



LSE Economics of Environment & Energy

EEE Hour Discussion Notes

Lent Term 2021

<https://github.com/LSE-EEE>

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I - January 28, 2021 [Ideas]

Recording: [click here](#)

I. JACK THIEMEL

- Little Ice Age: period in 16-19th century as a climate shock
- Trends that emerged following this cold period
- How do you change behaviours based on your exposure to cold spells from the little ice age?
- How does downward pressure on agricultural productivity lead to (or prevent) structural change

- Two key channels of structural change - non-homothetic preferences and differential productivity growth trends combined with non unitary elasticities of substitution. Both of these channels could be affected by this event.
- Ishan Nath - [The Food Problem and the Aggregate Productivity Consequences of Climate Change](#)
- Margaret Drabble - A Writer's Britain
 - Book on behavioural responses to climate changes, mentions little ice age
- Climate data: how micro can we go in terms of seeing how much different areas were impacted during this period?
- Climate history podcast has a few episodes about the little ice age
<https://soundcloud.com/climatehistorypodcast>
- Famine during little ice age in Netherlands -- possible existing literature
- Guy Michaels - counties in the US - if you have oil in the ground you are less likely to develop manufacturing (nor a functioning tax system)
 - https://personal.lse.ac.uk/michaels/michaels_specialization.pdf
- Pischke - Of Mice and Merchants - Phoenician trade links and the emergence of urban centres/cities (path dependence)
 - http://eprints.lse.ac.uk/103007/1/Coasts_v19_paper.pdf
- Did it really exist? <https://voxeu.org/article/myth-europe-s-little-ice-age>
- Macro Development Virtual Course: [STEG Virtual Course on “Key Concepts in Macro Development”](#)

II. MICHELLE RAO

- How do policymakers learn from evidence?
- How do we communicate what's happening with climate change?
- Defeatist attitude: not much we can do about it
 - What are the impacts of these attitudes? What does it mean for behavioural change?
 - How do we change these attitudes?
- Could impact micro decisions on adopting, say, energy efficient technologies or firms making large investments
- Past experiments on nudging behaviours based on climate messaging
 - Negative messaging more effective? (<https://www.nature.com/articles/s41558-018-0122-0>)
 - Other literature on media shows negative news hits and sticks more
- How do we get across what all is happening? Breaking down complexity of topic to society
- Create a country index on environmental progress to induce competition (e.g. Climate action tracker)
 - <https://dashboards.sdgindex.org/map/goals/SDG13> this map track performance on SDG 13 (climate action) by country
- Is climate change an existential threat to humanity?
 - Perhaps unlikely. Most impacts for rich countries come from migration flows.
 - How would you present 'truth' if the goal is to maximise some global measure of welfare
 - Perhaps people care about non-quantifiable aspects of climate change.

- Are they really non-quantifiable? → difficult to integrate
- Weitzman may disagree with some of this debate (can't remember his work well) (<https://scholar.harvard.edu/files/weitzman/files/modelinginterpretingeconomics.pdf>)
- Weitzman's suggestion to solving the Noah's Ark problem: who do we save if we can't save all? (this suggests where you should focus conservation efforts) (https://www.jstor.org/stable/pdf/2999617.pdf?casa_token=xrr773tQ378AAAAA:mwljEBbKNe6NwuXCJu0uZS4Aiz-mpmbpZX9MSTKMWvXR4Jsatp2E_xChKxqMLFjBEY59sWbowpqyQ4O7s3CXr8SFutj839zxGz8CUSPORFfO3uTjyQU)
- How do we portray information that is accurate but which is not excessively negatively tinged (or positively!)
- Nature paper discussing communication: <https://www.nature.com/articles/s41558-018-0122-0>
- So many diverse opinions on why people are dealing with climate change, why they care about it, why they don't care about it, etc.
 - An area where running simple experiments is plausible or possible
- Evolution of social norms on changing behaviours for environmental reasons
 - E.g. growth of veganism
 - Does it play well in my social network? Does it allow me to signal the things I want to signal?
- Individual actions to mitigate global externalities → individually irrational. But why do some people still choose to do it?
 - Collective action problem vs. individual preference parameter
 - Social norms or social network? Wanting to fit in or conform to the norms
 - Being part of a group creates utility for people
 - Likewise, in a social network, even if I do not care about environment, if enough people around me do care and signal that they do then maybe I should do the same as well
 - Definitions of rationality that we are giving are not great.. what should it look like?
 - Unravelling effects of repeated games easy to demonstrate in lab games
 - Moving away from normative judgements about the term "rational" (i.e. rational behaviour is "good") and just focusing on how benchmark economics models define a rational agent, lots of individual climate action is "irrational" given expected MB is super low. Understanding exactly why behaviour deviates from the "rational agent" benchmark seems useful for modelling/empirics/practice.
- In terms of global welfare, maybe this isn't top of the list relative to trade, innovation, etc
- Do bureaucrats have poor / outdated reference points on costs of new technologies?
 - Does providing them info / new reference points change behaviour?
 - Can you do this in an experimental setting?
 - Gautam Rao paper on evidence and policy: <https://gautam-rao.com/pdf/HMRS.pdf>

III. IGNACIO BAÑARES SÁNCHEZ

- Why do we see such small returns to electrification?

- Need for complementary appliances which they do not have access to?
- Transition equation with electrification and poverty traps
 - 2x2 matrix: does removing the poverty trap remove the result that impacts of electrification are small?
 - How would the production functions look like for these households?
- Is electrification only valuable to people once they are wealthy enough?
 - Wolfram & Miguel Kenya people: people reveal that they would rather have money than have electrification
 - <https://www.sciencedirect.com/science/article/pii/S235272851530035X>
 - Is there a threshold after which we would see large effects?
- Paradox: electrification has big returns in macro studies, but they seem muted in micro studies
 - Selection
 - Measurements
 - Complementarities: transportation costs + electricity? Electricity + something else?
 - Dynamic effects: returns to electrification do not happen in a static setting
- If we were in 1960s Korea, would we promote universal electrification? If we hadn't, what would have the outcome been?
 - Go back and get detailed records of where the grid went and where + secondary data on household and firms
 - Sum up all gains going forward
 - General equilibrium effects
- [Rural electrification and development in South Korea](#)
 - people were allowed to pay back over decades
- Is the path out of poverty broad or narrow?
 - Narrow: maybe we need electricity as a key input, without which we wouldn't experience development
 - Broad: maybe electricity isn't a first order requirement but is part of it
- We will provide electricity regardless but question is when is the right moment? Is it the first thing we have to do?
- To study complementarities is extremely difficult
 - Instrument for roads, instrument for electricity, instrument for roads and electricity (for example) -- you need to instrument for the complementarity

II - February 4, 2021 [Reading Group]

Paper: Barrage (2020) - *Optimal Dynamic Carbon Taxes in a Climate–Economy Model with Distortionary Fiscal Policy*, *Review of Economic Studies*

Presented by: Derek Pillay

Recording: [click here](#)

- What is the optimal tax on carbon in an economy where there is a distortionary fiscal policy?
- Assumes temperature anomaly from pre-industrial levels is a sufficient statistic for climate change
 - Key to keep in mind this is a global representative agent model (though it does have extensions)
 - Damages enter only as level effects
 - Damages from production + utility loss not particularly large and very much at variance with what other scientific literature on climate change has to say (for example, impact of 5 degree warming above preindustrial levels on welfare still relatively minimal).
 -
- Model assumes perfect foresight of agent and planner
 - How might adding in uncertainty change our analysis here?
- Difficult to do theories that have clear and crisp comparative statics
 - Idea: we need to take fiscal policy into account. How can we take these mechanisms into account and turn them into a paper?
 - Macro papers enable you to make these points without having amazing identification and theory
 - Acemoglu: we want a carbon tax on top of a directed subsidy
- Chamley-Judd result on zero capital taxation: Straub & Werning (2017) shows this is wrong
 - What would incorporating this into the model mean for a change in predictions on optimal carbon tax?
 - What if we relax the representative agent assumption and introduce some country heterogeneity with low vs high capital countries? Might this warrant an optimal redistribution between the two, especially if there is equal heterogeneity on how climate impacts outcomes by countries?
- Does not include the ability for substitution in energy technologies: carbon taxes do not need to necessarily raise costs; renewables are cheaper than many fossil alternatives even without pricing in the externality
- Pushing forward:
 - Add IAMs to a heterogeneous agent framework that is used on the macro frontier
 - How do the distributional consequences of climate change and fiscal policy interact?
 - Would you get strange results where a 'vulnerable but small' agent is happy to make lump sum transfers to 'rich but large' countries which emit a lot of emissions in order to avoid future climate damages?
 - Big asymmetry between OVER taxing carbon vs UNDER taxing carbon
 - Per Krussel: Over taxing is much less welfare harming than undertaking. Overtaxing only creates a fiscal externality. Though he only has a first best framework
 - Transfer resources to areas that have the lowest marginal abatement cost and have them mitigate

- Tipping points:
 - Lemoine and Traeger paper on optimal policy with tipping points
<https://www.aeaweb.org/articles?id=10.1257/pol.6.1.137>
 - Pindyck & Wang paper on economic and policy implications of catastrophes:
https://www0.gsb.columbia.edu/faculty/nwang/papers/Pindyck_Wang_AEJ_2013.pdf
 - Weitzman: if we are concerned about this extreme tipping points the optimal policy would be a tax of - infinity. Anything times -infinity = -infinity! So in some sense trying to model all of this closely isn't that valuable
 - ON MODELING AND INTERPRETING THE ECONOMICS OF CATASTROPHIC CLIMATE CHANGE
<https://www.mitpressjournals.org/doi/pdfplus/10.1162/rest.91.1.1>
 - Rudrik (2020) optimal climate policies when damages are known
<https://www.aeaweb.org.gate3.library.lse.ac.uk/articles?id=10.1257/pol.20160541>
 - Seems like there are important interactions between (a) tipping points/discontinuities/etc and (b) uncertainty. For example, in the Barrage paper, if we add a damage function with a tipping point a temperature level above the maximum temperature obtained under the standard damage function, this will not affect the optimal tax or path of emissions in the model. If, however, uncertainty about the potential future path of economy/climate is added along with such a tipping point, this would presumably push up the optimal tax and reduce optimal warming. Similarly, uncertainty about the location of the tipping point would also have this effect so long as the tipping point could lie somewhere in the range of the previously assumed optimal temperature increase.
- Add in more realistic constraints on how factors of production can move across space. Labour is much less mobile and likely to be impacted.
- Consider the growth effects (e.g. repeated losses each year because you fall behind the growth channel)
- Damage functions:
 - Suppose we block borders and don't let anyone leave following a climate crisis. This could spur conflict and chaos, with huge costs. Would this enter in the current damage function?
 - Core idea: need to think about modeling these frictions and the role of borders
- Adding in inequality into the model:
 - Government may need to engage in more redistributive fiscal transfers when we add in inequality. One could imagine that this increases the marginal cost of public funds due to a larger wedges between MRS and MRT of agents; however, accounting for inequality may also lower the marginal cost of public funds once inequality concerns are embedded in the social welfare function via Paerto weights on agents.
 - Increases these climate-fiscal interactions
- Stern: getting out of climate change is not only about getting the carbon price right
 - Very concerned about the extreme outcomes

- Much more about how we design cities, build resilience, etc

III - February 11, 2021 [Ideas]

Recording: [click here](#)

I. SOROUSH SABET

- How might the energy transition affect aggregate fluctuations like business cycles?
 - Gabaix & Carvalho on fundamental volatility
<http://pages.stern.nyu.edu/~xgabaix/papers/greatdiv.pdf>
 - Changes in aggregate fluctuations that stem from microeconomic shocks
 - Role of micro cost shocks like energy (petroleum) leading to aggregate fluctuations
- Channel 1: Concentration of production of fossil fuels geographically (and among fewer markets)
 - Solar resources are much more decentralized (geographical and market structure - e.g. high fixed costs?)
 - Compare
- What happens as we shift towards greener sources of energy as we shift away from more carbon based?
 - Increasing returns to the sector → small number of large players // Decentralisation?
 - Will we have many small providers of energy or few large producers? What are the consequences of this for examining the aggregate fluctuations?
- We need to factor in that the substitutability between energy sources and how this is evolving over time
 - Renewables much more of a feasible option now compared to in the past, not just simply based on costs
- Macro level implications of stranded assets?
- How volatile is oil and coal historically? How does this compare to renewables?
 - Expect there to be less supply side shocks
 - How do we identify supply side shocks in energy markets? Are they becoming less volatile over time due to the shift in green energy?
 - Do we think the shift to green energy will also change the shape/elasticity of the supply curve such that energy prices are also less/more sensitive to demand shocks?

II. POLLY SIMPSON

- How do shocks from extreme weather events pass through supply chains?
 - Climate change → more volatile weather
 - In the short run what is the incidence of these costs? Who bears the costs -- only the places that experience the event or other countries/firms inside the broader production network?
- Example 1: Intel vs. Nike
 - Intel = supply chains / production around all the world. Owned by Intel

- Nike = spread production but they don't own any of the factories abroad
 - If a shock hits, can Nike more easily switch and source from elsewhere?
- Example 2: Canadian maple syrup
 - Forest fires in Canada with all of it wiped up. Canada, with its reserves, pushes up prices to passthrough these shocks to customers
- Does exposure to extreme weather events correlate with countries/firms/contexts that have less price setting power (e.g. less ability to pass through these shocks to customers)?
 - How does passthrough of costs differ based on your position in the supply chain / market power?
 - Aggregate up to a country level to get a measure of sorts at the country of how much they might be able to pass on the costs that come from climate damages (and overlapped with their actual exposure)
- Distributional impacts of these shocks?
- Are firms forward looking? Do they change their supply networks in order to avoid future climate change shocks?
 - Choice of supply chains + how these links get broken over time
- Look at country contexts where there is near autarky (e.g. in import of goods) to see how they examine shocks
- Trade literature on cost pass-through. Could build on this
- Event study at an aggregated level, e.g. using input-output tables that capture sale (exports) of manufactured goods pre and post disaster
 - Does a country recover? If it does, is this evidence that supply chains did not change? Or did they have to find new buyers / enter new supply chains?
- Rocco Macchiavello: The Value of Relationships -- how flower producers respond to shocks (violence)
 - <https://pubs.aeaweb.org/doi/pdfplus/10.1257/aer.20120141>
- Ganapati, Shapiro & Walker: Energy Cost Passthrough in US manufacturing
 - https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2783473
 - Also look at Jan De Loecker work on markup estimation
 - <https://sites.google.com/site/deloeckerjan/>

III. CHIARA SOTIS

- Polarization on climate change: not rational updating of beliefs on climate change and what should be done; instead you build up your social identity through the interactions you have with people around you
 - From a policymaker's perspective, given this polarization, how do I communicate messages effectively? Who to target, and what to say to them?
 - What are the salient issues that determine polarization?
- Political economy model: if you have limited resources as a policy maker, who do you target to make this happen?

- Extremists?
- What constitutes identity for these people?
- Ripple effects across the different behaviours for climate change?
- Network papers in development -- how do you best pass information along? Expert networks versus social networks.
 - Banerjee, Chandrasekhar, Duflo & Jackson --
https://web.stanford.edu/~arungc/BCDJ_gossip.pdf
 - Can you assume truthful transmission?
- Measuring network structures:
 - Breza, Chandrasekhar & co -- Using Aggregated Relational Data to Feasibly Identify Network Structure without Network Data <https://web.stanford.edu/~arungc/BCMP.pdf>
 - De Paula, Rasul & Souza -- Identifying Network Ties from Panel Data [Identifying Network Ties from Panel Data: Theory and an Application to Tax Competition](#)
- Do people become more extreme or are they just now finding a focal point to coordinate around?
 - Matthew Gentzkow: is there actually polarization or have we just found the ability to coordinate?
- Tim Besley & Torsten Persson paper: value changes and climate change <http://perseus.iies.su.se/~tpers/>
- Intergenerational transmission of values (up as well as down) -- are households with kids more progressive in terms of values on climate change and say adopting veganism?
- Nielsen barcode consumption data: revealed preference on how much people care about climate change based on their consumption
 - E.g. consumption of meat substitutes
 - Xavier Jaravel and Lucie Gadenne looking at calculating your ecological footprint using similar types of data
- Step 1: define the policymaker's objective function. What are they aiming to do, and what does this mean for the ideal interventions / nudges?
 - Macro theory - don't need 100% of support for beliefs to endogenously change
- Carbon tax support?
<https://kleinmanenergy.upenn.edu/podcast/why-americans-want-a-carbon-tax-but-wont-support-one-at-the-polls/>
- Matthew Jackson:
 - https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3269543
 - https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3049748
 - https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3606003

IV - February 18, 2021 [Reading Group]

Paper: Bolton & Kacperczyk (2020), *Global Pricing of Carbon-Transition Risk*, *working paper*

Presented by: Soroush Sabet

Recording: [click here](#)

- How are financial markets and investors pricing climate change risks and the green transition?
 - How do (and should) these risks enter into the pricing of financial assets?
- Large companies are as significant as countries in terms of their contribution to GDP as well as global emissions
 - By some measures, largest 100 countries are 'responsible' for 70% of emissions
 - Do we blame the firm or the consumer for these emissions?
 - JEEM - The carbon dioxide emissions of firms:
<https://www.sciencedirect.com/science/article/abs/pii/S0095069612000654>
- Do stock returns reflect investor's concerns about transition risks?
- Paper looks both at direct and indirect emissions
 - Scope 1 = direct emissions in production
 - Scope 2 = upstream including how you are consuming electricity
 - Scope 3 = downstream emissions including
 - (Increasing emissions as you go up in scope)
- Positive carbon risk premium in North America, Asia. Lower in Europe.
- Are we capturing the beliefs of investors well? Looking at ex post returns based on ex ante beliefs
 - Is it just contemporaneous effects? Can the regression include more dynamics?
 - Are there any issues here regarding investors needing to learn how to form appropriate expectations about climate risk if pricing this risk is still new? Does this create complications in terms of going from realised returns to expectations? E.g. issues around ergodicity
- Carbon premium is lower in countries which have a higher share of renewables. Higher carbon premium in fossil fuel / commodity dependent countries, in particular if they are not democracies
- What does the carbon premium mean for the role of the financial sector in steering the green transition? Isn't the logical extension of this paper that the carbon premium has to approach infinity as the demand for fossil fuels runs out?
 - Is there a weird channel through which that keeps more capital in the fossil sector as investors seek greater returns especially in this environment where yields are so low elsewhere? Hunt for yield dynamics (might be misunderstanding basic finance...)
- Significant change in carbon premium post Paris Climate Accord -- almost entirely driven by Asia
 - What does this reveal about extent to which knowledge of climate change enters only with a significant lag into the financial sector?
 - Or is it the crowd nature e.g. I know climate change will destroy things and these are stranded assets but I won't move until I think others are starting to move too (reinforcing feedback loop)
- What is the channel through which the carbon premium influences the allocation of resources?

- What is the effect of fluctuation in equity values of currently listed companies on those companies' investment/allocation decisions and also the composition of new entrants to financial markets?
- Transition towards service economy should yield a flattening of emissions
 - Is some of the transition we are seeing becomes some countries are moving towards more of a service oriented economy?
 - Have these firms been less hurt by the pandemic? Has this explained any of the 'flattening' that is happening e.g. shift towards more online
 - Is it our preferences (towards services) are moving which are causing reductions? Or are we getting more efficient at producing manufacturing goods
 - Squaring this structural transformation story with what it means for emissions growth
 -
- Shapiro paper: decline in pollution in manufacturing in the US
 - <https://www.aeaweb.org/articles?id=10.1257/aer.20151272>
- Is the risk of future regulation causing low productivity, high emissions projects to be cancelled? Then the effect of these policies is to remove these low productivity projects from happening (e.g. how much pollution is cancelled by the risk of future regulation)?
 - Nick Bloom literature on measuring uncertainty about a future
 - How polluting is each of the cancelled projects/products?
- Are we starting to see changes in what firms are choosing to do based on these growing risks?
 - I feel like Rick Van der Ploeg might have some papers that related to this:
<https://www.economics.ox.ac.uk/people/rick-van-der-ploeg-0#collapse2449026>
- How do firms respond to potential existential risks? Can we document the actions fossil firms are taking now in response to these future risks?
 - Are there historical examples of a firm in a dying industry that was successful in reinventing itself? Or do they all just go extinct?
- Link emissions to firms directly and then use the firm as unit of analysis to think of how public policies and skewing financial instruments could impact changes
- Bloom & Van Reenen -
- Acemoglu directed technical change: incorporate a crossing point where production function of clean just dominates production function of dirty
 - Trace out production costs over time
 - This could help pinpoint the sectors where we might need regulation and other sectors where we can stop putting further support

V - February 25, 2021 [Guest]

Guest: Rocco Macchiavello (LSE) r.macchiavello@lse.ac.uk

Recording: [click here](#)

Broad interest: environment and supply chains

Specific: PES (Payments for Ecosystem Services) in supply chains

Rocco's expertise: Supply chains (in developing countries)

- In a variety of areas legislation is being introduced requiring sustainable imports; this is becoming more and more prominent
- Supply-side issues for many commodities key for understanding deforestation, pollution, conservation, water use, etc.
- Big constraint historically: lack of data on firm-to-firm trade
 - Use of VAT data has improved coverage, but often missing information on certain aspects (what is being traded, under what circumstances, where goods come from, etc)
 - Someone else is collecting data on traceability and for tracking purposes, especially relating to data on **environmental** impacts
 - Public agencies collecting data on where meat in Brazil comes from, for instance
- In his experience companies are taking actual initiatives to change things on the ground
- 2 types of initiatives: (i) single firm initiatives (Codes of conducts/VSS), (ii) sectoral standards (alliances, eg. RSPO)
- How do we deal with the problem of leakages? E.g. one firm approves, another fills in the void
- What is driving company decisions to make these sustainable changes?
 - Legislation has not yet kicked in (but what about companies anticipating the future introduction of legislation and reacting now to it?)
 - Company culture may encourage firms to make these changes.. Not just the bottom line in terms of profits
 - Consumer demand seeking more sustainable forms of production also encouraging these shifts
- The largest firms comprise a big chunk of total emissions. Are companies measuring how their changes or sustainability initiatives translate to emissions reductions?
- Sustainability initiatives taken within firm versus traded in a market
 - Assumption that market should be able to efficiently decouple supply and demand for sustainability
 - Any frictions to this? For example, information frictions? Maybe also “PR frictions” (i.e. consumers favour within company initiatives). Can we identify these? Welfare costs?
- Who are the beneficiaries from PES?
 - People benefit from keeping their watershed clean... but what about ensuring species diversity in the local ecosystem?
- Contract design
 - Transaction costs - including transparency, enforcement, commitments,
- How do we compute the benefits of these programs in a dynamic setting?

- Example: when I am linked with a supplier that has a forest conservation program, I plant trees; but when I switch supplier I may no longer be incentivised to do so (supply chain approach to sustainability could potentially introduce tradeoffs between maintaining relationships to promote sustainability on one hand but flexible supply chains that can respond efficiently to secular trends and short term fluctuations)
- In many settings long-term relationships emerge between buyers and suppliers
- We need to get into the micro details on measurement in order to look at the GE effects + to be able to impute benefits to the program (e.g. Nespresso helps planting a lot of trees but the company working next door damages the environment)
 - What is the interest from the company side of improving measurement?
 - Hansen: 30x30m deforestation data for the whole world
- Enveritas: help companies monitor supply chains to ensure compliance with legislations/sustainability plans (<https://www.enveritas.org/>)
- Imagine you are a US coffee drinker and you want to ensure diversity of bird species in Colombia. In many ways you do not have a direct channel to do this.
 - Supply chains change this: Nespresso takes products from the rainforest in Colombia (coffee) and sells to consumers. These companies collect payments from people which might already be the indirect beneficiaries of conservation. Unique link
- How much are consumers willing to pay? What is the premium they would be happy with?
- Nespresso: how should we introduce PES in their supply chain?
 - Already help farmers get Rainforest Certification which gives farmers a small premium (a form of PES, but it is attached to the coffee price) - to what extent will this premium exceed costs of implementing?
 - Programmes where they are already helping farmers plant trees

VI - March 4, 2021 [Reading Group]

Paper: Khanna, Liang, Mobarak & Song - **The Productivity Consequences of Pollution-induced Migration in China**

Presenter: Ignacio

Recording: [click here](#)

- Core motivation: pollution may influence the spatial distribution of workers if migration responses hinge on the degree of pollution
 - Notably, we are interested in differential responses between skilled and unskilled workers
- Channels: disutility from pollution → migration → misallocation
- Pollution has a direct utility effect, a direct production effect (lower productivity), and an interactive effect between the two (e.g. worker sorting based on pollution preferences)

- Question: To what extent is this paper potentially consistent with the more reduced form damage function used in papers like Barrage's? That is, is it just a matter of changing the functional form specification/parameters, or does the reduced form macro strategies miss something fundamental that cannot be captured in those models?
- High skilled workers more likely to migrate away from pollution compared to low skilled one
 - Reflects preferences (e.g. richer may place a greater premium on clean air)
 - Reflects institutional constraints on mobility (hukou system)
- Typically migration is from cleaner (agriculturally dominant) areas to dirtier areas (cities)
 - Tradeoff between insurance mechanism of moving to cities which are more polluted but less reliant on the weather in terms of incomes
- Skilled and unskilled workers are complements
- Core idea: pollution, through adaptation via migration, can affect productivity in a certain area
 - What are the implications of this on the structural transformation experience?
 - Have we seen these dynamics in the past (e.g. pollution in Europe during industrialization)?
 - What is the effect of cleaner technology adoption on mitigating the patterns we observe in this paper?
- Fighting pollution has been highly sensitive and salient among urban Chinese
- No information on work at the origin and work at the destination
- What about the longer term firm location response to these changes?
 - If unskilled cannot move, though, seems like there are some movement frictions that could stop some firms from relocating.
- Are there sectoral shifts in the jobs that a migrant takes in the origin compared to the destination?
 - Census data should have this
- What would happen if the high skilled people were not allowed to migrate?
 - Could this potentially be welfare enhancing?
 - Migration as an optimal response to climate issues... but access to migration will be differential, which could reduce welfare
- Are we seeing simple spatial/firm responses to pollution in India?
 - Is firm location a revealed preference?
 - Pollution as a second order concern for individuals/firms in India?
- China undergoing structural transformation already.. may not
- The Hidden Cost of Industrial Pollution: Environmental Amenities and the Location of Service Jobs
<http://yatanglin.weebly.com/uploads/8/7/8/7/87879450/jmpdraft.pdf>
- Because pollution may cause outmigration by those able to -- often the more skilled, leaving those who are constrained behind -- perhaps this creates an extra argument for why we should clean up our cities
- East Side Story: Historical Pollution and Persistent Neighbourhood Sorting:
<https://www.journals.uchicago.edu/doi/abs/10.1086/713101>
- Will people return? Productivity is driven by agglomeration . Change in which areas become the high productivity/low productivity areas with enough time?

- Possible asymmetries in benefits to low/high skill people of being in proximity to other high skill people?
 - Spatial inequality implications? Balancing out?
- Theory: innovation requires R&D and manufacturing being close together. Let the engineers talk to the scientists.
 - Can we find out more about whether co-location has become a magnet, e.g. co-location of complementary sectors determines where agglomeration and growth of say services or manufacturing takes place?
 - This depends on where a technology is in terms of its technology life cycle. Benefits most at early stages of development from co-location. Later on, however, there may be decoupling
 - China expanded its production of solar panels at the point where the technology was relatively mature and where you could come in with sheer size to get economies of scale
 - Marshallian spillovers encourage co-location through shared suppliers, labour markets, knowledge etc
 - Role of other constraints in preventing this co-location: land in India, for instance
- Structural change and global emissions
 - Is the shift away from manufacturing into more services reducing overall emissions? Or is the main emissions reductions coming from improvements within existing production processes (a la Shapiro)?
 - What does the global share of manufacturing vs. services look like over time?

VII - March 11, 2021 [Guest]

Guest speaker: Nicholas Stern

From Pigou to the Dynamics of Fundamental Change

Recording: [click here](#)

Presentation

- Important to realise the stakes at play: for many people they are existential -- way behind what we normally deal with in expected utility theory
- Pigou: when there are externalities people do not face the true cost of production. Idea is to introduce a tax to take into account this difference
- Arrow-Debreu assumptions
 - Complete, perfect markets
 - No IRS
 - Taxation possibilities which don't distort
 - All of the above are necessary for us to assert the Pigou story is the right one -- but in practice all of these assumptions are wrong in many important ways
- Policy maker interest on climate dates back 30 years

- How wrong is the Pigouvian response to the climate problem?
 - Not totally, but it is not the whole story
- DICE model by Nordhaus: let's ask how all of this (corrective taxes, climate damages) affects output and growth
 - Should you slow down your growth story in order to take into account the damage to the environment that occurs through the growth process? To grow or not to grow
 - If 5C only reduces output by 10%, why would we care? This is in 100 years and damage is relatively small
 - Does not capture massive stakes like large scale migration
- Economies of scale are enormously important in production as well as discovery (innovation)
 - Pigouvian story requires increasing marginal costs of action from decreasing returns to scale -- incompatible
- Deeper flaws of existing models -- they leave out critical elements pertaining to the climate problem:
 - Beyond issues about functional forms/parameters
 - Existential risk -- not even included (e.g. warfare - it may make more sense to think about reducing the probability of it, not estimated exp. utility losses)
 - Weak on distributions (income, dislocations, changes in relative prices)
 - Imperfections & non-existence of markets
 - Greenhouse gas
 - R&D
 - Capital markets
 - Networks (roads, electricity grids)
 - Information
 - Co-benefits/co-damages
 - How to change structure of economy very quickly
 - How do change cities? Land use? Transport? Energy systems? Carbon prices help here but are they quick enough to implement this structural change?
 - Is expected utility theory the tool we use to examine these issues? Probably not
- Next 20 years we will double the world's stock of infrastructure
- 20% or so of world's annual deaths are associated with air pollution
- A competitive equilibrium with missing markets is not Pareto efficient
- Missing markets make expectations crucial.
- Circular economies: sharing of capital (e.g. Uber)
 - Many aspects of making efficient use of resources

Q&A

1. Better coordination within environmental economists [Pia]

- Be an economist -- not a field economist -- importance of breadth
- Value of a big tent

2. Agricultural subsidies and data on food waste [Veronica]

- Systemiq - think tank? -> FOLU - growing better
- McArthur - circular economy
- Enormous losses for lack of food storage in developing countries -- or theft in the transportation of goods
- V: What seems weird to me is that developed and developing countries all waste about 30% of food (if the data we are using is any good), just at different stages of the supply chain.

3. Issue: models we use or the perceptions humans have e.g. behavioural challenges [Chiara]

- Original work can be done here -- apparently some work done by Eric Maskin thinking about how we should contemplate immense losses
- Weitzman always struggled with divergent integrals -- an infinity makes it analytically unmanageable e.g. what do we do next if MC \rightarrow infy ?
- Maximising expected utility doesn't seem like the right approach here. Need to think about way to incorporate consequences in our actions that includes larger damages

4. How much do we need add to IAMs vs develop whole new macro framework [Derek]

- We need lots of models that help us understand different aspects
- Edenhofer (Potsdam) economists and climate scientists working together . Work on cost structures.
- Instincts to not just make the existing models bigger and more complicated. Better to have different models and approaches. Question, though, about how to analyse potential interactions.
- Tim Palmer at Oxford

5. Innovation policies and directed technical change [Tim]

- Role of targets: zero carbon electricity, no internal combustion engine vehicles, etc.
 - How strong will these effects be?
 - Could this have a perverse effect on demand - people rush to purchase sooner to avoid target coming into effect? I.e. shifts emissions forward?
- Don't need to prescribe what will do this -- we just have confidence that we can (e.g. not picking particular winner technologies)
- Combination of price mechanisms, regulations, standards, and direct investment into R&D
- What Gates doesn't discuss: incentive structures that focus on the problem and which give powerful returns for those that propose solutions

6. Questions from politicians

- They have finally grasped the growth story: addressing climate change does not just mean costs, it can mean growth
 - E.g. electricity is already cheaper in a clean way and will only continue this way
- Help in showing and describing the growth story
- Practical distribution implications: rich people buy electric cars, poor people do not
 - Need a driveway to charge an EV
- How to handle the people who will be dislocated
- Much more now *how* do I it, less *why* should I do it

7. Climate impacts, air pollution impacts, migration [Anshuman]

VIII - March 18, 2021 [Ideas]

Recording: [click here](#)

I. VERONICA SALAZAR RESTREPO

- **Interest:** economics of food waste
 - Under-researched - data constraints?
 - Why is there more supply than demand?
 - Huge potential for mitigation given that about 30% of the food that is produced is wasted
 - Large externality with throwing away things
- Some leading reasons: logistics / distribution
 - In developed countries more waste comes at the consumer stage (e.g. excess catering)
- What are the effects of agricultural subsidies on food waste?
 - A lot of subsidies are price floors ensuring farmer gets a minimum amount, ruining the role of the price mechanism in reducing total amounts in equilibrium
- If there is waste, how can you get it and use it productively?
 - Food banks in Chicago
 - Huge amount of waste in donated food because there is no price signal.
- Market design: what is the missing market / market failure that constrains the ability of this waste to be utilised?
 - Nudges: how can we change behaviours e.g. changing use by/sell by labelling
 - To what extent are price signals “wrong”? What would the distributional implications be of higher food prices?
- Who benefits from food waste?
- Consider the nutritional value of food that is being grown and the distortions that certain price signals may provide in terms of skewing production to less nutritious varieties

II. ANANYA KOTIA

- 5 years ago mining licenses have been cancelled in certain parts of India
 - Mining in Goa was entirely banned despite providing a huge share of total iron ore production
 - What are the GE costs of this type of command-and-control regulation?
 - Similar story in Karnataka in 2015
 - Politically popular
- What are the shocks through the production networks of these regulatory changes?
 - What happens to those in the areas affected by the decline of these industries?
 - ASI panel to construct input-output matrices to estimate the production networks

- Revealed preference of biodiversity: can we use this instance to backout how much the Indian state is valuing biodiversity?
- Are prices better than command and control?
 - Supreme Court intervention causing a recession for years by cutting off economic activities (mining permits)
- Framework: GE of China trade shocks
 - No developing country application of this yet
 - Instrument: ROW imports from China
 - Reallocation process e.g. how people move in/out following the change
- If a legislator abandons their duty, what are the costs of leaving this to the courts to make the right calls?
 - Possibly different policy tools available to courts vs. legislature
- What were the environmental benefits?
- Disconnect between the local population that wants destruction of local natural resource (low value of having intact forest); think about how policy can change the incentives of the local population to make them more interested in conservation
 - E.g. it's the people in Delhi or Stockholm who value this most
 - Compensation to minres for the loss of livelihood

III. AMENJALAL

- Gender differential responses to shocks → gender differential responses to climate change
- Home production of goods more unsafe/difficult for women?
 - Ground water depletion, receding forests, etc. increases time burdens
- Gender based violence increased in contexts of greater groundwater depletion
- The role of time-saving technologies on labour force participation (e.g. Dinkelman 2011)
 - Climate change makes this more difficult over time... is this reducing female labour force participation?
 - Reverse of <https://www.jstor.org/stable/3700686?seq=1>
- Are men migrating out in response to climate change? What does this mean for the time allocation of women e.g. do they suddenly have greater burdens? What about their kids -- are they pulled out of school?
- Is there more pressure on women to sell their assets in response to these shocks?
- Do women specialise on tasks that are more dependent on natural resources (weather) and hence more adversely affected?
- Would electrification help women differentially?
 - Cooking and lighting
- Time cost vs wage costs
 - Responses to weather shocks may differ depending on occupations
- Poverty traps in reverse: destroyed capital may throw you below the threshold

- Supreet Kaur: get data from around the world (e.g. droughts) and think about big shocks that might kill capital. Can we find evidence of occupations 'disappearing'?
- If a drought kills your livestock, then you should be thrown back into whatever you were doing before (e.g. wage labour? farming)
- Gendered differences in occupations in agriculture
- Climate mortality by gender?
 - Barecca et al (2016) paper as a starting point but applying it to gender
 - Are women more susceptible to heat shocks?

IX - March 25, 2021 [Reading Group]

Topic: Optimal Solar Geoengineering Development

Main Paper: Solar Geoengineering, Learning, and Experimentation

<https://www.nber.org/papers/w28442>

Presenter: Polly Simpson

Recording: [click here](#)

- Solar geoengineering (SGE) addresses the symptoms rather than the causes of warming
 - Aerosols, mirrors in space
 - Can be grouped with direct carbon removal e.g. CCS as another form
 - Concerns: what are the indirect effects of these technologies?
- IPCC 1.5 scenario requires having some degree of CCS or CDR -- no SGE though
- Model: adds in solar geoengineering into a DICE model
 - How does the planner make the tradeoff between emissions abatement (e.g. energy efficiency) vs relying on these tools which directly lower temperatures?
 - How do these optional policies depend on the information that is available to the planner?
- The role of information:
 - Uncertainty over climate sensitivity, effectiveness of solar geoengineering, and possible damages from SGE
- Adding in SGE delays abatement until later in time and it lowers the optimal carbon tax
 - Driven by exogenous decreases in abatement costs
 - Uncertainty about SGE damages lowers optimal amount
 - SGE deployment, however, slows learning
- [Background on typical DICE models] Models how radiative forcing depends on carbon concentrations and exogenous changes in forcing
 - Radiative forcing in turn leads to increases in temperature
 - Damages from climate change quadratic to temperature
 - Exogenously falling abatement cost

- What if investments into abatement are endogenous to investments into/success of SGE? Moral hazard critique of geoengineering
 - Economic growth independent of climate
- DICE model with SGE:
 - Radiative forcing can be reduced with SGE
 - Quadratic damages depend on stock of temperature and carbon concentrations (atmospheric and in the ocean)
 - Additional quadratic damages come from SGE
- Because SGE does not fully offset the effect of GHGs, and abatement costs exogenously fall over time, in effect the role of adopting SGE by the planner is to buy time -- in the future they swap over to abatement once that becomes cheaper
 - How large is this 'gap'? Is abatement cheap enough already?
- Uncertainty affects optimal policy due to risk aversion
 - More uncertainty about climate sensitivity = more abatement, more SGE (loss aversion)
 - Uncertainty over SGE does little to change abatement
- Models that ignore SGE will abatement too much that cost too much
 - These models all ignore any damages that come from local pollutants
- How does SGE affect learning?
 - Signal strength effect: SGE puts downward pressure on temperature changes; if temperatures are not changing very much we have a harder time distinguishing between what has happened from weather shocks vs SGE
 - Noise amplification effect: adds noise to the climate system which slows our learning about the climate system
- **Check:** how precisely do aerosols spread? The papers model a global SGE project; does where we release aerosols matter?
 - Which areas experience the greatest reduction in temperatures from the release of SGE? What does this mean for optimal policy?
- Is learning the right approach?
- SGE and abatement technologies are substitutes -- is the exogeneity assumption of abatement cost decline realistic?
- How do you compare competing technologies (e.g. relative impact of planting 1 bn trees vs. aerosols vs. going entirely renewable)?

X - April 1, 2021 [Ideas]

Recording: [click here](#)

I. MENNA BISHOP

- Cumbria mine: first mine to be built in the UK in 30 years

- Designed for making steel for exports
 - Inquiries into whether or not mine should go ahead (other political factors at play too like COP in November)
- What are the costs of not going ahead with the mine?
 - Alliance between poorer places (e.g. in UK or US) and dirty jobs (e.g. jobs in industries that are very polluting)
- Fits more generally into the idea of how we can compensate 'losers' from the green transition
 - Green transition cannot be detrimental for inequality
- Are green jobs 'good jobs'? Or are green jobs likely to be good jobs?
 - Are there alternatives?
 - Small literature documenting what green jobs are and what the necessary skills to do these jobs are
- Grantham work on this: <https://www.lse.ac.uk/granthaminstitute/profile/marion-dumas/>
- Another Grantham person working on mapping green skills to green jobs: <https://www.lse.ac.uk/granthaminstitute/profile/aurelien-saussay/>
- Even if you adjust wages for physical hardship (e.g. health risks etc) mining or dirty jobs can still be quite attractive e.g. have a wage premium
 - Losing these jobs could be bad then
- Germany pay outs for coal mining regions: around 45bn euros
<https://www.climatechangenews.com/2020/01/17/germany-agrees-pay-out-to-states-and-companies-in-coal-phase-out-deal/>
- Hafstead and Williams from RFF have done some research (original and summarising) from the macro perspective on environment versus jobs
[\(https://www.rff.org/news/press-releases/new-research-hafstead-and-williams-jobs-and-environmental-regulations/\)](https://www.rff.org/news/press-releases/new-research-hafstead-and-williams-jobs-and-environmental-regulations/)
- If dirty industry like heavy industry won't come back, what will come back?
 - How do you encourage occupational shifts / industry shifts in a local community?
- Look at the literature on automation/AI/trade and employment. Predating this, econ history literature on role of technological revolutions (e.g. industrial revolution)
 - Dynamics are quite similar: some jobs (tasks) benefit, others lose, what happens in equilibrium
- Moving away from some of the very dirty activities in some contexts is just impossible -- e.g. coal in India
- Urban econ would say we are interested in people not places; check out Glaeser & Summers paper (https://scholar.harvard.edu/files/glaeser/files/jobs_for_the_heartland_nberwp.pdf)
 - Cheaper to create a job in a poorer community than in a wealthy community, hence from a public finance perspective it might make sense to focus resources into these communities
 - Shifting views on location based industrial policy (e.g. as we understand more about mobility frictions)
- Steady state vs transitory path to get to these equilibria

- Macro approach to transitory effects have so far focused on search and matching/efficiency wage type frictions (as far as I can tell)
- What are the intergenerational effects of job loss?
 - Allen & Donaldson (2020) model on path dependence would be an interesting starting point
 - https://dave-donaldson.com/wp-content/uploads/AD_PathDependence.pdf
- Do you just need to buy people out?

II. DEREK PILLAY

- Carbon market linkages globally
- In reality we see a large patchwork of carbon markets around the world
 - Not just disparate markets but also different carbon regimes
- What happens as these markets start getting integrated? What are the gains and costs?
 - Natalie Bau & Matray paper on capital market integration and misallocation in India
<https://www.nber.org/papers/w27955>
- If you are a small open economy, which carbon market do you want to link with? Do you link on quantities or prices? What about exchange rates?
- What is the incentive to join?
 - From the regulator end, there are advantages in terms of greater liquidity and greater efficiency in reducing emissions
 - What does it mean for firms? Are there heterogeneous effects for firms from a linked carbon market? It could depend on relative comparative advantages
- Model the endogenous choice on linking markets and setting emissions caps
- Linking markets can be stabilizing as it enables substitution across a greater market
 - Does specialization matter? How might linking carbon markets encourage spatial concentration of emissions intensive production?
- In trade models you have gains from trade from a low cost area entering the network -- but none of these incorporate externalities that come from production
 - Should you ban trade in trash? E.g. trash processing industries in China are much less clean than, say, in the US. So who you are trading with is important
 - By not taking into account the externalities we are missing a dimension that is not often incorporated in standard trade or macro models
- UK leaving ETS empirical evidence
 - As a result of Brexit UK has had to establish its own emissions trading scheme
 - First auctions will begin in May 2021
 - Price likely to be significantly higher than EU ETS as UK has restricted number of allowances even further than its old allocation under the EU ETS