How can technological advancement lead to unemployment?

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Acknowledgments

Abstract

My paper talks about how technological changes has both directly and indirectly impacted unemployment. I use secondary data and Microsoft Excel regression to form correlations between the two. These correlations help me reach to my conclusion about the effect technological changes has on unemployment in the economy.

INTRODUCTION

Technological advancement is a form of economic growth that is caused due to an increase in technology available for the economy's use. This has often caused structural unemployment, as when the economy starts to use more technology there is a change in the structure of the economy. This unemployment has been seen throughout history and has continued to the present. Just after the industrial revolution (which is claimed to be one of the biggest technological advancements), many jobs had been replaced as the manufacturing process was made more efficient, for example, people responsible for screwing the toothpaste cap on the packaging were replaced by robots. This is a form of direct unemployment caused due to technological advancements. This question is extremely pertinent to today's lifestyle as technological changes are happening every second. Every second there is a new app, machine or method created to help reduce our effort thus potentially reducing the need for labour. This is also one of the reasons due to high unemployment in many countries. **My research question is "How can technological advancement lead to unemployment?"** My hypothesis is that there is a direct relationship between technological advancements and unemployment. The aim is to find a definite answer supported by statical data to answer the research question.

Literature Review

There have already been many papers on the topic of "Technological Unemployment". The main papers include the paper authored by Andzej Klimcsuk and Magdalena Klimczuk-Kochańska from the University of Chicago titled "Technological Unemployment" this paper starts by talking about what technological unemployment is: "Technological unemployment is a situation when people are without work and seeking work because of innovative production processes and labor-saving organizational solutions". The second subtopic talks about how many well-known 18th century economists like James Steuart, Adam Smith, Jean Baptiste Say, Thomas Malthus, Dacid Ricardo and John Manard Keynes believed in the compensation theory which states that the negative employment effect caused by improvement in technology is just a temporary phase of maladjustment and in the long run

the problem will be solved by society and will increase living standards as prices of goods would decrease due to greater efficiency leading to lower production costs. The paper also talks about how Karl Marx was a critic of this compensation theory. His viewpoint was that the increase in wealth would be distributed among the 1% (the owners of the big firms) increasing income inequality he also says that industries will be less likely to have sufficient a number of jobs to balance out the negative effect. The next part talks about the viewpoint of contemporary researchers who are believers in "the end of work". In this concept, the automatic system which compensates for the loss of jobs is broken leading to massive unemployment.

The second research article, I have read, is an article published by the United Nations Department of Economic and Social Affairs. Titled "Will robots and AI cause mass unemployment? Not necessarily, but they do bring other threats". It starts by talking about how technology has evolved and then goes on to talk about how by 2050 is estimated there are 6 billion people in the working class whereas in today's date we are not even able to employ the 71 million people available. It then talks about technologies different aspects of how its contributing to income inequality, unemployment. It also gives a solution that the government could use.

 The third research article is an article published by Ebenezer Agbozo, Victoria F. Turygina (from the Urarl Fedral University) and Adven Masih (from University of Sialkot). The article is titled "The Effects of Technology on Employment (What the Future Holds)". It starts by talking about technology and states its benefits like higher productivity and higher returns on investments. It then talks about how the advancement in technologies has caused job vacancies in many industries due to technology being more efficient and how it "eradicates the need for human effort". It then gives a solution to this which is to add innovative courses in school curriculum. It then talks about the challenges to implement such as "financial constraint", "availability of inadequate professionals". And then it gives a solution to these challenges which is the government could raise funds, and online courses.

Methodology

As is it not possible for me to prepare a survey or any other primary research technique. **I will be analysing secondary data I have found on the topic. Many sites like the world bank site, etc have data talking about unemployment**, by analysing this data I will be able to write a research paper.

Discussion

Driverless Automobiles

In recent years a company called Waymo, in the US, has produced a driverless taxi. This taxi has lower fare prices as wages don't need to be high so the cost of production is low, as in the long run, the total cost of building the car would be less than the aggregate wages that had to be paid and also since machines are more efficient many big taxi companies such as (Laxmi Taxi Company and Electro Car India along with Cruise and Motional in the US) are now opting to use driverless cars. Other than lower fares, the high demand for this type of taxis is

also since they are more sanitary as considering the recent pandemic there is no human driver who may carry diseases. Also, the increase in demand for these taxis could be attributed to them being a fad, something that everyone wants to try due to their recentness. This has made many cab drivers unemployed. This unemployment is a type of structural unemployment as the structure of the cab market has changed. Many cab drivers also may not be able to find any other jobs as they are not qualified enough. This would mean that since they would not have an income, they may not be able to afford the daily necessities causing living standards in the economy to fall.

Waiterless Restaurants

Many restaurants in Tokyo are now slowly converting to a semi-robot semi-human staff. This means that water and other condiments are now brought to tables by robot waiters. This again lowers the restaurant's cost of production as robots do not need breaks between shifts, this makes robots more efficient than human waiters increasing their productivity thus increasing the restaurants' profits. Also, since fewer humans are involved in bringing the food, the food may be more hygienic as there will be less chance of contamination. As more restaurants switch to robot waiters, the need for human waiters is reduced, which causes more structural unemployment.

Automated Toll booths

Many toll booths in the US and around the world are now automated as they are more efficient as there are no shifts and they can scan the tickets and give commands to open the barriers much more quickly. This has made them favourites of the public as they are able to save and the long lines at toll booths have shortened, this also means they are more productive and thus generate higher profits for the government, as no wages have to be paid either. This means that those previously employed at toll booths are no longer employed as now the demand for them has decreased. This increases unemployment in the economy.

Also, an important thing to note in all these situations, the jobs that have been replaced by robots are primarily ones that do not require any qualifications or academic skills as such. This means that the people being unemployed will have a harder to find jobs as they will not be considered under the 'skilled' class of the workforce.

Improvement in technology has also caused many secondary impacts on unemployment. Because of situations created by improvements in technology, many people have lost jobs. Here are a few examples.

Improvement in Communication

Due to an increase in communication technology, more people are now opting to work from homes as not only is it more comfortable to work from your home environment but due to COVID-19 many people have gotten accustomed to such working habits and are now finding it tough to change their habits. Due to this many restaurants and social places that co-workers would maybe visit after finishing their work have now shut down due to more people working online. This would mean the waiters and chefs working there would now become unemployed. These layoffs would increase unemployment in the economy. However, this may only be a type of frictional unemployment as they may find jobs in other restaurants.

Global Warming

Due to increase in technology, there has been an increase in the consumption of fuel to run those machines and technology. The use of technologies that emit CO_2 has resulted in an increase in CO_2 emissions. An increase in the consumption of fossil fuels would mean an increase in CO_2 levels, which would mean more greenhouse gases which would cause more global warming causing an increase in temperatures. This increase in temperature could cause a lot of unemployment. This could be due to many crops not being grown anymore due to unsupportive weather conditions, to weather that is too hot to work during for example in India during the peak summers if there is a heat wave passing through, the government makes it mandatory for offices and school to shut down). These off days would decrease productivity which would eventually lead to an increase in unemployment in the economy.

Global temperature increases over time are linked to increases in the unemployment rate. A linear regression using the unemployment rate as the dependent variable and the temperature anomaly in degree Celsius as the independent variable finds a statistically significant ($p = 0.0339$) association between the variables. Since $p < 0.05$, this association is statistically significant at the 0.05 level. The model predicts that a 1-degree Celsius increase in the temperature is associated with a 0.6219% increase in the unemployment rate.
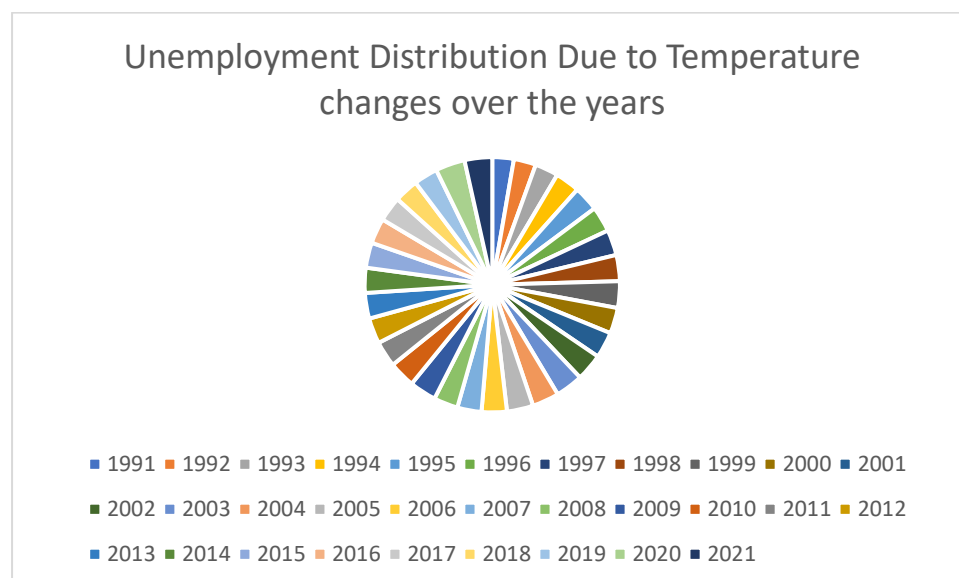
Overfishing

Another way technology has affected unemployment is due to overfishing. Big fishing companies use technological advancements to catch huge unsustainable amounts of fish in the sea, while there may be plenty of fish in the oceans, there aren't unlimited fish. This has caused a reduction in the number of fish in the ocean causing many local fishermen to struggle as there are not any fish left for them to catch. This has caused a lot of unemployment in the fishing industry which has increased the unemployment level in economies like that of Barbados which is extremely dependent on the fishing sector.

Evaluation

However, there isn't always a necessity that technological advancements will increase unemployment it may in some cases also have a net effect to reduce unemployment in the economy. For example, if the technological change may have caused a high demand for new machinery, then to build those new machinery's labourers would have to be employed. The number of labourers employed may be greater than the number of jobs lost by the implementation of that machinery, which would have a net negative effect on unemployment, reducing it.

Conclusion

My hypothesis is correct to a certain extent as we can see indirect factors that have been caused due to technological advancement do have a direct relationship with unemployment. Since technological advancement affects productivity, productivity can be used as a measure of technological advancement. For the United States, productivity does not have a statistically significant association at the 0.05 level between productivity and unemployment. However, for a recently developed country like India, we can see that $p < 0.05$, this association is statistically significant at 0.05 level.

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RESULTS (TABLES)

Correlation Between Temperature and Unemployment:

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.3819898							
R Square	0.1459162073							
Adjusted R Square	0.116465042							
Standard Error	0.3320421122							
Observations	31							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	0.546244888	0.546244888	4.954513887	0.03395602217			
Residual	29	3.197306964	0.1102519643					
Total	30	3.743551852						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	5.356465726	0.1651190648	32.44001977	0	5.01875932	5.694172131	5.01875932	5.694172131
Temperature Anomaly	0.621921991	0.2794057817	2.225873736	0.03395602217	0.05047300417	1.193370978	0.05047300417	1.193370978

Correlation Between India's TFP and Unemployment:

Multiple R	0.701594							
R Square	0.492234							
Adjusted R	0.474099							
Standard E	0.460428							
Observatic	30							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	5.754253	5.754253	27.14349	1.56242E-05			
Residual	28	5.935827	0.211994					
Total	29	11.69008						
	Coefficients	standard Erro	t Stat	P-value	Lower 95%	Upper 95%	ower 95.0%	Upper 95.0%
Intercept	0.934217	0.195958	4.767446	5.24E-05	0.532816058	1.335618	0.532816	1.335618
X Variable	-0.1518	0.029136	-5.20994	1.56E-05	-0.211481171	-0.09212	-0.21148	-0.09212

Correlation Between USA's TFP and Unemployment:

SUMMARY OUTPUT

Regression Statistics

Multiple R	0.058818693
R Square	0.003459638
Adjusted R S	-0.01211130
Standard Err	1.571316361
Observations	66

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.548583936	0.548583936	0.222185555	0.638982569
Residual	64	158.018246	2.469035107		
Total	65	158.5668308			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	5.126086678	1.626075262	3.152428918	0.002464424	1.877627907	8.37454545	1.877627907	8.37454545
RTFPNAUSA	0.905490131	1.920993125	0.471365628	0.638982569	-2.93213480	4.743115063	-2.93213480	4.743115063