

A Visual Analysis Approach to Explore the Effect of Globalisation on the Living Standards of Young Adults in America

I. Motivation and Introduction

The nation with the most advanced economy in the world have this year elected a president with zero political experience who promised to overhaul their current establishment if elected. Experts will continue to theorise over what led Americans towards this seemingly visceral decision. A compelling theory is that although globalisation has allowed USA to flourish economically, due in part to the increase in international trade, this has come at the expense of many of its own citizens; especially those at the bottom of the socioeconomic ladder, whose frustrations have brewed over the years as a result of unaffordable housing, declining wages and high youth unemployment despite the economy growing consistently in the past 32 out of 36 years [1].

That, in part, is what the focus of this data science project will be. We will analyse census data¹ of young adults, those aged between 18-34 years-old, in America over three decades to try and understand the underlying trends that have led to a decline in living standards and prospects of millennials today. The census data includes many features such as the demographic information, education levels, median earnings and living arrangements of young adults in the years 1980, 1990, 2000 and 2010, both state-by-state and for the USA as a whole. This project will seek to investigate the following research question:

- **How has globalisation affected living standards of young-adults in America?**

The pertinence of this research is showcased by many aspects, most notably in that the decline in living standards and prospects in the Western world has seen many millennials turn to far-left political candidates [2] such as Bernie Sanders in the USA and Jeremy Corbyn here in the UK. It is clear a change is needed as the current system isn't working for everyone; this project will thus aim to understand if aspects of globalisation are to blame for this decline and hopefully further this debate.

First, the task at hand and approach that will be used to tackle this research question is introduced in Section II. Section III will then present the analysis of this project, Section IV will discuss the findings and will aim to answer our research question in full, before finally Section V involves a critique that primarily comprises a discussion of the limitations and potential extensions of our work.

II. Task and Approach

To tackle our research question, the first step is to select features from the main data set that will characterise living standards of young adults in America. In which real median earnings was selected as it is a good indicator of socioeconomic prospects of citizens over time when adjusted for inflation. As America's economy has grown, one would expect that the median earnings of its own citizens would also grow, especially since more and more Americans are attending university. Thus the percentage of young adults with university degrees in each state was another feature chosen for analysis. The first task in this project was to examine the relationship between proportion of university educated young adults and their median earnings. By looking at the state-by-state data, we examined if a correlation between education levels and median earnings exists and whether it has subsided of late.

Now to align to the research question in full, features of globalisation were selected and tested against these median earnings. A core facet of globalisation is an increase in international trade which has been conducive to the explosion of wealth and growth that USA has experienced. This increase in economic growth is analogous to an increase both in immigration and GDP [3] – which are therefore the data features of globalisation that will be used in this project.

Although increasing immigration reportedly has negligible overall effect on salaries, any effect experienced will likely impact salaries of low-end and minimum wage jobs, which are disproportionately held by young adults [4]. Since the data does not include immigration figures, we will use the demographic data to examine if the states in USA that have had a larger increase in minorities over time will also be the states that have experienced a large decline in median earnings.

To examine the other aspect of globalisation, we will see if a drop in living standards for millennials is due to unequal or uneven economic growth. Where perhaps although GDP has grown significantly, those states that have experienced a smaller share of this overall growth are likely to be the states where living standards have dropped. To do this, we gathered GDP growth per state from the years 1980 to 2010² and merged it with our main data set.

So in short, the analysis section will follow two main steps. The first will be an analysis of living standards of young adults in America from 1980 to 2010, where median earnings and education levels will be used as a

1. <http://www.census.gov/censusexplorer/censusexplorer-youngadults.html>
 2. <http://www.bea.gov/iTable/index Regional.cfm>

basis to assess any trends over this period. The second part of the analysis will then assess the effects of globalisation on these median earnings in order to align to our research question, by analysing if increases in immigration or unevenness of GDP growth across USA are to blame. All computational analysis was conducted via the Python programming language, particularly the preliminary data merging and munging prior to analysis. To complement the Python computational analysis, Tableau software was used to visualise choropleth maps of the USA – which will offer intuitive insight into the proposed tasks.

III. Analysis

The first step in the analysis is to assess the trend of median earnings and educational levels of young adults in the USA between 1980 to 2010. As Figure 1 shows, the percentage of young-adults with at least a Bachelor's degree, shown by the orange line, has steadily increased from 1980 to 2010. Meanwhile, as shown by the blue line, the median earnings of young adults across the USA experienced increases between 1980-2000 that matched the trend in increasing educational levels, before it fell between 2000 to 2010. Of course, this graph does not do much asides from confirming the motivations behind this project: what is behind this decline in median earnings of young adults since the year 2000?

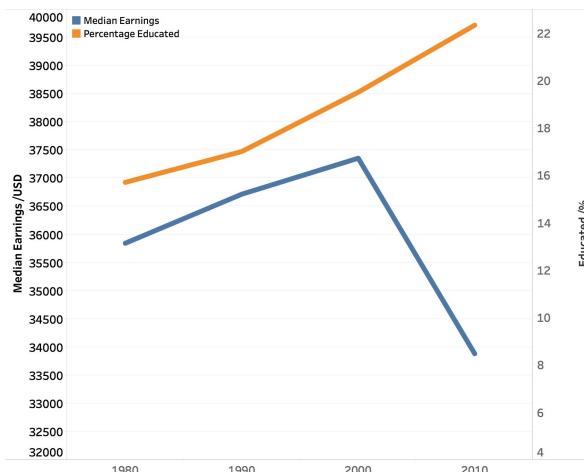


Figure 1: trend of median earnings (blue line), adjusted for inflation and measured in USD, and education levels (orange line), as a percentage of those with at least a Bachelor's degree, of 18-34 year-olds in the USA

Choropleth maps of the USA were then produced, showing the difference in median earnings between 1980 to 2010 and between 2000 to 2010, where the colour blue indicates states that have seen an increase in median earnings between those years. As Figure 2 shows, fourteen states have seen a rise in median earnings of young-adults between 1980 to 2010, and there is an even fewer number of states, four, seeing a rise in median earnings when comparing 2000 to 2010.

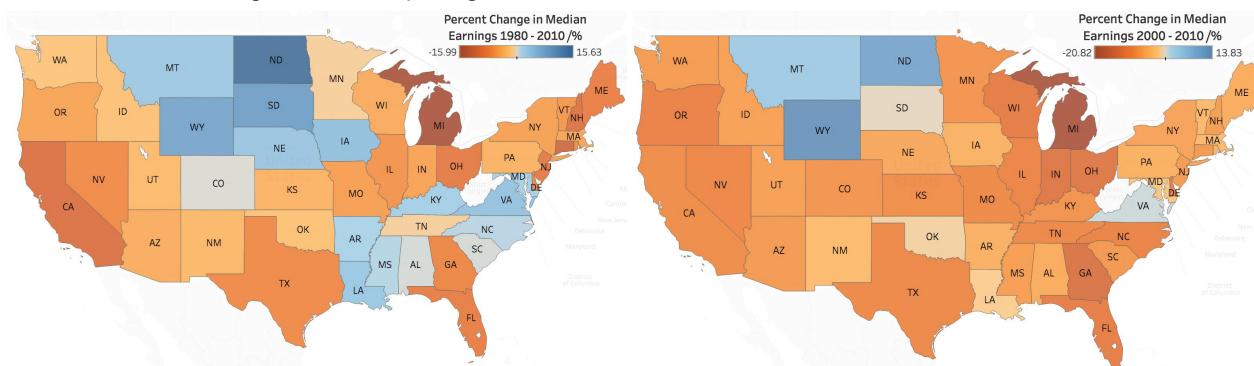


Figure 2: choropleth maps of the USA showing the difference in median earnings of young adults between 1980 to 2010 (left) and 2000 to 2010 (right). Where blue coloured states indicating an increase and orange indicates a decrease in median earnings.

We will thus first analyse if a relationship still exists between education levels and earnings. To test this, all states in America were plotted on a scatter plot with the percentage of those educated in that state on the x-axis and median earnings of young adults on the y-axis. A regression line was then drawn to analyse the correlation between the two in 1980 and 2010, and shown in Figure 3.

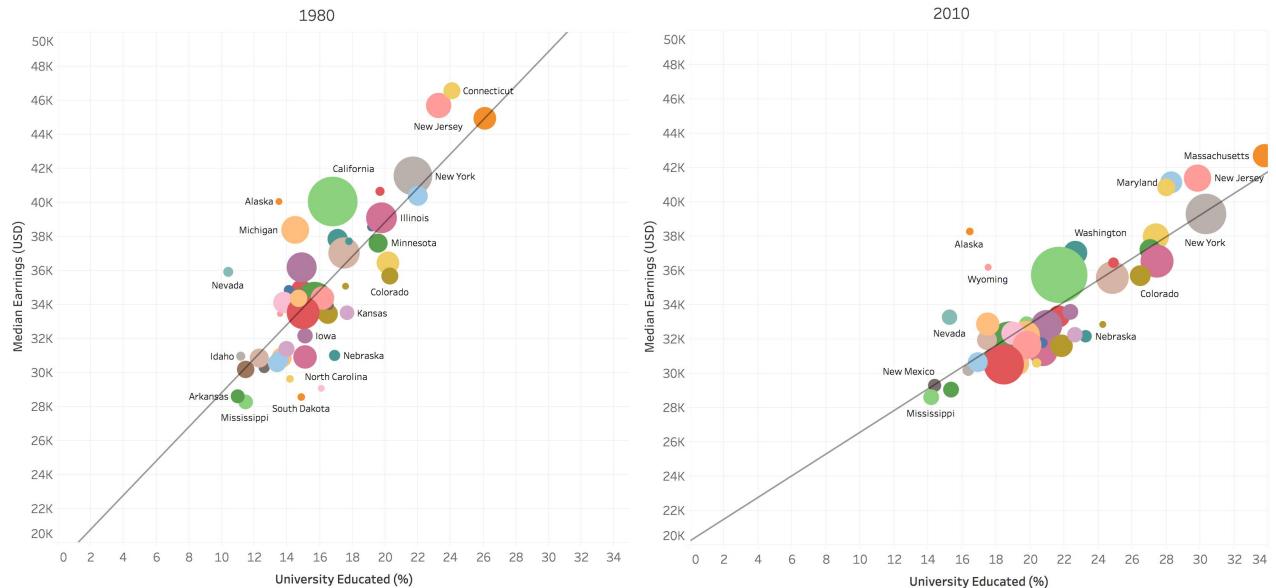


Figure 3: regression analysis of percentage of young adults with at least a bachelor's degree in each state against the median earnings in 1980 (left) and 2010 (right), where the colour indicating a state in USA and the size indicating the population in that state.

The regression analysis shows a strong positive correlation, indicating that states with higher percentages of young adults with a university degree have higher median earnings, both in 1980 and in 2010. Therefore, according to this analysis, it perhaps isn't that university education is no longer conducive of higher earnings in young adults in USA, but another underlying factor behind this trend.

This leads to the assessment of globalisation and its effect on this drop in median earnings. To begin, choropleth maps of USA are visualised with the increase in the proportion of minorities in each state shown between each decade - 1980 to 1990, 1990 to 2000 and 2000 to 2010. Shown in Figure 4, with the colour scale on these maps set between a minimum of 0% to a maximum of 20% for uniformity and to allow easy visual analysis.

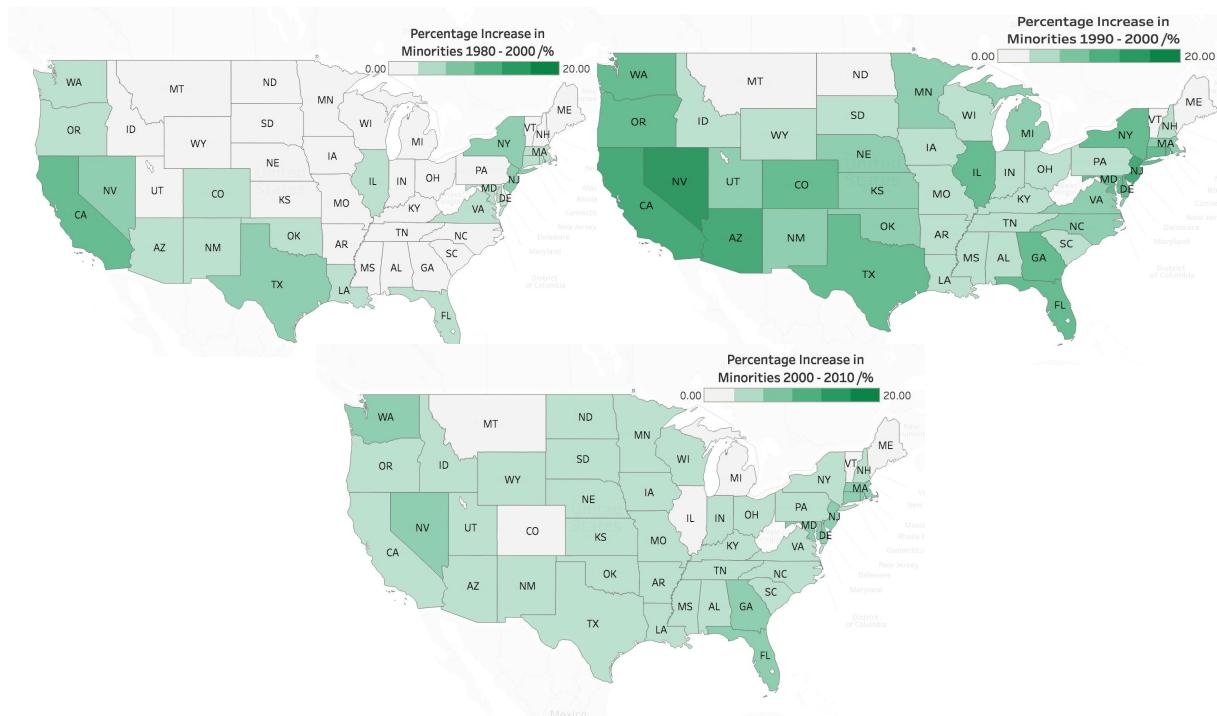


Figure 4: choropleth maps showing the percentage increase of ethnic minorities amongst young adults in each state between 1980 to 1990 (top-left), 1990 to 2000 (top-right) and 2000 to 2010 (bottom).

Reflecting on Figure 4, it is clear that the increase in percentage of minorities amongst young adults was greatest between 1990 to 2000. Interestingly, most states only experienced a moderate rise in minorities between 2000 to 2010 and there are no parallels between this choropleth map and that in Figure 2 earlier. Thus, it perhaps isn't a rise in immigration that is to blame for the drop in median earnings for young adults in the USA and as such we move onto the next part of the study – assessing economic growth across the nation. GDP growth for each state is visualised to assess how economic growth has been proportioned each 10-year period 1980 to 1990, 1990 to 2000 and 2000 to 2010 – the results of which are shown in Figure 5.

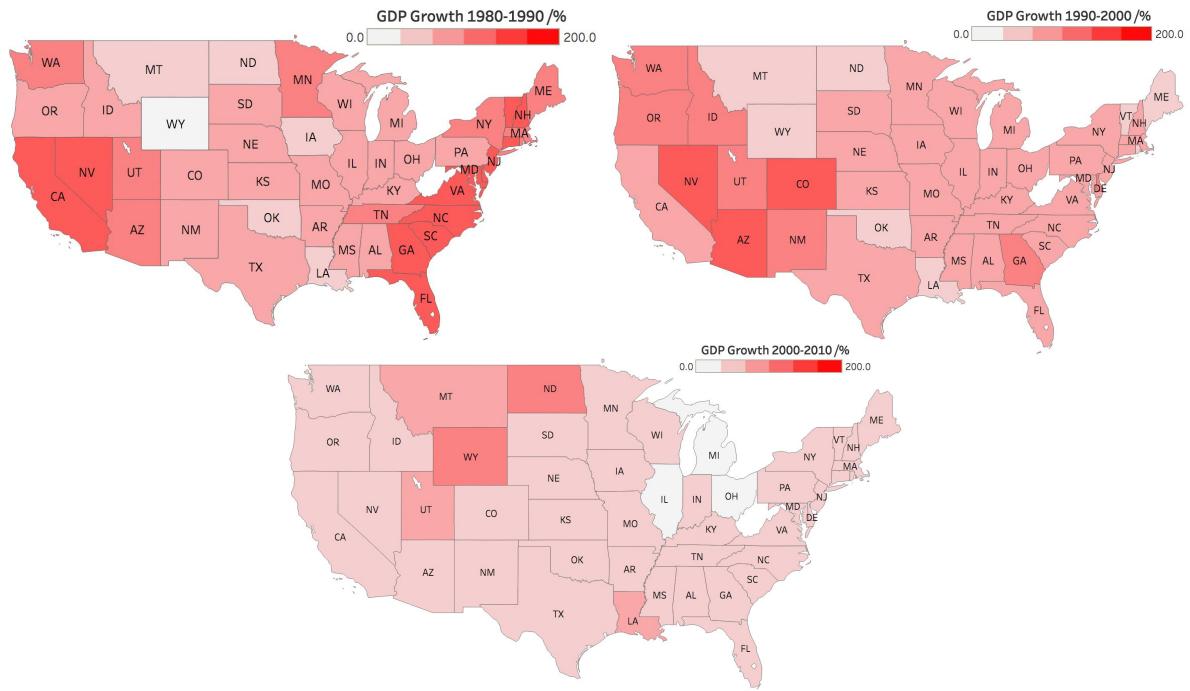


Figure 5: choropleth maps of GDP growth across each state in USA between 10 year periods 1980 to 1990 (top-left), 1990 to 2000 (top-right) and 2000 to 2010 (bottom).

Setting the scale on the choropleth maps in Figure 5 from 0% to 200% to aid comparison between each decade, it is clear that GDP growth was comparable in the periods 1980 to 1990 and 1990 to 2000. However, GDP growth as a whole across almost all states subsided between the year 2000 to 2010. This matches the trend of lowering living standards of millennials since the turn of the millennium as this tapering of GDP growth across the majority of the USA would leave those at the bottom worse off. Comparing Figure 5 with the earlier Figure 2 shows that three of the four states that saw an overall increase in median earnings of young adults between 2000 to 2010 and also 1980 to 2010, namely Wyoming (WY), North Dakota (ND) and Montana (MT), were the three states that also saw a larger increase in their GDP between 2000 to 2010 – as shown by the darker shades in Figure 5.

To supplement this, GDP per-capita is calculated to assess if economic growth has kept up with rises in population in each state. So by accounting for the change in population in each state, the GDP growth in Figure 5 is calculated at a per-capita basis for each state and visualised in a choropleth map. The results of this are shown in Figure 6 with the same scale once again of 0 to 200%.

As expected, using the GDP per-capita furthers the debate that growth in the US economy has been poor since the turn of the millennium. Almost half of the states in America fell into the lowest slice of GDP per-capita growth between 0% and 30% when looking at 2000 to 2010, compared to just one state in each of the 10-year periods preceding it. Meanwhile, there is a clear parallel between the states where median earnings of young adults in that state increased between 1980-2010 in Figure 2 and the states that experienced relatively high GDP per-capita in Figure 6.

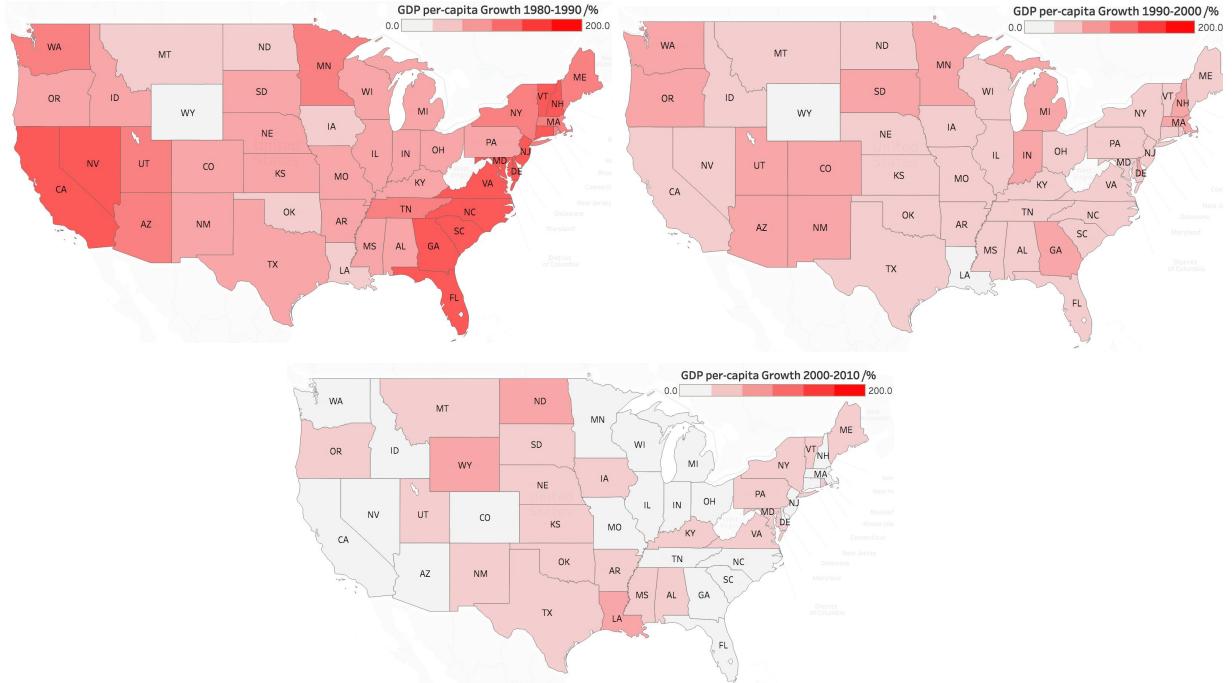


Figure 6: choropleth maps of GDP growth calculated at a per-capita basis by taking into account increases in population across each state in USA between 10 year periods 1980 to 1990 (top-left), 1990 to 2000 (top-right) and 2000 to 2010 (bottom).

III. Findings

Ultimately, we find that median earnings have decreased amongst young adults in America since the turn of the millennium, and even when comparing 1980 to 2010, despite an increase in the number of adults gaining university degrees (Figure 1). The regression analysis in Figure 2 inferred that university degrees are still a determining factor in earnings, by observing a strong positive correlation between states that have a higher percentage of young adults with university degrees and the median earnings of young adults in that state, both in 1980 and 2010.

In order to analyse whether globalisation can be blamed for this drop in living standards, we first identified states that have gone against this trend of decreasing earnings amongst young adults using Figure 3. Of note, Wyoming (WY), Montana (MT) and Nevada (ND) were three states that saw an increase in median earnings amongst young adults when comparing both 1980 to 2010 and 2000 to 2010. The first facet of globalisation examined was the increase in the proportion of minorities in each state for each decade between 1980 to 2010 and visualised in Figure 4. From this, no parallels could be drawn between states that saw a larger increase in minorities and the states identified as either having a larger increase or decrease in median earnings from Figure 3. Furthermore, the decade that saw the largest increase in minorities amongst most state was unquestionably between the years 1990 to 2000, which coincided with a period when median earnings were improving. Suggesting that immigration isn't to blame for the fall in living standards for young adults in America.

This in turn led to the next aspect of globalisation to be examined and consequently the most profound discovery of our research – that it is the poor economic growth across the USA that is of the detriment to living standards of young adults. To reach this conclusion, GDP growth in USA for each 10 year period was visualised per state in Figure 5. This analysis returned that although USA has seen GDP grow fairly consistently between 1980 and 2010, a majority of this GDP growth has been shared amongst only a handful of states, which unsurprisingly are the states that have also saw increases in median earnings. To supplement this, any GDP growth has been blighted by large simultaneous increases in population, showcased by the GDP per-capita analysis in Figure 6. Both these factors have been particularly impactful since the turn of the millennium, resulting in living standards to fall.

IV. Critical Review

We must reiterate that the results of our high level analysis return that increases in immigration are not the cause of this stagnation of living standards and it is instead that the US economy simply hasn't kept up with the growth it experienced in the late 20th century. This though, is not the fault of globalisation. It is simply the lacking economic growth that should be blamed as states that have had sufficient growth have seen median earnings also grow. Indeed, protectionist policies and reversing trade agreements will not solve this. Instead the government needs to focus on ways to boost the economy again, such as increasing infrastructure spend in states that have had a lag in growth, and simultaneously work on improving prospects of young-adults, such as focussing on improving the housing market and increasing minimum wages.

There was a plethora of other features from our initial data set that could have been analysed, all pointing to the same conclusion that living standards for young adults in America have worsened since the turn of the millennium. Namely, unemployment is by and large greater, poverty rates are increasing, marriage rates are shrinking and more young adults are living at home than ever before. Thus, although our choice of using median earnings as our gauge for living standards to narrow the scope of this project can be debated, the sentiment behind this analysis that living standards have at the very best stagnated over the past few years is concerning. Research like ours should be brought to the fore and addressed ever more so today as we head into disruptive times riddled with job displacements due to the rises in automation and technology [5], which will hamper living standards of young adults even more so than it is today if it is left unaddressed.

Our analysis also highlights an inherent problem with using a headline figure of GDP growth as the economic indicator for USA – it does not take into account growth imbalances in the country. A portion of states could grow at a much higher rate so as to skew the overall GDP growth figure for the USA as a whole – which is exemplified in Figure 5.

There are a number of limitations to this study and consequently the findings drawn upon from it. As previously mentioned, using median earnings as the ultimate litmus-test for living standards is not absolute. For instance, some states may well have had a small increase in median earnings, which would make it appear favourably in this study, meanwhile housing and consumer product prices could have also increased significantly in that state as to negate any advantages experienced from this increase in earnings. Median earnings also do not equate to living standards insofar as it doesn't consider other factors that could arguably be of more importance, such as hours and nature of the work that corresponds to that earning. Another limitation that should be mentioned is the financial crash that occurred in 2008, that has seen major economies still not fully recover from, may have potentially skewed the data in the year 2010.

Naturally, another limitation exists due to the analysis methods of this project, namely that we relied exclusively on inferences drawn from visualisations of our data. As such, a critique of our work could be that our research question was tackled at a high level and subsequently is lacking intricate value to the domain of America's current socio-economic discourse. Nonetheless, the visual analysis methods used offer intuitive and instant insight into trends that may be difficult to appreciate by solely relying on numerical analysis. Thus we believe with an increased scope and by complementing our visualisations with more detailed computational analysis would enrich this study.

This leads to the potential further work and extensions to this project. Firstly, it would be more insightful if yearly data was studied as opposed to decadal and analysing the data at a city or metropolis level as opposed to a state level. Doing so could potentially uncover further trends and allow a more detailed analysis of the living standards in USA over time for young adults. Secondly, the analysis in this project could be undertaken using data of adults at all age ranges, instead of just young adults aged 18-34, which could decipher if these trends are restricted to millennials or are encompassing all. Finally, incorporating other factors that characterise living standards such as house prices, crime rates and unemployment, and also other factors that could be impacting these living standards such as job automation and government spending, would be beneficial to extend the work in this project.

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