



# The Challenge of “4H” Shocks to Labor Markets, Institutions, and Policies

1. What are “4H” Shocks?
2. Lessons from recent 4H shocks
3. Policies to address 4H shocks
4. Conclusion and Addendum: Is AI bigger shock coming?

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## 4H Shocks are:

1. **Big** -- enough to affect much of the world, though often indistinguishable early on from smaller shocks whose effects are localized or dissipate.
2. **Rare** – enough that we have few similarly sized events to learn from, but usually connected to smaller events by power law/extreme value distributions, where big rare events are likelier than in normal curve.
3. **Unpredictable** – enough in timing or magnitude to require policy responses under “deep uncertainty” with limited information or time for preventive action, that highlights value of policies that improve supply chain of responses against generic shocks.
4. **Sometimes Transformative** – can change economic institutions and markets in a short period by accelerating on-going trends or altering attitudes and behavior that upends the old and creates a new ‘normal’.

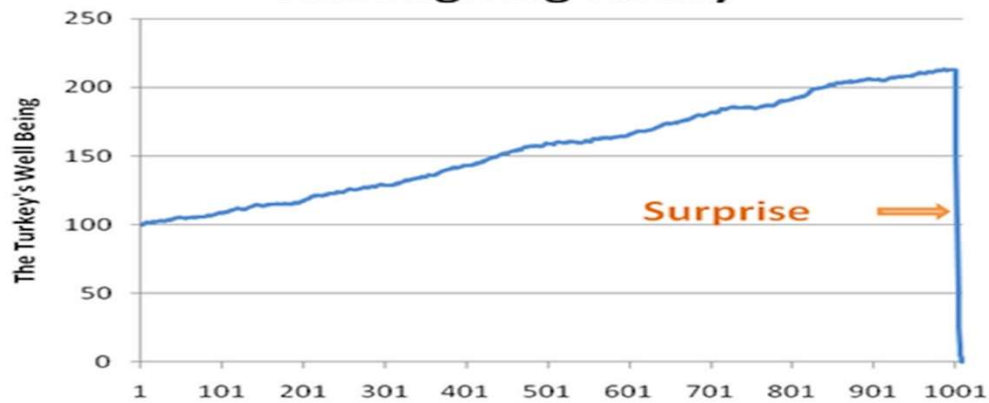
**4H shocks** differ qualitatively from standard econ shocks. They generate *positive feedback* loops that can diverge to attain outcomes (“new world”) far from current reality. Standard shocks reign in big changes through negative feedback loops that converge to current reality.

# Conceptual example and representation

## Taleb's American turkey

Alive until Thanksgiving Day (any life-death situation to creature) ... Today on Internet/cell-phone. Tomorrow? Heaven or hell or ??

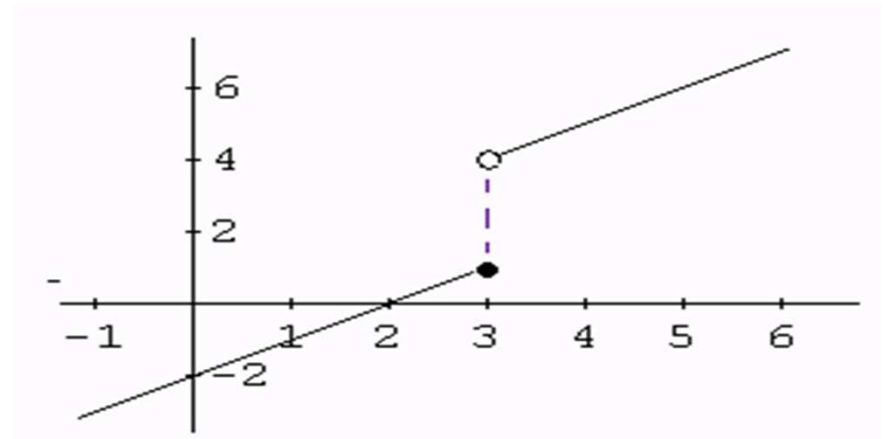
1000 and 1 Days in the Life of a Thanksgiving Turkey



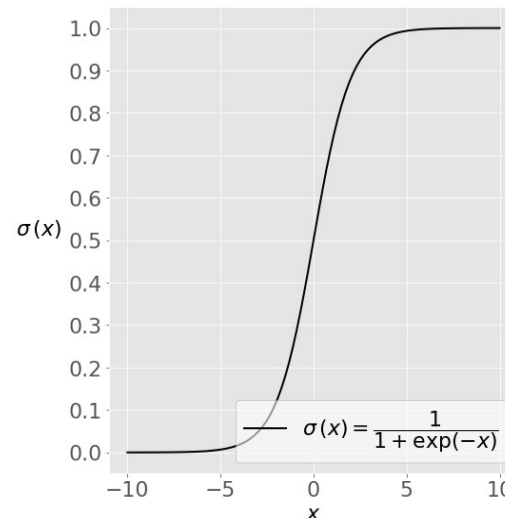
Usually analyze these discontinuities with continuous curves with a rapidly changing derivative – slow, fast, then slowing to some limit: sigmoid/cumulative distribution that allows for concentrated change, logit curve, or ln-normal with small  $\sigma$ , or mixtures of curves with cut-off points or thresholds.

## Discontinuity/singularity in math/sci

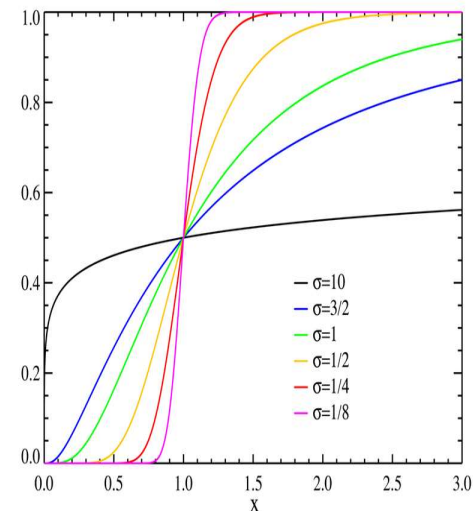
Y jumps from 1 to 4 when X is 3, compared to modest increases at all other X values. Examples in world: Ice to water. Financial panics that spread rapidly, turning points in global warming.



Logistic



Ln normal



# Greatest 4H shock in planetary history: Chicxulub impactor



Which led to Cretaceous–Paleogene (K–Pg) mass extinction of dinosaurs.

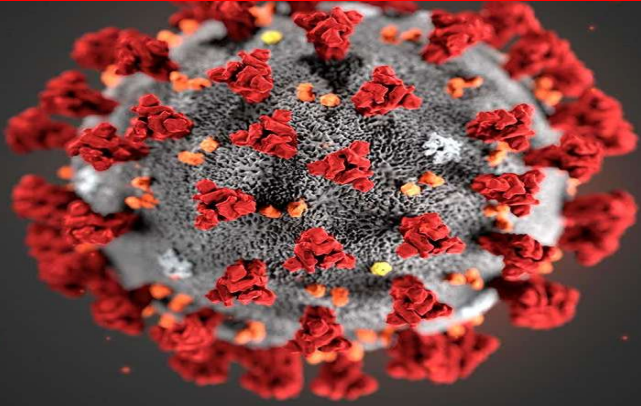
“According to NASA, the probability of an asteroid capable of destroying a city striking Earth is 0.1% every year (with)... a 70% chance it will land in the ocean, and a 25% chance it will land over a relatively unpopulated area ... per the Tunguska impact in Russia just over a hundred years ago ... **The odds of a 5-10 kilometer wide asteroid**, the likes of which made the dinosaurs go extinct, hitting Earth is **almost negligible** at 0.000001%” – that is once in a 100 million years.” (But fits with ~170 million years dinosaurs/reptiles dominated planet)

Now, thanks to NASA’s Double Asteroid Redirection Test (DART) launched on 24 Nov 2021, we have the technology to remove the almost negligible risk. DART was a “smashing success”. “The change in the orbit of (asteroid moon) Dimorphos demonstrates that kinetic impactor technology (can) ... defend earth if necessary.” (Nature, April 2023)

**Unfortunately, we are not so prepared for the 4H shocks that have disrupted world in early part of 21<sup>st</sup> century nor for the possible AI shock coming down the pike.**

# Today's 4H Shocks

**Pestilence: Covid/Contagious Disease**



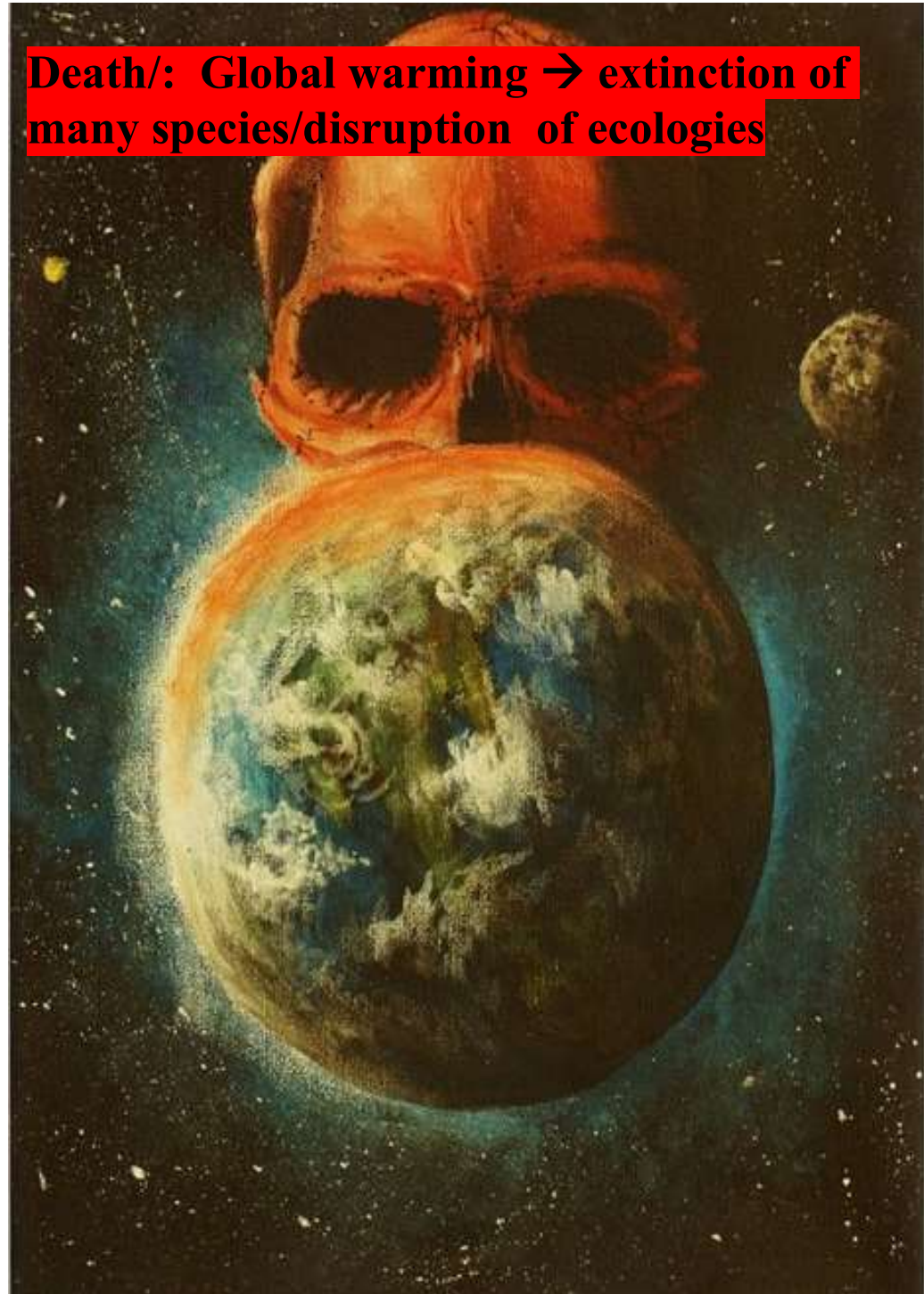
**Famine: Bank/Financial Meltdown -Depression**



**War:/ War, War, War**



**Death/: Global warming → extinction of many species/disruption of ecologies**



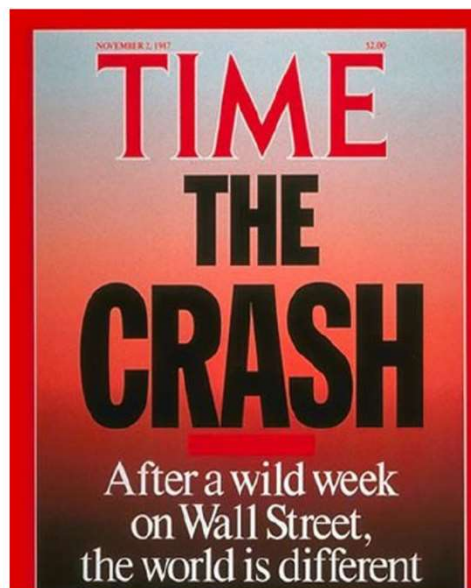
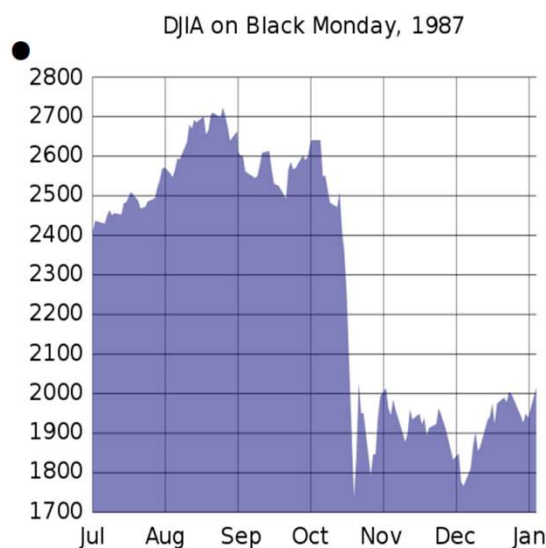
# Recent (*and possible next*) Horsemen Shocks

- **Implosion of Wall Street Finance/Great Recession** in 2008: first global macro-turndown to rival Great Depression, contravening finance/macro-economic *Greenspan delusion* that global finance had conquered business cycles by spreading risk widely. (*US fail to deal with debt limit?*)
- **Covid-19** in 2020: first pandemic since 1918, following zoonotic viral attacks that petered out and growing anti-bacterial resistance (OECD, *Stemming Superbug*, 2018; 2022) that has not yet produced major contagion (*Next Covid mutant, new zoonotic virus, ABR disease?*).
- **Russian Invasion in Ukraine** in 2021: biggest war in Europe since WW2, with mass destruction of civilized life and threats of nuclear weapons, in world that had 60+ wars of different magnitudes in many continents. (*China invade Taiwan? Russian Chaos? Revised Ec Sanctions ?*)
- **Paris Agreement to address Global Warming** in 2015, committed governments worldwide to respond to rising temperatures that threaten to bring planet to climate tipping point amidst increased extreme weather events. (*Sluggish response bcs easier to sign agreements than to act and attention on more immediate disasters?*)

# Shocks Can Change Future

By altering growth trajectories, 4H shocks can impact economy and society long after their initial shock, often in unexpected ways. Example: During COVID-19 crisis lock-downs forced many white-collar workers to work at home and many consumers to rely on Internet deliveries for getting goods. After the crisis, things did not go back to normal: a large proportion of workers chose WFH and e-commerce kept booming, which may create commercial real estate crash in large cities.

## But can also be false alarms



Oct 19, 1987 Black Monday, Dow Jones fell from 2246 to 1738 a 23% drop that was 34 SDs off normal variation. In next decade or so, financial crisis in many countries – Sweden, 1992, East Asia, 1997, Mexico 1994, Russia 1998 -- but did not spread globally. Then on Sept 12-15 2008, Lehman Bros collapsed → Wall Street implosion.

# Implications for Labor and Economic Well-Being Writ Large

To extent that big shocks drive world, should give more analytic and policy attention to those shocks than to marginal changes in policies and practices in world where markets behave normally. Value in planning major reforms/campaigns for shock period and recovery from shock.

- **Shocks of Great Depression/WW2 created opportunities** to improve labor relations systems (and political systems) in dways favorable to workers. Unions in US and most other advanced countries grow in spurts in crises, accompanied by changes in structure from craft to industrial unions; from firm to industry bargaining; etc.
- **Today's opportunity?** 1) Preserve some programs that set safety nets for low-income workers in Covid lockdowns. 2) Find ways to improve well-being through WFH/telework/remote work that can save commuting costs and office space while altering supervision and worker-to-worker contact. 3) Seek to influence new software/digitalization of work.
- **Today's dangers -- shocks in modes of information** that opened door for “bad guys” to sell anti-democratic nationalist xenophobia to workers whose economic situation has not kept pace with economic change; and **AI (the missing fifth horseman) shocks** that can automate white collar. Organized labor may be most credible way to address both of these issues.



## 2. Lessons from 4H shocks

Ideally, lessons would outline stunning results of forthcoming chef d'oeuvre “How to succeed in turning 4H shocks into prosperity and happiness without even trying“ -- that analyzes and models each and predicts what comes next and ends with insight into missing horseman, AI, as tool or master. But while each crisis adds to our knowledge, it also challenges us with surprises. As big, rare, unpredictable, possibly transformative events must do almost by definition. So, per the OECD title of talk, will focus on recent and intensely studied, on which I have worked.

### **Covid-19 Pandemic Shock**

- *“Unimagined just a few short months ago, the ongoing COVID-19 pandemic has upended our entire planet, quickly challenging past assumptions and future certainties.”* (Morens and Fauci, Cell, 2020).
- *“The COVID-19 pandemic triggered the largest global economic crisis in more than a century. In 2020, economic activity contracted in 90 percent of countries, the world economy shrank by about 3 percent, and global poverty increased for the first time in a generation. ...the largest global economic crisis in more than a century... (with) a dramatic increase in inequality within and across countries.”* (World Bank, WDR, 2022).

# Big Effects on Labor in US

- Short term huge crisis in second quarter 2020 as US GDP dropped 9%, with shutdown of millions workplaces so that in May 2020 50 million Americans were unable to work because their employer closed or lost business during the pandemic. But the jobs of many white collar and educated workers were saved as **digitalization of work and software technologies allowed them to Work-From-Home.**

## BLS May 2020 data with new crisis questions

By Occupation	%WFH	% Not work bcs Covid Shutdown	By Education	%WFH	% Not work bcs Covid Shutdown
Managers	57	14	<High School	5	20
Professionals	55	16	High School Grad	15	20
Other White Collar	35	19	Some College	25	21
Construction	8	23	Bachelor's Grad	54	17
Production/Transport	6	22	<b>Advanced Degree</b>	<b>69</b>	<b>14</b>
Service	8	33			

By August 2020 the number who could not work because of Covid shutdown had fallen roughly in half, still far in excess of recession unemployment in all periods save for Great Depression.

## **Longer term effects as Economy returned to “normal”**

1) New division in labor market based on WFH. Instead of flocking back to office many white-collar workers preferred WFH, leaving about half of major urban office space empty. Most blue collar and service workers had no WFH options, but enhanced shift to e-commerce buying from home altered retail and wholesale jobs.

2) While immediate job losses for blue collar and service sector workers should have raised inequality, opposite occurred once emergency legislation bailed out low-income workers and their employers. In summer 2020 about 15% of workers were paid for hours not worked and benefitted from various progressive subsidies – for rent, etc. This produced **biggest reduction in poverty and income** inequality in recent decades (Cortes and Forsyth 2020 IZA WP).

3) Lower employment to population rate, with labor participation falling in part because of long covid, and in part because older workers chose early retirement. But employment rate increased for disabled workers, who benefitted from new acceptance of WFH (Schur, 2022).

4) Increased “militancy” of workers in form of high quit rates and highest approval/positive sentiment for unions in decades → expanded unionization of grad students with the possible broader “spurt” elsewhere if social pressures/govt activities reduce employer opposition from extreme to moderate.

## 5) Huge supply responsiveness from scientists worldwide



- May Science 2020 reports “COVID-19 literature published since January has reached more than 23,000 papers and is doubling every 20 days”. Medical journals cut publication times. Paper quality may have fallen (some shocking retractions} but qual x quant surely rose.
- New ways of reporting and assessing. Yale sets up preprint medRxiv; bioRxiv expands; MIT starts open access journal of reviews of Covid-19 preprints to distinguish misinformation from credible research. Group of centers set up COVID-19 Open Research Dataset to provide free more than 130,000 scholarly articles on coronavirus. NSF gives emergency grants to study economic issues.
- **Can society spark science work on other 4H shocks?**

**Some may object to studying the 4H shocks as comparable events:  
“Covid, Financial Implosion, Climate Change and War differ too much  
to gain from considering them under the same “umbrella”.**

- Discussing Black Swan events, Taleb disparages academics for offering detailed specific after-the-fact-explanations about particular events that cannot possibly generalize. On the other side, specialists in history/case studies might argue the any broad theory/insight will invariably be too abstract to explain any real situation.
- My view is that depthful case study/history and abstractions across domains are complementary. Detailed case studies can provide hypotheses to guide theorizing. Simulations/lab experiments of theoretical interactions of factors can test the robustness of “after-the-fact” stories. And only detailed studies of the different 4H shocks can determine similarities and highlight where idiosyncratic features create dissimilarities.
- Analyzing shocks through a single economic framework of supply& demand or similar economic structure should improve estimates of key parameters and of related adjustment parameters.
- Can benefit policy decision if crisis/cures go through same *supply chain of impacts and responses* -- ie all crisis need emergency health support, impact buildings, benefit from efficient labor institutions, so policy to address one 4H problem can generalize to others.

### 3. Policies to Address 4H Shocks

Start with success: how did we conquer the crashing asteroid potential end of humanity?

- DART success built on sci-engineering knowledge from astronomy, rocket sci, and other sci-tech areas that the dinosaurs never had, developed from public and private R&D. Broad base of **research** knowledge was invaluable in allowing for the development and testing of way to keep asteroid from crashing into earth.
- The R&D allowed for an **early warning system** via satellites and telescopes of an approaching asteroid headed at planet. Whatever dangerous shock coming down pike, need sensors/leading indicators to build response.
- Was it worth costs?
- Might justify asteroid project even with almost negligible chance of asteroid threatening earth on basis that asteroid posed potential *existential risk* to Earth, per Weitzman's benefit-cost analysis of investing against low probability existential disasters even at huge cost. But easier to justify if what you learn is **part of broad knowledge that can help with many problems**. Both vaccine development in Covid-19 and finding way to deflect crashing asteroid benefitted from broad investment in basic and applied R&D.

# Proposed early warning system for pandemics

Seeking to prevent contagious diseases, preventepidemics.org has studied the cases of recent epidemics petered out and sought to generalize in its Epidemics That Didn't Happen Report <https://preventepidemics.org/epidemics-that-didnt-happen/> and concluded that what was needed was a worldwide program to adopt 7-1-7, designed to improve **the supply chain of response**.

A timeliness metric, 7-1-7 proposes that all public health threats should be detected within 7 days of emergence, that public health authorities should be notified within 1 day of detection and that all necessary early response actions are completed within 7 days of notification. Where other measures of success score theoretical capabilities, timeliness measures a system's actual performance in real-time, under pressure. 7-1-7 helps countries identify bottlenecks and facilitators and in turn helps justify investments targeted to specific areas of improvement.

# Making Decisions Fast with limited knowledge

Given speed with which a 4H Shock can impact world, responses to limit its bad effects requires “battle-field” fast decision-making with only limited data that fits better with **Decision-making under Deep Uncertainty (DMDU)** analysis than with the standard optimizing behavior in which the decision-makers can gather more evidence about the state of the world to determine an optimal response.

**Deep uncertainty is defined as a situation** in which a decision-maker knows neither (i) **the model** that drives the shock (aka having too many competing models) nor (ii) **the probability distributions** of the key variables in the model or the magnitude or their impacts on outcomes (aka too wide distribution around possible parameters).\*

**The DMDU hypothesis/claim** is that in such situations **the best way to make a decision** is to see how each possible decision fares in each possible future and pick the decision that performs reasonably well under most/all situations. That decision will be robust and presumably highly adaptable.

\* (Lempert et al. (Shaping the Next One Hundred Years: New Methods for Quantitative, Longer-Term Policy Analysis. RAND 2003). I leave out Lempert’s third attribute – that decision-maker “does not know how to value alternative outcomes”/weight trade-offs.



Though the distinction between *Risk*, quantifiable by probability analysis or by a theory or by frequencies of outcomes, and unquantifiable *Uncertainty* lies at the heart of Frank Knight's (1921) *Risk, Uncertainty, and Profit*, and resonates with Keynes' (1921) *Treatise on Probability*, economists have given short shrift to DMDU modeling. By contrast, climate researchers have found DMDU sufficiently useful in their studies that the World Bank published two Policy Research WPs (#6193 (2012) and 6906 (2014)) that made the case that for projects that were (1) vulnerable; (2) had trade-offs between robustness and cost; and (3) contained responses that were flexible to varying future conditions a DMDU *Agree-on-Decision* process in which decision-makers **stress-tested decisions under different possible conditions** would produce better outcomes than a “*Predict then Act*” process that sought the best decision for the most likely outcome. In a nutshell, in a world where you don't know whether the future will deliver best, worst, or middling conditions, it is better to decide on basis that all three are possible than to invest in finding out which is most likely and choosing the best decision in that case.

## Under Deeply Uncertain Conditions, Often Useful to Run the Analysis “Backwards”



## **In a world of uncertainty about which 4H shock is likely to hit next, the robust best strategy would be to improve the “Supply Chain of Response”**

- Why? Because the disasters from any 4H shock are likely to have some similar effects on outcomes that will stretch the supply chain of responses. This invariably focuses attention on emergency services and health care, which are needed when a big shock upends normal life, be the shock a global pandemic, earthquakes, war, or global warming induced fires or floods or droughts, or financial implosions that can leave many homeless
- But it also focuses attention on the construction/housing sector industry – the “squeaky wheel” of modern industry, with low productivity growth and a key place in almost every 4H disaster: the destruction of buildings in the Turkey/Syria earthquake and in Russia’s invasion of Ukraine, the critical role of mortgage securities in 2008 Wall Street implosion and other recessions; importance of residential lockdowns in the battle against Covid lockdowns; on-going relocation of work to homes.
- Since emergency services, health care, and construction workers have specialized skills and in many countries are unionized or organized into strong professional societies, this entails assuring reasonably good labor relations and working conditions to maintain an ample supply of labor.

## 4. Conclusion

1. Big, rare, unpredictable, potentially transformative “4H” shocks deserve analytic, research, and policy attention as phenomenon that are far more likely to impact lives adversely than normal negative economic shocks.

2. Given the difficulty of predicting 4H shocks, investment in improving early warning systems/leading indicators about their occurrence has great potential value.

3. Given the uncertainty surrounding 4H shocks, analyses of DMDU modes of decision-making and policies that respond flexibly to shocks of differing magnitude and form also has potentially greater value than efforts to find ideal policies for “most likely” shocks.

4. Improvements in the supply chain of responses to disasters offers a way to ameliorate adverse shocks of widely different types, which directs attention to special economic of analysis of ways to improve the construction and funding of infrastructure and housing.

5. Addendum: This presentation did not address the one shock that (may) rule them all: advanced AI software programs. Many concerned persons, from students in my 2023 class on discontinuous changes who analyzed papers, blogs, and prediction markets of AI experts about the potential risks of AI to the many specialists and “notable persons” who signed a June 2023 statement that warned that AI posed dangers comparable to pandemics and nuclear war (<https://www.safe.ai/statement-on-ai-risk>). At the same time, however, AI is a major tool in advancing science and business that can help overcome the 4H pandemics, war, global warming, and economic/financial disasters, and thus appears to be more as a mixed blessing – closer akin to the mysterious fifth horseman deserving separate investigation.