Changing Nature of Risk in Sub-Saharan Africa

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Risk = f(Hazard, Exposure, Vulnerability)
Although the total number of disasters reported worldwide has been rapidly increasing, the number of killed has not (except in Africa). The yearly numbers of disasters are plotted in Figure 1, together with their total and average magnitudes. Since 1960, the number of disasters has, on average, increased by around 5 percent per year and the number of affected by 4 percent. However, the number of killed has only increased by an insignificant 0.1 percent per year. In other words, the average magnitude of the reported disasters has fallen.

What explains the growth in the number of natural disasters? More frequent extreme weather events may explain part of the increase in droughts, floods, and storms. According to the Intergovernmental Panel on Climate Change (2007), there is likely to have been an increase in heavy precipitation events and, in some regions, increases in tropical cyclone activity and extreme weather events causing droughts in the period 1970–2000.

More complete reporting may also be driving this increase. Although, the number of earthquakes that hit populated areas has not increased since 1970 (Peduzzi, 2005), the numbers of reported earthquakes display the same 5 percent yearly increase from 1960–2004 as do disasters in general. The reason may be that the propensity to report earthquakes has increased roughly at this rate. Over the periods 1970–79, 1980–92, and 1993–2003, the EM-DAT reported, respectively, 11, 25, and 31 percent of the earthquakes that hit populated areas (Peduzzi, 2005). Over the same three time periods, the average reported number of earthquakes per year in EM-DAT was 10, 23, and 27.

Population growth may also turn more natural hazard events into disasters, by exposing more people. To get a rough estimate of the importance of this factor, I regressed the number of disasters in each country and each year from 1960 to 2004 on the country's population, allowing a separate population coefficient for India and China, and only including country and year fixed effects. The population

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Question:

*How has the exposure to risk changed since 2000 in Sub-Saharan Africa?*
Megatrends in Sub-Saharan Africa

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Megatrends in Sub-Saharan Africa

- Population growth
Megatrends in Sub-Saharan Africa

- Population growth
- Urbanization

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Megatrends in Sub-Saharan Africa

- Population growth
- Urbanization
- Climate change
Megatrends in Sub-Saharan Africa

- Population growth
- Urbanization
- Climate change
- Economic development
Risk factors in Sub-Saharan Africa

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Risk factors in Sub-Saharan Africa

- Drought
Risk factors in Sub-Saharan Africa

- Drought
- Flood
Risk factors in Sub-Saharan Africa

- Drought
- Flood
- Malaria

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Risk factors in Sub-Saharan Africa

- Drought
- Flood
- Malaria
- Conflict

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Approach

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Approach

- Geo-spatial overlay analysis of population estimates with 4 types of hazards (or risks): drought, flood, malaria, and conflict.
Approach

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- Population data available for years 2000, 2005, 2010, and 2015 at 1 km pixel level - in total around 29 mio. pixels each year.
Approach

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- Population data available for years 2000, 2005, 2010, and 2015 at 1 km pixel level - in total around 29 mio. pixels each year.

- We define a pixels as being urban in a given year if it has a population of more than 150 and a travelling distance to nearest urban center of less than 1 hour.
Population

Legend
Population density 2000
People / km²
- 5,000 - 100,000
- 2,500 - 5,000
- 1,000 - 2,500
- 500 - 1,000
- 250 - 500
- 100 - 250
- 50 - 100
- 25 - 50
- 10 - 25
- 0 - 10

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Drought hazard

Legend
Number of droughts 2000-2014
10th percentile
- 12
- 11
- 10
- 9
- 8
- 7
- 6
- 5
- 4
- 3
- 2
- 1
- 0

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Flood hazard

Legend
Riverine floods
Number of events/100 years

- 0
- 1
- 2
- 3
- 4 - 38

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Malaria risk

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Conflict risk

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Table 3 shows in the first two rows the aggregate population numbers and urban/rural shares for four years. Secondly, it shows the number of people exposed to different types of hazards at different probabilities. For instance, the share of total population who faced a 20% risk of experiencing a drought in 2000 was 16.5%. This number increases to 34.0% as the probability of the hazard occurring decreases to 10% and so forth. Drought risk is not considered for urban areas.

Table 3: Population shares exposed to hazards at selected risk levels

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Population</td>
<td>Urban</td>
<td>Rural</td>
<td>Urban</td>
</tr>
<tr>
<td></td>
<td>Million</td>
<td>Million</td>
<td>Million</td>
<td>Million</td>
</tr>
<tr>
<td></td>
<td>671</td>
<td>133</td>
<td>539</td>
<td>752</td>
</tr>
<tr>
<td>Share</td>
<td>19.8%</td>
<td>80.2%</td>
<td>20.9%</td>
<td>79.1%</td>
</tr>
<tr>
<td>Drought</td>
<td>20% risk</td>
<td>16.5%</td>
<td>17.3%</td>
<td>16.3%</td>
</tr>
<tr>
<td></td>
<td>10% risk</td>
<td>34.0%</td>
<td>34.7%</td>
<td>34.0%</td>
</tr>
<tr>
<td></td>
<td>5% risk</td>
<td>62.2%</td>
<td>61.4%</td>
<td>62.4%</td>
</tr>
<tr>
<td></td>
<td>1% risk</td>
<td>6.36%</td>
<td>8.07%</td>
<td>5.93%</td>
</tr>
<tr>
<td>Malaria</td>
<td>20% risk</td>
<td>33.4%</td>
<td>29.9%</td>
<td>34.2%</td>
</tr>
<tr>
<td></td>
<td>10% risk</td>
<td>37.7%</td>
<td>34.2%</td>
<td>38.6%</td>
</tr>
<tr>
<td></td>
<td>5% risk</td>
<td>41.9%</td>
<td>38.6%</td>
<td>42.7%</td>
</tr>
<tr>
<td></td>
<td>1% risk</td>
<td>46.5%</td>
<td>42.4%</td>
<td>47.5%</td>
</tr>
</tbody>
</table>

Note: Author’s own calculations based on data sources described in previous section. Conflict (a) describes the risk of being located within 25 km from conflict event with at least 10 fatalities, while conflict (b) relates to the estimated risk of being killed in conflict based on location.

Figure 7: Distribution of key risks in 2015.
The first noteworthy result from table 3 may be the relatively large differences in the risk levels associated with the different hazard types. Around 34% of Sub-Saharan Africa's population faces a 10% risk of experiencing a relatively harsh drought every year. For subsistence farmers, this type of drought event has been shown to have real negative effects on income and health (see e.g. Alfani et al. 2015). A somewhat similar share of the population faces a 10% risk that their newborns will contract malaria within their two first years, although this share has declined from 36% in 2000 to 30% in 2015. A risk of being flooded of 10% per year, however, is only experienced by around 0.4 percent. At the low-probability end of the spectrum, only between 0.06 and 0.31 percent of the population face a 1% risk of being killed in conflict or political violence based on their location. On the other hand around a third of the population live in areas with at least 5% risk of a serious conflict event occurring within 25 km.

In terms of the distinction between urban and rural areas, a few observations need mention. Firstly, we do not measure drought as a direct risk factor in urban settings. This is because drought constitutes a much more imminent threat to rural dwellers; especially smallholders living off rain-fed agriculture. Flood risk is larger in urban areas; for instance 8% of the urban population had a 1% risk of experiencing this hazard in 2000 against 6% in rural areas. This makes sense since cities are often located on the banks of major rivers. The overall increase in population shares exposed to flood risk from 2000 to 2015 can thus to a certain extent be attributed to urbanization. Malaria is generally more prevalent in rural areas; a fact that is supported by the medical literature (e.g. Alirol et al. 2010). Whether conflict poses a larger risk in urban or rural areas depends on the definition. Following our first definition, a person is exposed merely by living within 25 km of a conflict event. Population density thus becomes a prominent determinant for exposure, which is evident from the table: exposure is around 4 times larger in urban areas than in rural areas. When using our second approach, namely the risk of being killed in conflict, we use the population in our denominator, meaning that there is no strong difference between urban and rural areas.

Figure 8 shows population shares exposed to different hazard types across the period 2000-2015. Note that drought and malaria risk is measured at the 10% risk level whereas the flood indicator uses 1% and conflict (a) 5% and (b) 0.1%. It is also clear from the figure that drought and flood hazard (as well as conflict a) is measured statically (using the same hazard map for the whole period) whereas the risks of malaria and conflict are allowed to vary over time.
Results

Figure 9: Development over time in number of exposed people, index 2000=100
Results

Table 4: Correlations between various hazard types

<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th>Drought</th>
<th>Flood</th>
<th>Conflict</th>
<th>Malaria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drought</td>
<td>-0.068</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flood</td>
<td>0.086</td>
<td>0.022</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conflict</td>
<td>0.409</td>
<td>-0.082</td>
<td>0.005</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Malaria</td>
<td>-0.016</td>
<td>0.047</td>
<td>-0.008</td>
<td>0.001</td>
<td>1.000</td>
</tr>
</tbody>
</table>
Conclusions

The share of people exposed to drought is stable, slightly increasing for floods, dramatically reduced for malaria, and volatile or increasing for conflict depending on the definition. The number of people exposed to drought, flood, and conflict has increased about 40-50 percent whereas the number of people exposed to malaria has increased about 10 percent.

A main driving force for the development in exposure to the selected hazards is urbanization. Cities are often located near coasts or rivers, associated with higher risk of floods, lower risk of drought. Malaria is less widespread in cities whereas risk of being close to a conflict increases.

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Thank You

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