Determinants of civil war risk: an empirical assessment

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ABSTRACT
This paper examines the impact of various determinants on civil war risk in developing countries. Based on data from the World Bank and the United Nations Development Program, we apply logistic regression to a sample of twenty-one developing economies and find that religious and ethnic diversity as well as the interaction term between them, inequality in the distribution of land and income, years of education, population size, share of exports in the GDP, the proportion of the male population between 15 years of age and 24 that is not in school and who are unemployed, and per capita GDP growth all contribute to the risk of civil wars in these countries. On the other hand, political democracy and civil liberties as measured by the Polity IV index and the share of primary commodity exports in the GDP are not statistically significant in influencing the risk of civil wars. We observe that the coefficient estimates of three explanatory variables do not have their anticipated sign due possibly to the severe degree of multicollinearity among them. Statistical results of such empirical examination will assist governments in developing countries identify issues that need to be effectively dealt with in order to minimize the risk of civil war.

KEY WORDS
Civil War, Income Inequality, Land Inequality, Population Size, Developing Countries, Ethnic Diversity, Religious Diversity

JEL CODES
O12, O15, O40

1. Introduction

While the 2011 World Development Report offers some advices on how to move beyond conflict and fragility and secure development, such as investing in citizen security, justice, and jobs in order to reduce violence, the issue of the determinants of civil war risk has not received adequate attention in
the development economics literature. Collier and Hoeffler (1998) use probit and tobit models to empirically test the proposition that rebels will be engaged in a civil war if the potential benefits of doing so exceed its costs. They find that initial income, ethno-linguistic fractionalization, the amount of natural resources, and initial population size are significantly strong factors influencing the duration and the risk of civil wars. They also find that the relationship between civil wars and ethno-linguistic diversity is non-monotonic, i.e. highly fragmented countries do not experience a higher risk of civil war relative to homogeneous ones. On the other hand, Gurr (1993) assesses a general model of communal groups’ mobilization to defend and promote their collective interests. Using coded data for 227 communal groups throughout the world, he shows that cultural identity, inequalities, and historical loss of autonomy are all significant in explaining their grievances. Furthermore, whether the conflict results in a protest or a rebellion depends on the level of democracy, the power of the state and the extent of institutional change.

A more recent study on the effects of economic policy and foreign aid on the risk of civil war by Collier and Hoeffler (2002) reveals that while conflict risk is not directly affected by aid and policy, it is indirectly impacted through the effects of the latter on a country’s growth rate and the degree of its dependence on primary commodity exports. Through simulation they show that a package of policy reform and increased aid reduces the risk of conflict in the recipient country by almost 30%. Fearon and Laitin (2003) find that, similar to results of Collier and Hoeffler’s (1998) study, the risk for civil war is not so much due to a country’s ethnic or religious characteristics, but rather to conditions that are conducive to insurgency, namely the extent of poverty, the degree of political instability, terrain roughness, and large population size.

The current study empirically examines the effect various factors on civil war risk. Using data from the World Bank and the United Nations Development Programme for a sample of twenty-one developing economies for the period from 1970 to 2011, we find that religious and ethnic diversity as well as the interaction term between them, inequality in the distribution of land and income, years of education, population size, share of exports in the GDP, the proportion of the male population between 15 years of age and 24 that is not in school and who are unemployed, and per capita GDP growth all contribute to the risk of civil wars in these countries.

On the other hand, political democracy and civil liberties as measured by the Polity IV index and the share of primary commodity exports in the GDP are not statistically significant in influencing the risk of civil wars. We observe that the coefficient estimates of three explanatory variables do not have their anticipated sign due possibly to the severe degree of multicollinearity among them. Statistical results of such empirical examination will assist governments in developing countries identify issues that need to be effectively dealt with in order to minimize the risk of civil war.

This paper is organized as follows. In the next section, the formulation of a statistical model to be estimated is discussed. Theoretical underpinnings for the inclusion of explanatory variables are presented in this section. Statistical results are reported in the subsequent section. A final section gives concluding remarks as well as policy recommendations.

2. The statistical model

If we assume that various exogenous factors affect the level of per capita GDP in a developing country, we can state the following statistical model:

\[
\text{CivilWar} = \beta_0 + \beta_1 \text{Male15-24} + \beta_2 \text{LandGini} + \beta_3 \text{IncGini} + \beta_4 \text{PrimGDP} + \beta_5 \text{PrimGDP}^2 \\
+ \beta_6 \text{Religion} + \beta_7 \text{Ethnic} + \beta_8 \text{EthnRelig} + \beta_9 \text{EthnRelig}^2 + \beta_{10} \text{PolityIV}
\]
\[ (+) \quad (+) \quad (-) \quad (-) \quad (+) \]
\[ + \beta_{11} \text{PolityIV}^2 + \beta_{12} \text{XptsGDP} + \beta_{13} \text{EducYrs} + \beta_{14} \ln \text{Pop} + \beta_{15} \text{GDP}_{pc} + \varepsilon \quad (1) \]

where \( \text{CivWar} \) = Binary dependent variable taking on the value of 1 for countries that had a civil war during the 1990-2008 period and 0 otherwise.

\[ \text{Male15-24} = \text{Fraction of the male population 15-24 years of age who are either not in school or unemployed.} \]

\[ \text{LandGini} = \text{Land Gini coefficient.} \]

\[ \text{IncGini} = \text{Income Gini coefficient, 2000-2011.} \]

\[ \text{PrimGDP} = \text{Share of primary commodity exports in the GDP, in 2005.} \]

\[ \text{Religion} = \text{Religious diversity, with a value of 0 for religious homogeneity and 1 for complete diversity.} \]

\[ \text{Ethnic} = \text{Ethno-linguistic fractionalization, with a value of 0 for ethnic homogeneity and 1 for complete ethnic diversity.} \]

\[ \text{EthnRelig} = \text{Interaction term between ethnic and religious diversity, measured as the product of the two variables.} \]

\[ \text{PolityIV} = \text{Level of democracy/autocracy, ranging from -10 (strongly autocratic) to +10 (strongly democratic), in 2010.} \]

\[ \text{XptsGDP} = \text{Share of total exports in the GDP, in 2005.} \]

\[ \text{EducYrs} = \text{Mean years of education, in 2009.} \]

\[ \ln \text{Pop} = \text{Natural logarithm of population size.} \]

\[ \text{GDP}_{pc} = \text{Average annual growth rate of per capita GDP, 1970-2008.} \]

According to Huntington (1996), countries that have an excessive amount of young males are susceptible to civil violence since the latter possess physical and even psychological features that turn them into capable guerrillas, thereby leading to a higher risk of insurgency. To capture this effect we include the fraction of the male population between the ages of 15 and 24 who does not have a job or who are not in school and expect the coefficient estimate for this variable to have a positive sign.

Collier and Hoeffler (1999) argue that groups may have a reason for grievance as a result of poor economic outcomes. These outcomes may be due to poor macroeconomic performance or to particular groups being disadvantaged. Following them, we use per capita GDP growth as proxy for macroeconomic performance and the income and land Gini coefficients as proxies for grievances based on the degree of inequality in either income or assets. We expect the coefficient estimate for per capita GDP growth to be negative while those for both Gini coefficients to be positive.

Collier and Hoeffler (2001) hypothesize that the likelihood of insurgency is high when financing sources are readily available in a particular country. According to them, up to a point, higher levels of primary commodity exports may provide more motivation and opportunity for insurgents to be self-supporting through “looting.” However, once a threshold is attained, additional exports revenues incurred by the government may be sufficiently large to thwart any threat of civil war. Fearon and Laitin (2003) find weak evidence of this hypothesis in their data. We wish to test this hypothesis ourselves by including both the share of primary commodity exports in the GDP and its square term in our statistical model.
to take account of the possible non-linearity in the effect of this variable on the risk of civil war. We expect the coefficient estimate for the share of primary commodity exports in the GDP to be positive while that for its square term to be negative.

Another source of grievance may be the social composition in a country. Horowitz (1998), for example, finds evidence that different groups often do not like each other.

To capture the effect of grievance due to social composition on civil war risk we use two variables: the degree of ethnic fractionalization and that of religious fractionalization. We expect that both these variables will make a positive impact on the risk of civil war. In addition, it is also possible that these two types of fractionalization perfectly cross-cut one another. As a result, it would be appropriate to include the product of these individual fractionalizations and expect that its coefficient estimate to have a negative sign. To take account of the possible non-linear effect of this interaction term on civil war risk, we also include its square term and expect that its coefficient estimate to also have a negative sign.

In general, political democracies should have lower levels of broad social and political grievances. However, as pointed out by Collier and Hoeffler (1999), societies have the tendency of being more prone to civil war as they attempt to democratize, but the risk diminishes after a certain level of democracy. We choose to test this hypothesis by including both the Polity IV index of democracy/autocracy and its square term and expect the coefficient estimate of the Polity IV variable to be positive while that of its square term to be negative.

In constructing a looting model of rebellion, Collier and Hoeffler (1999) use the mean number of years of education as proxy for the opportunity cost of enlistment for a prospective recruit. They argue that education increases labor income and that it is usually concentrated on young males. As a result, the mean number of years of education is a good proxy for the opportunity cost of young male labor. As this variable increases, the likelihood of a young male to become a rebellion recruit is lower, and hence the lower the risk of civil war.

Fearon and Laitin (2003) hypothesize that in a country with a large population, there is a need for the state to increase the tiers of agents in order to keep tabs on who is doing what at the local level, and there is also a higher pool of potential recruits to a rebellion. We thus choose to include the natural logarithm of population and expect that the coefficient estimate for this variable to have a positive sign.

Finally, Etsy et al. (1998) use a measure of “state failure” that includes both civil war and “disruptive regime transitions” to show that trade openness reduces the risk of civil war. We wish to test this hypothesis by including the share of total exports in the GDP in the model and expect that the coefficient estimate of this variable to have a negative sign. Data for all variables are from the 2006 World Development Report and the 2007/8, 2010-11 Human Development Reports.

3. Empirical results

Table 1 gives maximum likelihood estimates of regression coefficients in equation (1) for a sample of twenty-one developing countries. We observe that eleven explanatory variables are significant, the coefficient estimates of five of which do not have the anticipated sign, namely the interaction term between ethnic and religious fractionalization and its square, the share of total exports in the GDP, the mean number of years of education, and the growth rate of per capita GDP. As the fraction of the young male population in a developing country increases by 1 percentage point, we would expect a three-percent increase in civil war risk, other things being equal. The positive sign of the coefficient estimate for both the land and income Gini coefficients suggests that high inequality in the distribution of assets
or income may give groups stronger grievances and hence results in a higher risk of rebellion. All else equal, a one-percentage point increase in the land Gini index is expected to lead to an increase of almost 5 percent in civil war risk, while this risk is expected to increase by about 4 percent for every one percentage point increase in the income Gini coefficient. Regression results also show that a one-percentage point increase in religious fractionalization is expected to lead to a 6 percent increase in civil war risk, while this risk is expected to increase by 5 percent for every one percentage point increase in ethnic fractionalization, ceteris paribus. In addition, while both the interaction term between the two fractionalizations and its square term are statistically significant, their coefficient estimates do not have the anticipated sign.

Table 1 - Empirical Results

<table>
<thead>
<tr>
<th></th>
<th>Coefficient Estimate</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-7.416</td>
<td>0.026</td>
</tr>
<tr>
<td>Male15-24</td>
<td>3.057</td>
<td>0.080**</td>
</tr>
<tr>
<td>LandGini</td>
<td>4.651</td>
<td>0.031*</td>
</tr>
<tr>
<td>IncGini</td>
<td>4.229</td>
<td>0.038*</td>
</tr>
<tr>
<td>PrimGDP</td>
<td>1.424</td>
<td>0.233</td>
</tr>
<tr>
<td>PrimGDP^2</td>
<td>0.553</td>
<td>0.457</td>
</tr>
<tr>
<td>Religion</td>
<td>5.848</td>
<td>0.016*</td>
</tr>
<tr>
<td>Ethnic</td>
<td>5.248</td>
<td>0.073**</td>
</tr>
<tr>
<td>EthnRelig</td>
<td>5.288</td>
<td>0.021*</td>
</tr>
<tr>
<td>EthnRelig^2</td>
<td>5.218</td>
<td>0.022*</td>
</tr>
<tr>
<td>PolityIV</td>
<td>1.218</td>
<td>0.270</td>
</tr>
<tr>
<td>PolityIV^2</td>
<td>2.663</td>
<td>0.103</td>
</tr>
<tr>
<td>XptsGDP</td>
<td>4.299</td>
<td>0.038*</td>
</tr>
<tr>
<td>EducYrs</td>
<td>3.585</td>
<td>0.058**</td>
</tr>
<tr>
<td>LnPop</td>
<td>1.446</td>
<td>0.038*</td>
</tr>
<tr>
<td>GDP_{pc}</td>
<td>2.953</td>
<td>0.086**</td>
</tr>
</tbody>
</table>

*Significant at the 5 percent level.
**Significant at the 10 percent level.

We note that the share of total exports in the GDP, the mean number of years of education, and per capita GDP growth all are statistically significant but that again their coefficient estimates do not have the expected negative sign. Finally, we observe that the logarithm of population variable is statistically significant at the 5 percent level and its coefficient estimate does have the expected positive sign. All else equal, a one-unit increase in this variable is expected to lead to a 1-percent increase in civil war risk.

Table 2 – Sample Correlation Coefficient Matrix

<table>
<thead>
<tr>
<th>EthnRelig^2</th>
<th>EthnRelig</th>
<th>EducYrs</th>
<th>XptsGDP</th>
<th>GDP_{pc}</th>
</tr>
</thead>
<tbody>
<tr>
<td>EthnRelig^2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The fact that we obtain statistical results that seem to be inconsistent with our hypothesis about the impact of the interaction term between religious and ethnic fractionalization, of its square term, trade openness, per capita GDP growth, and mean number of years of education on the risk of civil war could be due to a simultaneity bias or the extent of the multicollinearity among explanatory variables. The extent of the latter problem is reported by the sample correlation coefficient matrix on Table 2. This undoubtedly makes the interpretation of the coefficient estimates on these variables more problematic.

4. Conclusion

In this paper we use a logistic model and data from a sample of twenty-one developing economies to empirically analyze the impact of several explanatory variables on the risk of civil war. From the statistical results we are able to draw the following conclusions:

1. Within the set of developing economies in this study, a relatively large proportion of young males without a job or not attending school in a particular country do make it more prone to civil violence. Governments in these countries need to devise programs aimed at lowering the unemployment rate among young males between the ages of 15 and 24 or ensuring that they stay in school in order to reduce the risk of civil war.

2. Governments in developing countries need to pursue sound macroeconomic policies to ensure that their economies grow since poor performance gives groups a good reason for higher levels of grievances and hence makes country more susceptible to civil violence.

3. Government efforts to reduce inequality in the distribution of income and assets may be beneficial in not only fostering economic growth (see, for example, Alesina and Rodrik (1994) but also in reducing the risk of civil war.

4. Like Fearon and Laitin (2003), we do not find strong statistical evidence of the impact of the relative size of primary commodity exports in the economy on the incidence of civil violence. This result suggests that the use of this variable as a proxy for the availability of resources for financing insurgency may not be appropriate.

5. Developing countries in this study that are more diverse ethnically and religiously are more prone to civil war. To minimize such risk may require that governments in these countries see to it that various ethnic and/or religious groups do not perceive themselves as being severely disadvantaged.

6. Statistical results show that there is no apparent statistical relationship between the level of democracy and the risk of civil war, at least within the sample of developing countries used in this study.

7. Developing countries that have large populations may be at a greater risk for civil war.
5. **Acknowledgement:**

I would like to thank Thi Minh Chi Le for her support during the completion of this paper.

6. **References:**


Notes

1The sample consists of the following countries: Argentina, Bangladesh, Brazil, Colombia, Honduras, Indonesia, Jordan, Malawi, Nepal, Nicaragua, Pakistan, Panama, Paraguay, Peru, Poland, Senegal, Slovenia, Thailand, Turkey, Uganda, and Uruguay.