

PPOL 5202 Data Visualization  
Final Project Insights Report  
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## Research Background

War and conflict can have drastic implications for a nation's economy (Kiel Institute 2024). While wartime economies are often touted as robust due to the amount of jobs they have the potential to create, the actual effects of conflict on world economies are much more nuanced (Watson Institute 2023). For instance, professors of International Affairs at Brown University estimate that over 1 million more jobs would have been created in the United States if defense spending allocated for Iraq and Afghanistan during the height of the war on terror was spent on education and infrastructure instead (Ibid). War is also often detrimental to the economies of the countries that bear the brunt of the actual fighting (Kiel Institute 2024). The harmful effects can also work both ways: youth unemployment is often a prime driver for political, ethnic, and gang violence (Cramer 2011).

This study aims to descriptively explore the relationship between violent conflict and economic performance. Under the assumption that violent conflicts could either increase or decrease job opportunities for various occupations or sectors, the measure used in this study to reflect a country's economic health is unemployment.

Many existing studies try to investigate the causal relationship between violent conflicts and unemployment. For example, according to Frances Stewart's 2015 think piece for the United Nations Development Programme, *Employment in Conflict and Post-conflict Situations*, there is no evidence that unemployment brings about violent conflict nor that conflict causes unemployment (Stewart 2015). She states that while unemployment resulting from workplace discrimination and marginalization provides a potential pool of recruits for violence, actual mobilization requires motivated leaders, which has little to do with the employment landscape. Conversely, Stewart notes that while civil wars destroy formal sector jobs, they create opportunities - both legal and illegal - for informal sector opportunities (Ibid).

Our study does not implement analyses designed to make causal claims. Instead, we focus on exploring the correlation between violent conflicts and unemployment. In doing so, we aim to provide descriptive insights that might be leveraged to formulate policies for peacebuilding and economic development in countries with existing violent conflicts. In our discussions of key insights, we provide hypotheses about the potential directionality of relationships; however, the reader should note that these are purely observational and do not have statistical substantiation.

## Research Questions

To investigate the correlation between violent conflicts and unemployment, this study will explore the following research questions:

1. How does the relationship between conflict and employment vary across different global regions?
2. Does employment in certain industries have a positive / negative correlation with conflict?
3. How does unemployment vary across demographic groups during times of conflict?

## Data Sources

### 1. Armed Conflict Location and Event Data (ACLED)

We queried armed conflict data from Armed Conflict Location and Event Data (ACLED), a non-profit housing a database of documented conflict events (ACLED 2024). ACLED reports data on a range of conflict types, including battles, violent protests, gang violence, clashes, riots or violence against civilians (ibid). ACLED observations follow a dyad structure, with each unit of analysis including the actors involved in the incident, the date the event took place, location coordinates, event type, and number of reported casualties (ibid). For this study, we queried instances of all conflict types in all available countries for the period January 1, 1997 to November 20, 2024. Table 1 provides select incidents and fields from ACLED to illustrate the contents and structure of the data.

Table 1. Selected incidents and fields from ACLED data

Event date	Country	Event type	Actor 1	Actor 2	Casualties	Event description
12/20/2022	China	Violence against civilians	Police Forces of China	Civilians	0	“Around 20 December 2022 (as reported), a female journalist and a female book editor became incommunicado, after being arrested in Beijing (coded to Beijing). They had participated in a white paper demonstration that came in the wake of a fire in an apartment building in Urumqi, Xinjiang that killed 10 on 24 November 2022. The Chinese public had attributed the deaths to local coronavirus lockdowns, which had made evacuation difficult. The incident was later censored by the Chinese government.”
4/15/2023	Indonesia	Battle	TPNPB: West Papua National Liberation Army	Military Forces of Indonesia	6	“On 15 April 2023, TPNPB engaged in an armed clash with the Indonesian military forces in Mugi district (Nduga regency, Highland Papua province). The military troops were looking for a New Zealander pilot kidnapped by the rebels on 7 February 2023. The military stated that six soldiers died, nine were captured, and 21 were missing. On 2 May, TPNPB released a statement claiming to have killed 12 soldiers. The authorities released the four victims' names and evacuated the bodies, while TPNPB did not provide any proof regarding their claim.”
6/5/2024	Uruguay	Demonstration	Protesters	Police Forces of Uruguay	0	“On 5 June 2024, in Montevideo (Montevideo), Members of the Single Union of Sea and Allied Workers (SUNTMA) and PIT-CNT demonstrated in front of the Ministry of Labor and Social Security (MTSS) to show support for their representatives who were negotiating

						with businessmen from the fishing sector and government officials. The protesters denounced that they had not been able to work for six months, blaming the business community for this. During the demonstration, the participants blocked traffic. Then, the police used tear gas and rubber bullets to clear the road, leaving some protesters injured.”
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Source: Armed Conflict Location and Event Data, 2024.

## 2. World Bank - World Development Indicators (WDI)

We utilized the World Bank Group’s World Development Indicators (WDI) API to retrieve data on unemployment at the demographic level by country and year. We extracted variables for male and female unemployment rates, youth unemployment rates, and total unemployment rate from 1990 to 2024 for all countries (190+). According to the World Bank, “youth unemployment refers to the share of the labor force ages 15-24 without work but available for and seeking employment”; however, they caveat that “definitions of labor force and unemployment differ by country” (Metadata Glossary, 2024). We also retrieved country-level population counts for these years to facilitate calculating metrics per 100,000 people.

## 3. International Labour Organization (ILO) - Employment by Sector

We extracted the “Employment by ILO sector and sex (thousands)” table from the International Labour Organization (ILO) ILOSTAT data explorer dashboard to obtain data on industry employment rates by country and year. The original data also disaggregates sector-level employment rates by sex, but our analysis focused only on total employment rates. The data was available from 2000 to 2023 and included at least one year of data for 129 countries/geographic areas. Data is reported for 22 industry categories (e.g., “Construction”, “Commerce”, “Health Services”) plus a category of “Not elsewhere classified.”

## Data Cleaning and Preprocessing

We took numerous preprocessing steps to assemble files for visualization. For instance, the ACLED data is reported at the event level while the ILO and World Bank sources are reported for countries at the annual level; accordingly, we created constructs from the ACLED data aggregated at the year - country level in order to merge ACLED with the other two sources. In addition, the original World Bank WDI data set was in a wide format, with one column per year; in order to create data at the year - country level, we pivoted the data long. To facilitate clean merges between files on country name, we utilized the `countrycode` R package to standardize variation in country spelling and punctuation.

Ultimately, preprocessing yielded three analytic datasets:

- (1) Year - country aggregated ACLED data merged with year - country unemployment data by demographic group
- (2) Year - country aggregated ACLED data merged with year - country employment by economic sector
- (3) Comprehensive ACLED incident-level data for geospatial visualization

## Exploratory Analysis

### Conflict Distribution Across Regions over Time

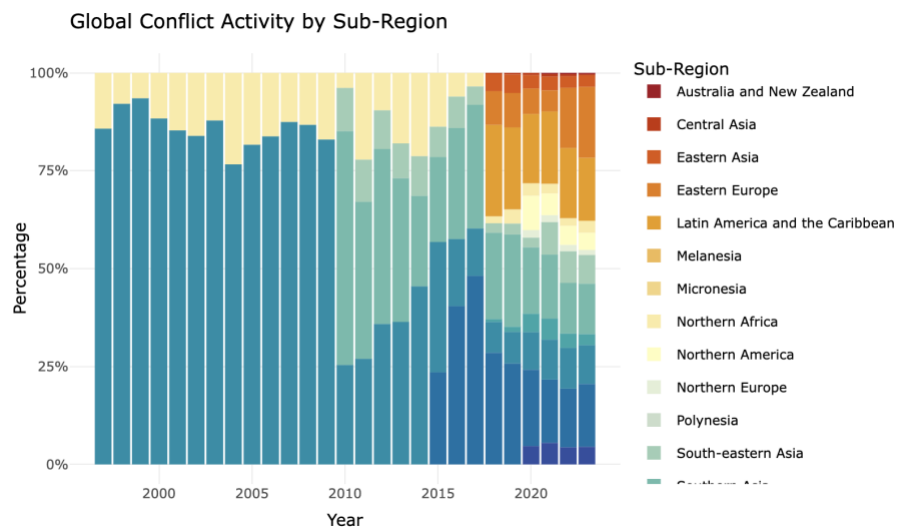


Figure 1.1

Figure 1.1 plots the proportion of the total global annual incidents that occurred in the respective geographic region. It is imperative to note that data are not available for every region - year combination. Accordingly, readers should note that the denominator for these percentages is the total number of annual reported incidents and the discussion that follows is predicated on this understanding.

As displayed in Figure 1.1, from 1997 to 2009 Sub-Saharan Africa and North Africa were the two main contributors to the violent conflicts, where Sub-Saharan Africa dominated the violent conflict percentage. On average, 85.82% of all violent conflicts originated from Sub-Saharan Africa, and 14.18% originated from North Africa.

From 2010 to 2023, additional regions such as South Asia, Southeast Asia, West Asia, Latin America and the Caribbean, and East Europe, joined the conflict landscape, which decreased the previously dominant percentage value of violent conflicts in Sub-Saharan Africa. Between 2010 and 2017, despite more regions' presence in the global conflict landscape, South Asia became the dominant contributor to the violent conflict, which has an average 35.75% across overall violent conflicts. Therefore, due to the high percentage values of violent conflicts, the rest of the analysis in the study will explore the correlation between conflicts and unemployment in these two regions: Sub-Saharan Africa

(many countries in southern, eastern and west Africa, including Cameroon, Zimbabwe, and Ethiopia) and South Asia (India, Sri Lanka, Pakistan, Nepal, and Turkmenistan).

## Key Insights

### Impact of Conflicts on Unemployment by Demographic in Selected Regions (Sub-Saharan Africa and South Asia)

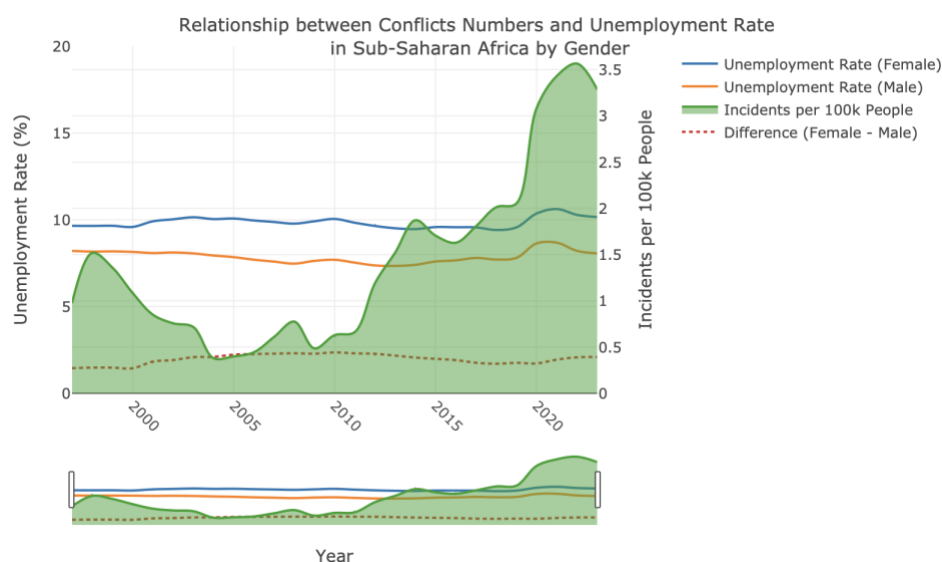


Figure 2.1

In Figures 2.1 - 2.4, conflict intensity is measured as the simple average of the number of incidents per 100,000 people in the respective region's constituent countries for each respective year (i.e., Sub-Saharan African countries in Figures 2.1 and 2.2; Southern Asian countries in Figures 2.3 and 2.4). Unemployment rate by demographic subgroup (i.e., gender and age) was calculated as the simple average of the respective region's constituent countries' unemployment rates in that year.

Figure 2.1 displays the relationship between conflicts—such as the civil war in Ethiopia and the long-running conflicts in South Sudan and the Central African Republic—and unemployment rate by gender groups in Sub-Saharan Africa (Latif 2024). According to this figure, even though the conflict intensity fluctuated across the study period, the unemployment rate percentage point disparity (female - male), shown by the red dash line, remained relatively constant. Notably, while there was a consistent escalation in conflict intensity between 2019 and 2023, the unemployment rate had an obvious decrease in 2021-2023, which might indicate that conflicts add job opportunities. However, further statistical analysis is needed to validate whether the decline in unemployment during this period is statistically significant.

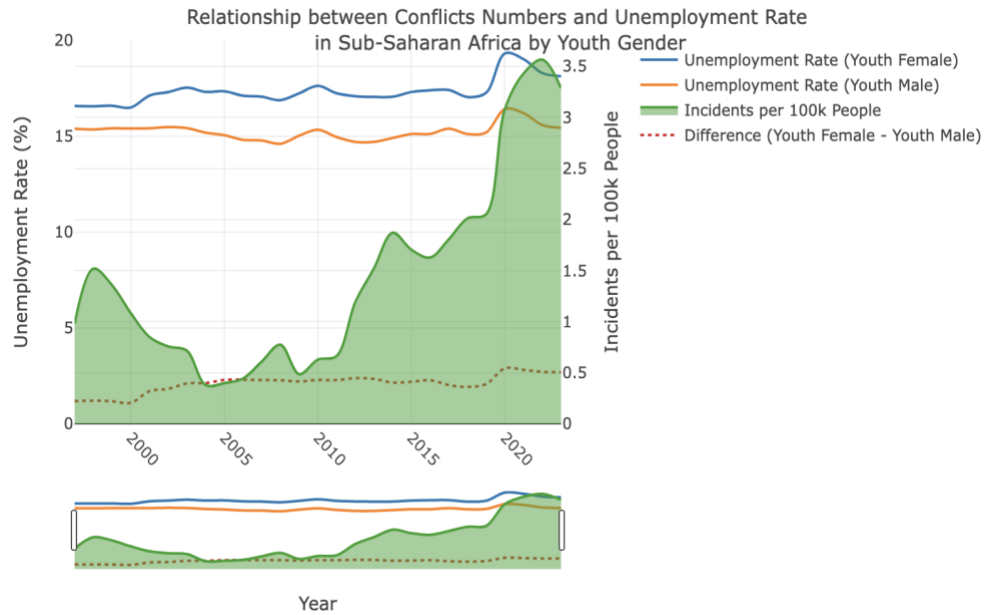


Figure 2.2

Figure 2.2 examines youth employment dynamics in Sub-Saharan Africa during periods of conflict. Compared to the total population, youth groups had higher unemployment rates during the study period. Besides the similar pattern with Figure 2.1, the unemployment rate disparity between young females and males had more notable fluctuations, which underscores the heightened economic vulnerability of young women in Sub-Saharan Africa.

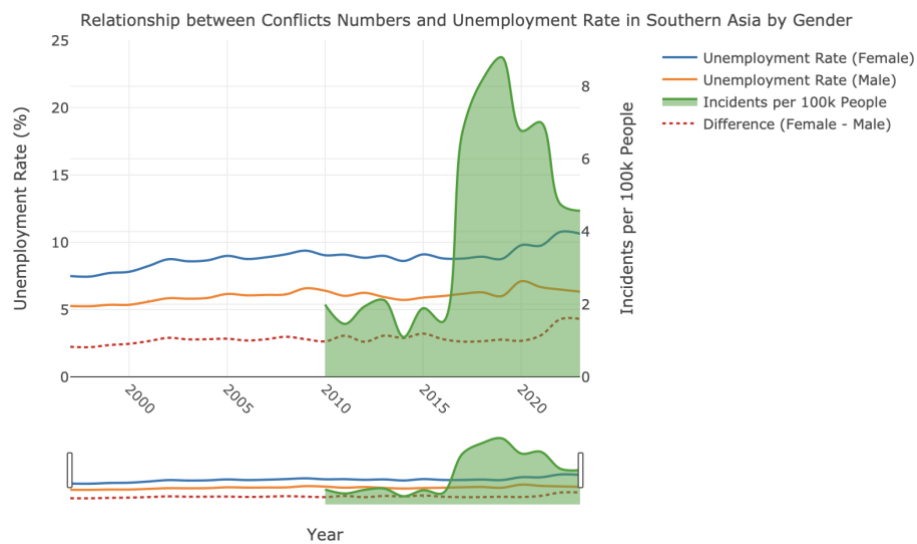


Figure 2.3

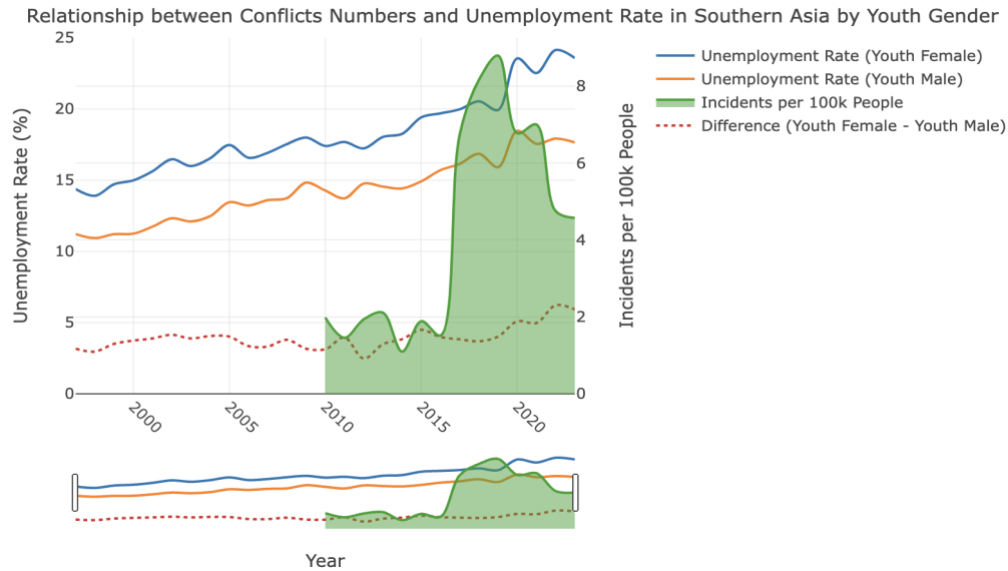


Figure 2.4

Due to the lack of conflict data before 2010 in South Asia, the interaction between armed conflict intensity and unemployment can be shown only by post-2010 data. Some examples of armed conflict in South Asia include a major internationalized civil war in Afghanistan and high-intensity interstate border and subnational armed conflicts in Pakistan (Stockholm International Peace Research Institute 2020). In general, both unemployment rates in the total population and in the youth groups are smaller in South Asia than Sub-Saharan Africa. However, the unemployment rate disparity of the youth groups in South Asia is bigger than the one in Sub-Saharan Africa, revealing that young females experienced more economic vulnerability in South Asia during conflict periods.

For youth unemployment, Figure 2.4 presents a consistently increasing unemployment rate during the study period. Since the ACLED does not have the conflict data before 2010, this study cannot draw comprehensive insights on the extent to which unemployment rate was positively correlated with conflict. Another notable finding from both Figure 2.3 and Figure 2.4 is that the unemployment rate disparity started to increase in 2020 after the conflict intensity reached its peak in 2019, which might indicate a difficult job market during post-conflict situations in South Asia.

#### Impact of Conflicts on Employment by Sector in Selected Regions (Sub-Saharan Africa and South Asia)

For figures 3.1 - 3.4, we calculated the employment increase rate by grouping the data by country and sector and then computing the year-over-year percentage change in the proportion of the population employed in each sector in each country, simply:

$$\text{Employment Increase Rate} = \frac{\text{Current Year's Employment Rate} - \text{Previous Year's Employment Rate}}{\text{Previous Year's Employment Rate}}$$

We then grouped the data to the year - subregion - industry level and created the average sector employment increase rate as the mean of the employment sector increase rate across all country-year

combinations reporting any employment in that sector for the given sub-region. Similarly, we calculated the average incidents per 100,000 people as the average incidents per 100,000 people across all country-year combinations reporting any employment in that sector for the given sub-region. In all calculations, missing values were excluded.

Figures 3.1 and 3.3 display the correlation between the increase in conflict incidents and employment increase rates across different sectors in Sub-Saharan Africa and Southern Asia, respectively. The reported correlation coefficients were calculated over the complete set of country-year combinations for the respective subregion. Figures 3.2 and 3.4 display the relationship between the conflict rate and the sector-level employment increase rate across time for both respective subregions.

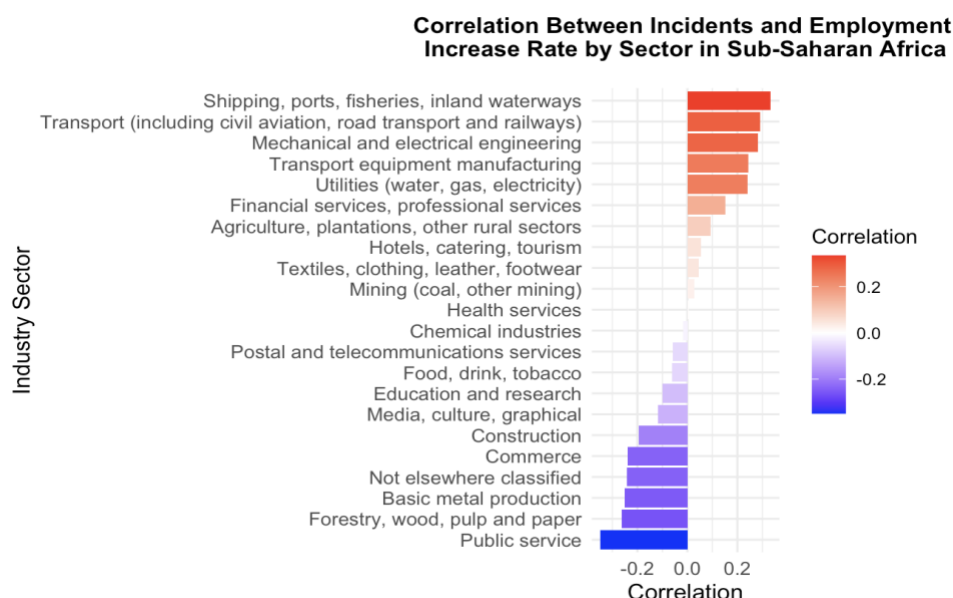


Figure 3.1

Sectors such as shipping, ports, fisheries, inland waterways, transport, and mechanical and electrical engineering exhibit positive correlations, suggesting that these industries may be in higher demand during times of conflict. For example, based on our conjecture, in conflict-affected areas in Sub-Saharan Africa, land-based trade routes would become unsafe or impassable due to fighting, checkpoints, or destruction of infrastructure. As a result, shipping and inland waterways become critical for transporting goods and essential supplies, which creates job opportunities in this sector. In addition to the discussion of formal employment, conflicts might create opportunities for informal workers to transport smuggled goods like fuel, food, or weapons to circumvent official supply chain disruptions (Donati 2024).

Conversely, sectors like public service, forestry, wood, pulp and paper, and basic metal production show negative correlations with violence, suggesting vulnerability of these industries to disruption during conflicts. For example, basic metal production requires stable energy supplies, well-functioning infrastructure, and secure supply chains for raw materials. Conflicts would likely disrupt these prerequisites, which could lead to plant closures or reduced operations.



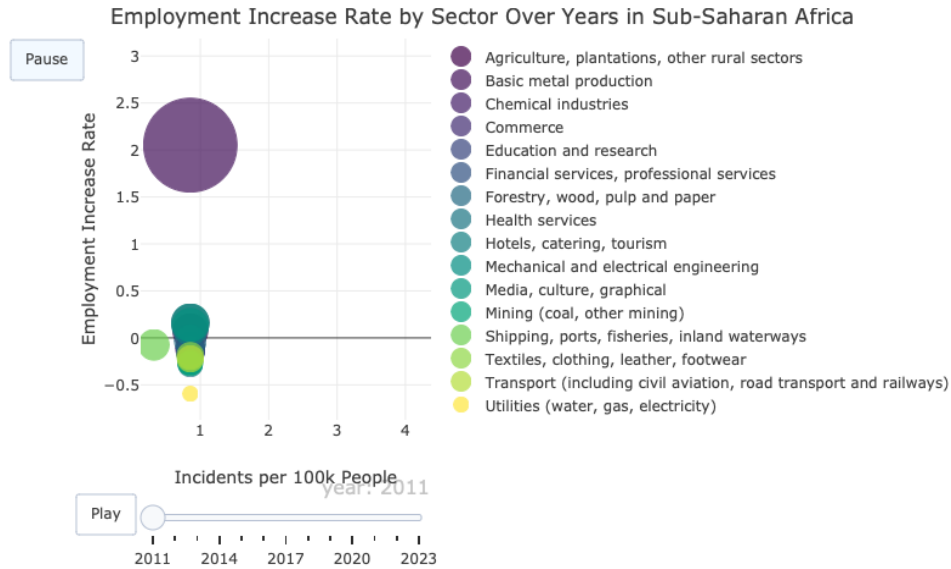


Figure 3.2

Figure 3.2 reveals the change of the correlation between 2011 and 2023. The employment increase rate in basic metal production experienced the largest decrease over time, starting with the largest employment increase rate in 2011. This is consistent with Figure 3.1 under the reasoning of plant closures and reduced operations in the industry. In contrast, with the increasing conflicts after 2016, oil and gas production started to increase job openings and had the largest employment increase rate in 2023. This notable increase could be because oil and gas are critical resources, especially during conflicts.

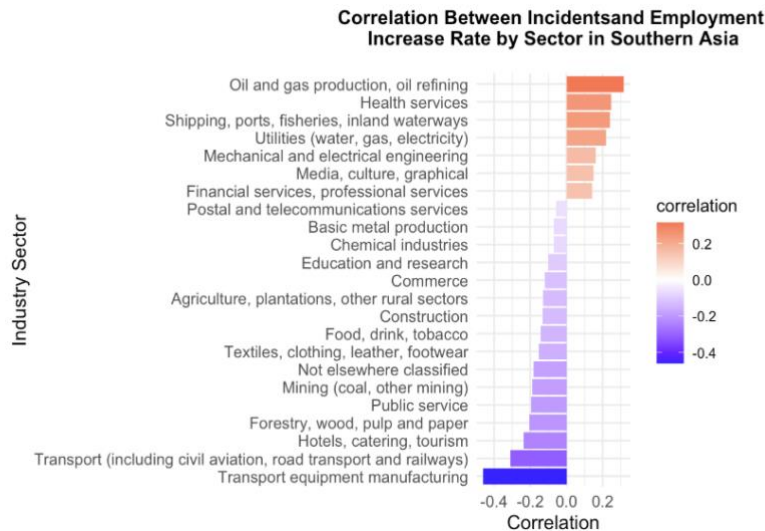


Figure 3.3

Figure 3.3 shows the correlation between the increase in conflict incidents and employment increase rates across different sectors in South Asia. Sectors such as oil and gas production, health services, shipping, ports, fisheries, inland waterways, utilities, and mechanical and electrical engineering exhibit positive correlations, suggesting that conflict may create demand for these industries. For

example, in conflict-affected areas in South Asia, violent conflicts lead to higher casualties, injuries, and health issues (e.g., trauma, malnutrition, infectious diseases), necessitating a surge in healthcare services. This drives the need for more healthcare workers, including doctors, nurses, paramedics, and support staff. One of the possible reasons why health services do not exhibit strong positive correlation in Sub-Saharan Africa is the underdeveloped health system in Sub-Saharan Africa (Zuckerman et al., 2019). Many countries in Sub-Saharan Africa lack sufficient hospitals, clinics, or healthcare professionals (Oleribe et al., 2019). Therefore, an increasing exposure to conflicts might not correlate with a significantly high increase in employment in the health service sector.

In addition, conflicts might stimulate informal job opportunity growth for sectors like health services. For example, low access to sanitation facilities might accelerate the spread of disease caused by conflicts (Calderon et al. 2018). Informal healthcare workers, such as community health workers or unlicensed practitioners, may step in to address these needs.

One notable difference of negative correlations between the two regions is that the public service sector did not exhibit the largest negative correlation in South Asia. This may be due to differences in countries' institutions and how they administer services within the two regions.



Figure 3.4

Figure 3.4 only displays the correlation by sector between 2010 and 2023 due to the lack of conflict data before 2010 in South Asia, as indicated in Figure 2.3 and 2.4. From Figure 3.4, South Asia displays a completely different trend as Sub-Saharan African scenarios. Most of the sectors had relatively stable employment increase rate regardless of the respective conflict intensity, except for the construction sector that experienced a sudden 20% increase in employment between 2012 and 2013, but this trend did not continue in later years.

## Limitations

### 1. ACLED data gaps

As seen in our analysis of South Asia, one of the most glaring limitations in our analysis was a dearth of data in certain countries in specific year ranges. For example, while ACLED researchers note that the main conflict in Afghanistan began in 2001, ACLED only has data on conflicts in this country beginning in 2017 (“Afghanistan”, 2024). ACLED researchers also continue to experience methodological difficulties in gathering reliable information on conflict due to issues like lack of media coverage on these events, especially conflict that takes place in the more rural areas, and changes in political power (“Afghanistan”, 2024). Therefore, in our analysis we cannot infer that a country or region’s lack of conflict data is always a true representation of actual situations on the ground, and may not indicate “stability” in the area. In future research into this topic, we suggest utilizing additional data sources to help fill in some of the gaps in the ACLED data.

## **2. Impact of data aggregation on analysis**

Another limitation is the level of granularity in the data procured. In our ACLED data, we chose to investigate conflict holistically, not by conflict type (battle, gang violence, terrorist attack, etc.). Because the unit of observation for our data on employment from the World Bank and ILO was at the county-year level, we chose to aggregate the daily conflict data to the year level. Additionally, for our visualizations we chose to group countries together by global region to make it easier to display trends over time. While our data transformation decisions enabled us to link together all data sources, we are potentially losing nuances in the patterns between conflict and employment that may have been discoverable before aggregation. In future research on this topic, a subgroup analysis on the different forms of conflict or analyzing the relationship between conflict and employment in particular countries may help reveal differences in patterns.

## **3. Inability to make causal inferences**

Finally, we are not implementing an experimental or quasi-experimental framework that would enable causal inferences. Additionally, while our visualizations may reveal correlations between the number of conflicts and unemployment/employment rates, without proper control variables like GDP per capita we acknowledge we have significant omitted variable bias. Future iterations of this analysis could include additional country-level variables that may lend additional inferential credibility to the study.

## **Conclusion**

Based on our visualizations, we found that the relationship between conflict events per 100,000 people and unemployment varied based on the global region. In our examination of two global regions, Sub-Saharan Africa and South Asia, we did not observe conflict to have a significant differential effect on adult male versus adult female employment rates. However, our results suggest that youth employment outcomes may be more significantly affected by conflict.

Based on our employment increase rate measure, we found that the effect of conflict on different economic sectors varied by industry and region. Overall, we found that manufacturing-related industries such as oil-refining and shipping were more likely to be positively correlated with conflict, whereas

industries such as education and public service are more likely negatively correlated with conflict. This aligns with previous research on the varied impact of conflict on different sectors.

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