	Fiji $_c$	55	Nepal $_c$	85	United States
26	Finland	56	Netherlands	86	Uruguay
27	France	57	New Zealand	87	Venezuela
28	Gambia	58	Nicaragua	88	Zambia
29	Germany	59	Niger	89	Zimbabwe
30	Ghana	60	Norway		

Note: Subscripts c represent countries those are excluded from the analysis when the corruption variable is employed.

Appendix C: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
GDP p.c. (log)	801	8.32	1.33	4.77	10.82
GDP per capita growth rate	796	0.02	0.03	-0.36	0.19
Military Expenditure over GDP (%)	778	2.81	2.81	0	28.62
Natural Resource Rents	797	0.04	0.08	0	0.64
Energy Resource Rents	797	0.03	0.08	0	0.64
Oil Rents	667	0.03	0.07	0	0.64
Population Growth rate	801	0.07	0.01	0.01	0.14
Real Investment ratio	801	0.23	0.09	0.04	0.72
Life Expectancy (log)	801	4.13	0.19	3.16	4.40
Schooling (log)	801	1.61	0.67	-1.24	2.57
Openness (log)	801	3.99	0.62	2.21	6.06
War Intensity	799	0.01	0.04	0	0.29
External Conflict Incidence	801	0.12	0.56	0	5
Internal Conflict Incidence	801	0.93	1.75	0	5
Cumulative Incidence of Ext. Conflict	801	1.11	2.99	0	16
Cumulative Incidence of Int. Conflict	801	8.38	11.83	0	45
Dist. to major navigable river (10^3 km)	783	1.55	1.33	0.001	9.1
Soil	801	0.37	0.21	0	0.98
Tropical	801	0.43	0.45	0	1.00
Democracy	799	4.84	4.29	0	10
Polity2	799	2.58	7.15	-10	10
Probability of civil conflict onset	618	0.013	0.032	0	0.327
Corruption	491	3.16	1.40	0	6

Note: Descriptive statistics are based on panel country averages for the period of 1970-2010 and a sample of 89 countries, except the last two. Summary of civil conflict onset probability is restricted to the period of 1970-2000. Respective statistics of corruption are summarized for 82 countries data set over the period of 1985-2010.