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Climate Change and Economic Development in Emerging and Developing Economies: Growth Dynamics, Structural Vulnerabilities, and Policy Responses

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ABSTRACT

This study is a literature review of the economic effects of climate change in developing economic systems until 2024. A PRISMA-based systematic review categorizes 50 influential and traceable studies in the areas of aggregate growth, agriculture, labor and health, disasters and infrastructure, trade and energy, inequality, adaptation and institutions. The literature suggests that the effects of warming are more negative in hotter, less affluent economies; but the estimated effects differ depending on functional form, adaptation assumptions, time horizon and spatial scale. Climate shocks have multiple and interacting impacts, including crop production, decline in labor productivity, health impacts, human capital losses, capital losses, migration, trade and fiscal impacts. Adaptive capacity is a large part of persistence. The review integrates macroeconomic and sectoral evidence in a climate-growth transmission framework, which is built around exposure, sensitivity/adaptive capacity, and proposes a research agenda for causal adaptation evidence, nonlinear thresholds, compound shocks, distributional impacts, and climate finance.

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1. Introduction

Climate change is increasingly understood as a macro-development problem rather than solely an environmental externality. Rising temperatures, changing precipitation, drought, flooding, storms and other extremes influence the productive capacity of economies through agriculture, labor, health, infrastructure, energy systems, migration, investment and public finance. These mechanisms are particularly important for developing economies because

climate-sensitive activities often account for large shares of employment and income, while households, firms and governments possess fewer resources for adaptation.

The empirical climate-economy literature has expanded rapidly. Dell et al. (2012) show that higher temperatures are associated with lower economic growth in poorer countries and affect both agricultural and non-agricultural activity. Burke et al. (2015) have estimated a nonlinear relationship between temperature and economic production, suggesting significant risks for the already warm economies. Kahn et al. (2021) conclude that long-term macroeconomic impacts of persistent departures from historical temperature variability exist. Studies that occurred in more recent years, such as Kotz et al. (2024), remain another example of potential for significant income loss as well as of uncertainty regarding magnitude and adaptation.

The economic effect of climate change cannot, however, be represented by a single coefficient. Crop production and food prices are affected by climate, worker productivity and labor availability by climate, damage to infrastructure by storms or floods, water scarcity affecting cities and industry, and fiscal stress, migration and investment uncertainty caused by disasters. These channels interact. A crop shock can lead to an increase in food prices, a decline in real household income, an impact on nutrition, an impact on the fiscal budget, and a decrease in the investment in education, all of which can cause a development loss that does not resolve in the short term.

Economies are not homogeneous in the developing world. There are significant variations in baseline climate, agricultural dependency, urbanization, income, governance, financial depth, energy systems and adaptation capacity. This means that the same temperature rise may yield varying economic impacts in various locations and countries. The method of choice is also important. Different studies rely on the different data used, such as the national GDP, subnational output, firm productivity, crop yields or worker outcomes, and estimates vary due to the nature of the model, including its treatment of nonlinear effects, lagged impacts and adaptation.

The diversity opens a good case for systematic synthesis. While existing climate-economy reviews offer valuable building blocks, the policy question for developing economies needs to be explicitly addressed in terms of transmission channels and adaptation capacity. Current review uses evidence cutoff 2024 and combines macroeconomic, sectoral and household level evidence. It asks: What is the direction and strength of the evidence to support the relationship between climate change and economic growth? How do climate shocks get passed through to economic outcomes? Why are impacts estimated in different ways in different settings and methods? What adaptation and development approaches can minimize ongoing losses?

The paper is a contribution which connects the concept of exposure, sensitivity and adaptive capacity in one economic package. It separates the direct production effects from indirect effects via labor, human capital, capital accumulation, trade and public finance. It also identifies where evidence remains weak, particularly regarding low-income countries, compound shocks, adaptation effectiveness, distributional outcomes and the macroeconomic returns to climate-resilient investment.

2. Theoretical and Conceptual Background

The climate-growth literature can be organized around a production-function perspective in which climate affects labor, capital and total-factor productivity, and around a development perspective in which poverty and institutions shape vulnerability. Exposure describes the climatic hazard; sensitivity reflects the dependence of economic activity on climate-sensitive resources and sectors; adaptive capacity reflects the ability to prevent, absorb and recover from losses.

The integrated framework starts with temperature and precipitation variability and extreme events. These shocks impact on agriculture, labor productivity, health, human capital, infrastructure, energy and ecosystems. The sectoral effects are then captured in prices, trade, migration, the fiscal balance and investment. The long-term impact of the growth effect depends on adaptation, financial access, insurance, governance, and diversification and reconstruction speed.

This approach is also able to consider the possibility of disagreement between short-range weather forecasts and long-range climate forecasts. Adaptation of economic agents happens through technology, mobility, capital replacement and structural transformation, and it is costly and incomplete. Studies that do not adapt will overestimate the long-run damages and studies that assume full adaptation will underestimate the transition costs and constraints in poor economies.

3. Review Methodology

The review is framed in the logic of PRISMA 2020 and according to the structure that is generally followed in international systematic reviews from economics, business and sustainability research. The goal is to be repetitive, not to tell the story impressionistically. The deadline for evidence is 2024. Since live Web of Science and Scopus subscription exports are not provided with this manuscript, database-specific identification numbers are not needlessly created. The final submission will redo the search strategy documented in those databases and enter the PRISMA counts. The analytical corpus chosen for this study consists of 50 highly influential and traceable texts that are directly relevant to the research questions.

3.1. Quality Appraisal and Data Extraction

Each retained contribution has been evaluated with respect to relevance, transparency of the data and methods, appropriateness of the identification or modeling approach, clarity of the outcome measurement, and usefulness for the question(s) being addressed in the review. A numerical quality score was not imposed as the corpus includes experiments, econometric studies, theoretical models, systematic reviews and institutional syntheses which cannot be validly ranked by one measure. Rather, stronger causal designs are afforded greater interpretive weight when causal claims are discussed, and descriptive and modeling studies are used in situations of mechanisms, scenarios and context.

The coding framework included the publication year, setting, and unit of analysis, exposure, outcome, method, principal finding and thematic contribution for each study. Thematic synthesis was selected over meta-analysis as it was not possible to pool a single coefficient without significant loss of meaning given the heterogeneous nature of the effect measures, unit, exposure, and research designs.

3.2. PRISMA Reporting and Reproducibility

The exact number of records found in Web of Science and Scopus, number of excluded duplicates, number of screened records, number of full-texts evaluated, and number of studies included, should be reported in the submission-ready PRISMA flow diagram. Those counts must be from actual database export. This manuscript thus offers the complete reporting structure and analytical synthesis with the counts in the database to be inserted from the completed reproducible search. This approach will help you to prevent the common but serious mistake of creating screening numbers.

3.3. Analytical Boundaries and Evidence Hierarchy

The review differentiates between shorter time scale weather shocks and longer time scale climate change. Annual temperature anomalies are used to detect responses to temperature deviations from a local baseline, and not the full economic impacts of a permanently warm climate. Crop, worker and firm studies provide mechanisms, but may neglect general-equilibrium adjustments. While cross-country GDP panels provide an overall picture of outcomes, they can mask country vulnerability. Integrated assessment models make assumptions about economics and climate scenarios and damage are conditional projections, not measured causal estimates. It is important to maintain separate evidence categories for interpretation of disagreements.

4. Descriptive Profile of the Evidence

The evidence inventory is based on 50 scholarly and institutional contributions; these should not be viewed as the outcome of a completed database-wide screening exercise. The literature is interdisciplinary, yet economically coherent, with studies ranging from macroeconomics to labor economics, development economics, innovation, and environmental economics and policy. The 2020–2024-time frame includes a significant increase in empirical work, with earlier contributions dealing with theory and measurement. The corpus also shows a significant geographical imbalance, with advanced economies being better represented in AI research and a higher share of developing countries and cross-country evidence in climate-growth research, while both fields have substantial missing elements in the case of low income and fragile states.

4.1. Distribution Of Evidence by Outcome and Scale

The contributions reviewed work at several levels. Changes in output or growth are estimated by national and regional panels. Yields, profits and adaptation are estimated in agriculture studies. Labor and health studies find changes in work and human capital due to heat. Estimates of reconstruction and persistence based on disaster research. Assessment and modelling studies integrate mechanisms in long runs scenarios. GDP, crop yields, worker output and household welfare are not the same, so the review aggregates them as interacting components of an economic transmission system as opposed to adding their reported coefficients.

5. Thematic Findings

5.1. Aggregate Growth and Productivity

A key conclusion is that climate impacts are spatially variable and are systematically related to underlying conditions. Dell et al. (2012) conclude that higher temperatures result in lower economic activity in less developed countries. Burke et al. (2015) estimate a nonlinear global temperature production relationship, such that damages grow when already warm economies get warmer. Kahn et al. (2021) demonstrate a negative relationship between deviations from climate historical averages (DHAs) and long-run output. Regional evidence, as provided by Kalkuhl and Wenz (2020), reveals significant spatial variability, and Kotz et al. (2024) estimate large commitments in income to past changes in temperature and precipitation. The magnitude of these studies is varied but all point to the fact that climate is not economically neutral.

Within this theme, differences in estimates are due to baseline climate, income, sectoral structure, adaptation and empirical scale. National annual data may mask local losses or sectoral or worker level studies may show mechanisms that can cumulatively produce macroeconomic

impacts. The synthesis thus provides context to effect sizes instead of taking various effect sizes as equivalent.

5.2. Agriculture, Food Systems and Rural Incomes

One of the most direct routes of transmission is by agriculture. The studies of Schlenker and Roberts (2009) and Lobell et al. (2011) report nonlinear yield losses in response to warming temperatures and reveal that historical climate trends have already impacted crop yields. Agricultural shocks in developing economies have spillover effects not only on agriculture output, but also on food prices and rural wages, trade balances and nutrition. Some adaptation can be achieved by irrigation, switching crops and altering planting dates, but there can be limits, with Burke and Emerick (2016) warning that adaptation observed does not necessarily compensate for climate sensitivity. This is especially relevant in the context of smallholders, where financing and institutional constraints are important.

In this theme, differences in estimates are based on the differences in baseline climate, income, sectoral structure, adaptation and empirical scale. The national annual data can mask the local losses, and sector-based and/or worker-level studies can identify mechanisms that may eventually add up to macro-economic effects. The synthesis thus helps to provide context for the effect sizes and does not regard different estimates as direct substitutes.

5.3. Labor Productivity, Health and Human Capital

Heat exposure impacts capacity and willingness to work, particularly in agriculture, construction and manufacturing. Graff Zivin and Neidell (2014) demonstrate how temperatures affect labor allocation, and (Somanathan et al., 2021) conclude that higher temperatures negatively influence productivity and labor supply in Indian manufacturing. This is related to evidence of Chinese manufacturing provided by Zhang et al. (2018). There is also evidence that heat affects human-capital accumulation and learning (Park et al., 2021). These mechanisms suggest that climate change may affect long-run growth despite being seemingly moderate in terms of GDP losses.

In this theme, the variation in estimates is related to baseline climate, income, sectoral structure, adaptation and empirical scale. National annual data may miss out on the local losses while sectoral or worker-level studies may give clues on mechanisms that can subsequently add up to macroeconomic losses. The synthesis thus does not equate various estimates but rather puts them in the context of their effects.

5.4. Disasters, Infrastructure and Capital Accumulation

Extreme events cause losses of physical assets, disruption of supply chains and reconstruction expenses. Noy (2009) demonstrates that macroeconomic effects are related to structural and institutional factors. Felbermayr and Gröschl (2014) recognize negative disaster growth effects, and Cavallo et al. (2013) demonstrate the persistency's fluctuation in different catastrophic events and contexts. Hsiang and Jina (2014) identify long-run impacts of cyclone exposure. However, for developing economies, insufficient insurance, immature financial markets and fiscal space may be a restraint, and temporary losses may become a long-term capital deficit in reconstruction.

In this theme, differences in estimates are due to differences in baseline climate, income, sectoral structure, adaptation and empirical scale. Local losses may not be picked up in national annual data, and sectoral or worker-level studies show mechanisms that can be built-up to macro effects. Thus, the synthesis is not interpreted as a direct swap between the different estimates of effect sizes but rather in context.

5.5. Trade, Energy, Migration and Structural Transformation

Growth is also indirectly impacted by climate change via international and structural channels. Dellink et al. (2019) demonstrate that ‘climate damage can be transmitted across borders through trade, influencing comparative advantage and losses. Energy demand and supply is sensitive to climate, especially if hydropower, cooling needs or vulnerable power supply are relevant. Migration can also be affected by climate-related livelihood shocks; the World Bank's Groundswell analysis suggests a potential for significant internal climate migration under the worst climate scenarios. Migration can be adaptive, however, if forced and poorly managed, then it can strain urban infrastructure.

Within this theme, the difference in estimates is due to the different baselines in climate, income, sectoral structure, adaptation and empirical scale. National-level annual data may mask losses at the local level, and losses in sectors or at the individual worker level may have mechanisms that sum up over time to macroeconomic effects. Thus, the synthesis takes steps to interpret effect sizes in context and not use various estimates as direct substitutes.

5.6. Inequality, Conflict and Poverty

Climate change also has indirect impacts on growth via international channels and structural channels. Dellink et al. (2019) show that damages from climate change can propagate through trade networks and alter the comparative advantage and disseminate damages internationally. Energy demand and supply are sensitive to climate, particularly when hydropower or cooling demand or sensitive energy supply are involved. The World Bank's Groundswell analysis also points to potential for significant internal climate migration in challenging scenarios, which can be shaped by climate-related livelihood shocks. Migration is adaptive, but it can also place a burden on urban infrastructure if forced and poorly managed.

In this theme, differences in projections are due to baseline climate, income, sectoral composition, empirical climate range, and adaptation level. National annual data may mask local losses, and sectoral or worker-level studies may provide information on mechanisms which can add up to macroeconomic effects. The synthesis thus does not take effect sizes without putting them into context but does not consider different estimates as directly exchangeable.

5.7. Reconciling Estimates of Climate Damages

The variation in estimated damages is not just an agreement of statistics. A model with fixed capital and fixed production techniques will give a different counterfactual than one that is willing to pay for adaptation. Annual weather variation can highlight immediate responses, but not investments in cooling, irrigation or relocation. Large local losses can be hidden in national aggregates, as can extremely heat, and the timing of rainfall or other compound shocks in average-temperature models. Baseline climate is also important; what is good in one production environment can be bad in another. The review is thus focused on conditional findings and transmission mechanisms.

5.8. Distributional Consequences and Measurement

GDP is an incomplete measure of climate-related welfare. A decline in national output can lead to long-term losses for poor households because of disrupted schooling, asset sales, or illness. Administrative data may not capture informal firms, and subsistence production may be poorly captured. Disaster reconstruction can lead to higher expenditure recording without improving the pre-disaster welfare. Household consumption, health, learning, assets and local employment should thus all be considered in a credible synthesis, in addition to macroeconomic

growth. This is particularly relevant when evaluating the benefits of policies on vulnerable groups.

5.9. Adaptation, Institutions and Policy

The adaptive capacity is the most important conditioning factor connecting exposure to climate change and economic damage. Whether shocks persist is shaped by infrastructure quality, irrigation, public health, early warning, insurance and social protection, fiscal capacity and governance. IPCC assessments highlight that there are still significant adaptation gaps, particularly in vulnerable areas. Stern and Stiglitz (2023) found that climate and development do not have to be conflicting goals if policy is geared towards innovation, infrastructure and market failures. The economic rationale for adaptation is thus most compelling when adaptation helps maintain productivity and human capital and lessens inequality.

In this theme, the different estimates are due to the different baseline climates, income levels, sectoral structures, adaptation and empirical scales. National annual data may mask local losses and sectoral or worker-level studies may show mechanisms that can eventually lead to macroeconomic effects. Hence, the synthesis does not take the view of direct substitution of different estimates of effect sizes in context.

5.10. Reconciling Estimates of Climate Damages

The range of estimated damages is not just a "statistical" difference of opinion. A model with fixed capital and fixed production technologies will give a different counterfactual than a model which allows for costly adaptation. Annual weather variation can identify immediate responses but investments in cooling, irrigation or relocation may not be captured. A national average can mask significant regional losses, and average-temperature models are unable to capture extreme weather events, such as heat, or the timing of precipitation and/or the concurrent occurrence of multiple shocks. Also, there are differences in the base climate: the same rise in temperature may be good in one production area and bad in another. So that's why the review focuses on conditional findings and modes of transmission.

5.11. Distributional Consequences and Measurement

GDP is not a complete indicator of welfare in the context of climate change. If a country's production has bounced back, the poor could still be worse off due to school closures, asset sales or disease. Informal enterprises may not show up in administrative data and subsistence production is difficult to measure. Reconstruction after disasters can lead to higher reported expenditures but not necessarily higher pre-disaster welfare levels. Therefore, a credible synthesis should consider household consumption, health, education, assets, and employment at the local level, in addition to macroeconomic growth. This is particularly relevant as regards the evaluation of the advantages of the policies for vulnerable groups.

6. Discussion

Four general conclusions are obtained from the synthesis. First, climate change is economically significant, with damage being variable. Poorer and more climate-sensitive economies tend to have larger risks, as do hotter economies. Second, macroeconomic effects can occur through several channels, and there is no direct link between temperature and GDP. Agriculture, labor productivity, health, human capital, infrastructure and fiscal stress are interrelated and can amplify each other.

Thirdly, adaptation is key and yet it is incomplete. Cross-sectional differences illustrate the fact that societies can adapt to climate, but adaptation takes time, institutions, technology

and capital. The transition costs could thus be greater in developing economies, although long-run adaptation might be technically feasible. Fourth, distribution matters. However, aggregate GDP may underestimate welfare losses, if poor households experience large shocks in consumption, health or assets and have limited insurance.

These findings may account for the different estimated damage found in various studies. The various units of observation and climate variables, functional forms and horizons, point to various aspects of the climate-economy relationship. Future studies should focus on discovering what mechanisms are predominant in certain development circumstances, and which adaptation investments are most efficient at mitigating constant losses instead of finding a one-size-fits-all coefficient.

6.1. An Integrated Explanation of Heterogeneous Economic Outcomes

Climate exposure impacts economic production both directly, as in a physical sense, as well as indirectly, as in a behavioral sense. Changes in labour, energy demand due to heat; changes in water availability and crop yield due to rainfall; damage to capital and disruption of transport due to extreme events. Firms and households cut investment, work, migration and consumption and governments shift spending toward relief and reconstruction. It will depend on whether these responses maintain productive capacity or decrease the extent of future investment and human capital. Adaptive capacity is not simply a regressed control variable at the end of the regression but rather incorporated at all stages.

6.2. Interpreting Evidence for Developing Economies

High exposure and agricultural livelihoods can often be found in developing economies, along with restricted insurance and public finance, but with a very different climate, income and institutions. Therefore, using a global average effect to get an average effect to an individual country can be misleading. Country-level policy must connect the mechanisms with employment, fiscal capacity and trade, subnational studies and sector-specific evidence helps identify mechanisms. The research priority is not only the estimation of damages, however, but the identification of investments that reduce persistent losses, who they benefit, and the institutional context of the investment.

7. Conclusion

By the end of 2024, literature demonstrates that climate change can limit development by interacting impacts on productivity, agriculture, labour, health, human capital, infrastructure and public finance. The size of the evidence varies, but it is consistent and suggests higher risks for economies that are already hot, climate-sensitive and adaptation-constrained. Hence, adaptive capacity needs to be placed at the core of climate-growth analysis. Development and climate policies should be co-developed: Resilient infrastructure, social protection, health systems, agricultural adaptation, finance and diversification can make the difference between climatic shocks and permanent losses. Future research needs need to shift from documentation of vulnerability; to causal effectiveness and distributional returns of adaptation.

7.1. Theoretical Contributions

The review makes the valuable effort of combining production-function and vulnerability approaches. Climate shocks impact labour, capital and productivity, and the magnitude and duration of these impacts will vary with exposure, sensitivity and adaptive capacity. This synthesis is an advance beyond a climate-GDP relationship and clarifies the reason that the conditions of development are not just control variables but rather constitutional aspects of climate damage.

7.2. Policy Implications

Climate adaptation needs to be part of development planning and not a stand-alone environmental program. Economic resilience is affected by the standards of infrastructure, water systems, agricultural extension, public health and urban planning. Social protection, disaster finance and insurance can stop temporary shocks from leading to distress asset sales, malnutrition, school withdrawal and firm exit. Sustainable energy systems can minimize lost productivity from unreliable energy supply and increased demand for cooling, while economic diversification can minimize dependence on climate sensitive sectors. Climate finance needs to be assessed based on development outcomes and emissions metrics. Projects that preserve productivity can also induce macroeconomic benefits, even if some of the benefits are not readily measurable in short-run GDP statistics.

7.3. Research Gaps and Future Research Agenda

There are limitations to this review. The evidence-based is different in method and outcome, limiting the possibility of a defensible pooled meta-analytic effect, without more restrictive eligibility criteria. The review will consider influential institutional and working-paper evidence if it is relevant to the fast-moving economic questions; future versions may be limited to peer-reviewed articles depending on the target journal. Final Web of Science and Scopus exports are required for most importantly determining the exact PRISMA identification/exclusion counts. The cut-off in 2024 is an intentional one to exclude later evidence.

Authors' Contribution

Gbenga Johnson Adegbayibi: Contributed to conceptualization and manuscript drafting.
Dupe Oluwasesan: Conducted the literature review and methodology
Stephen Alaba John: Contributed to critical review, editing, and final manuscript approval.

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Appendix A: Study Level Evidence

No.	Publication / Contribution	Relevance to the synthesis
1	Dell et al. (2012). Temperature shocks and economic growth. American Economic Journal: Macroeconomics, 4(3), 66-95.	Growth, output and economic damage
2	Dell et al. (2014). What do we learn from the weather? Journal of Economic Literature, 52(3), 740-798.	Theory, climate mechanisms and policy context
3	Burke et al. (2015). Global non-linear effect of temperature on economic production. Nature, 527, 235-239.	Growth, output and economic damage
4	Kahn et al. (2021). Long-term macroeconomic effects of climate change. Energy Economics, 104, 105624.	Theory, climate mechanisms and policy context
5	Kalkuhl and Wenz (2020). The impact of climate conditions on economic production. Journal of Environmental Economics and Management, 103, 102360.	Growth, output and economic damage
6	Kotz et al. (2024). The economic commitment of climate change. Nature, 628, 551-557.	Theory, climate mechanisms and policy context
7	Tol (2024). A meta-analysis of the total economic impact of climate change. Energy Policy, 185	Theory, climate mechanisms and policy context
8	Newell et al. (2021). The GDP-temperature relationship. Journal of Environmental Economics and Management, 108(07)	Growth, output and economic damage
9	Diffenbaugh and Burke (2019). Global warming has increased global economic inequality. PNAS, 116(20), 9808-9813.	Disasters, inequality and adaptation
10	Carleton and Hsiang (2016). Social and economic impacts of climate. Science, 353(6304).	Theory, climate mechanisms and policy context
11	Fankhauser and S.J. Tol (2005). On climate change and economic growth. Resource and Energy Economics, 27(1), 1-17.	Growth, output and economic damage
12	Moore and Diaz (2015). Temperature impacts on economic growth warrant stringent mitigation policy. Nature Climate Change, 5, 127-131.	Growth, output and economic damage
13	Dietz and Stern (2015). Endogenous growth, convexity of damage and climate risk. Economic Journal, 125(583), 574-620.	Growth, output and economic damage
14	Stern and Stiglitz (2023). Climate change and growth. Industrial and Corporate Change, 32(2), 277-303.	Growth, output and economic damage
15	Nordhaus (2017). Revisiting the social cost of carbon. PNAS, 114(7), 1518-1523.	Theory, climate mechanisms and policy context
16	Pindyck (2013). Climate change policy: What do the models tell us? Journal of Economic Literature, 51(3), 860-872.	Theory, climate mechanisms and policy context
17	Deschênes and Greenstone (2007). The economic impacts of climate change: Evidence from agricultural output. American Economic Review, 97(1), 354-385.	Agriculture, labor and human capital
18	Schlenker and Roberts (2009). Nonlinear temperature effects indicate severe damages to crop yields. PNAS, 106(37), 15594-15598.	Agriculture, labor and human capital
19	Lobell et al. (2011). Climate trends and global crop production since 1980. Science, 333(6042), 616-620.	Agriculture, labor and human capital
20	Burke and Emerick (2016). Adaptation to climate change: Evidence from US agriculture. AEJ: Economic Policy, 8(3), 106-140.	Agriculture, labor and human capital
21	Somanathan et al. (2021). The impact of temperature on productivity and labor supply. Journal of Political Economy, 129(6), 1797-1827.	Agriculture, labor and human capital
22	Zhang et al. (2018). Temperature effects on productivity and factor reallocation. JEEM, 88, 1-17.	Agriculture, labor and human capital
23	Graff Zivin and Neidell (2014). Temperature and the allocation of time. Journal of Labor Economics, 32(1), 1-26.	Agriculture, labor and human capital
24	Park et al. (2021). Heat and learning. AEJ: Economic Policy, 12(2), 306-339.	Agriculture, labor and human capital
25	Hsiang (2010). Temperatures and cyclones strongly associated with economic production. PNAS, 107(35), 15367-15372.	Growth, output and economic damage

26	Hsiang and Jina (2014). The causal effect of environmental catastrophe on long-run economic growth. NBER Working Paper 20352.	Growth, output and economic damage
27	Noy (2009). The macroeconomic consequences of disasters. Journal of Development Economics, 88(2), 221-231.	Disasters, inequality and adaptation
28	Felbermayr and Gröschl (2014). Naturally negative: The growth effects of natural disasters. Journal of Development Economics, 111, 92-106.	Growth, output and economic damage
29	Cavallo et al. (2013). Catastrophic natural disasters and economic growth. Review of Economics and Statistics, 95(5), 1549-1561.	Growth, output and economic damage
30	Callahan and Mankin (2022). Globally unequal effect of extreme heat on economic growth. Science Advances, 8(43).	Growth, output and economic damage
31	Cashin et al. (2017). Fair weather or foul? Journal of International Economics, 106, 37-54.	Theory, climate mechanisms and policy context
32	Hsiang et al. (2013). Quantifying the influence of climate on human conflict. Science, 341(6151).	Theory, climate mechanisms and policy context
33	Miguel et al. (2004). Economic shocks and civil conflict. Journal of Political Economy, 112(4), 725-753.	Theory, climate mechanisms and policy context
34	Hallegatte and et al. (2016). Shock Waves: Managing the Impacts of Climate Change on Poverty. World Bank.	Disasters, inequality and adaptation
35	Hallegatte et al. (2017). Unbreakable. World Bank.	Theory, climate mechanisms and policy context
36	World (2021). Groundswell Part 2: Acting on Internal Climate Migration. World Bank.	Theory, climate mechanisms and policy context
37	Ipcc (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. Cambridge University Press.	Disasters, inequality and adaptation
38	Ipcc (2023). Climate Change 2023: Synthesis Report. IPCC.	Theory, climate mechanisms and policy context
39	Blimpo et al. (2024). Climate change and economic development in Africa. Energy Policy, 187, 114044.	Theory, climate mechanisms and policy context
40	Adom (2024). The socioeconomic impact of climate change in developing countries over the next decades: A literature survey. Heliyon, 10(15).	Theory, climate mechanisms and policy context
41	Feriga et al. (2024). The impact of climate change on work: Lessons for developing countries. World Bank Research Observer.	Theory, climate mechanisms and policy context
42	Burke et al. (2018). Large potential reduction in economic damages under UN mitigation targets. Nature, 557, 549-553.	Theory, climate mechanisms and policy context
43	Carleton and Hsiang (2016). Temperature stress and the direct impact of climate change. Review of Environmental Economics and Policy, 10(2), 347-362.	Theory, climate mechanisms and policy context
44	Dellink et al. (2019). International trade consequences of climate change. OECD Working Paper.	Theory, climate mechanisms and policy context
45	Acevedo et al. (2020). The effects of weather shocks on economic activity. IMF Economic Review, 68, 523-559.	Theory, climate mechanisms and policy context
46	Burke et al. (2009). Warming increases the risk of civil war in Africa. PNAS, 106(49), 20670-20674.	Theory, climate mechanisms and policy context
47	Hsiang et al. (2017). Estimating economic damage from climate change in the United States. Science, 356(6345), 1362-1369.	Theory, climate mechanisms and policy context
48	Dell et al. (2009). Temperature and income: Reconciling new cross-sectional and panel estimates. American Economic Review Papers & Proceedings, 99(2), 198-204.	Growth, output and economic damage
49	Mendelsohn et al. (1994). The impact of global warming on agriculture. American Economic Review, 84(4), 753-771.	Agriculture, labor and human capital
50	Schelling (1992). Some economics of global warming. American Economic Review, 82(1), 1-14.	Theory, climate mechanisms and policy context