Senior Thesis

Department of Economics

"State Strength and Terrorist Activity in the Middle East"

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Abstract

This paper examines the relationship between state strength and terrorist activity through the number of attacks and total deaths in the Middle East and North Africa. To do so, my variable of interest is arms transfers received. In addition to arms transfers, multiple variables are used in the spirit of the Greed-Grievance model proposed in Collier and Hoeffler (2004). Using panel data and a zero-inflated Poisson regression technique, this study finds that while statistically significant, arms transfers have a minimal impact on the amount of terrorist activity measured through both dependent variables.

Acknowledgements:

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I.   Introduction

The daily threat of terrorism in the Middle East and North Africa (MENA) is a well-documented phenomenon that is a clear disruption to the establishment of prosperous and peaceful societies. In recent years, countries that are outside the traditional sphere of influence on the MENA have played an increased role in the region's politics, one that is both contested and supported by citizens of MENA countries and the foreign influencers.

Following the September 11th attacks on the World Trade Center in 2001, the United States and the Western coalition invaded Iraq in 2003, toppling Saddam Hussein and his single-party Ba'athist government. In doing so, a regional power-broker was displaced, leading to widespread unrest and terrorism in a newly established, fledgling state. In the years following the end of the Hussein regime, the U.S. and other Western states have attempted to create a government capable of standing on its own. The methods of assistance have been varied, including military, humanitarian, and economic aid. However, these forms of aid are not limited just to Iraq; the U.S. and the rest of the West are heavily involved in aiding MENA countries as they suffer from constant terrorism, powerful non-state actors, kleptocratic dictators, and other societal scourges.

One form of economic aid – arms transfers – bears particular consideration. The purpose of arms transfers is to give weak states the ability to defend themselves from threats, both foreign and domestic. The U.S. and other Western states allowance of billions of dollars in arms transfers over the past decade or so is noteworthy. As previously stated, the foreign donor countries supply help in various forms and knowing if one form of help is effective or not is essential to correctly gauging the correct

allocation of recipient resources. If these western countries are truly committed to the business of state building and stabilization, then it is worthwhile to investigate how the arms transfers are performing in their supposed role of strengthening states against non-state actors. Such an investigation has significant policy implications; depending on the findings, it may logically follow to shift recipient resources away from arms transfers or shift resources towards arms transfers. Additionally, the findings of this research may indicate to Western countries the manner in which their ability to influence is best used.

In order to adequately gauge how the arms transfers have affected violence in MENA countries, a specification of terms is necessary. Arms transfers for the purpose of this study are arms that have been transferred to MENA states by Western states such as the U.S., Great Britain, and France. The definition of terrorism will be confined to armed-assault style terrorism. This includes attacks with the objective of causing harm to human beings through the use of firearm, incendiary, or sharp instruments that may or may not be accompanied with explosive weapons (Global Terrorism Database). The attack must register a minimum of one fatality to be counted.

II. Literature Review

Before Collier and Hoeffler (2004), most of the models about a country's risk of facing a conflict were based on political and sociological variables. Collier and Hoeffler (2004) is the first study to model rebellion (whether or not civil war occurred in a five year period) as a function of the opportunity cost of participating in rebellion – foregone income, chance of death, etc. In their econometric model, they include opportunity cost variables together with grievance variables to gauge the probability that one is engaging

in rebellion and find that their economic and opportunity cost indicators were much stronger predictors than their grievance ones. Using logit regression they found that for every percent of GDP growth since the last period, risk of conflict fell by 0.113 percent. Additionally, when proxying for foregone income with GDP per capita, Collier and Hoeffler found that for every percent increase in GDP per capita, risk of conflict fell by 0.95 percent. On the other hand, the grievance-based variable of democracy (on a -10 to 10 rating) indicates that an increase of one point only led to a 0.042 reduction in the odds of civil war occurring in a five year period. With a mean risk of 11 percent across the board for all countries that did fall into civil conflict from 1960-1999, the opportunity-based results above illustrate the importance of economic conditions on civil conflict.

Concerned about the endogeneity of random income shocks in countries embroiled in civil war, Miguel et al. (2004) ran a two-stage least-squares regression using current and lagged rainfall as an instrument for per capita economic growth. Current and lagged rainfall are both significantly related to income growth at the 95 percent level. They find a larger result than Collier and Hoeffler (2004) - that a single percentage point of GDP growth decreases the risk of civil conflict by 2.25 percent. Miguel et al. also looked at GDP per capita through two separate OLS regressions and interestingly got opposite effects, one negative (-0.041) and one positive (0.085). They do not go on to explain this abnormality. Moreover, the democracy variable used in their OLS regression was not impactful. Using the same democracy scale and data set as Collier and Hoeffler (2004), their coefficient was only 0.003.

Piazza (2006) and Abadie (2006) also compare economic conditions to political and sociological variables but got significantly different results than the previously

mentioned papers. Piazza used two alternative dependent variables; (1) casualties and (2) incidents of terrorism in ninety-six countries from 1986-2002. For each dependent variable they estimated four OLS regressions: in the baseline regression he finds that none of the economic variables were significant. In the next three OLS regressions he included sociological and political variables which he found to be much better predictors of terrorist incidents, although the direction of the effects are inconsistent. For example, the coefficient on population growth variable varied from a low of -0.091 to a high of 0.351. The inconsistencies are interesting, but it still stands that in Piazza (2006), non-economic factors are better predictors of terrorist incidents. Similarly, Abadie (2006)'s findings suggest that non-economic factors are better predictor of terrorist incident. Piazza (2006) and Abadie (2006) findings are in sharp contrast to Collier and Hoeffler (2004) and Miguel et al. (2004) and opens up the discussion as to what are the driving factors of terrorist activity.

Bridging the gap between research that points to either economic or sociopolitical factors being important is Fearon and Laitin (2001). In their research using logit regression, they find that both economic factors and sociopolitical factors are important in the prediction of civil conflict. Their study was specific to conflict from 1945-1999. In concordance with Collier and Hoeffler (2004), they found that GDP growth was a powerful determinant, as it reduced the risk of civil war onset by 30 percent for every point of GDP growth from the previous period. Most interesting, however, is their variable that accounts for political instability in the three years prior to the year in question. They find a 2.7 percent increase in the odds of conflict for a single unit increase in the instability variable.

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Clearly, the current literature has yet to come to a consensus on what the root causes of rebellion and terrorism are. With some research pointing to economic factors, some to sociopolitical factors, and some to both, the verdict is not in. What this paper aims to do is establish a relationship between state strength and the level of terrorist activity in a country.

III. Theoretical Model

The mainstream school of economic thought behind civil conflict is rooted in opportunity costs, that is, the cost of engaging in war against the state. The economic theory for this paper was developed in Collier and Hoeffler's 2004 paper titled "Greed and Grievance in Civil War". Collier and Hoeffler propose in their model that opportunity cost as well as grievance is what drives a rebel's decision to act. The difference between this paper and Collier and Hoeffler (2004) is in the way that the opportunity cost of fighting the state is measured. Collier and Hoeffler proxied for the tools at the disposal of rebelling forces by using the number of a specific ethnic group in the United States, assuming that the rate of sympathy for rebel groups is constant across all ethnicities. For example, when accounting for the capabilities of the Tamil Tigers in Sri Lanka, Collier and Hoeffler (2004) used the number of Tamils in the United States. This paper will use the tools at the disposal of the state (arms transfers received and military expenditure) to account for the opportunity cost of fighting the state. In this study, variables will either be classified as an opportunity cost (greed) variable or a grievance variable.

Greed		Terrorist Activity		Grievance
The opportunity cost of disengaging from the economy and fighting the state.				Socio-political reasons for fighting the state.

Dependent Variables

The Global Terrorism Database has many variables to classify each attack. For example, total casualties, total killed, motivation for attack, type of attack, and weapons used are just a few of them. The first of two dependent variables will be the number of armed-assaults (with at least one death) per year in a country. This variable was selected due to the capabilities that arms transfers provide to countries; they strengthen the state against traditionally-styled military attack, which armed-assaults most closely resemble. It is not fair to expect an F-16 or an Abrams tank to prevent non-traditional attacks like suicide bombings, so those will not be included in the analysis. Additionally, the second dependent variable will be the total number of deaths from armed-assaults in a year in a country. This is used to determine the effectiveness of terrorist organizations and whether

or not arms transfers abate that effectiveness. This data will be obtained from the Global Terrorism Database sponsored by University of Maryland.

Greed (Opportunity Cost) Variables

The variable of interest, arms transfers received, is being used as one of the proxy variables for state strength, as is state military expenditure. These two variables together capture some of the costs of engaging in military-style action against the state and will be obtained from the Stockholm International Peace Research Institute (SIPRI). Additionally, when a terrorist chooses to act against the state, they are electing to not participate in the economy and forgo income through traditional means. Foregone income will be measured through GDP per capita, courtesy of the World Bank.

Grievance Variables

One of the primary grievances that citizens can have against a government is the inability to have a say in their government, and this will be accounted for through a democracy variable. The democracy variable is quantified as -10 to 10, with the lower bound being a totally autocratic state and the upper bound being a wholly democratic state. The purpose of including it in the model is to account for the ability of the citizens in a country to have a say in the way that their country is run. The expected sign is negative, with a higher democracy rating leading to lower terrorist activity. Another grievance variable to be included will be an ethnic fractionalization variable courtesy of Fearon (2003). This variable will be held constant for each country at each year, as it is a slowly changing variable that shifts over generations. Because the ethnic makeup of a

country changes very slowly, it is common practice in the literature to hold this constant for each country over the period of study; this study will follow suit. The final grievance variable will be population. The intuition behind including this variable is that the larger a population is, the greater the chance is that that population is not homogenous, whether it be politically, religiously, or any other forum in which people commonly disagree, increasing the chances of conflict.

IV. Econometric Model

This paper will be looking at MENA countries from 2003 to 2014. The panel data will be analyzed using a zero-inflated Poisson regression. This technique accounts for a high frequency of zeroes in count data, something that is present in both of the dependent variables. Additionally, the zero-inflated Poisson automatically applies the natural log to whatever the dependent variable is, even if it is not input as a natural log function. This makes all of the outputs of the model different types of elasticities, whether the independent variable has had the natural log applied to it or not. Based on the Greed-Grievance model, I hypothesize that state strength will have a negative relationship with armed-assaults per year in a country as well as total number of people killed.

$$lnArmedAssaults \text{ and } lnTotalKilled = \beta_0 + \beta_1 lnATR + \beta_2 Milex + \beta_3 EthnicFrac + \beta_4 Democracy + \beta_5 lnGDPpC + \beta_6 lnPop + \varepsilon$$

lnATR, the variable of interest, measures the natural log of the arms transfers received by a country. The expected sign is negative because it increases the opportunity cost of fighting a state. Milex measures the military expenditure of a country in billions of 2011 USD in a given year. This relationship is also expected to be negative because greater military expenditure should increase the opportunity cost of taking up arms against the state. EthnicFrac measures the ethnic fractionalization of a country from 0 to 100 in 1 point increments. The expected relationship is positive because the more ethnically fractionalized a country is, the more opportunities there are to disagree about important issues as well as have ethnic rivalries come to a head. Democracy is a rating of a country's political and civil rights that scales from -10 to 10, with -10 being an autocracy and 10 being a democracy. The expected relationship is negative because as democracy rating increases, the incentive to change the government through force decreases. lnGDPpC measures the natural log of GDP per capita which is expected to have a negative relationship with terrorist activity because as income grows, the incentive to overthrow the government should fall. lnPop measures the natural log of the population. The expected sign is positive because as population grows, the number of opportunities for intense disagreement amongst the population grows. lnArmedAssaults measures the natural log of armed-assaults and lnTotalKilled measures the natural log of the total number of deaths from armed-assaults.

V. **Data**

The GDP per capita and population variables were obtained from the World Bank Indicators for the years 2003-2014 and because of both the heightened level of conflict

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and lack of development in some of the MENA countries, there is a significant number of holes in the data. Additionally, the democracy variable was obtained from the Polity IV Project sponsored by the Center for Systematic Peace while the military expenditure and arms transfer data was obtained from the Stockholm International Peace Research Institute, better known as SIPRI. The last variable used was ethnic fractionalization from Fearon (2003). In Fearon's 2003 index, a rating of 0 would indicate complete ethnic homogeneity while a value of 1 would indicate of complete ethnic fractionalization. Clearly, Fearon's paper was published before the time frame observed in this study, and this study will follow the common practice of the literature in applying Fearon's ethnic fractionalization index to all the years observed for each country. The rationale for doing so is that the ethnic make-up of a country is very slow moving over time, so it is sensible to apply the constant value to all the years observed. Because this study focuses on the occurrence of terrorism in the MENA area following the displacement of a regional power-broker (Hussein), it is naturally limited in scope, covering only 2003 to 2014.

VI. Results and Discussion

Variables	Armed-Assaults MENA Countries	Total Killed MENA Countries	Armed-Assaults MENA w/o Iraq	Total Killed MENA w/o Iraq
	Zero-Inflated Poisson Models			
lnPop	***0.213 (0.05)	0.026 (.0258)	***0.322 (0.062)	***0.18 (0.034)
lnGDPpC	***-2.23 (.065)	***-2.49 (0.036)	***0.435 (0.08)	***-0.168 (0.052)
EthnicFrac.	***0.06 (0.001)	***0.064 (0.0007)	***-0.027 (0.0025)	***-0.014 (0.0015)
Democracy	***0.169 (0.006)	***0.14 (0.0035)	***-0.053 (0.0097)	-0.005 (0.006)
Milex	-0.0049 (0.0075)	***0.019 (0.003)	***-0.0684 (0.008)	***-0.039 (0.005)
lnATR	***0.411 (0.021)	***0.466 (0.012)	***-0.097 (0.029)	***-0.056 (0.016)
Obs.	177	177	166	166

*standard errors in parentheses. *,**,*** indicates 90, 95, and 99 percent confidence respectively

The variable of interest, arms transfers received, showed as positive and statistically significant in the first two regressions with a one percent increase in arms transfers received leading to a 0.411 percent increase in armed-assaults and a 0.466 percent increase in total deaths. Additionally, democracy is shown in both of the first two regressions to increase terrorist activity while military expenditure is shown to increase terrorist activity in one of the two dependent variables. These go against the Greed-Grievance model applied in this study, so naturally, it was questioned why.

These two regressions included all MENA countries and because of it, the distribution shape of the dependent variables was distorted. The zero-inflated Poisson calls for a falling frequency of dependent 'events' as you get further away from zero. With all countries included, the data had multiple observations ranging from 96 to 447 - where the frequency should be negligible and approaching zero – all due to Iraq suffering from an unusually high number of attacks per year whereas other countries suffer from far fewer, with a mean of 5.76 per year. Because the shape of the data with all countries included violates the assumptions needed for the model, the same two regressions were run with Iraq removed from the data.

The results that were returned with respect to arms transfers received took the expected sign when Iraq was removed from the data set. A one percent increase in arms transfers received leads to a 0.097 percent decrease in number of armed-assaults and a 0.056 percent decrease in total deaths. To put this in perspective, a doubling of arms transfers received (a 100 percent increase) would lead to a 9.7 percent decrease in armed-assaults and a 5.6 percent decrease in total deaths. The other state strength variable, military expenditure, showed a statistically significant but small effect on terrorist

activity. For every billion 2011 USD of military expenditure, the number of armed-assaults falls by 0.0684 percent while the total number of deaths only falls by 0.039 percent.

Interestingly, once Iraq was removed from the data set, democracy and ethnic fractionalization flipped signs for both dependent variables while GDP per capita flipped signs for only one of the dependent variables. The democracy variable went from positive to negative – most likely due to the removal of Iraq and its always-rising democracy trends in the period of the study in which terrorism rose alongside the level of US involvement. Ethnic fractionalization, the measure of a country's ethnic homogeneity, also ended up with a negative effect on terrorism – something that was highly unprecedented. GDP per capita had the largest effect on terrorist activity across the board. In the two regressions without Iraq, a one percent increase in GDP per capita showed a 0.435 percent increase in armed-assaults effect and a 0.168 percent decrease in total deaths. The positive effect of GDP per capita on terrorist activity could be due to several factors. First, rising income inequality could be to blame. If the GDP of a country is rising but all of the gains go to the top, GDP per capita will be a distorted figure when accounting for foregone income. Additionally, because of the law of diminishing returns, as each new unit of income is gained its value is lower than the previous unit gained. Such an effect could render GDP per capita change past a certain point negligible in predicting terrorist activity.

VII. Policy Implications

When it comes to arms transfers, the data indicates that they are most likely not the best method by which to reduce terrorist activity. With a doubling of arms transfers received leading to only a 9.7 percent decrease in the number of attacks and a 5.6 percent decrease in number of deaths, arms transfers are a costly method of reducing terrorism that over-flood the market with deadly tools. Additionally, military expenditure proved to be fairly inefficient in typical countries as well with every extra billion 2011 USD spent on the military leading to only a 0.039 percent decrease in total deaths from armed-assaults.

From this, it should be recommended to MENA state with terrorist activity issues that they should focus their resources in other places once they are reasonably defensed. These areas could be anything from promotion of civil participation in society and government to increasing the standard of living for their citizens. Moreover, it is unlikely that the West will abandon its interests in the region all together. If, however, major arms dealing countries in the West reconsidered allowing shipments of weapons to MENA countries in turmoil in favor of a 'soft power' approach, the situation may improve. For example, such an act may look like the reestablishment of the United States Information Agency, albeit in a 'lighter' form, an organization whose explicit purpose was to advocate for US policies to foreign cultures.

VII. Conclusion and Limitations

The major takeaways from this study are numerous. First and foremost is that the sheer level of terrorist activity in Iraq is a regional and global anomaly. The second major

takeaway is that while increasing state strength does deter terrorist activity, it is not a very effective method of doing so. Additionally, arms transfers and military expenditure are very expensive and often cost in the billions of dollars, money that could be better spent domestically for countries that are already adequately defensed. Lastly, the largest effect over all of the regressions is GDP per capita. This most likely means that above all else, people value the ability to make a living over political rights and their capabilities of fighting the state.

A limitation of this study is the loss of observations due to missing a variable or two and having to delete the whole observation. Another issue was the inability to account for the non-monotonic effect of the democracy variable. Literature has shown that the further away from zero that the democracy rating is, the lower the terrorist activity level. Additionally, the arms transfers received variable was in total 1990 USD. Because of this, differences in weapons systems and their effectiveness is unaccounted for. At cost of production, one F-16 is approximately the cost of two M1 Abrams tanks, which is approximately the cost of 26,857 M4 Carbines. Clearly, these all have vastly different purposes, purposes that were unable to be accounted for when using total dollar values. Lastly, this study assumes that there is no two-way causality and possible endogeneity may bias the results. Future work should focus on correcting these issues.

IX. Appendix

Descriptive Statistics All Countries					
Variable	N	Mean	Standard Deviation	Minimum	Maximum
Armed-assaults	214	15.83	54.55	0	447
Total Killed	226	51.63	200.36	0	2337
Population	214	24447885.32	25264025.39	668165	89579670
GDPpC	206	12611.88	15202.14	698.97	62168.77
EthnicFrac	202	45.59	22.78	4.00	78.00
Democracy	214	-2.72	6.06	-10	10
Milex	200	8.226	11.65	0.501	73.717
ATR	199	3.645	4.70	0.01	27.82

Descriptive Statistics Without Iraq					
Variable	N	Mean	Standard Deviation	Minimum	Maximum
Armed-assaults	202	5.76	16.78	0	122
Total Killed	214	20.13	54.8	0	421.16
Population	202	24126491.47	25962153.40	668165	89579670
GDP per Capita	194	13263.83	15431.54	978.97	62168.77
EthnicFrac.	190	45	23.37	4	78
Democracy	202	-2.79	6.13	-10	10
Milex	189	8.458	11.939	0.501	73.717
ATR	188	3.639	4.825	.01	27.82

Variables and Descriptions	
Armed-assaults	Armed-assaults: N. Total armed-assaults in a country in a year resulting in at least one fatality.
Total Killed	Total Killed: N. Total number of people killed in a country in a year due to armed-assaults.
lnPop	Natural log of Population: % change effect. Expected sign (-)
lnGDPPC	Natural log of (GDP per Capita): Current USD. Divided by 1000 so that a value of 1 = 1000 dollars per capita. Measures the gross domestic product of a country per person. Expected sign (-)
EthnicFrac	Ethnic Fractionalization: A measure ranging from 0 to 1 multiplied by 100. 0 is completely homogeneous; 100 is completely fractured. Expected sign (-)
Democracy	Democracy: A -10 to 10 rating of the political rights of citizens in a given country. Expected sign (-)
lnPop	Population: % change effect. Expected sign (-)
Milex	Military Expenditure: USD (2011) (Millions) Divided by 1000 so that 1 = 1 Billion dollars spent by the federal level of government on the military. Expected sign (-)
lnATR	Arms Transfers Received: Natural log of (USD (1990) (Millions) originally in thousands) so that 1 = 100 million dollars. Arms imported per person in the country. Expected sign (-)

MENA Countries	
Algeria	Bahrain
Egypt	Iran
Iraq	Israel
Jordan	Kuwait
Lebanon	Libya
Morocco	Qatar
Saudi Arabia	Syria
Tunisia	Turkey
United Arab Emirates	Yemen

* some countries had to be omitted because of lack of data or one database included one and another did not.

SAS Code

```
/*cutting GTD to armed-assaults for the years, countries, and nkill I
want*/

data one;
set sproject.gtd;
if iyear > 2003;
if iyear <2015;
run;

data two;
set one;
if region = 10;
run;

data three;
set two;
if attacktype1=2;
run;

data sproject.gtd;
set three;
if nkill>0;
run;

/*reorganizing GTD data*/

proc sort data=sproject.fulldata out=sproject.sortedfull;
by country_name year;
run;

/*counting up armed-assaults*/

proc means data=sproject.gtd;
by iyear country;
out=out1 n= occurrences;
run;

/*merging armed assault by country/year data with world bank data */

DATA merged ;
MERGE work.out1 sproject.sortedfull ;
BY country_name year ;
run;

Proc means data= work.merged;
 qntldef=1
 n median q1 q3;
 var occurrences;
run;

/*makes output easier to interpret, some variables may go unused*/

data work.mergedclean;
```

```
set work.merged;

	logoccurrences=log(occurrences);
	logpop=log(population);
	PopD1000= Population_Density/1000;
	GDPpC1000=GDP_per_capita/1000;
	logGDPperCapita=log(GDP_per_capita);
	Ethnic100=Ethnic_Diversity*100;
	EVI1000=Export_Value_index/1000;
	Milex1000=Milex/1000;
	AT100=Armstransfers/100;
	logAT=log(Armstransfers);


run;

data work.mergedcleaner;
set work.merged;

	logoccurrences=log(occurrences);
	logpop=log(population);
	PopD1000= Population_Density/1000;
	GDPpC1000=GDP_per_capita/1000;
	logGDPperCapita=log(GDP_per_capita);
	Ethnic100=Ethnic_Diversity*100;
	EVI1000=Export_Value_index/1000;
	Milex1000=Milex/1000;
	AT100=Armstransfers/100;
	logAT=log(Armstransfers);

	if year = 2015  then delete;

run;

/*creating second dependent variable, nkill*/

proc sql;
create table countedagain as
select country_txt, iyear, sum(nkill) as nkill_sum from work.four group
by country_txt, iyear;
quit;

proc sql;
create table m as
select * from mergedcleaner, countedagain
where mergedcleaner.country_name=countedagain.country_txt and
mergedcleaner.year=countedagain.iyear;
quit;

data countedagain;
set countedagain;
rename country_txt=Country_name;
rename iyear=year;
run;

data z;
set mergedcleaner;
```

```
run;

data z;
merge mergedcleaner countedagain;
by country_name year;
run;

data zzz;
set z;
 if nkill_sum = "." then nkill_sum = 0;
 kpo=nkill_sum/occurrences;
 run;

data a;
set zzz;
      if country_code = "IRQ" then delete;
run;

/*proc means for appendix*/

proc means data = zzz;
run;

proc means data = a;
run;

/*zero-inflated poisson models*/

proc genmod data = zzz;
  model occurrences = logpop logGDPperCapita Ethnic100 Democracy
milex1000 logAT /dist=zip;
  zeromodel /link = logit;
run;

proc genmod data = zzz;
  model occurrences = logpop logGDPperCapita Ethnic100 Democracy
milex1000 logAT /dist=zip;
  zeromodel /link = logit;
run;

proc genmod data = a;
  model occurrences = logpop logGDPperCapita Ethnic100 Democracy
milex1000 logAT /dist=zip;
  zeromodel /link = logit;
run;

proc genmod data = a;
  model occurrences = logpop logGDPperCapita Ethnic100 Democracy
milex1000 logAT /dist=zip;
  zeromodel /link = logit;
run;

/*fin*/
```

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