How global energy and environmental trends affect local communities

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Overview

Lecture Overview I

Global trends and developments with impacts on local communities

- Exogenous (to a degree) to local communities
- Report by Ernst & Young: *"Are you reframing your future or is the future reframing you?"*

Examples of relatively slow moving trends

- Aging and urbanization
- Climate change
- Decarbonization of the economy

Examples of shocks with potentially long-run implications

- Inflation and spike in energy prices
- War in Ukraine and food security

Lecture Overview II

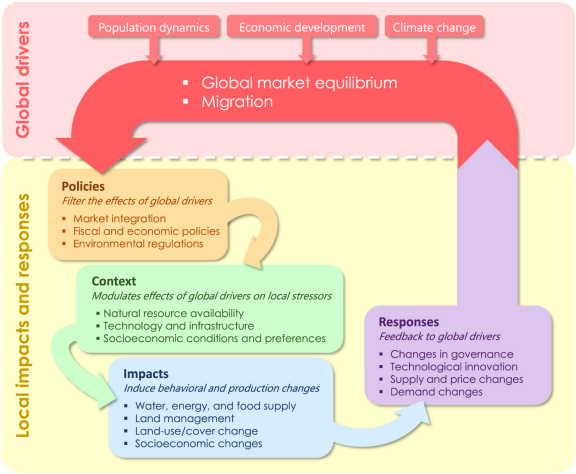
Adaptation of local communities

- Envision the future to make adequate investments now
- Importance of interactions between various levels

Topics

1. Global (mega-) trends
2. Demographic change
3. Climate change
4. Transportation
5. Conclusion

Example of Global-Local-Global Linkage



Source: Hertel et al. (2019), *Environmental Research Letters*.

Global (Mega-) Trends

Some Global (Mega-) Trends

Megatrends as phenomena transforming global societies

- Significant interest in finance and national security circles

Examples

- "Global Trends 2040: A More Contested World" by the National Intelligence Council (2021)
- "Five Megatrends And Their Implications for Global Defense & Security" by PwC (2016)
- "Are you reframing your future or is the future reframing you?" by Ernst & Young (2020)

National Intelligence Council (NIC) I

Global trends (GT) reports

- Published every four years
- NIC as the intelligence community's center for long-term strategic analysis

GT 2012: Alternative worlds (2030)

- **Individual empowerment**: Poverty reduction and growth of the global middle class, greater educational attainment, and health care
- **Diffusion of power**: Multipolar world with no single hegemonic power
- **Demographic patterns**: Urbanization, migration, and aging
- **Food, water, energy nexus**: Climate change

National Intelligence Council (NIC) II

GT 2017: Paradox of progress (2035)

- *"The achievements of the industrial and information ages are shaping a world to come that is both more dangerous and richer with opportunity than ever before. Whether promise or peril prevails will turn on the choices of humankind."*

Global trends and key implications:

- The rich are aging, the poor are not.
- The global economy is shifting.
- Technology is accelerating progress but causing discontinuities.
- Ideas and Identities are driving a wave of exclusion.
- Governing is getting harder.
- The nature of conflict is changing.
- Climate change, environment, and health issues will demand attention.

National Intelligence Council (NIC) III

GT 2021: A more contested world (2040)

- **Demographics and human development**
- **Environment**: Climate change as a threat to human and national security
- **Economics**: Rising national debt, complex and fragmented trading environment, new employment disruptions, and continued rise of powerful firms
- **Technology**: Transformation of human experiences and capabilities, global competition for technological supremacy

Important emerging dynamics

- *"Increasingly pessimistic and distrustful* [populations] *as they struggle to deal with disruptive economic, technological, and demographic trends."*

More on Megatrends I

Five Megatrends (PwC 2016):

1. Shift in global economic power
2. Demographic shifts
3. Accelerating urbanization
4. Rise of technology
5. Climate change and resource scarcity

Ernest & Young (2020):

- Decarbonization, techonomic cold war, behavioral economy, synthetic media, future of thinking, work and life unbounded, microbiomes, synthetic biology

More on Megatrends II

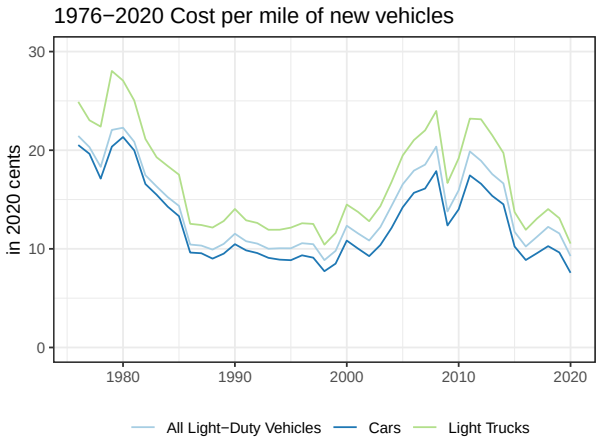
SITRA (Finnish Innovation Fund under supervision of the Parliament):

- Ecological reconstruction as a matter of urgency.
- The economy is seeking direction.
- Technology is becoming embedded in everything.
- Relational power is strengthening.
- The population is aging and diversifying.

Blackrock

- Shifting economic power
- Climate change and resource scarcity
- Technological breakthroughs
- Demographics and social change
- Rapid Urbanization

Inflation and spike in energy prices



Notes: Based on regular gasoline retail prices from EIA and ORNL's TEDB

War in Ukraine and food security

Recurring Trends Across Reports

Demographic change

- Aging and urbanization

Environment and natural resources

- Climate change as a slow-moving process affecting all aspects of life and changing the planet

Shift in global economic power

Demographic Change

Demographic Change: Overview

2017 National Population Projections

- People 65 and older: 15% (2006) to 23% (2060)

Problems associated with an aging population:

- Social security and discretionary spending
- Design of livable cities given aging and urbanization

Discretionary and Mandatory Spending

Discretionary spending

- Flows through the annual appropriation process
- Congress can adjust spending levels as they deem fit
- Decreased from approximately 74% of total outlays in 1962 to 30% in 2016

Mandatory Spending

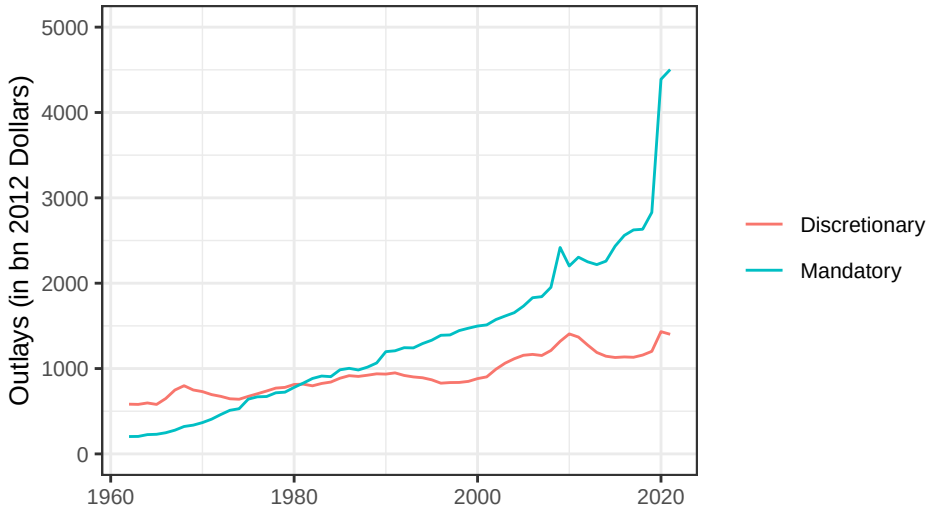
- Not part of the regular appropriations process
- By formula to benefit people, "automatic pilot spending"

Means- vs. non-means tested of mandatory spending

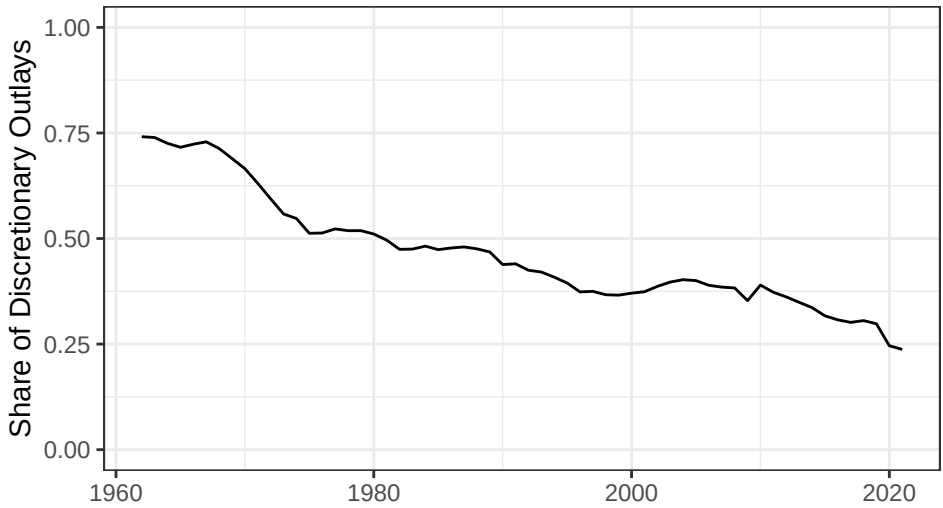
- Means-tested: Assistance depends on economic status of recipient
- Non-means tested: Assistance is based on demographic or other eligibility, not economic status

Data: Latest CBO Budget and Economic Outlook: 2022 to 2032

Evolution of Discretionary and Mandatory Spending



Evolution of Discretionary Spending Share



Problems with Financing Social Insurance

Until mid-1980s, handled on pure "pay-as-you-go" basis

- Premiums collected this year covered benefits paid this year

Problem: Ratio of workers to beneficiaries is drastically falling, i.e., not enough payments to cover benefits.

- Low birth- and death rates
- Retirement of baby boomers
- 5 workers for each recipient in 1960 and 2 to 1 by 2030
- Increase in health care costs

Possible solution: Actuarial Funding

- Pay into the fund during working years and receive principal plus interest upon retirement

Livable Cities

World Health Organization: Global Age-friendly Cities Framework

- Community and health care
- Transportation
- Housing
- Social participation
- Outdoor spaces and buildings
- Respect and social inclusion
- Civic participation and employment
- Communication and information

Climate Change

Climate Change: Physical Aspects

The furnances of the world are now burning about 2,000,000,000 tons of coal a year. When this is burned, uniting with oxygen, it adds about 7,000,000,000 tons of carbon dioxide to the atmosphere yearly. This tends to make the air a more effective blanked for the earth and to raise its temperature. The effect may considerable in a few centuries.

Climate Change

Previous newspaper article:

- Rodney and Otamatea Times, Waitemata and Kaipara Gazette, 4 August **1912**, Page 7

Difference between physical and social aspects

- Focus on energy and environmental policy

Avoiding greenhouse gas emissions by implementing a carbon policies

- Agricultural and transportation sector

Complex interactions between policy design(s), climate change, and human behavior

Distributional Aspects of Climate Change Policy

Economists view on climate policy

- No individual incorporation of cost associated with carbon emissions
- Economic solution: Price carbon emissions
- Changes the relative prices between products and increases the price of carbon emitting items

Human Behavior

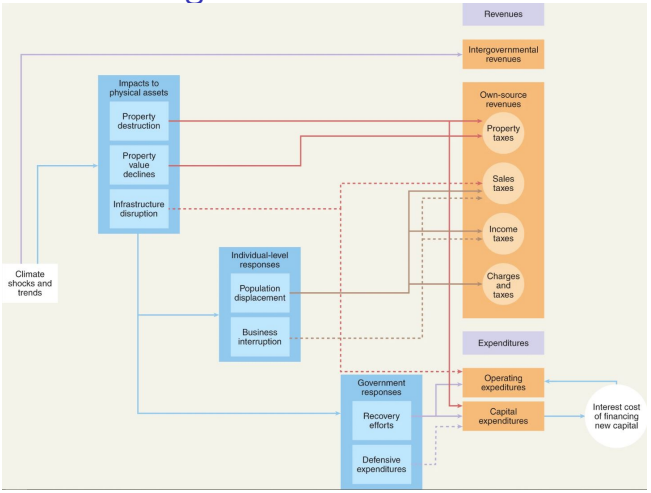
- Humans are driven by incentives presented to them
- Adverse and unintended consequences associated with policies
- Importance of not losing sight of the big picture in an interconnected world

Consumer Expenditure Survey in the U.S.

Consumer Expenditure Survey 2020

Decile	Income before taxes	Income after taxes	Energy Share
1st	$7,121	$8,681	8.0%
2nd	$19,207	$21,482	8.2%
3rd	$29,361	$31,714	7.7%
4th	$39,709	$41,053	7.5%
5th	$51,748	$51,499	7.1%
6th	$67,161	$64,557	7.0%
7th	$85,470	$79,995	6.4%
8th	$108,931	$99,504	5.3%
9th	$147,049	$128,671	5.0%
10th	$289,919	$223,907	3.8%

Climate Change and Local Government Finance



Source: Climate change will increase local government fiscal stress in the United States by Gilmore et al. (2022) in *Nature Climate Change*

Additional Impacts of Climate Change

List by Aufhammer (2018)

- Agriculture
- Forestry
- Species loss
- Sea-level rise
- Energy
- Human amenity
- Morbidity and mortality
- Migration
- Crime and conflict
- Productivity
- Water consumption
- Pollution
- Storms

Transportation

Decarbonization of the Road Transportation Sector

- Increasing fuel efficiency and additional alternative fuel vehicles (AFV), e.g., electric vehicles
- Numerous policies in the European Union and the U.S. to increase AFV
- Reduction in fossil fuel emissions assuming low-carbon electricity production

Consequences beyond Road Transportation Sector

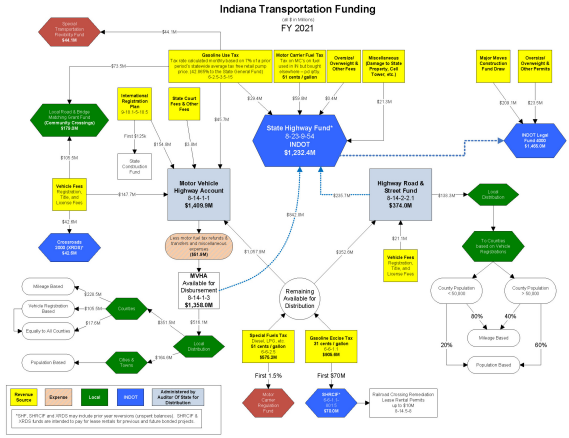
United States

- Road and infrastructure funding comes from fuel taxes
- Decreasing fuel tax revenue

European Union Emission Trading System

- Emissions from electric utilities are capped
- Shift of the EU car fleet under the emission system

Indiana Fuel Tax Distribution



Source: 2021 Indiana Handbook of Taxes, Revenues, and Appropriations

U.S. Biofuel

MTBE (Methyl-tert-butylether) as an additive for gasoline to raise octane

- Ban of MTBE due to health concerns
- Maize ethanol as a substitute for MTBE

Other concerns:

- Energy independence and greenhouse gas emissions
- Significant increase in maize demand for ethanol use not without controversy

High oil prices in 2008 lead to high gasoline prices which made ethanol an attractive substitute due to its low price at the time

- Law of one price (purchasing of the energy content in ethanol)
- Discussion on the issue of indirect land-use change

Electric Vehicles and Agriculture

U.S. maize (corn) production

- About 1/3 of global production
- About 1/3 of U.S. production for ethanol

Long-term decline ethanol demand

- Possibility of sustainable aviation fuels
- Welfare implications for farmers and consumers

Interactions with climate change and food prices

Conclusion

Many more Challenges and Opportunities

Climate change and food security

- Crop yield impacts of climate change

New opportunities for landowners to mitigate carbon emissions

- Examples: Carbon farming, biochar, anaerobic digesters

Biogas production

- Cows in California where the manure is half as valuable as the milk

Conclusion

- Need for collective action
- Individual self-interested action without constraints leads to externalities
- Minimizing unintended consequences by integrated approaches
- Distributional aspects of climate policy are important for societal and political reasons