CIÊNCIAS SOCIALMENTE APLICÁVEIS:

INTEGRANDO SABERES E ABRINDO CAMINHOS

JORGE JOSÉ MARTINS RODRIGUES
MARIA AMÉLIA MARQUES

(Organizadores)

VOL VIII

EDITORA ARTEMIS
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APRESENTAÇÃO

O oitavo volume desta coleção segue a lógica dos livros anteriores. Procura apresentar ao leitor uma coletânea de artigos sobre problemáticas que são transversais ao campo das ciências sociais aplicadas.

Sendo discutível, na metodologia seguida na organização dos vários volumes procurou-se privilegiar artigos que abordassem novas tendências e/ou problemáticas transversais relevantes, adotassem metodologias mais holísticas e/ou modelos de investigação aplicada, apresentassem estudos de caso nacionais e/ou internacionais e procurassem ser reflexivos. Nesse contexto, o presente volume está organizado em três grandes eixos – Programação, Sustentabilidade, Educação e redes sociais.

Na construção da estrutura de cada eixo procurou-se seguir uma lógica em que cada artigo possa contribuir para uma melhor compreensão do artigo seguinte, gerando-se um fluxo de conhecimento acumulado que se pretende fluido e em espiral crescente.

Assim, o eixo Programação é constituído por um conjunto de oito artigos. A programação pode ser entendida como um conjunto de actividades que visam transformar tarefas repetitivas e monótonas em rotinas cooperativas e colaborativas. Estas rotinas são algoritmos e modelos matemáticos geradores de informação estruturada e eficiente que, apesar da sua racionalidade limitada, é útil para a tomada de decisões, sejam individuais ou de grupo.

O eixo Sustentabilidade junta um conjunto de sete artigos que, em comum, contribuem para a construção da responsabilidade social. As mudanças climáticas estão a perturbar a vida de milhões de pessoas no planeta, com especial ênfase nas regiões rurais mais pobres e com impacto negativo na economia. Assim, exigem-se políticas públicas inclusivas que incentivem o uso de materiais multiusos, amigos do ambiente. Os resíduos sólidos urbanos necessitam de ser melhor geridos e as empresas deverão ser incentivadas a incorporar aquelas políticas nas suas estratégias, para reforço dos seus valores, conforto e bem-estar dos seus constituintes.

O eixo Educação e redes sociais tem seis artigos. As principais teorias de liderança parecem apontar para que esta seja contingencial, podendo ser ensinada e as respectivas competências treinadas e melhoradas. Todo o ensino, presencial ou a distância, tem os seus pontos fortes e pontos fracos. Exigem-se comportamentos éticos, nomeadamente em ambiente de redes sociais, para evitar fraudes quer com os conteúdos quer com a respectiva avaliação, com eventuais traumas psicológicos em quem é visado.

Com a disponibilização deste livro e seus artigos esperamos que os mesmos gerem inquietude intelectual e curiosidade científica, procurando a satisfação de novas necessidades e descobertas, motor de todas as fontes de inovação.

Jorge Rodrigues, ISCAL/IPL, Portugal
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CAPÍTULO 9

CLIMATE SHOCKS AND THE US ECONOMY

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ABSTRACT: Climate change is already disrupting the lives of millions of people. Since the onset of the climate crisis, it has become a hot topic in economics. In this chapter, we review the evidence on the impact of climate shocks on the economy, using the United States as an example. Studies based on the evidence for the United States show that climate shocks have a negative impact on the economy. Climate extremes, such as cold and heat waves, droughts and floods, and wildfires, are deadly and dangerous. US media reports that large parts of the United States are at risk of climate change. It is therefore important that US policymakers take urgent action on climate change. Climate extremes in 2021 have put pressure on US federal and state governments to adopt more climate-friendly policies. The findings of this study have important policy implications for the United States at the federal and state levels.

KEYWORDS: Climate. Climate change. Climate crisis. Climate shock. Economy. United States.

CHOQUES CLIMÁTICOS E A ECONOMIA DOS ESTADOS UNIDOS

RESUMO: A mudança climática já está perturbando a vida de milhões de pessoas. Desde o início da crise climática, tornou-se um tópico quente em economia. Neste capítulo, revisamos as evidências sobre o impacto dos choques climáticos na economia, usando os Estados Unidos como exemplo. Estudos baseados em evidências para os Estados Unidos mostram que os choques climáticos têm um impacto negativo na economia. Extremos climáticos, como ondas de frio e calor, secas e inundações, e incêndios florestais, são mortais e perigosos. A mídia dos Estados Unidos informa que grandes partes dos Estados Unidos estão em risco de mudança climática. Portanto, é importante que os formuladores de políticas dos Estados Unidos tomem medidas urgentes em relação à mudança climática. Os extremos climáticos em 2021 colocaram pressão sobre os governos federal e estaduais dos Estados Unidos para adotar políticas mais amigáveis ao clima. Os

achados deste estudo têm importantes implicações políticas para os Estados Unidos em nível federal e estadual.
PALAVRAS-CHAVE: Clima. Mudança climática. Crise climática. Choque climático. Economia. Estados Unidos.

CHOQUES CLIMÁTICOS Y LA ECONOMÍA DE LOS ESTADOS UNIDOS

RESUMEN: El cambio climático ya está perturbando la vida de millones de personas. Desde el inicio de la crisis climática, se ha convertido en un tema candente en economía. En este capítulo, revisamos la evidencia sobre el impacto de los choques climáticos en la economía, utilizando Estados Unidos como ejemplo. Estudios basados en la evidencia para Estados Unidos muestran que los choques climáticos tienen un impacto negativo en la economía. Los extremos climáticos, como olas de frío y calor, sequías e inundaciones y incendios forestales, son mortales y peligrosos. Los medios de comunicación de Estados Unidos informan que grandes partes del país están en riesgo por el cambio climático. Es por ello importante que los responsables políticos de Estados Unidos tomen medidas urgentes en relación al cambio climático. Los extremos climáticos en 2021 han presionado a los gobiernos federales y estatales de Estados Unidos para adoptar políticas más amigables con el clima. Los hallazgos de este estudio tienen importantes implicaciones políticas para Estados Unidos a nivel federal y estatal.
PALABRAS CLAVE: Clima. Cambio climático. Crisis climática. Choque climático. Economía. Estados Unidos.

1 INTRODUCTION

In many parts of the world, climate change is already disrupting to some degree the normal functioning of economies and societies. Climate migration is expected to increase in the near future, especially in South Africa, South Asia and South America, putting pressure on resources in other parts of the world. During the twenty-seventh session of the Conference of the Parties, many climatologists and climate economists called for climate action at individual and collective levels. There is a growing body of evidence on the impact of climate change on the economy (see, e.g., Burke et al., 2015; Heal, 2017; Jones & Olken, 2010; Pendleton et al., 2013). This evidence shows that climate change has a negative impact on production and consumption.

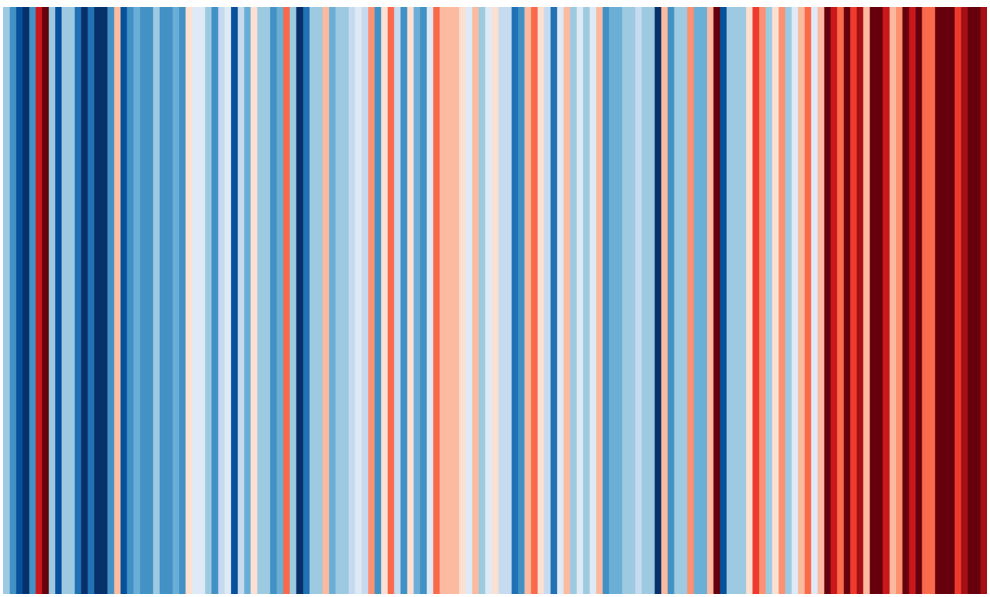
In recent years, many countries, including the United States, have experienced climate shocks (i.e., extreme climate events), such as extreme cold and heat waves (i.e., extreme cold and heat, respectively). For example, the United States experienced a cold wave in February 2021 and a heat wave in June and July 2021. Both waves had a negative impact on the economy. The extreme cold in February 2021 hit Texas the hardest, causing power outages. As a result, more than 4.5 million businesses and households were without power and more than 57 people lost their lives. According to US media reports, the big

freeze caused disruptions in oil and gas production in West Texas, causing oil and gas prices to rise.

The aim of this chapter is to review the evidence on the impact of climate shocks on the economy. We focus on the United States, which has been hit hard by natural disasters in recent years. For example, on 10 December 2021, Arkansas, Illinois, Kentucky, Mississippi, Missouri, and Tennessee were hit hard by a tornado outbreak. The US media reported that more than 77 people lost their lives in Kentucky alone. There are signs that Tornado Alley is moving southeast, raising concerns for the safety of people in the region. According to many US climatologists, it is unclear whether climate change is to blame.

Recent surveys (Ballew et al., 2022; Carman et al., 2022; Carman et al., 2021; Leiserowitz, Carman et al., 2022; Leiserowitz, Maibach et al., 2022) show that a growing number of Americans are already feeling the effects of climate change in their daily lives. This is not surprising, as the United States is at risk from climate change (Kiley, 2021). In 2022, the United States has experienced 18 weather and climate disasters, each causing at least $1 billion in damage. These events have led to a surge in public support for climate action in the United States (Leiserowitz, Maibach et al., 2022). Nevertheless, it is widely accepted that human activities are the main cause of climate change (Schiermeier, 2011). The fact is that North America, including the United States, is warming (see Figure 1 and Figures A.1–A.6 in the Appendix).

Figure 1: Temperature change in North America since 1972.



Note: For a description of the methodology, see https://showyourstripes.info/faq.
Source: Ed Hawkins, https://showyourstripes.info/.

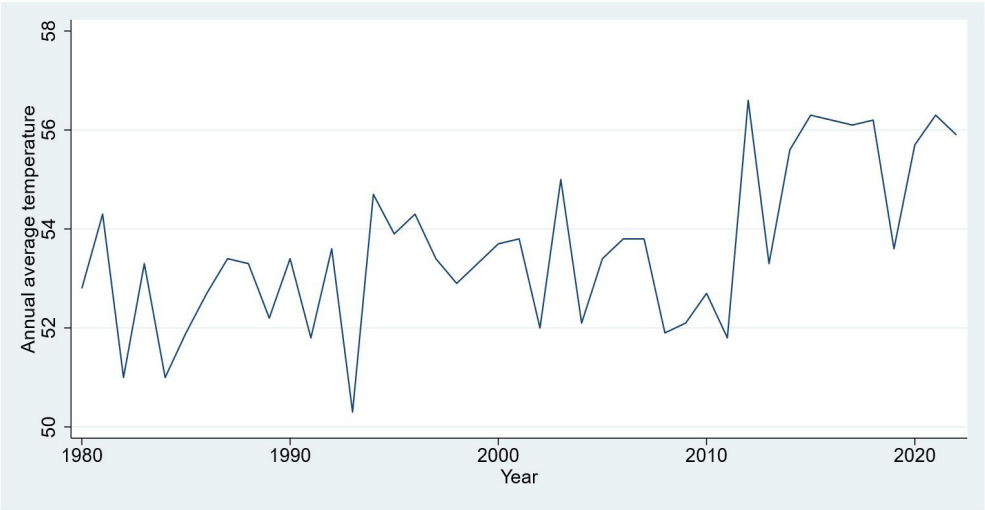
2 METHODS

In recent years, economists have become increasingly interested in studying the impact of climate shocks on the US economy (see, e.g., Changnon, 2003; Hsiang et al., 2017; Kiley, 2021). As a result, there is a growing body of evidence on this topic. In this chapter, we review the evidence on the impact of climate shocks on the US economy. In doing so, we use data from the National Center for Environmental Information and the Institute for Environmental Analytics (see https://showyourstripes.info/).

3 RESULTS

Evidence from the United States (Changnon, 2003; Hsiang et al., 2017; Kiley, 2021) shows that climate shocks have negative effects on people and the environment (ecosystems). Businesses and households in the United States need to mitigate the effects of climate change and adopt a different strategy in dealing with the situation. The fact is that ecosystems in the United States are at risk from climate change (warming). In 2022, the annual average temperature in the United States was 55.9 degrees Fahrenheit (13.3 degrees Celsius) (see Figure 2), 2.3 degrees Fahrenheit (1.3 degrees Celsius) above the average annual temperature for the period from 1980 to 2022, putting ecosystems in the United States under stress.

Figure 2: Annual average temperature in the United States in degrees Fahrenheit by year.

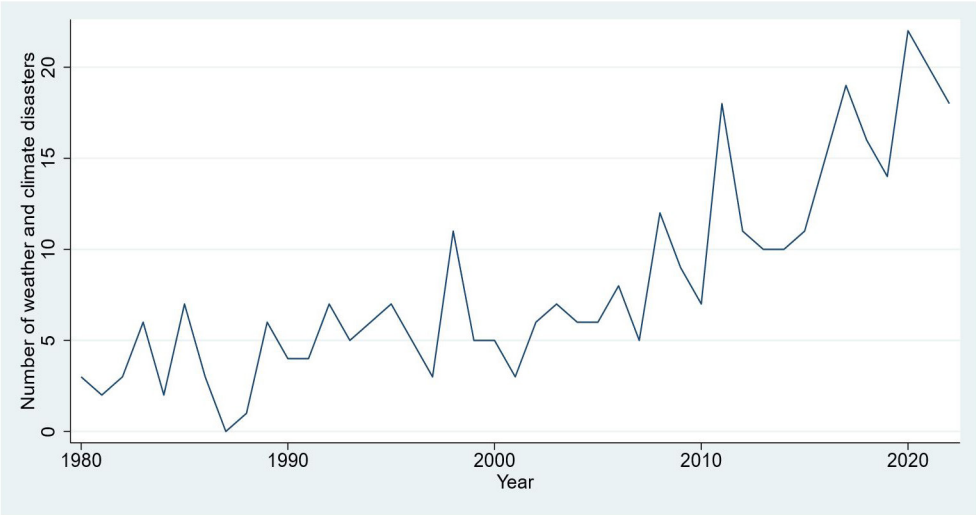


Source: National Weather Service (2023).

3.1 THE IMPACT OF CLIMATE SHOCKS ON THE US ECONOMY

Since 1980, the United States has experienced 348 weather and climate disasters, each causing at least $1 billion in damage (see Figure 3).

Figure 3: Number of weather and climate disasters in the United States by year.

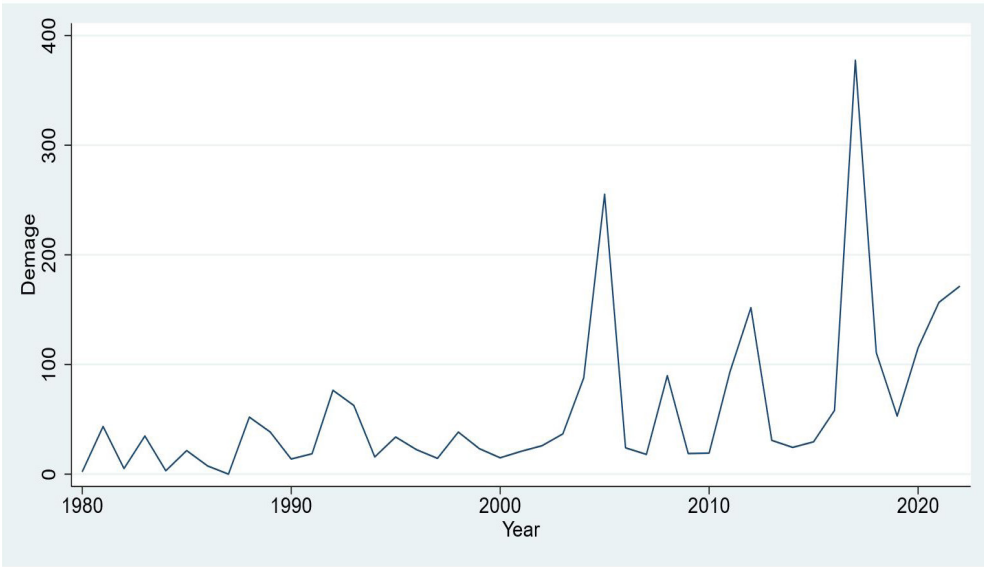


Source: Smith et al. (2023).

These events have occurred in every state in the country and have cost a total of more than $2.5 trillion (see Figure 4). In 2021 alone, the United States experienced 20 such disasters that cost a total of more than $156.7 billion. Of all types of disasters, tropical cyclones have the highest average cost per event at $20.3 billion. According to US media reports, Hurricane Katrina (August 2005, $191.3 billion) has been the costliest tropical cyclone ever. Since 1980, the damage was highest in 2017, mainly due to hurricanes Harvey (August, $152.5 billion), Irma (September, $61.0 billion) and Maria (September, $109.8 billion).

The reality is that hurricanes cause great damage to the infrastructure necessary to keep the US economy running. In addition, hurricanes also cause disruptions and other problems in the supply chains of US businesses, which also has a negative impact on the US economy. We must not forget that time is money and that delivery delays cause great costs for businesses and households.

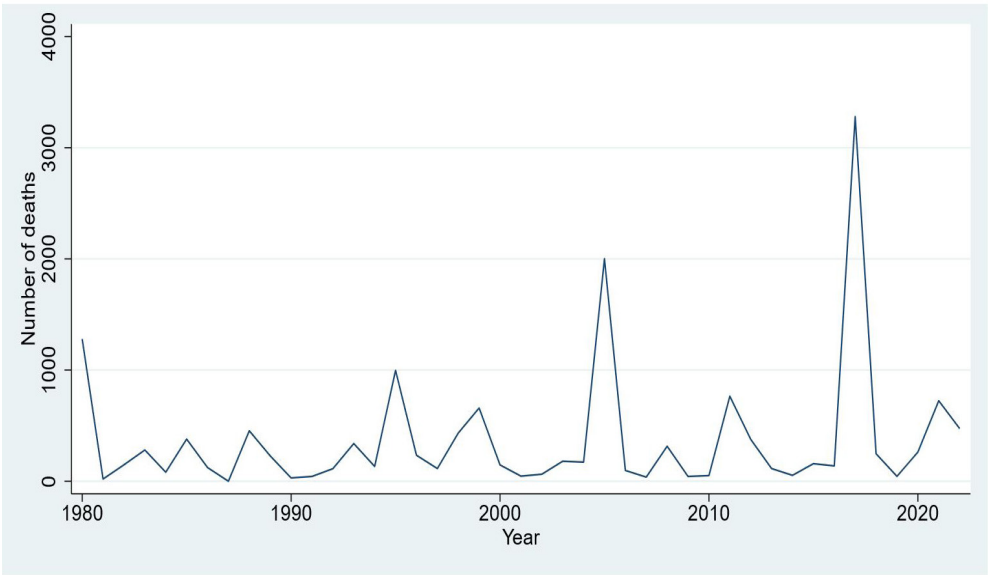
Figure 4: Damage caused by weather and climate disasters in the United States in billions of US dollars by year.



Source: Smith et al. (2023).

Weather and climate disasters have not only caused great damage, but have also claimed many lives (see Figure 5). Since 1980, the most people died in 2017 (3,280), mainly due to Hurricane Maria (September, 2,981).

Figure 5: Number of deaths caused by weather and climate disasters in the United States by year.



Source: Smith et al. (2023).

Texas has been hit particularly hard by weather and climate disasters. In the last four decades, there have been more than 100 events causing at least $1 billion in damage. This underscores the need to build infrastructure that is resilient to weather and climate disasters, especially in the energy sector. Winter Storm Uri (February 2021, $25.9 billion), the costliest winter storm in US history, showed that Texas is not resilient to weather and climate disasters. This is also true for other US states.

Many climatologists predict that the South will experience more deadly and dangerous climate extremes in the near future. Therefore, it is important for Southern states to address climate change. Many climate activists believe that climate change will disproportionately affect the poor. Therefore, policymakers need to make more efforts to mitigate the impact of climate change on the have-nots. In the near past, the media has reported that climate extremes such as hurricanes and tornadoes have disproportionately affected low-income communities (e.g., due to poor construction).

All in all, the climate crisis has put pressure on the government to provide climate justice for all. History teaches us that climate change can have a negative impact on food supply (harvest). Climate shocks, such as (extreme) droughts, can lead to (extreme) food shortages (crop failures). As of 21 December 2021, 46.2% of the United States and 185.1 million acres of cropland were in drought, affecting millions of businesses and households. In some parts of the United States, drought has short- and long-term impact on the economy.

3.2 THE IMPACT OF CLIMATE SHOCKS ON US SUPPLY CHAINS

Since the onset of the climate crisis, which has put pressure on all parts of the supply chain, policymakers and researchers have become increasingly interested in studying the impact of climate change on the supply chain. In this section, we ask what can we learn from the Covid-19 shock. To do so, we draw on evidence from the United States.

Following the Covid-19 outbreak, many US businesses shifted from just-in-time to just-in-case deliveries while facing increasing shortages of labour and parts. Evidence shows that the Covid-19 pandemic has had a negative impact on supply chains. To contain Covid-19, the US government was forced to take measures, including border closings, which led to disruptions in the supply of goods and services in North America. According to US media reports, many small US businesses were at risk of closure due to shortages of labour and parts. We all know that the Covid-19 shock hit the US economy hard. So,

all in all, the analogy to climate shocks is quite apt. Hurricane Ida, for example, the fifth costliest hurricane in US history, disrupted crude oil production in the Gulf of Mexico and drove up oil prices.

In February 2021, Winter Storm Uri caused the closure of gas and oil refineries in Texas and disrupted the supply chains of the chemical industry and, by extension, the automotive industry in the United States. This resulted in lost sales, pointing to the need to increase the resilience of supply chains to climate change.

In October 2021, US media report that pandemic-related traffic congestion at the Port of Los Angeles has further disrupted the supply chains of US businesses. This highlights the ongoing challenges manufacturers face in maintaining their supply chains and meeting demand.

Evidence shows that climate change impacts supply chains (see, e.g., Leslie, 2022). Therefore, it is important for US businesses to increase the resilience of their supply chains to climate change. Climate shocks such as fires, floods and tropical cyclones can disrupt US supply chains and negatively impact the supply of goods and services in affected areas.

4 DISCUSSION

Climate extremes, such as droughts and floods, can affect the lives of millions of people. That is why it is important to monitor climate change. Worst-case scenarios predict that climate extremes will become even more deadly and dangerous in the near future, affecting even more people. One solution to this problem is to adapt to the changing conditions, because it seems that we have already reached a tipping point. Therefore, policymakers need to adapt their policy mix to meet the changing conditions caused by climate events. It is also important to conduct climate stress tests to determine the extent to which financial institutions and markets are exposed to climate risks (see, e.g., Arseneau et al., 2022; Brunetti et al., 2021; Mallucci, 2020).

Let us consider the case of Texas. Texas is the 9th largest economy in the world and, since most of its industry is oil-related, it is also one of the top 10 polluters in the world (and among the largest in the US). So, climate change is having a negative impact on Texas, and one could say that many of the “wounds” are self-inflicted. As mentioned earlier, climate change is making Texas drier and hotter, and climate events such as floods, heat waves, hurricanes and wildfires are becoming increasingly deadly and dangerous.

Texas has the potential not only to help itself, and by extension the entire United States, but can also lead the world in combating climate change and mitigating its effects. As the paper shows, the state has suffered many billion-dollar weather and climate disasters, and these are expected to get worse in the near future.

The three major polluters in Texas are industry, particularly petrochemicals, oil and gas, transportation and power generation. As a potential world leader in the fight against climate change, Texas would need to shift to renewable energy sources and reduce its dependence on fossil fuels to hopefully achieve net-zero emissions by 2050. And so far, Texas has made progress in that direction. Renewable energy production, especially wind and solar, has increased, but there is still plenty of room for growth. Larger cities have committed to the goal of having net zero emissions by 2050, and many local businesses are trying to influence their customers to think in that direction. For example, the city of San Antonio's electricity provider, CPS Energy, offers many clean energy programmes, encouraging its customers to use less energy during peak periods and rewarding them when they do. And there are many more such individual examples across Texas. The problem is Texas state politics.

Unfortunately, the stigmatisation of climate change is real at the level of state government, led by a Republican majority and Governor Abbott. The issue is barely discussed and there are few official measures to combat it. And that would have to change quickly, or Texas may be too late in its efforts to offer meaningful solutions to this important fight. The state government should take the lead in trying to change the consumption patterns of its residents. However, in the current political climate in the United States and Texas, such action may not be effective. Trust in government is historically low and, combined with a highly individualistic culture fuelled by a strong consumer culture, such change could be a difficult hurdle to overcome. But there is still time.

5 CONCLUSION

This chapter contributes to the growing number of studies on the impact of climate shocks on the economy. In the United States, for example, many businesses and households are exposed to climate risks. In recent years, the United States has been hit by extreme cold and heat waves, droughts and floods, and wildfires. As a result, there is a growing trend among researchers and policymakers (e.g., at the Federal Reserve) to assess the exposure of businesses and households to climate risks (see, e.g., Fiedler et al., 2021).

Evidence shows that climate shocks can have a negative impact on the US economy in the short and long term (see, e.g., Hsiang et al., 2017; Kiley, 2021). By taking steps to mitigate the impact of climate shocks on the US economy, for example through the use of artificial intelligence, the United States can become more resilient to climate change. This is important because climate shocks can cause damage and losses, as evidence from US states shows.

The fact is that the United States cannot stop climate change. But it can adapt to it and mitigate its impact on the US economy. But this requires a change in the way Americans live and think (Lacroix et al., 2022). The United States must achieve climate neutrality as soon as possible and become an example for other countries in the region, especially Brazil, which is considered the most biodiverse country on the planet.

To achieve this goal, the United States must use all available resources, including artificial intelligence. This can, for example, help climatologists (at the Climate Prediction Center) to improve climate (prediction) models (by adding new information) and scenarios for predicting future climate.

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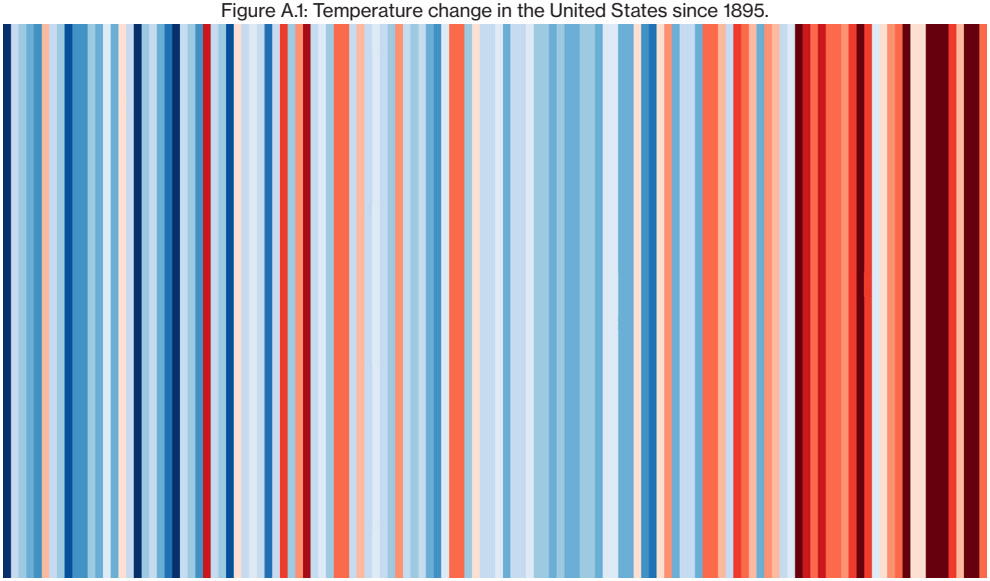
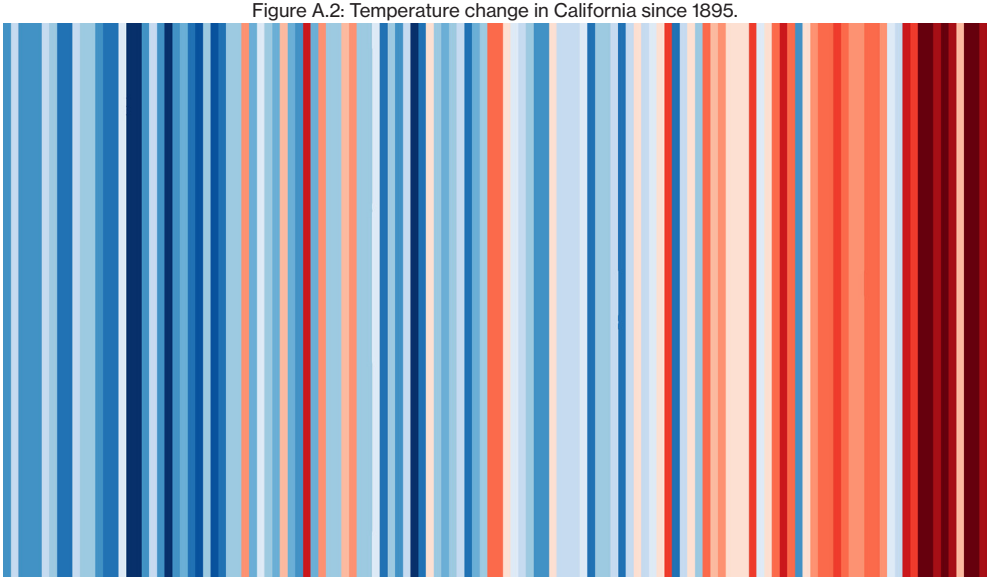
APPENDIX

Figure A.1: Temperature change in the United States since 1895.



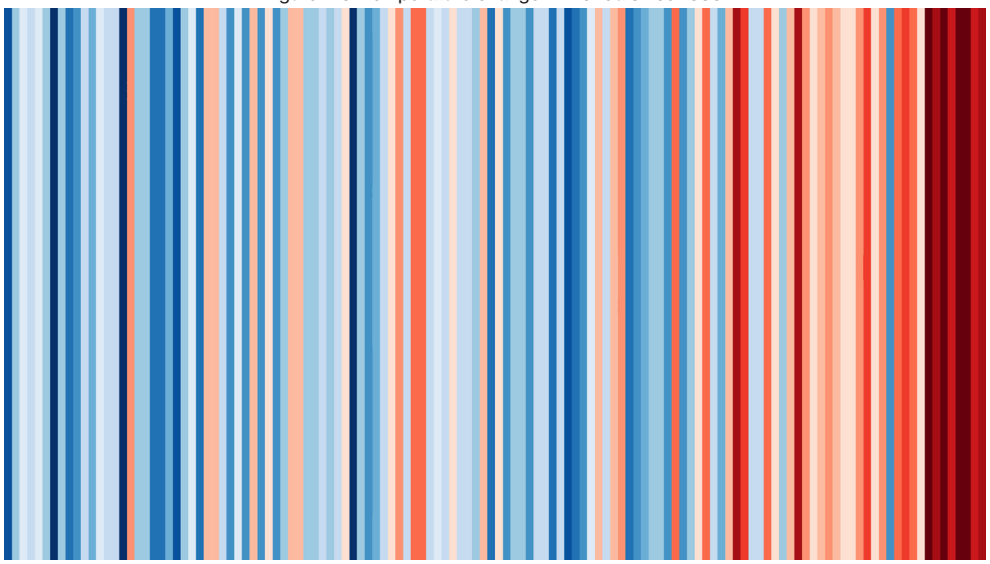
Note: See Figure 1.
Source: Ed Hawkins, https://showyourstripes.info/.

Figure A.2: Temperature change in California since 1895.



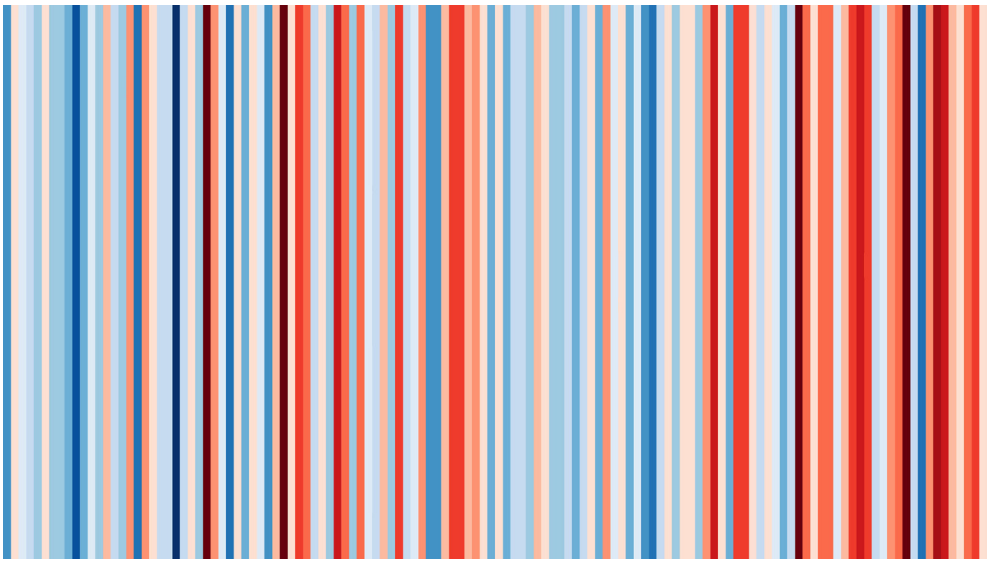
Note: See Figure 1.
Source: Ed Hawkins, https://showyourstripes.info/.

Figure A.3: Temperature change in Florida since 1895.



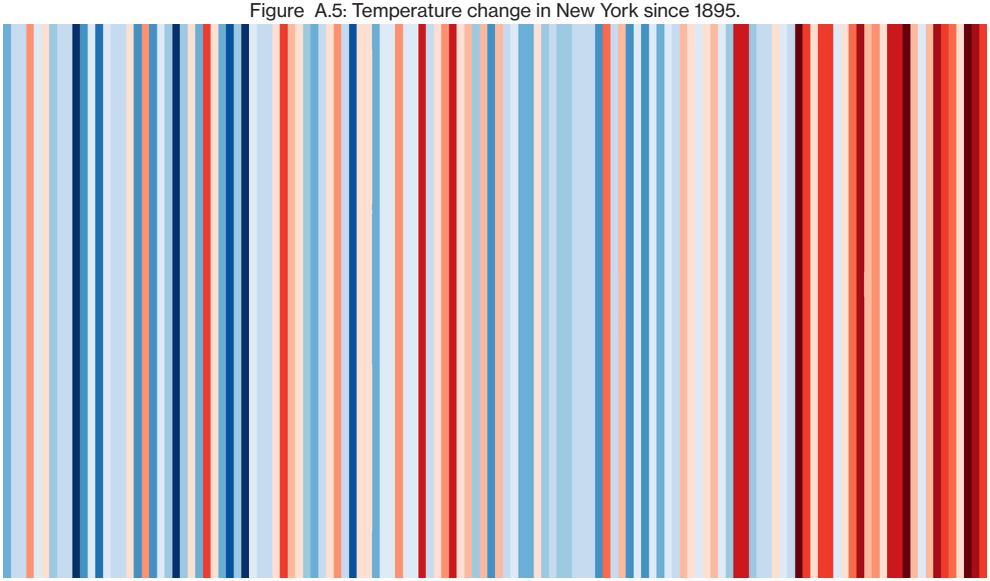
Note: See Figure 1.
Source: Ed Hawkins, https://showyourstripes.info/.

Figure A.4: Temperature change in Illinois since 1895.



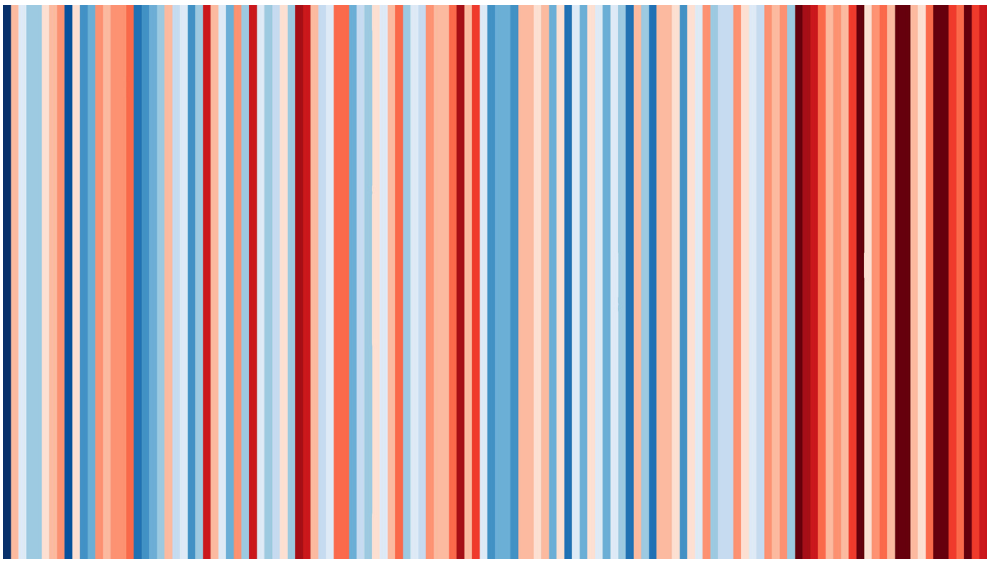
Note: See Figure 1.
Source: Ed Hawkins, https://showyourstripes.info/.

Figure A.5: Temperature change in New York since 1895.



Note: See Figure 1.
Source: Ed Hawkins, https://showyourstripes.info/.

Figure A.6: Temperature change in Texas since 1895.



Note: See Figure 1.
Source: Ed Hawkins, https://showyourstripes.info/.

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