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RESEARCH PAPER

Impact of COVID-19 on Employment with Visualization Techniques

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ABSTRACT

The objective of this research is to study the impact of the COVID-19 pandemic on employment with data visualization via R. The COVID-19 pandemic has significantly disrupted employment, resulting in an unprecedented decline in working hours. Leveraging secondary data, this study examines the varying consequences of COVID-19 on employment in 189 countries across six continents of the world, utilizing R programming language visualizing tool kit with statistical techniques: tree maps, bar charts, pie chart, and grouping and faceting. The findings of this study indicate that South American countries experienced the highest average loss of working hours at 15%, followed by North American countries at 12%, and Asian, African, and European countries at 9%, 8%, and 7%, respectively. While regions of Oceania are the least affected with a 5% loss in working hours compared to 4th quarter of 2019. This study underscores the necessity to reduce the pandemic's negative consequences on employment and provide policymakers with valuable insights to offer post-pandemic support and focused interventions.

KEYWORDS Employment, COVID-19, Working Hours Lost, Data Visualization, Secondary Data Analysis

Introduction

In December 2019, Wuhan City, China reported the first case of infection, which subsequently named as coronavirus by the World Health Organization (WHO). This pandemic emerged as the most significant global health crisis since World War II, impacting economies, health systems, and societies worldwide. Governments have implemented the stringent measures including partial or complete lockdown to avoid the spread of the virus. However, these necessary measures have come at a considerable cost, as they have drastically slowed economic activities leading to the operational challenges and resultantly notable loss of employment (Naseer et al., 2023; Yaseen, et. al. 2020). Due to coronavirus pandemic, more than 20 million people lost their job in two months during the initial phase. This number is higher than any recorded in other postwar recession. The unemployment rate reported during COVID-19 was the highest since the Great Depression of 1930s (Petrosky- Nadeau et al., 2020). The combined impact of shutdowns and pandemic-related anxiety rocked labor markets, lowering total employment. Some affected individuals may have been compelled to seek further government support or even early retirement to make up for the loss of employment, even though longer unemployment insurance and direct cash payments may have been adequate to compensate for some (Goda et al., 2023).

This research intends to investigate the multifaceted consequences that COVID-19 has had on employment using various data visualization approaches, within the continually expanding body of research regarding COVID-19's impact on global job

market. This paper uses secondary data obtained from ILO and applies data visualization techniques such as treemaps, barchart, piechart and grouping/faceting to find the consequences of COVID-19 on employment using valuable employment related variables mainly percentage of working hours lost and draw a comparative analysis to determine which region got the most affected.

Literature Review

To assist those workers who have lost their job recently due to COVID-19, the Department of Labor of Azerbaijan devised a plan. In light of the coronavirus outbreak, ILO predicts two scenarios. According to the 360° TV channel, the first scenario projects that 5.3 million people will lose their jobs, while the second predicts that the number of unemployed people will be four times higher. In order to assist those who got unemployed due to the coronavirus pandemic, the Ministry of Labour has devised a support program by giving opportunity of skill improvement and funds facility (Akbulaev et al.,2020).

In the first quarter of 2020, Europe was struck by the COVID-19. Since January, when first few cases were registered, the number of deaths has been increasing over time, and confinement measures have been implemented to restrict the economic activity in most countries to prevent the spread of coronavirus. The COVID-19's consequences on employment were carefully examined, with a focus on the early months of the outbreak. The research aimed to assess the impact of the crisis on employment, categorizing economic sectors as crucial or not according to national confining laws, and investigating potential short and long-term effects on labour markets. Several European countries were involved in this multi-country enquiry, including Germany, Italy, Spain, the UK, Sweden, and Poland. The study uses a broad range of parameters and indicators, including the classification of economic sectors, demographic profiles, income levels, employment distribution, and alternatives for teleworking etc. FRED Economic Data was the source of the information. The research technique combined quantitative analysis of job data with qualitative examination of confinement decrees to understand the various implications of COVID-19 lockdowns. The analysis found that COVID-19 lockdowns had extraordinarily disproportionately affected people in low-productivity service industries and worsened previously existing inequalities, especially in places like Spain, Italy, and the UK. To decrease the negative economic and political repercussions, the importance of flexible and progressive policies should be realised, such as the EU Green Deal and a possible European Welfare State, in fostering economic recovery (Fana et al., 2022)

According to Hossain (2021), his paper highlights the different ways in which the living standard and employment of marginalized groups have been affected in Bangladesh due to pandemic. Furthermore, it analyses the state of economic policies at the moment and offers suggestions for how to mitigate the challenges posed by the COVID-19. His research highlights that in the post-COVID era, Bangladesh's economic and development goals need to be re-evaluated, shifting from growth-centric models to multi-dimensional approaches. It examines several kinds of the pandemic's consequences faced by different working-class groups. Additionally, several industries have been disproportionately impacted indicating varying impact of pandemic. There has been a rapid increase in unemployment due to COVID-19 in both urban and rural areas. Informal work has proven particularly vulnerable and is a vital source of income for many marginalized individuals and communities. It encourages inclusive development and emphasizes how important it is to involve legislators and partners in building a more robust and resilient social and economic environment and states that inclusive growth is only possible by reducing poverty, removal of inequality and creating

more job opportunities. This study provides policy recommendation to government of Bangladesh to deal with the consequences of pandemic for better economic future.

According to Cheshmehzangi(2020), a collection of small island republics in Oceania, many of which are affiliated with the Commonwealth, have successfully avoided the impact of the epidemic so far. These Oceania nations make up 70% of the countries in the region that have effectively attained zero COVID-19 cases. These countries were among the first to recognize the substantial risks presented by the outbreak, particularly in light of the potential impact on their flourishing tourism sectors. These governments, acknowledging their vulnerability, promptly established international border control measures in response to the outbreak. The goal was to reduce the risks and potential emergencies that could have led to a substantial loss of life on their coastlines. The notable feature is in the cooperative approach embraced by these smaller nations in addressing COVID-19. To restrict the movement and discourage the foreign travels, governments imposed the strict lockdowns and bans to avoid the spread of virus. Through the adoption of this measures, these nations have established a broader zone that is free from the Covid-19 virus, enabling reasonably secure mobility among them. From an economic perspective, this decision is beneficial as long as there is continued trade and business operations between these regions. Based on their early and effective actions and the acknowledgment by their respective governments of the potential risks to public health, it may be inferred that there has been successful regional coordination.

Material and Methods

This research is conducted through a multi-dimensional framework of different data visualization techniques such as treemaps, grouping/faceting, barcharts, piecharts, using secondary data sourced through Kaggle, obtained from ILOSTAT. Data of different variables has been combined from the covid monitoring section. All the variables used in the data are almost from 2020. This research offers understanding of consequences of the pandemic on employment and its subsequent effects on the quality of life using employment-related variables containing 189 observations of 12 variables which includes country, continent, percentage hours lost 48 hours per week (thousands), percentage hours lost 40 hours per week (thousands), labor dependency ratio, total weekly hours worked (in thousands), employed female (thousands), percentage of working hours lost (4th quarter of 2019), percentage employed male (thousands), ratio of weekly hours worked, , total weekly hours worked (in thousands), and actual working hours lost(thousands).

Results and Discussion

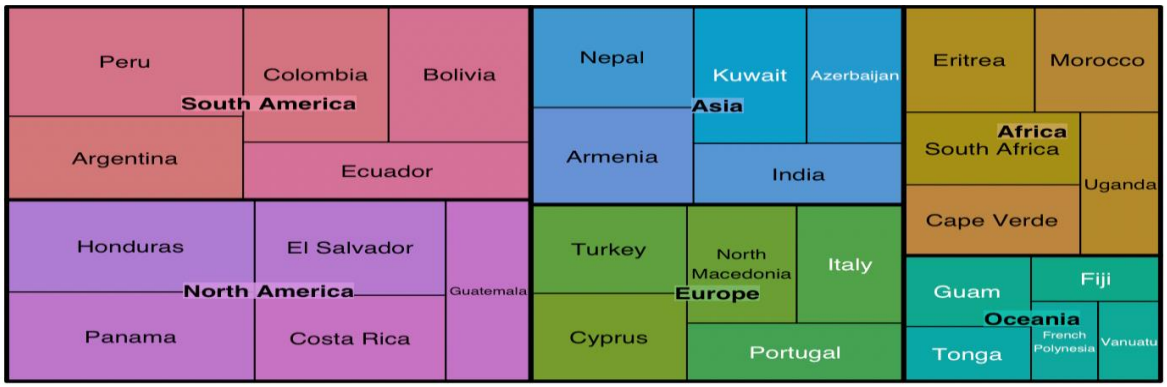

Figure1: Treemap for Top 5 Countries of Each Continent having Highest Percentage of Working Hours Lost.

In Figure 1, grouping and subgrouping extensions is used to represent the countries most affected by COVID-19 in regard to working hours lost in each continent. Continents are represented as "groups" whereas countries as "subgroups". The size of the rectangle represents the magnitude of the value of the percentage of working hours lost due to COVID-19. Some countries in plot have the minor difference between their percentages of working hours lost so it might not be visualized prominently so referring the numerical values is always recommended as shown in Table2. The treemap shows that Peru lost the highest percentage of working hours (27.5%) in South America and its employment was most affected by COVID-19. Peru does not only have highest percentage of working hours lost in South America, but it is also on the first place of the list of the world's top10 most affected countries out of 189 countries present in our data as shown in Figure3. Similarly, Guam lost the largest percentage of working hours (9.6%) in Oceania, Honduras lost the highest percentage of working hours (24.3%) in North America, Turkey lost the highest percentage of working hours (14.7%) in Europe, Nepal lost the highest percentage of working hours (17.4%) in Asia, and Eritrea lost the highest percentage of working hours (14.7%) in Africa which is indicated by Table1 as well.

TOP 5 COUNTRIES WITHIN EACH CONTINENT WITH HIGHEST PERCENTAGE OF WORKING HOURS LOST

Country	Continent	Percentage of Working Hours Lost
Peru	South America	27.5
Argentina	South America	21
Colombia	South America	20.9
Bolivia	South America	20.5
Ecuador	South America	17.6
Guam	Oceania	9.6
Tonga	Oceania	7.4
Fiji	Oceania	6.3
French Polynesia	Oceania	5.7
Vanuatu	Oceania	5.3
Honduras	North America	24.3
Panama	North America	23.5
El Salvador	North America	19.4
Costa Rica	North America	17.5
Guatemala	North America	16.4
Turkey	Europe	14.7
Cyprus	Europe	14.6
North Macedonia	Europe	13.8
Italy	Europe	13.5
Portugal	Europe	13.4
Nepal	Asia	17.4
Armenia	Asia	16.8
Kuwait	Asia	16.4
Azerbaijan	Asia	14.1
India	Asia	13.7
Eritrea	Africa	14.7
Morocco	Africa	14.1
South Africa	Africa	13.6
Cape Verde	Africa	13.3
Uganda	Africa	12.2

Table1 Values for Top 5 Countries of Each Continent having Highest Percentage of Working Hours Lost.

It is important to realize that there are some countries present in our dataset which belongs to two continents such as: Egypt, Turkey, Azerbaijan, Georgia, and Kazakhstan, Portugal, and Russian Federation. Egypt belongs to Africa/Asia, whereas Turkey, Azerbaijan, Georgia, Kazakhstan, Portugal and Russian Federation are from Europe/Africa.

Since there is a minor difference between the values of the percentage of working hours lost in the given countries, as shown in Table1, a separate treemap (Figure2) for Africa clearly shows a slightly higher value of the percentage of working hours lost in Eritrea (14.7) than Morocco (14.1), South Africa (13.6), Cape Verde(13.3) and Uganda(12.2). It is advisable not solely to rely on visualization; numerical observations are also critical and should be considered.

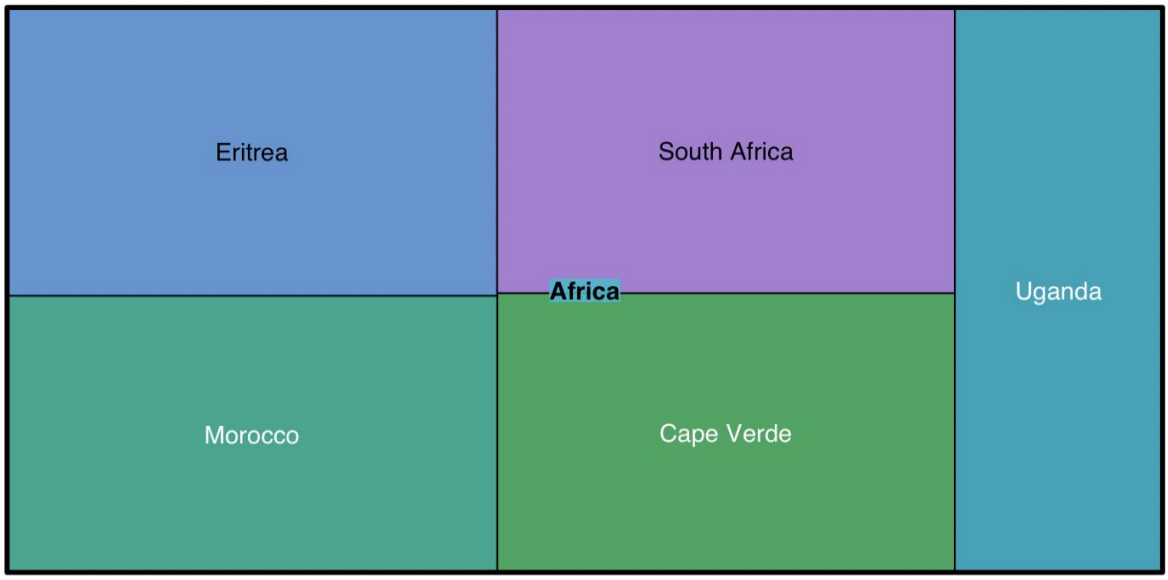

Figure2: Treemap for Top 5 Countries of Africa having Highest Percentage of Working Hours Lost.

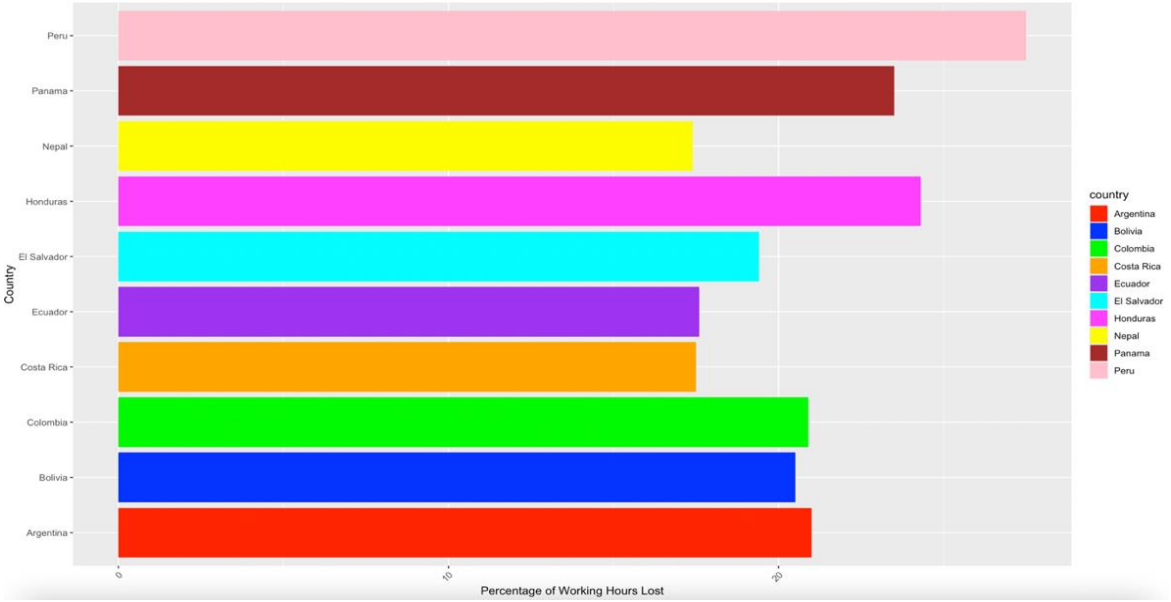

Figure3: Bar Chart Displaying Top 10 Countries with Highest Percentage of Working Hours Lost in World

In Figure 3, the y-axis of the bar chart shows the distribution of percentages of working hours lost across countries around the globe, and the x-axis shows the frequency of those values. Among these ten countries, five are from South America, four are from North America, and one is from Asia. No country from Europe is present in the top 10 countries in which employment was most affected due to COVID-19. Peru, located in South America, was the most affected, losing 27.5 percent of working hours; Honduras, located in North America, was in second place with 24.3 percent working hours lost, following Panama, located in North America, with 23.5 percent; Argentina, located in South America, with 21.0 percent, Colombia located in South America with 20.9 percent, Bolivia is located in South America with 20.5 percent; El Salvador is located in North America with 19.4 percent; Ecuador is located in South America with 17.6 percent; Costa Rica is located in North America with 17.5 percent, and Nepal is located in Asia in 10th place with 17.4 percent of working hours lost compared to the baseline (4th quarter of 2019).

Top 10 Countries With Highest Percentage of Working Hours Lost

Country	Continent	Percentage of working hours lost
Peru	South America	27.5
Honduras	North America	24.3
Panama	North America	23.5
Argentina	South America	21
Colombia	South America	20.9
Bolivia	South America	20.5
El Salvador	North America	19.4
Ecuador	South America	17.6
Costa Rica	North America	17.5
Nepal	Asia	17.4

Table2: Table representing Top 10 Countries with Highest Percentage of Working Hours Lost in World

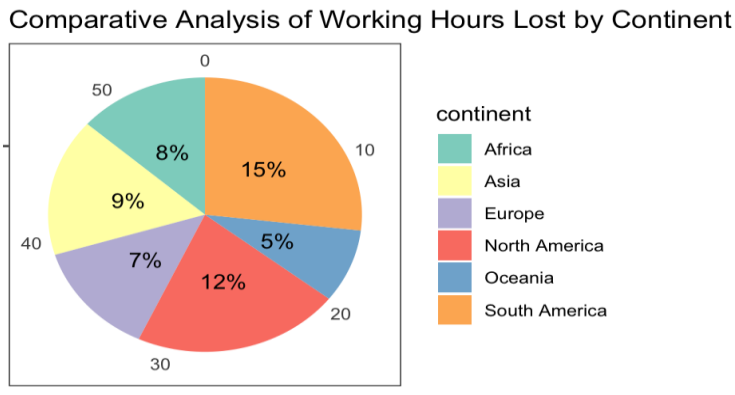

Figure4: Pie Chart Showcasing Comparative Analysis of Working Hours Lost by Continent

In Figure 4, Pie Chart is used for a comparative analysis of working hours lost across different continents. Our data contains countries from 6 continents, including 54 African countries, 49 Asian countries, 42 European countries, 20 North American countries, 11 Oceanian (Australian) countries, and 13 South American countries. The study uses the median of percentage of working hours lost of each continent to get the better understanding of the diverse impact of COVID-19. It is evident that South America is the most affected continent, as seen in the bar chart as well (Figure3), where 5 of the top 10 most affected countries were from South America, including Peru, Colombia, Bolivia, Argentina, and Ecuador. South American countries lost 15% of working hours on average, whereas North American countries lost 12% on average, followed by Asian countries, which lost 9% on average, African Countries lost 8% of working hours on average, European Countries lost 7% on average, Oceanian Countries losing 5% on average (compared to the 4th quarter of 2019).

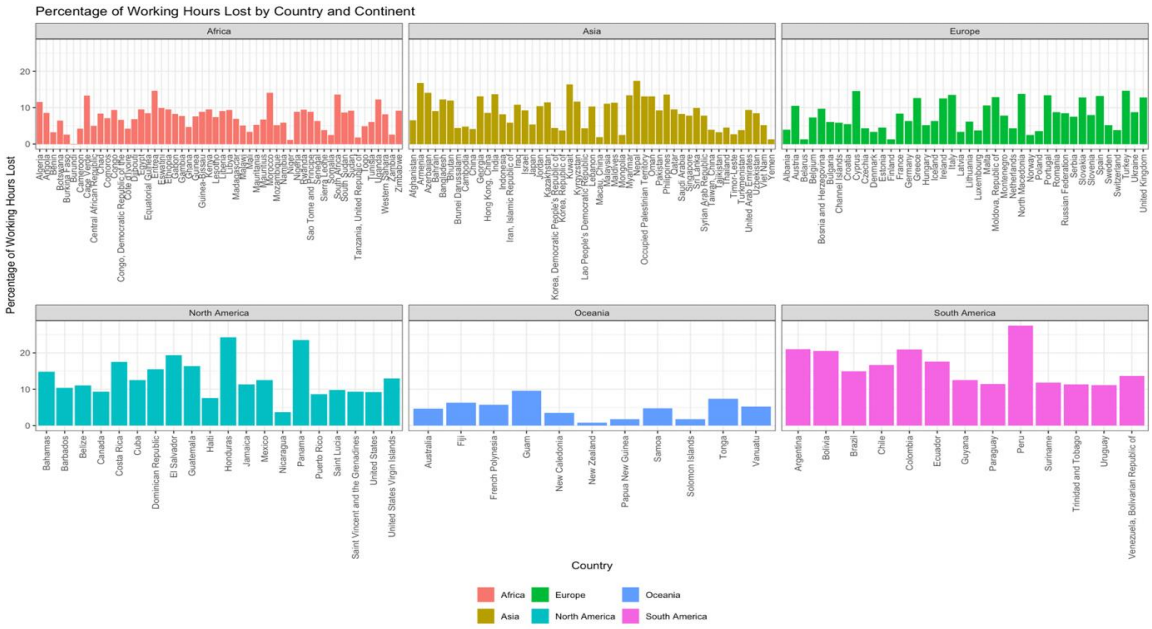

Figure 5: Grouping/ Faceting

In Figure 5, different continents are represented by different facets so that the overall level of working hours lost between continents and within continents can be compared. This grouping/faceting plot is a great tool of data visualization through which varying degree of consequences across different continents can be compared. This shows the power of data visualization that through a single visual, we can compare 189 countries across six continents of the world.

If we draw a comparison between these six continents, it can be observed that South America and North America had the highest percentages of working hours lost on average despite being highly developed continents as stated by Table1, Figure3 and Figure4. On the other hand, Asia's employment was not much affected by COVID-19 because most countries in Asia are developing. People are already unemployed there, so employment did not get much affected. Europe and Africa were also averagely affected, and Oceania got least impacted during COVID. This figure shows the comparison of countries within each continent through their bars. Burundi, located in Africa, lost the lowest percentage of working hours (-0.1%) and did not face unemployment during COVID-19. In contrast, in South America, Peru was adversely affected by COVID-19 and lost 27.5% of working hours.

Conclusion

The result of this study highlights the importance to address the negative consequences of COVID-19 to avoid its long-term side effects. The contribution of this research is to enhance the comprehension of the effects of COVID-19 on 189 countries across six continents of the world to identify those countries requiring support and focused intervention to deal with those consequences. Figure 5 shows the varying impact of COVID-19 on employment indicating that some countries are more affected by the pandemic than others such as South American and North American countries, despite being the highly developed countries, have the highest percentages of working hours lost as compared to five other continents. On the other hand, Oceania is seen to be the least affected due to COVID-19. It emphasizes on addresses the importance of negative consequences and verifies the requirement of providing solutions to deal with those negative effects further leading to economic betterment. This study uses different data visualization techniques throughout to interpret the results better and analyze my research question with the help of dplyr, ggplot, treemap, barchart, pie chart and grouping/faceting to make it useful and understandable for the people in this field of study. It is important to acknowledge the limitation of this study to encourage the in-depth analysis and more detailed research in future.

Recommendations

The research's importance resides in its ability to improve policy decisions, resource allocation, and awareness to handle the economic challenges produced by COVID-19 successfully assessed through the variables linked with unemployment utilizing a multidimensional framework and data visualization techniques, i.e., treemap, bar chart, pie chart, and grouping/faceting. This study underscores the regions with the most significant loss in actual working hours such as South American and North American countries. Additionally, to mitigate the negative impacts of COVID-19 on employment, this research recommends that these highly affected countries be provided targeted support like income support packages and job retention schemes. This study shows that the continent Oceania is the least affected by COVID-19, so it is highly recommended that other countries look into Oceania's strategic plan as discussed in literature review. This study can be used for policy making by concerned institutions like World Bank, IMF and WHO. To improve the comprehension of COVID-19's side-effects on employment, the quality research with evidence-based policy making and data collection should be encouraged.

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