Military Spending and the Risks of Coups d'Etat

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Abstract:

The governments of many developing countries face a risk of a coup d'état perpetrated by their own military establishment. The phenomenon is especially acute in Africa. We decompose the risk into its component parts: the risk of a plot; the risk that a plot will mature into an attempt; and the risk that an attempt with succeed; and analyze theoretically and empirically the interdependence between these risks and military spending. Since governments can be presumed to want to reduce the risk of a coup, we investigate how they might adjust military spending. We show that although the response might be either to reduce or increase spending, the expected relationship is non-monotonic, with governments reducing spending until a threshold level of risk is reached above which they increase it. Using both global and Africa-specific data sets we model the interdependence empirically. We find that in countries with low coup risk governments react to it by cutting military spending. However, when coup risk is high, as in Africa, governments respond by increasing spending. An implication is that in these high-risk environments external security protection against coups might reduce military spending.

1. **Introduction**

The governments of many developing countries face a non-negligible risk of a coup d'état perpetrated by their own military establishment. The phenomenon is especially acute in Africa: even since 2000 there have been successful coups in Mauritania, the Central African Republic and Togo, and failed coup attempts in Sao Tome and Principe, Cote d'Ivoire, Equatorial Guinea and Chad. In such countries the military has a dual aspect. It is both a defender of the government against external threats and internal rebellions, and itself a source of threat. Potentially, this threat against the government can become the predominant role, so that in setting military spending the government is more concerned to reduce the risk of a coup than to protect itself from other threats. The purpose of our paper is to investigate whether such behaviour is a significant phenomenon and, if so, how governments adjust the military budget.

In Section 2 we develop a theory of the interdependence of coup risk and military spending. We show that where the underlying risk of a coup is low an exogenous increase in coup risk will *reduce* military spending. However, where the underlying risk of a coup is sufficiently high the government will choose to buy the military off by increasing the budget. This provides a way of distinguishing empirically between militaries that are basically defenders of the nation, albeit posing some threat to the government, and those whose core perceived role is to reduce regime security.

In Section 3 we discuss the two data sets on coups d'états on which our analysis is based. One is standard and provides global coverage on all successful coups. The other, which is new, covers Africa only but includes not only successful coups but both failed attempts and all foiled plots that were reported in the media. Both are for the period since independence to 2003. In Section 4 we develop an empirical model of coups, including an explicit interdependence between coup risk and military spending. Evidently, the risk of a coup may both affect and be affected by the level of military spending. To address this problem of interdependence we draw on our previous work on military spending (Collier and Hoeffler, 2007), introducing instrumental variables which strongly affect military spending but do not directly affect coup risk. Section 5 concludes.

2. A Theory of Coups

The risk of a successful coup, R_c, can be decomposed into three component risks. These are the risk of a plot, R_p; the risk that a plot will mature into a coup attempt, R_a; and the risk that a coup attempt will succeed, R_s. Hence:

$$R_c = R_p.R_a.R_s. \qquad (1)$$

The determinants of these three risks are likely to have some variables in common and some that are distinctive. We first consider some variables that are likely to be common. In highly developed societies there are no coups. Thus, per capita income or something closely correlated with it reduces risks. Controlling for income, the risk of a coup may depend upon both motivation and feasibility. A potential motivation is that a successful coup captures the 'rents to sovereignty'. The most obvious such rents are natural resource rents and aid. An advantage of these rents from the perspective of potential coup leaders is that unlike tax revenues they do not provoke much citizen scrutiny. Both of these are in principle testable hypotheses, although whereas resource rents can reasonably be treated as exogenous to coup risk, aid is liable to be endogenous and so must be instrumented.

The feasibility of a coup is likely to depend upon the perceived legitimacy of the government. One source of legitimacy is recognition that the government has come to power through means that the society accepts. Democratic elections may be an important means of legitimizing the accession to power. A second potential source of legitimacy is time: if the regime has been in place a long time people may come to see it as part of the natural order. The type of government with the least claim to legitimacy may well be one that has itself recently come to power through a coup. It faces the internal contradiction that in claiming that the means by which it came to power were legitimate, it thereby legitimizes an equivalent attempt to replace it. Nor has it acquired the loyalty of tradition. This creates the possibility of a 'coup trap'. A third possible source of legitimacy is

economic performance. In a country that is growing rapidly the population is likely to be more reconciled to the government than one that is in rapid decline.

We now consider potential influences that are likely to be specific to each component risk, taking first the risk of a coup plot. Our African data set provides us with the details of coup plots, attempts and successful coups. Nearly all of these are initiated by members of the armed forces (93%) and one of the striking features is that coups can be launched from many positions within the military hierarchy. Suppose that each officer in the army has the same underlying scope to plot a coup, r_p. Onto this underlying risk is added a component determined by personal characteristics specific to each officer such as ambition and charisma, μ_i, that are randomly distributed. Then the overall risk of a coup plot, R_p, is:

$$R_p = r_p + \mu_1 + (r_p + \mu_2)(1 - (r_p + \mu_1)) + \ldots (r_p + \mu_n)(1 - \ldots.) \qquad (2)$$

For the pertinent range all these risks are very small, so that for a given value of r_p and a given pool of idiosyncratic risk, the expected value of R_p is approximately linear in the number of officers: the larger is the army, the greater is the risk that it contains a budding Napoleon. We assume for the present that the number of officers rises proportionately with the level of military spending, M. Hence, for a given pool of idiosyncratic risk, the expectation of a coup plot is approximately linear in the size of spending and the risk-per-officer:

$$R_p \approx r_p \gamma M. \qquad (3)$$

Now consider the risk that a coup plot will come to fruition as an attempt. Plots may be less likely to reach fruition if governments are able to use torture to gain information and imprison on suspicion. Potentially, the repression that permits these techniques may itself be endogenous to the need to contain coup risk. Repression may feed back onto the risk of a plot, although the sign of such an effect is ambiguous. It might increase the incidence

of plots by reducing the perceived legitimacy of the government, or it might reduce the incidence due to the deterrence of possible exposure.

The risk that a coup attempt might succeed may be affected by the structure of military organization. The technique for reducing the success rate of coup attempts proposed in the celebrated 'coup manual' by Luttwak (1968) is to divide the military into competing organizations.

We summarize these potential influences on coup risk as:

$$R_p = f(Y, L, T, M) \quad (4)$$

$$R_a = f(Y, L, T, Q) \quad (5)$$

$$R_s = f(Y, L, T, S) \quad (6)$$

Where: Y = per capita income
L = degree of democratic legitimacy
T = regime duration
Q = repression
S = structure of military organization

If (3) is the only way in which coup risk is endogenous to military spending then the government response will be to reduce spending below the level it would otherwise have chosen. To see this, consider the government decision problem. Following the conventional specification of the demand for military spending, government utility, U^g, is increasing in military spending due to deterrence, D, but this is subject to diminishing returns. Coup risk can readily be incorporated into this specification, entering negatively into government utility:

$$U^g = f(D(M), R_c(M)); U^g_D > 0; U^g_{Rc} < 0; D_M > 0; D_{MM} < 0; R_{cM} > 0 \quad (7)$$

For any given level of military spending, the introduction of coup risk reduces its marginal utility. Further, from (1) and (3), the higher are r_p, R_a and R_s the more coup-related disutility an increment in military spending will generate. Hence, having optimized with respect to the level of repression and the organizational structure of the military, the government will choose a lower level of military spending the higher is the risk of a coup.

We now introduce the possibility that officers might be motivated to plot a coup because they regard the military budget as insufficient. The evidence in support of such behavior comes partly from case studies of coups. For example, the 1999 coup in Cote d'Ivoire was triggered by a group of officers demanding that the president increase the military budget. Additionally, Collier and Hoeffler (2007) find that, controlling for other influences on military spending, military regimes set significantly higher military budgets. We suppose that while the government wishes to set a level of military spending, M_g*, the officer corps would prefer the higher level M_o*. The officer corps will plot a coup to achieve this objective if the expected pay-off is positive.

Evidently, one determinant of the pay-off is the chance that the plot will succeed. In the event that the coup plot fails, either because it is detected at the plotting stage or is defeated during attempted execution, the perpetrators can expect severe punishment, P. Hence, prior to the government revising its spending levels, the pay-off to plotting a coup is:

$$R_a R_s.(M_o^* - M_g^*) - (1 - R_a R_s).P \quad (8)$$

If R_a and R_s are sufficiently low then (8) is negative: officers do not plot in order to increase military spending. Over this range the government can thus set military spending at its preferred level, M_g*, without fear that this might provoke a coup plot. However, at

higher levels of coup risk (8) is positive and now the government faces a choice. It can implement its chosen level of military spending regardless, thereby provoking a coup plot which it can hope to survive with probability 1- $R_a.R_s$. Or it can revise its chosen level of spending to the higher level M_g**, this being the lowest level of spending at which the officer corps does not regard the further gains from a coup as being worthwhile. That is, it can set military spending such that:

$$R_a.R_s.(M_o^* - M_g^{**}) - (1 - R_a.R_s).P = 0 \qquad (9)$$

It will do this if the utility loss from the increase in spending is less than the utility loss from the additional risk of a successful coup:

$$U_g(M_o^* - M_g^{**}) < U_g\,(1-R_p).\,R_a.R_s. \qquad (10)$$

Whether this inequality holds cannot be determined *a priori*. However, the consequence of a successful coup is evidently likely to be regarded as catastrophic by the government. Further, the chance of a plot succeeding is relatively high since by virtue of (8) being positive R_a and R_s are high. Thus, the gains of averting a coup plot are likely to be viewed as substantial. As to the costs, the relevant range of variation in military spending is very small relative to GDP. Hence, the likely response is that the government buys the military off.

In summary, the introduction of coup risk as an influence upon military spending can potentially have three distinct outcomes. One is that the objective prospects of a coup are insufficiently promising for the officer corps to be induced into plotting with the objective of increasing spending. The second is that prospects are sufficiently good that the officer corps would plot to launch a coup with the purpose of increasing spending, but that this behavior is pre-empted by the government which increases spending beyond its otherwise desired level. The third is that following a successful coup the coup leaders reward the military.

Bringing the above effects together, military spending is thus endogenous to coup risk in three ways. In the first military spending is *decreasing* in coup risk. In the second the military is analogous to a successful protection racket with the government as its victim. Hence, over this range of coup risk military spending is *increasing* in risk. Although the two responses are opposing, they do not simply offset each other, but co-exist in distinct ranges of the level of exogenous coup risk. At low levels of risk a small increase reduces spending, while at high levels spending is increased. The third is that successful coups, which will of course be correlated with coup risk, will increase military spending.

3. Data

We use two data sets on coups, one global and the other confined to Africa but with more information[1]. The global data were obtained from Banks' Cross-National Time-Series Data Archive. One of the variables in this archive provides the number of extra-constitutional or forced changes in the top government elite and/or its effective control of the nation's power structure in a given year. Unsuccessful coups are not counted. Using these data we constructed a zero-one indicator for coups d'état, taking the value of one if there was at least one coup during the year and zero otherwise. Means and standard deviations for coups d'états and the key explanatory variables are shown in Table 1. The data are presented both for the global average and for Africa and all other developing countries as distinct groups.

We also obtained some remarkable and detailed African coup data for this analysis from Patrick McGowan (McGowan, 2003) who kindly made his original text files available to us. Using published sources this gives a comprehensive coverage of reported coup plots that got no further than plotting, and of coup attempts that failed, as well as of successful coups in Africa during the period 1956 to 2001. Due to restrictions on economic data we only consider these plots, attempts and coups from 1960 onwards. Even so, this gives a

[1] For a full description of the variables see Appendix 1.

substantial number of observations. There were 145 plots that proceeded no further than the plot stage, 109 coup attempts that failed, and 82 successful coups.[2]

Our first task was to code these data into machine-readable form. We assumed, reasonably enough, that all actual attempted coups, successful or not, had been plotted. Thus, our coding classified all three types of event as plots, some of which led on to coup attempts, while in turn some of these attempts were successful.

The more problematic task was to organize the data in a way suitable for statistical analysis. Plots, attempts and coups are rare events, but when they occur they tend to bunch together. In two cases there were five such events in the same country in a single year.[3] Our data have the characteristics of ordered data as well as count data. Conventional statistical approaches are not ideal for this type of event. One approach is an annualized probit analysis. For each year during which any of these three types of event happened - a plot, an attempt or a coup – the researcher simply codes an event. Poisson models and ordered probits are also possible methods. However, each of these approaches involves a loss of information. Our preferred approach conserves information. Since the maximum number of events in any year is five, we organize the data such that each year is divided into five equal periods of 73 days. Each period may or may not have one event. To the extent possible, events are then dated correctly within their appropriate period. In very rare cases, two events fall in the same 73 day period. Since we do not allow for multiple events within a period, we notionally shift the date of the event to the nearest event-free period within the same year. The alternative to this slight misrepresentation of the data would be to greatly increase the number of periods into which a year is divided. In turn, this would compound the problem of rare events, since the same number of events would be distributed over far more observations.

[2] In the published article McGowan reports a slightly lower number but since this is an ongoing data collection effort we used all of the plots, attempts and coups that were listed in the data description files, sent to us after the publication date.

[3] Burkina Faso experienced three plots, one attempt and one coup in 1983 and there were five attempted coups in Togo in 1991.

4. Results

Core results for the global sample

In our model military expenditure and coup risk are interdependent and we thus have to use a method which allows simultaneous estimation of both variables. This is a difficult task since military expenditure is a continuous variable while coups are measured by a dichotomous variable. Conventionally used instrumental variable analysis cannot handle this sort of simultaneous equation system. We follow Keshk (2003) who suggests the use of a two stage least squares probit approach. First, we formulate a simplified military expenditure model based on Collier and Hoeffler (2007). In this model the defence burden depends on the weighted neighbours' defence burden, a post cold war dummy and the years since the last coup. The likelihood of a coup d'état depends on income per capita, growth, the political regime, a time trend, and the years since the previous coup. In the first stage of the simultaneous equation estimation we regress the defence burden on the exogenous variables of the military expenditure model as well as on the determinants of the coup model. Similarly, using a probit model we regress coups on the determinants of coups as well as on the determinants of military expenditure. Based on these first stage regressions we use the predicted risk of a coup d'état in the military expenditure model and the estimated defence burden in the coup d'état model. Keshk's (2003) method adjusts the standard errors accordingly. Using global data we present the second stage regression results in Table 2, column 1. The top half of Table 2 shows the results for the military expenditure model and the bottom half the ones for the coup d'état model.

Considering first the regression that explains coup risk, military spending has no significant effect. We will see later that this is only true over a range. Low income and slow growth both significantly increase the risk of a coup, this is similar to the results shown by Gallego and Pitchik (2004). The political system is also significant, but its effect is not straightforward: democracies are neither systematically safer nor more a risk than autocracies. We distinguish between repressive political systems and non-repressive

types of regime. We proxy 'repression' using the Polity IV data set which ranges political regimes on the ordinal scale from -10 to +10. Gurr and Marshall (2005) define 'anocracies' as regimes with polity values between -5 and +5 and we define severely repressive regimes as those with a polity indicator lower than -5. We lag the economic and political system variables to reduce problems of endogeneity. To get a sense of the magnitude of these effects it is useful to take as a baseline the risk of a coup predicted at the sample mean values of the characteristics, this being 1.55%. If the level of per capita income is doubled the risk falls by about 27% and if it is halved the risk increases by 35%. While the implied elasticity with respect to income is fairly low, the range of per capita income among countries is extraordinarily wide so that even this modest elasticity produces large differences in risk. The effect of growth is more modest: when growth is raised by one percentage point the risk falls by 4.4%. Political regime has a strong impact on risk. Comparing the risk between repressive and non-repressive regimes we find that the coup risk in repressive regimes is half of that in other regimes. This is in contrast to O'Kane (1981) who concluded that the political system was less important than economic factors.

There is clear evidence of a coup trap: once a coup has occurred, the chances of a further coup sharply increase, confirming the results by Londregan and Poole (1990) and Galetovic and Sanhueza (2000). In addition to the existing literature we find that the coup trap effect fades with time. One year after a coup the risk is about 185% higher while after ten years it falls back by 69%. Since the effect fades with time it is not merely picking up a fixed effect – omitted unchanging characteristics of the country. However, we cannot exclude the possibility that it is it picking up some omitted transient effect that was the real cause of the coup. We can, however, guard against this possibility by investigating a large range of other explanatory variables, which we do in our robustness checks below.

The other significant variable is a time trend. Happily, coups are getting less common with time. In 1962 the risk was 141% higher whereas by 2002 it was 55% lower. Recall that this is a pure time effect, controlling for all other changes that are significant.

Since the use of two stage least squares probit estimation is uncommon[4] we compare our results to the more commonly used IV probit estimation results in column 2. Here we do not estimate military expenditure and coup risk simultaneously, but instrument military expenditure in the probit model. The results are very similar to the ones obtained in column 1.

We now turn to the examination of a possible non-linear relationship between coup risk and military expenditure. Due to the simultaneous nature of our model this is not straightforward. We explore two different options. First, we examine whether Africa's higher risk of coup d'état suggests a different behavioural pattern, and second, we introduce the square of risk of coup d'état in the model. In column 3 we include an Africa dummy in our model. Our results suggest that African defence burdens as well as coup d'état risk are determined in the same way as in non-African countries. There is no significant difference between Africa and the global sample. However, we know that Africa has a considerably higher risk of coup d'état: 5.5% of all African observations experienced a coup in contrast to only 3% of non-African observations. We interact the predicted coup risk with the Africa dummy in column 4. While the direct effect of the Africa dummy is still insignificant, the interaction term is positive and significant: something about Africa offsets the negative effect that coup risk normally has on military spending. Since one of the distinctive features of Africa is that its characteristics predispose it to a much higher coup risk, this suggests that there may be a non-linear relationship between risk of a coup d'état and military expenditure.[5] A further test is to introduce the square of coup risk in the military expenditure function. We converted the linear predictions from the probit into predicted probabilities and squared them. In column 5 we include them in the military expenditure model. Coup risk is negative and significant while the squared term is positive and significant. The coefficient estimates

[4] We also investigated linear probability models in which we instrumented for military expenditure. The results are qualitatively similar and are available upon request.

[5] One possible objection to these results is that the standard errors are not adjusted. However, the comparison of adjusted and non-adjusted standard errors in the core model suggests that the adjustment makes hardly any difference. All of the variables are significant at the same level, irrespective of adjustment.

suggest that for countries which have a coup risk of 9.7 percent or lower the effect of coup risk on military expenditure is negative while for high risk countries over 9.7 percent an increase in coup risk results in higher military expenditure.

For the range in which coup risk is low, governments behave in a way consistent with our first proposition: an increase in coup risk significantly reduces military spending. This is a robust result, not dependent upon whether the quadratic term is included or excluded. Note that for this to be a rational response does not depend upon the reduction in spending significantly reducing the risk of a coup. The rationale for governments to choose lower military spending in these circumstances depends upon the *level* of coup risk not its change. A (relatively) high coup risk reduces spending simply because it implies that the net contribution of military spending to government utility is lower.

Although the core regression of coup risk contains few variables, these variables differ so markedly between countries as to produce very large differences in our prediction of coup risk. A country combining the best observed characteristics in our sample on each variable would have faced a coup risk of only 0.001%, whereas a country combining the worst observed characteristics would have faced a risk of 67%. These wide differences suggest that the hypothesized bifurcation of government behaviour is at least potentially empirically pertinent. However, based on the results of Table 2 the evidence for the existence of a range of coup risk over which military spending in risk is weak. If the quadratic is included then the minority of governments that face a coup risk above 9.7% indeed behave as though they believed that increased spending would reduce risk. However, this belief appears misplaced since such higher spending does not significantly reduce coup risk. We will see shortly that this preliminary conclusion must be revised.

Robustness checks

We next turn to a range of robustness checks (Table 3). Of these robustness checks the most important are the introduction of political, social and historical variables that might be expected to influence the risk of a coup. In Table 3, column 1, we introduce a dummy

variable which takes the value of unity if there is a time limit to presidential office. This is significant at five percent. A finite term substantially reduces the risk of a coup. At the mean of other characteristics in the absence of a finite term the risk is 3.2% whereas with a finite term the risk falls to 1.4%. We might note that term limits were widely adopted as part of the wave of democratization in low-income countries during the early 1990s. In Uganda, Chad and Nigeria, all countries with a history of coups, they have recently been challenged as presidents have reached the limits of their terms. In column 2 we replace this variable with the number of years that the head of government has been in office. This is significant at ten per cent and positive: staying in office becomes progressively more risky. When these two variables are combined both are significant: presidents are safer if they have limited terms of office and do not stay in power for many such terms. Hence, presidents who reach the limit of their terms and then change the law are inviting trouble: indeed, these were the antecedents to the latest coup attempt, in Chad in April 2006, an event which is out-of-sample. We exclude these two variables from our core regression only because they impose a considerable reduction in sample size.

We investigated a wide range of other variables, some of which are reported in Table 3. Among the variables found to be insignificant were ethnic dominance, ethnic diversity, polarization, inequality, political checks and balances, press freedom, and human rights abuses. Neither was the identity of the colonial ruler. Although the end of the Cold War significantly reduced military spending it did not significantly affect coup risk.

A further check is the effect of development aid on the risk of coups. Since political instability in the recipient may be correlated with the donors' willingness to provide aid we instrument aid in our regression. We follow the methodology suggested by Tavares (2003) and instrument aid received by aid provided by the top donors. We concentrate on the top five bilateral donors and interact their overall aid allocation with the geographic, cultural and political distance between each donor and recipient. We use a parsimonious model in which all of our instruments are significant in the first stage regression. We present the results from the IV probit regression in which we instrument for military expenditure as well as for aid in column 6. Instrumented in such a way aid is significant

and positive at the ten per cent level. The effect of aid on the risk of a coup d'état is relatively large: increasing aid from average levels (5.4% of GNI) to African levels (9.9% of GNI) increases risk by 28%. Hence, part of the explanation for the higher incidence of coups in Africa is that it receives more aid.

Military personnel as the dependent variable

In the model of Section 2 coup risk was linear in military spending because the number of officers was assumed to be strictly proportional to spending. This is evidently a simplification. If the risk of a coup inheres in the number of officers, an increase in spending brought about by the purchase of equipment should not affect coup risk. Conversely, an increase in coup risk should lead the government to economize on personnel. We therefore investigate the number of soldiers that the government chooses. This variable becomes both a dependent variable, replacing military spending, and an explanatory variable in coup risk. Data on this variable are limited, especially for Africa. With the number of soldiers as the dependent variable we adapt the core model of military spending (table 2a, column 1) by the addition of population as an explanatory variable. Coup risk now reduces the number of soldiers (Table 2b, column 1), whereas an increase in external threat, as proxied by the military spending of neighbors, increases the number of soldiers, both effects being significant. In column 2 we add military spending as a control variable. With this control, a change in the number of soldiers must be offset either by a change in spending on military equipment, or by a change in the level of military salaries. The previous pattern remains: a higher risk of coups significantly reduces the number of soldiers for a given level of military spending: governments substitute away from the source of the coup risk. Conversely, an increase in external risk increases the number of soldiers for a given level of spending, although the result is now not quite significant. We are, unfortunately, unable to distinguish between equipment and the level of salaries. *A priori*, either is plausible. A rise in coup risk might lead either to a substitution from personnel into equipment, or to a substitution from the number of soldiers to higher pay.

Decomposing Coup Risk: Results for the Africa data

We now decompose coup risk into its component parts: the risk of a plot, the risk that a plot matures to an attempt, and the risk that an attempt succeeds. For this extension we only have the African data set. As a preliminary, still using the global sample we introduce a dummy variable for Africa into both the coup and military expenditure regressions (Table 2, column 3). In neither case is the Africa dummy even close to significance: basically, Africa conforms to the global pattern other than for the already noted difference in the effect of coup risk on military spending.

We next run our core regression on the new data set of African coup plots, coup attempts, and coups. The combination of the three coup-related events actually increases the number of events we are analyzing compared to the global data, which are confined to successful coups. We start from the core global regression (Table 4, column 1) on the 'plots' data, noting that our observations are coup plots which may have also been attempted coups, and that these in turn may have been successful. That is, 'plots' is an inclusive term for all coup-related events. Plot risk is significant at the one percent level. However, the striking feature of this regression is that the sign on plot risk is positive: the opposite of the result for the global sample. Before discussing this further, we refine the regressions further by adding the dummy variable for ethnic dominance into the plot risk regression (column 2). While this was insignificant in the global sample, it is highly significant for the African data: 'ethnic dominance' is a dummy variable which takes the value of unity when the largest ethnic group constitutes 45-90% of the population. It is highly significant in increasing plot risk. We take this pair of as our 'core' regressions for the African data. In contrast to our global regressions we do not include the dummy variable for repressive regimes because this variable was never significant, possibly due to insufficient variation in the African data. Including the repressive regime did not alter our results.

We next turn to the coup attempts conditional upon a plot. This radically reduces the sample size: we are attempting to predict whether a plot matures into an attempt from

only 291 observed plots. Recall that the government may be able to reduce the success rate of coups by means of repression. When repression is introduced into the coup attempts regression (Table 5, column 1) it is significant and negative: repression appears to be effective. However, since governments that are more prone to coup risk may choose to be more repressive we attempt to control for this endogeneity through instrumenting. We instrument using colonial origins. We found that the dummy variables for French and British colonies were valid instruments. So instrumented, repression remains negative but is not significant at conventional levels. However, by including the residuals from the first stage regression in the attempt model we find the coefficient on the residuals to be insignificant. This indicates that repression can be treated as exogenous in our model (Wooldridge, 2006 chapter 6). Indeed, while repression appears to reduce the chance that a plot matures the effect is small and so high coup risk might not itself induce repression. We find no effect of repression on the risk of a plot. Potentially the plots data are contaminated: repressive regimes may falsely allege plots as excuses for imprisoning opponents. However, if this were a significant problem, repression would raise the incidence of reported plots which we do not find. That repression reduces both the chances that a plot matures, and the overall risk of a coup (Table 2, column 1), suggests that it is indeed an effective technology.

Finally, we turn to successful coups conditional upon an attempt (Table 5, columns 4-6). Recall that here the hypothesis we would like to test is that division of the military into competing structures reduces the risk of a coup. We do not have data on military structures, but one observable variable which avoids the potential problem of endogeneity is whether the country is landlocked. Since landlocked countries lack a navy they have a more unified structure of military organization. We might thus expect that this would increase the risk that a coup attempt would be successful. We control for the number of neighbouring countries in case neighbours increase coup risk, since landlocked countries have more neighbours. The dummy for being landlocked is positive, and would be predicted by the hypothesis, but not statistically significant. However, since the sample for this test is very small this may well be due to the lack of observations.

The Africa results have two key differences from the global results. Results presented in Table 4 show that plot risk, attempt risk, and coup risk all significantly *increase* military spending, whereas in the global sample coup risk significantly reduces spending. Thus, African governments are responding to an exogenous increase in coup-related risk precisely contrary to non-African countries. African governments are behaving as though they believed that additional spending would reduce the risk of a coup. Why might African and non-African governments be responding in such different ways? The reason is probably that although Africa conforms to the global pattern of behaviour, its characteristics place it in a different range of behaviour. Africa's distinctive characteristics give it a far higher risk of coups. At Africa's mean characteristics the risk of a coup is almost double that for the global sample.

The other key difference is in the coup risk regression. Recall that in the global sample military spending did not significantly affect coup risk. In contrast, on the African data an increase in military spending significantly *reduces* coup risk so that buying off the threat of a coup is a rational use of government resources (Table 4, column 4). The affect on plots and attempts is weaker, suggesting that the response of higher military spending is concentrated on averting those plots that would be most likely to mature into successful coups, this being the prediction of (10). Clearly, what matters most for African governments is to be able to prevent those bids for power that would be successful and this is what higher spending achieves.

The two key differences evidently reinforce each other. Outside Africa, coup risk is usually not high enough to warrant governments buying off the risk of coup plots, and anyway, higher military spending is ineffective in reducing risk. In Africa coup risk is high enough for governments to buy off the risk of coup plots and such payments work.

One other feature of our Africa results is noteworthy. Whereas globally the end of the Cold War significantly reduced military spending, in Africa it significantly increased it. Hence, during the 1990s Africa was distinctive in not reaping a military spending peace dividend, but indeed experiencing precisely the opposite.

5. Conclusion

We have used global and Africa-specific data sets to analyze the risk of a coup d'état and its relation to military spending. Over time coups have been going out of fashion and are closely related to economic weaknesses: low income and low growth. As a consequence, outside Africa the phenomenon is now rare. However, because of the prolonged failure of the growth process in Africa, within the region coup risk remains high and this has had significant consequences for military spending. In particular, we find that African governments respond to a high level of coup risk by increasing military spending. By contrast, in the global sample, dominated by countries with much lower coup risk, the normal government reaction to coup risk is to cut military spending, and most especially to cut the size of the army. We find that this distinctive behaviour of African governments may indeed by appropriate. Whereas on the global sample there is no evidence that an increase in military spending is effective in reducing coup risk, in Africa it achieves a significant reduction. This distinctive behaviour of African governments, and the distinctive response of their militaries, is consistent with their use of military spending to buy off the military. This is consistent with a theory in which only above a threshold level of coup risk can coups not be adequately deterred by the fear of punishment.

Finally, we should note an uncomfortable implication of our results for aid agencies. We have found that aid significantly and substantially increases coup risk. This suggests that one inadvertent consequence of the large and increasing aid inflows to Africa will be to increase the risk of coups and thereby augment military spending. Since we have previously found that in Africa around 40 per cent of military spending is indirectly aid-financed due to fungibility (Collier and Hoeffler, 2007), donors are inadvertently implicated both in the high risk and its dysfunctional consequences.

Appendix 1 - Data Sources

Coups d'Etat,
Sources: (1) Global: Banks' Cross-National Time-Series Data Archive http://www.scc.rutgers.edu/cnts/about.cfm. (2) Africa: McGowan, 2003. This data set provides information on successful coups d'état as well as attempted coups and plots.

Economic growth
Using WDI 2003 data for GDP per capita we calculated the annual growth rates.

Ethnic Dominance
Dummy taking the value of one if the largest ethnic group in society is between 45 and 90 percent of the population. Source: Fearon and Laitin (2003).

Finite Term in Office
Dummy variable taking the value of one if there is a finite term in office. Source: Keefer (2002)

Fractionalization
The fractionalization variables are computed as one minus the Herfindahl index of group shares, and reflects the probability that two randomly selected individuals from a population belonged to different groups. Higher values proxy more heterogeneous countries. Source: Alesina et al (2003).

GDP per capita
We measure GDP per capita annually. Data are measured in constant 1995 US dollars and the data source is WDI 2003.

Military expenditure
We measure military expenditure as a percentage of GDP, data source: Stockholm International Peace Research Institute. We merged two different series, one for years prior to 1988 and one post 1988. We investigated whether there is a structural break between the two series by introducing a dummy in our core regression taking a value of one for the years 1988 and later. The dummy was insignificant and was hence dropped from our specification. We transformed the military expenditure variable by adding 1 to all of the values before taking the logarithm. This transformation reduces the problem of excessive weight in the low and high observations.

Military Personnel
Total military personnel. Armed forces personnel refer to active duty military personnel, including paramilitary forces if those forces resemble regular units in their organization, equipment, training, or mission. Source: World Bank, WDI

Post Cold War
Dummy taking the value of one for years 1990 and later.

Repression

Is a dummy variable taking the value of one for country year observations with polity scores less than -5. 'Polity' is the combined score of democracy and autocracy and ranges from –10 (least democratic) to +10 (most democratic). Source: Marshall and Jaggers (2002).

Years in Office
Years the chief executive has been in office. Source: Keefer (2002)

Years since Independence
Source for the date of independence: Gleditsch and Ward (1999).

Appendix 2:

Proposition: There is a critical value of coup risk below which the officers make no threats and above which they successfully extort.

Proof:

The key step in establishing this is the proof that the maximum threat, t^*, is a monotonic increasing function of the coup risk per officer, r. The proof starts from the behaviour of the officer corps in the neighborhood of r=0. From (9), as $r \rightarrow 0$, $L^{NC} \rightarrow 0$. Hence, (10) can only hold if t is chosen so that $L^C \rightarrow 0$. But from (9) this requires that $t^* \rightarrow 0$. Thus, when the coup risk per officer is negligible the optimal threat is negligible.

Again starting from the neighborhood of r=0, now consider the effect of an increase in r on L^{NC}:

$$dL^{NC}/dr = \beta(z-t)\gamma M^* - \delta t/\delta r(\beta\gamma r M^*) > 0. \qquad \text{(A2.1)}$$

Since the increase in r increases L^{NC}, to maintain (10) t must alter so as to achieve an equal increase in L^C. Differentiating L^C with respect to t:

$$dL^C/dt = M^{*2}ct^2 > 0. \qquad \text{(A2.2)}$$

Thus, as r increases from zero, the maximum threat also increases from zero. As r increases further, the second term of (A1.2) becomes non-negligible. However, this term can only be negative while $\delta t/\delta r > 0$. Suppose that at some stage t ceases to be increasing in r, so that $\delta t/\delta r = 0$. At this point the second term of (A1.2) collapses to zero, leaving only the first term, which, as long as $z>t$, is strictly positive. Hence, an increase in r must continue to increase L^{NC}, requiring an equal increase in L^C which must be achieved by an increase in t. Hence, as long as $z>t$, $\delta t/\delta r > 0$.

Tables

Table 1: Means and Standard Deviations

Variable	*Sample*	*Non Africa*	*Africa*
Proportion of observations with	0.038	0.029	0.055
Coup d'Etats	(0.191)	(0.166)	(0.228)
Military expenditure	3.349	3.662	2.782
(% of GDP)	(3.995)	(4.461)	(2.893)
ln Military Expenditure	1.252	1.294	1.175
	(0.596)	(0.635)	(0.509)
ln Neighbours Military	1.208	1.214	1.198
Expenditure t-1	(0.649)	(0.725)	(0.483)
Military Personnel	177,289	249,038	34,246
	(454,056)	(541,353)	(48,884)
ln Military Personnel	10.733	11.271	9.662
	(1.651)	(1.540)	(1.306)
GDP per capita	2424	3406	650
(const US$)	(4427)	(5226)	(891)
ln GDP per capita t-1	6.924	7.443	5.987
	(1.267)	(1.150)	(0.865)
Income growth t-1	1.237	1.603	0.577
	(5.985)	(5.832)	(6.199)
Repression dummy	0.458	0.363	0.635
	(0.498)	(0.481)	(0.482)
Post Cold War dummy	0.387	0.402	0.358
	(0.487)	(0.490)	(0.480)
Years since last Coup	24.856	26.518	21.854
	(16.887)	(16.669)	(16.870)
Time Trend	24.155	24.521	23.493
	(11.608)	(11.677)	(11.458)
Observations	3267	2103	1164

Note: Standard Deviations in parentheses.

Table 2a: Coup Risk and Military Expenditure

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
		Equation 1: ln Mil. Ependiture			
Coup risk	-0.465***		-0.464***	-3.160***	-10.697***
	(0.094)		(0.101)	(0.450)	(1.187)
ln Neighb.Milex t-1	0.404***		0.405***	0.415***	0.410***
	(0.040)		(0.040)	(0.017)	(0.017)
Post Cold War	-0.183***		-0.183***	-0.099***	-0.133***
	(0.061)		(0.062)	(0.021)	(0.022)
Years since last Coup	-0.009***		-0.009***	-0.002***	-0.006***
	(0.003)		(0.003)	(0.001)	(0.001)
Africa dummy			-0.011	-0.136***	
			(0.050)	(0.076)	
Africa dummy*				1.389***	
Coup risk				(0.491)	
Coup risk squared					55.076***
					(7.418)
R^2	0.27		0.27	0.24	0.25
		Equation 2: Coup Risk			
ln military expenditure	0.109	0.102	-0.119		
	(0.213)	(0.211)	(0.214)		
Ln GDP t-1	-0.177***	-0.174***	-0.163***		
	(0.047)	(0.047)	(0.053)		
Growth t-1	-0.018**	-0.018**	-0.018**		
	(0.008)	(0.008)	(0.008)		
Repression t-1	-0.250***	-0.242***	-0.267**		
	(0.110)	(0.110)	(0.116)		
Time since last coup	-0.019***	-0.019***	-0.019***		
	(0.004)	(0.004)	(0.004)		
Time trend	-0.017***	-0.017***	-0.017***		
	(0.004)	(0.004)	(0.004)		
Africa dummy			0.064		
			(0.118)		
Number of observations	3256	3256	3256	3256	3256
Pseudo R2	0.11		0.11		
Log likelihood	-440.2	-2827.18	-440.08		
Number of coups	124	124	124	124	124

Notes: Columns (1) and (3) are estimated by two stage least squares probit. Estimation in column (2) is based on IV probit. Columns (4) and (5) are estimated by OLS with robust standard errors, estimated coup risk obtained from the regression presented in column (1). p values in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%, all regressions include an intercept.

Table 2b: Coup Risk and Military Personnel

	(6)	*(7)*
Equation 1: ln Military Personnel		
Coup risk	-0.755**	-0.379**
	(0.332)	(0.174)
ln Neighb.Milex t-1	0.684***	0.133
	(0.151)	(0.092)
Post Cold War	0.024	0.267**
	(0.169)	(0.138)
Years since last Coup	-0.011*	-0.006*
	(0.006)	(0.003)
ln GDP t-1	0.135	0.216***
	(0.110)	(0.058)
ln population	0.894***	0.928***
	(0.044)	(0.028)
ln military expenditure		0.910***
		(0.079)
R^2	0.81	0.86
Equation 2: Coup Risk		
ln military personnel	-0.003	-0.007
	(0.054)	(0.061)
Ln GDP t-1	-0.266***	-0.240***
	(0.079)	(0.090)
Growth t-1	-0.022**	-0.027**
	(0.010)	(0.012)
Repression t-1	-0.056	-0.067
	(0.171)	(0.201)
Time since last coup	-0.013***	-0.012**
	(0.004)	(0.005)
Time trend	-0.022	-0.029
	(0.016)	(0.021)
Number of observations	1895	1425
Pseudo R2	0.13	0.13
Log likelihood	-158.16	-109.60
Number of coups	41	41

Notes: Two stage least squares probit estimation. p values in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%, all regressions include an intercept.

Table 3: Coup Risk – Some Robustness Checks

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	(6)
ln military	-0.407	-0.318	-0.068	0.114	0.100	0.099
expenditure	(0.357)	(0.331)	(0.211)	(0.213)	(0.224)	(0.270)
ln GDP t-1	-0.175***	-0.196***	-0.222***	-0.175***	-0.186***	-0.135
	(0.071)	(0.066)	(0.056)	(0.047)	(0.049)	(0.089)
Growth t-1	-0.025**	-0.025***	-0.018**	-0.017**	-0.018**	-0.020**
	(0.010)	(0.010)	(0.008)	(0.008)	(0.008)	(0.010)
Years since	-0.014***	-0.022***	-0.018***	-0.019***	-0.019***	-0.019***
last coup	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Time trend	-0.030***	-0.029***	-0.018***	-0.018	-0.017	-0.032***
	(0.010)	(0.009)	(0.004)	(0.004)***	(0.004)***	(0.009)
Repression t-1	-0.191	-0.213	-0.207*	-0.250***	-0.226**	-0.256***
	(0.155)	(0.137)	(0.109)	(0.110)	(0.115)	(0.147)
Finite term	-0.352**					
(dummy)	(0.177)					
Years in office		0.017*				
		(0.010)				
Years since			0.002**			
Independence			(0.001)			
Natural				0.060		
Res. Rents				(0.042)		
Ethnic					0.088	
dominance					(0.098)	
Aid						0.025*
						(0.015)
Number of observations	2162	2186	3224	3256	3109	2568
Pseudo R2	0.14	0.13	0.11	0.11	0.11	
Log likelihood	-226.64	-250.75	-438.01	-439.27	-460.12	-10601.66

Notes: Columns (1)-(5): Two stage least squares probit estimation, only probit results presented. Column (6) IV probit, military expenditure and aid are instrumented; instruments for aid: UN voting*French aid, geographic distance*UK Aid, UN voting*US aid, religion*German aid, UN voting*German aid. p values in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%, all regressions include an intercept. We also tried including the following variables in our core model: polity index, number of checks (veto players), income inquality (Gini), ethnic diversity (Alesina et al.), former British colony and press freedom. None of these variables were significant.

Table 4: Coup Risk in Africa: Plots, Attempts and Successful Coups

	(1)	*(2)*	*(3)*	(4)
	Plots	Plots	Attempts	Coups
		Equation 1: ln Mil. Expenditure		
Risk	0.588***	0.708***	0.109**	0.086**
	(0.001)	(0.000)	(0.045)	(0.049)
ln Neighb.Milex	0.403***	0.409***	0.395***	0.391***
t-1	(0.000)	(0.000)	(0.000)	(0.000)
Post Cold War	0.146***	0.148**	0.118***	0.065**
	(0.010)	(0.018)	(0.000)	(0.015)
days since	0.0001***	0.0001***	0.0000	0.00002***
last event	(0.000)	(0.000)	(0.307)	(0.000)
R^2	0.090	0.102	0.07	0.07
		Equation 2: Coup Risk		
Military	-0.161	-0.212	-0.243	-0.814***
expenditure	(0.333)	(0.217)	(0.242)	(0.011)
ln GDP t-1	-0.119**	-0.089*	-0.178**	-0.219**
	(0.024)	(0.091)	(0.017)	(0.033)
Growth t-1	-0.022***	-0.029***	-0.024**	-0.039***
	(0.008)	(0.001)	(0.026)	(0.014)
days since last	-0.0001***	-0.0001***	-0.0001***	-0.00003
Event	(0.000)	(0.000)	(0.000)	(0.158)
Time trend	-0.010***	-0.010***	-0.007	-0.016***
	(0.004)	(0.003)	(0.108)	(0.011)
Ethnic		0.273***	0.182*	0.343***
Dominance		(0.078)	(0.059)	(0.009)
Number of	5090	5090	5090	5090
observations				
Pseudo R2	0.05	0.06	0.07	0.09
Log likelihood	-808.53	-802.81	-491.36	-252.02
Number of events	203	203	109	49

Notes: Two stage least squares probit estimation, only probit results presented. z values in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%, all regressions include an intercept.

Table 4: Coup Risk in Africa: Plots, Attempts and Successful Coups, with repression

	(1)	*(2)*	*(3)*	(4)
	Plots	Plots	Attempts	Coups
		Equation 1: ln Mil. Expenditure		
Risk	0.141**	0.383***	0.009	-0.004**
	(0.073)	(0.092)	(0.044)	(0.033)
ln Neighb.Milex	0.407***	0.422***	0.413***	0.396***
t-1	(0.023)	(0.034)	(0.019)	(0.021)
Post Cold War	0.031***	0.053	0.054***	-0.005
	(0.026)	(0.018)	(0.021)	(0.023)
days since	0.0004***	0.0001***	0.000	0.00001***
last event	(0.0000)	(0.000)	(0.000)	(0.000)
R^2	0.09	0.11	0.08	0.06
		Equation 2: Coup Risk		
Military	-0.159	-0.215	-0.172	-0.626**
expenditure	(0.160)	(0.166)	(0.205)	(0.316)
ln GDP t-1	-0.124**	-0.090*	-0.188***	-0.235**
	(0.055)	(0.055)	(0.077)	(0.108)
Growth t-1	-0.033***	-0.042***	-0.029**	-0.039**
	(0.010)	(0.011)	(0.014)	(0.019)
days since last	-0.0001***	-0.0001***	-0.0001***	-0.00003
Event	(0.0000)	(0.000)	(0.0000)	(0.000)
Time trend	-0.008**	-0.009***	-0.007	-0.016**
	(0.004)	(0.004)	(0.004)	(0.007)
Repression t-1	0.031	0.017	-0.043	-0.156
	(0.090)	(0.090)	(0.105)	(0.140)
Ethnic		0.289***	0.188*	0.327**
Dominance		(0.081)	(0.101)	(0.139)
Number of	4820	4820	4820	4820
observations				
Pseudo R2	0.05	0.06	0.06	0.09
Log likelihood	-752.69	-746.69	-445.74	-228.86
Number of events	188	188	97	44

Notes: Two stage least squares probit estimation, only probit results presented. z values in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%, all regressions include an intercept.

Table 5: Detection and Prevention of Plots, Attempts and Coups

	(1)	(2)	(3)	(4)	(5)	(6)
	Attempts	Attempts	Attempts	Coups	Coups	Coups
Ethnic diversity	-0.006*	-0.001	-0.001	-0.002		
	(0.003)	(0.002)	(0.002)	(0.004)		
Repression t-1	-0.465***	-0.640	-0.640	-0.260		
	(0.179)	0.424	(0.395)	(0.223)		
		p=0.131	p=0.106			
trend	-0.0002	-0.003	-0.003	-0.025***	-0.027***	-0.028***
	(0.007)	(0.004)	(0.004)	(0.010)	(0.009)	(0.009)
ln GDP t-1					-0.326*	-0.424**
					(0.196)	(0.199)
Landlocked					0.213	
					(0.226)	
No of neighbours						-0.039
						(0.049)
residuals			0.480			
			(0.401)			
Pseudo R2	0.03	0.50	0.04	0.04	0.06	0.06
observations	291	291	291	160	161	161

Notes: Columns 1, 4-6 Probit estimation, z values in parentheses. Column 2: 2SLS estimation, instruments for repression are French and British colony. Column 3: OLS regression, * significant at 10%; ** significant at 5%; *** significant at 1%, all regressions include an intercept.

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