



Risk Nexus: Overcome by cyber risks?

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The Cyber Risk Trend

Each year sees:

- More data breaches
- More disclosures of critical vulnerabilities
- More nations building and employing offensive cyber capabilities
- Growing cyber insurance industry, set to triple by 2020
- Booming private cyber risk management industry, with billions in venture capital, and dozens of publicly traded companies



So, we know there are risks to being connected...



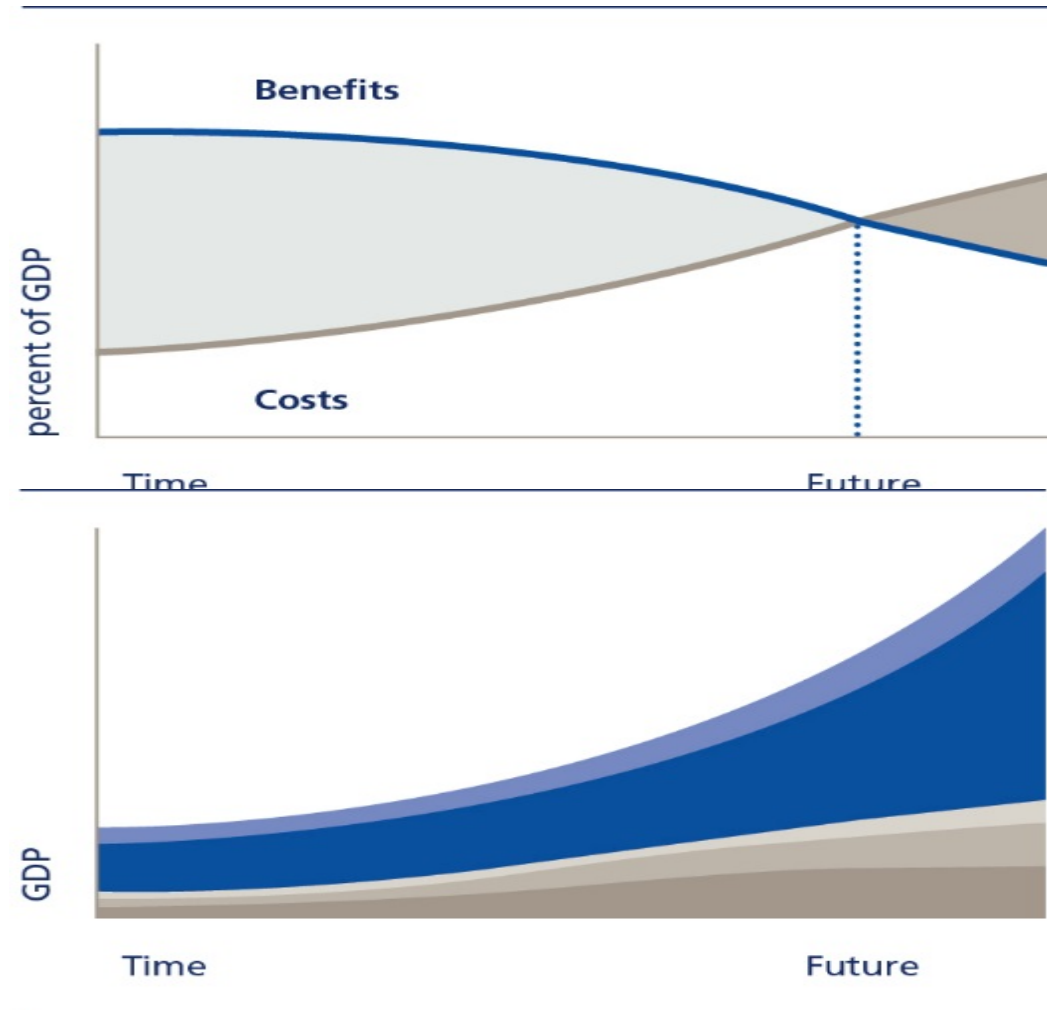
So, we know the risks of being connected...

Yet, we accept them to gain the benefits



But How Would We Know If:

The downside risks from being connected (whether those risks are realized or unrealized) are starting to outpace the upside benefits?





Will the next generation benefit from the cyber economy or be overwhelmed by the struggle to control its insecurities?

What can we do today as policy makers and risk managers?

Trends can lead to different futures depending on how we react to them.



<https://vimeo.com/138263949>



Overcome by Cyber Risks?

Economic Benefits and Costs of Alternate Cyber Futures

Atlantic Council

University of Denver's Pardee Center for International Futures

Zurich Insurance Group



Atlantic Council



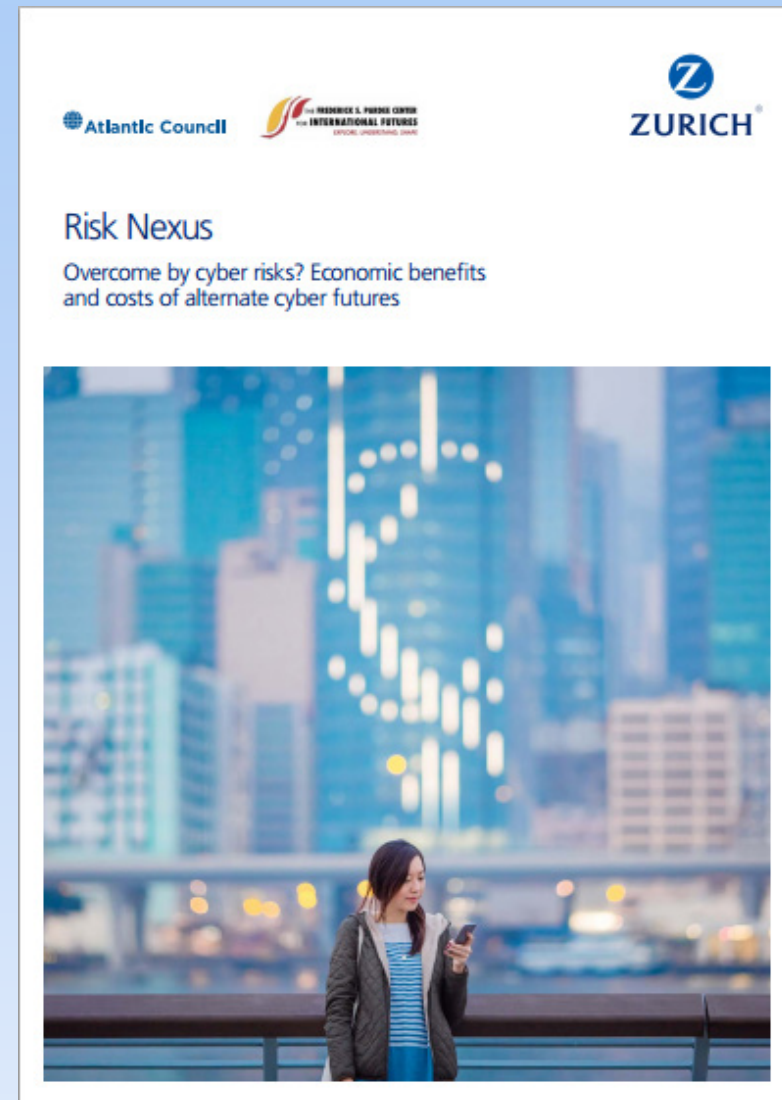
INTERNATIONAL FUTURES
AT THE PARDEE CENTER
Explore, Understand, Shape



ZURICH

Project on Global Risks

- Continuation of three-year relationship between **Zurich Insurance Group** and **Atlantic Council** on global risks
- New effort on global risks, partnering with the **Pardee Center for International Futures**, of the University of Denver:
 - Year 1: Examine and model alternate cyber futures
 - Year 2: Extend modeling to geopolitical and demographic risks
- Builds on success of report on “**cyber sub-prime**” of global interconnections of cyber risk



Four Traditional Cyber Threats

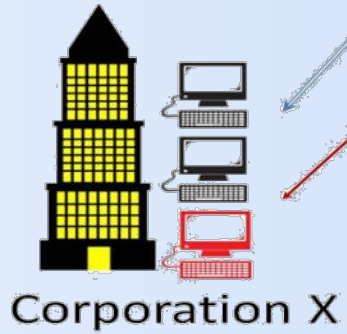
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- Common Terms:**
- Intrusion, hack
 - Cybercrime
 - Carders
 - Russia, East Europe
 - Stolen identity, credit cards, records
 - Extortion



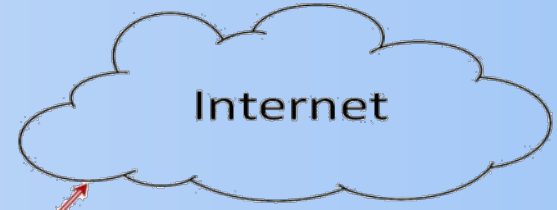
- Criminals**
- Hactivists
- Spies
- Militaries

Steal individual records with personal info to sell



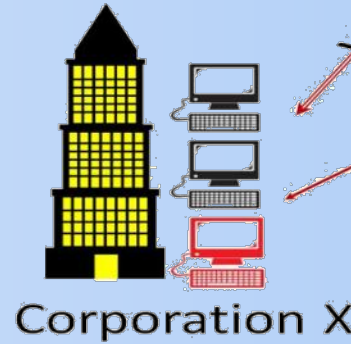
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- Common Terms:**
- Intrusion, hack
 - DDoS (distributed denial of service)
 - Anonymous
 - Patriotic hackers



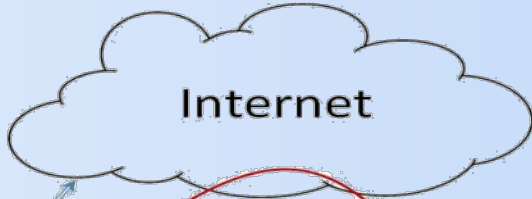
- Criminals
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Disrupt network or steal sensitive or embarrassing info



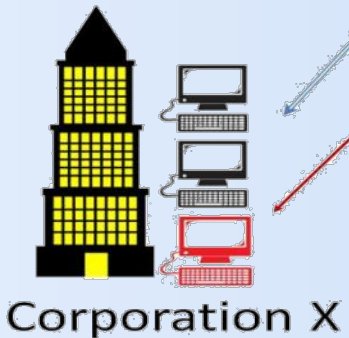
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- Common Terms:**
- Intrusion, hack
 - IP Theft
 - China
 - Advanced Persistent Threat



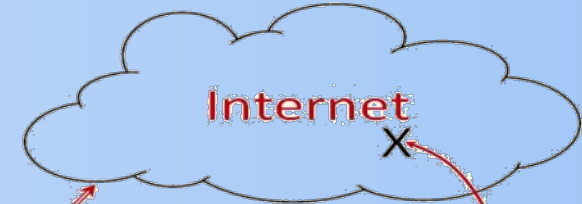
- Criminals
- Hactivists
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Steal R&D, business plans or negotiating strategies



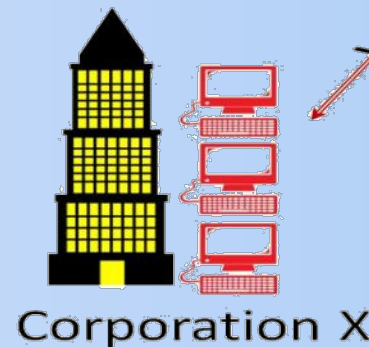
4

- Common Terms:**
- Stuxnet
 - Shamoon
 - Iran, US, China
 - Cyber war, cyber conflict



- Criminals
- Hactivists
- Spies
- Militaries**

Disrupt network or systems or even upstream Internet – very rare



Mainstream cyber risk management is strikingly similar to financial risk management prior to 2008

1. Risks only examined one at a time and one organization at a time, ignoring interdependencies
2. Risks then passed to outside organizations who further passed them along
3. Risks accordingly concentrated in little known ways and places
4. Little if any governance of the system as a whole



“Cyber Sub-Prime”



Why This Matters

1. Mainstream risk management likely ignores perhaps the greatest kind of risk: growing systemic upstream complexity
2. Future Internet may be far less business friendly with national borders, restrictions on data movement, frequent and severe outages
3. Companies (and nations) that are managing this risk have far better chance of surviving and thriving



What Do We Learn from Data and Modeling?

“It is the trend that matters ... look at the shape.” Dan Geer



How does information and communication technology (ICT)
benefit the global economy?

How do ICT security problems cost the global economy?

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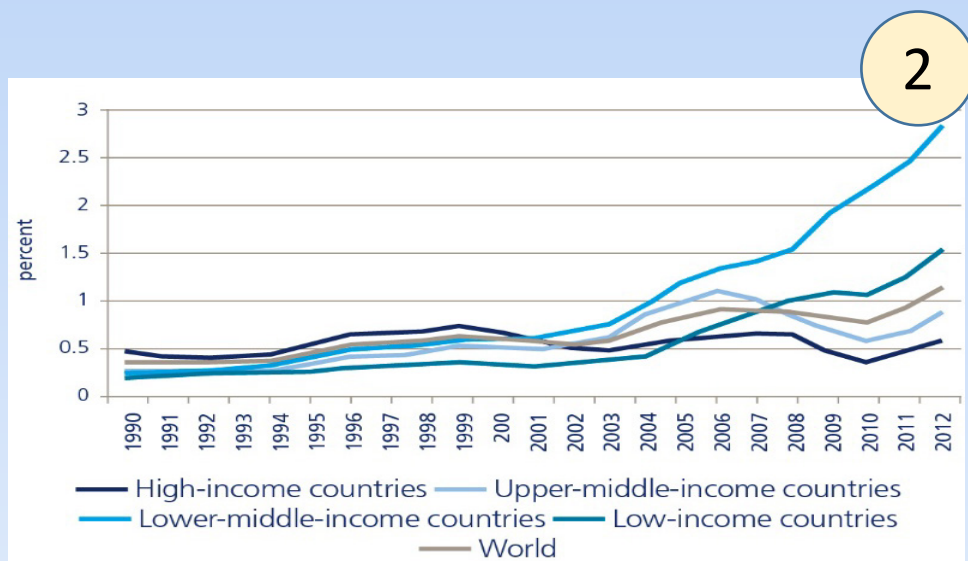
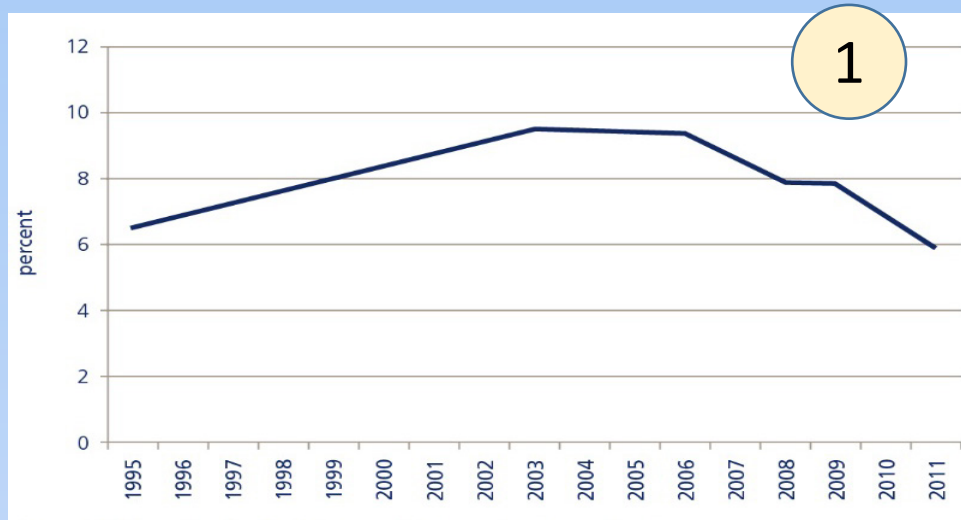
Cyber Benefits

1. ICT Sector Size
2. Productivity and GDP
3. Consumer surplus

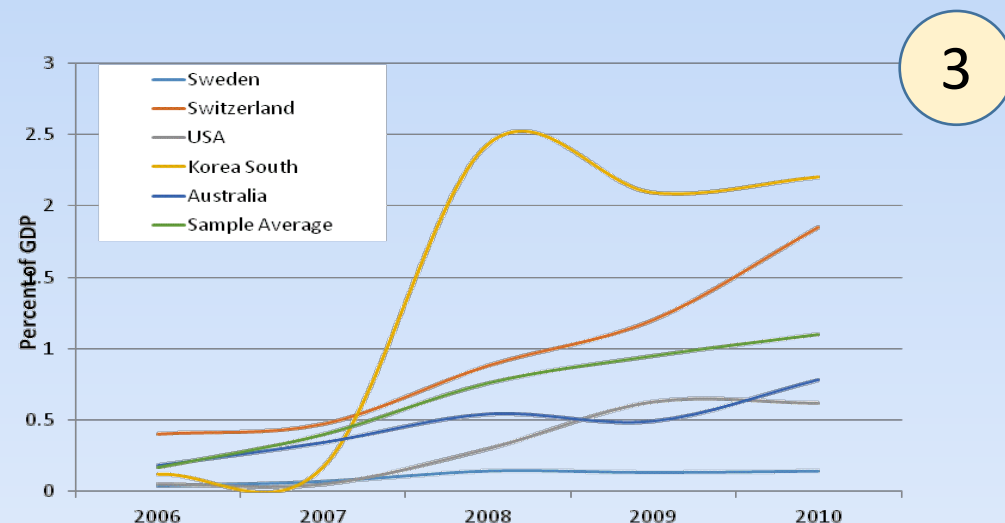
Cyber Costs

1. Spending on risk mitigation
2. Cost of adverse cyber events
3. Opportunity cost

Cyber Benefits

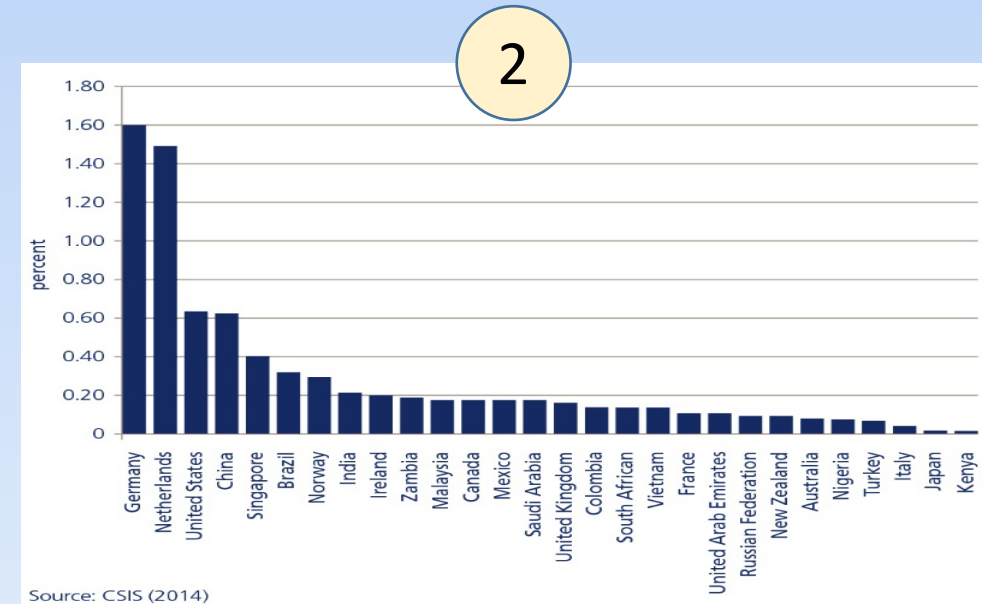
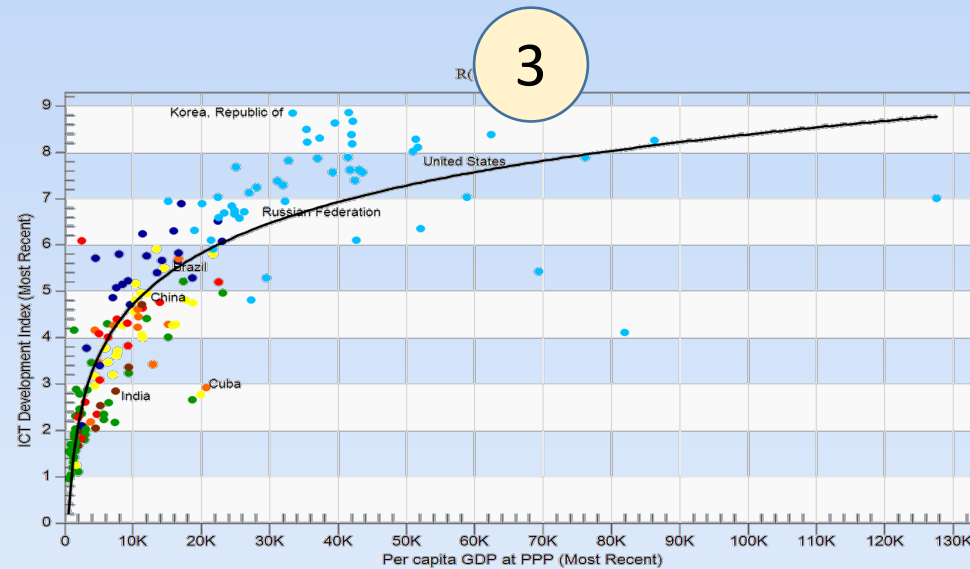
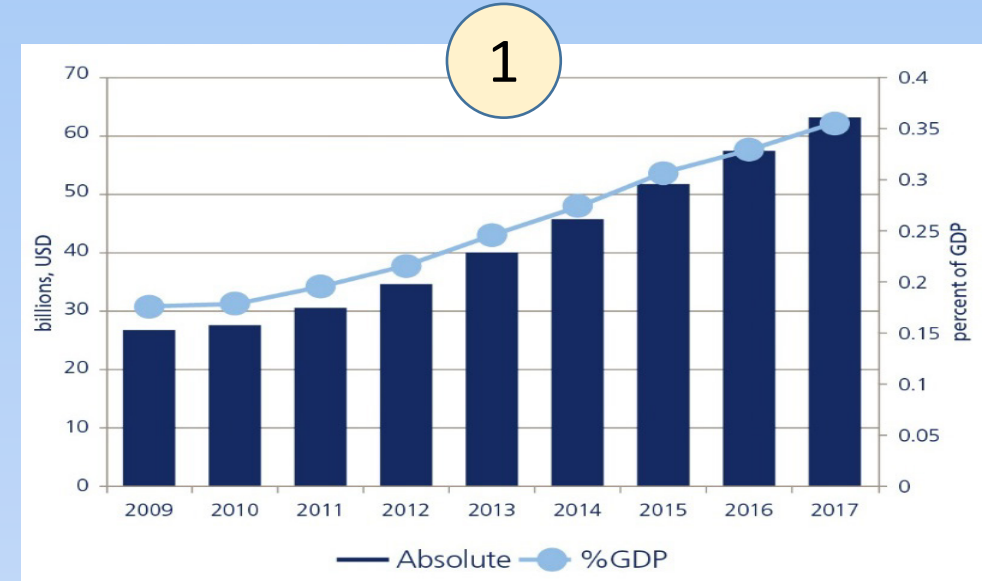


1. ICT sector size fundamentally stable and not contributing growth via size change
2. ICT contributing about 20 percent of economic growth with high ICT pervasiveness/penetration
3. Consumer surplus could be one-third to one-half the measured economic growth contribution



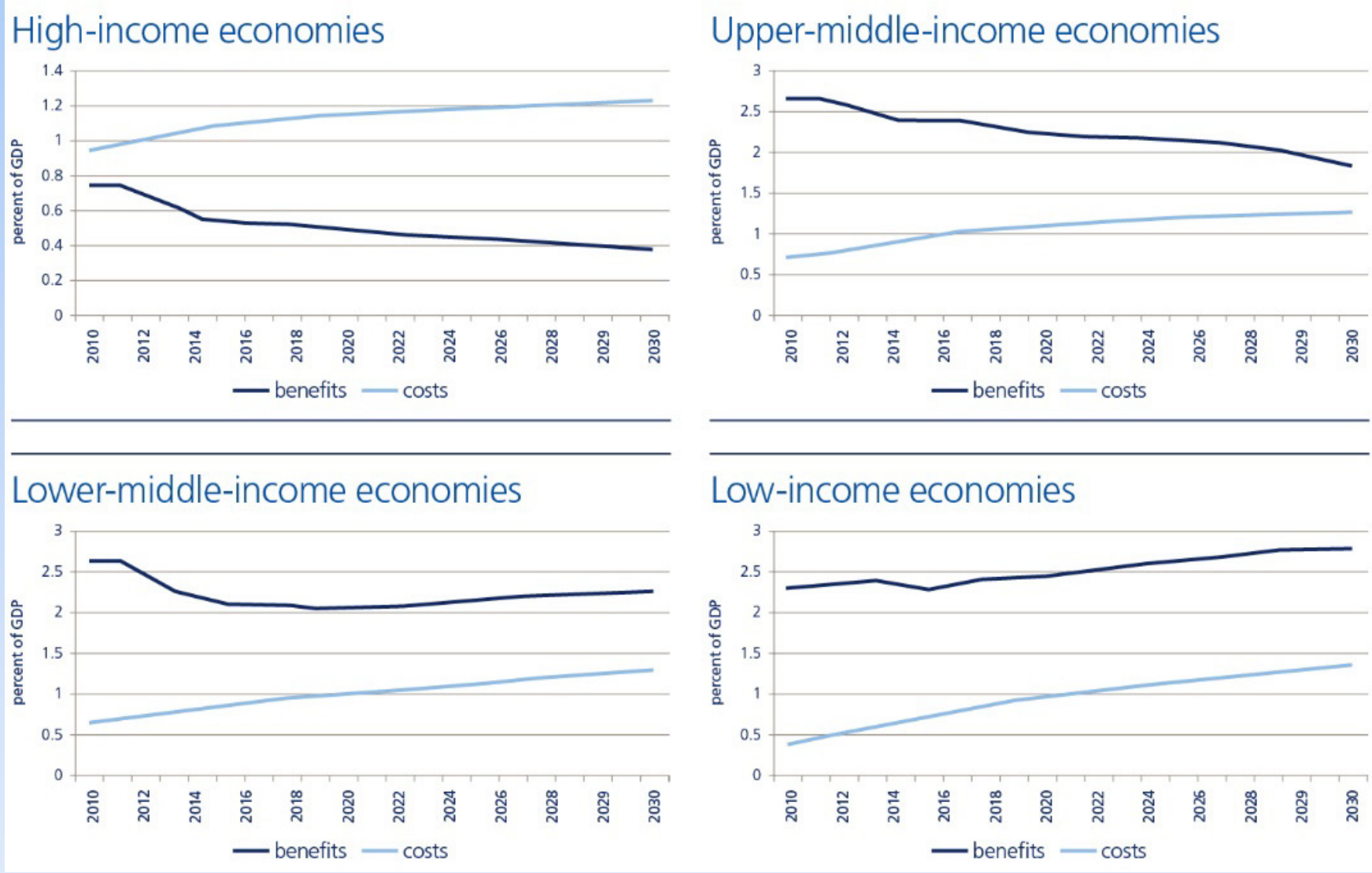
Cyber Costs

1. Spending on risk mitigation is as high as 0.4% of GDP in the US and rising; closer to 0.1% globally
2. Cost of adverse cyber events is about 0.7% in the U.S.; data elsewhere less extensive
3. Opportunity cost varies by ICT use and could be as high as 1% of GDP in Cuba



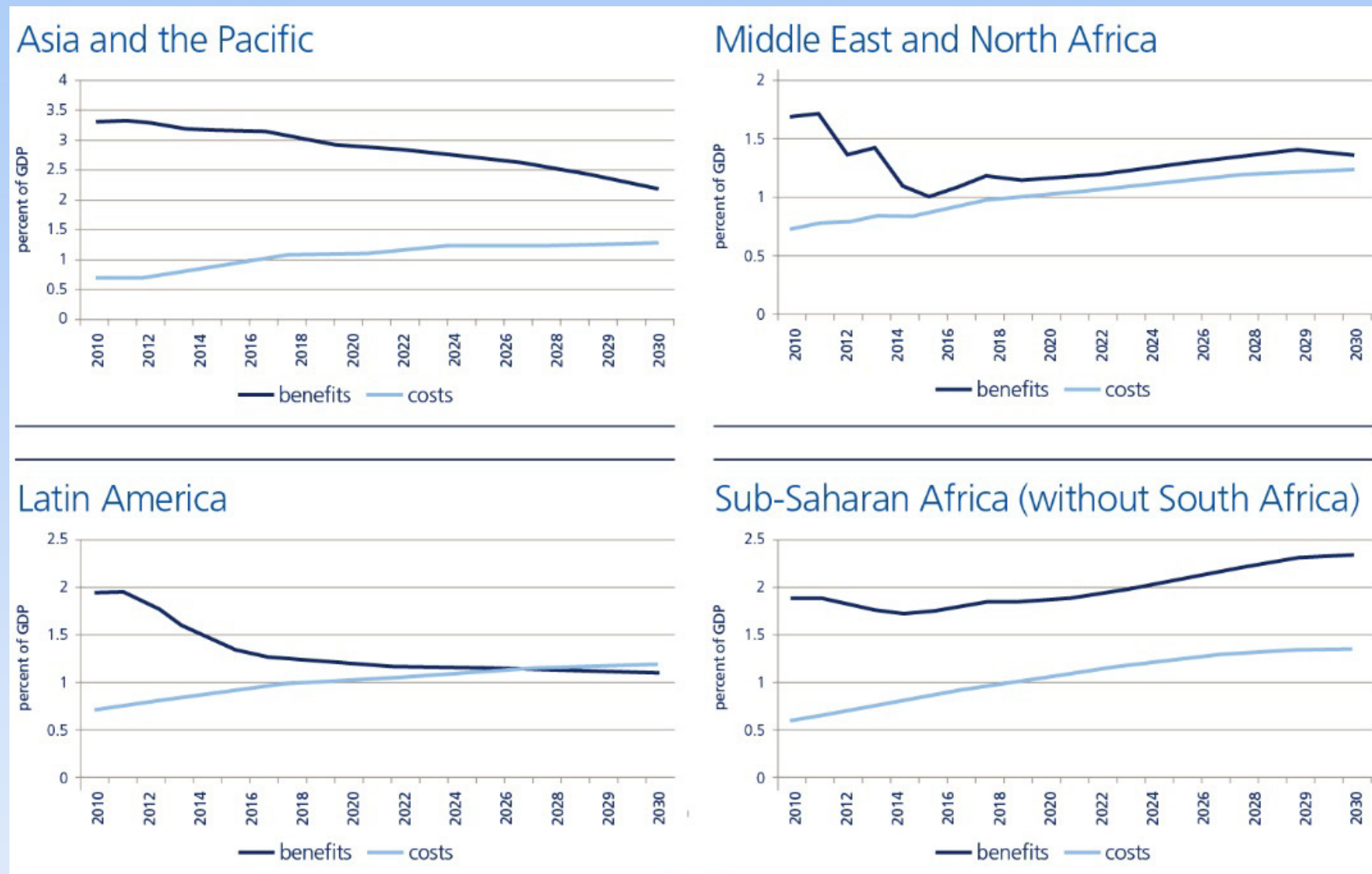


Forecast Annual Cyber Costs and Benefits

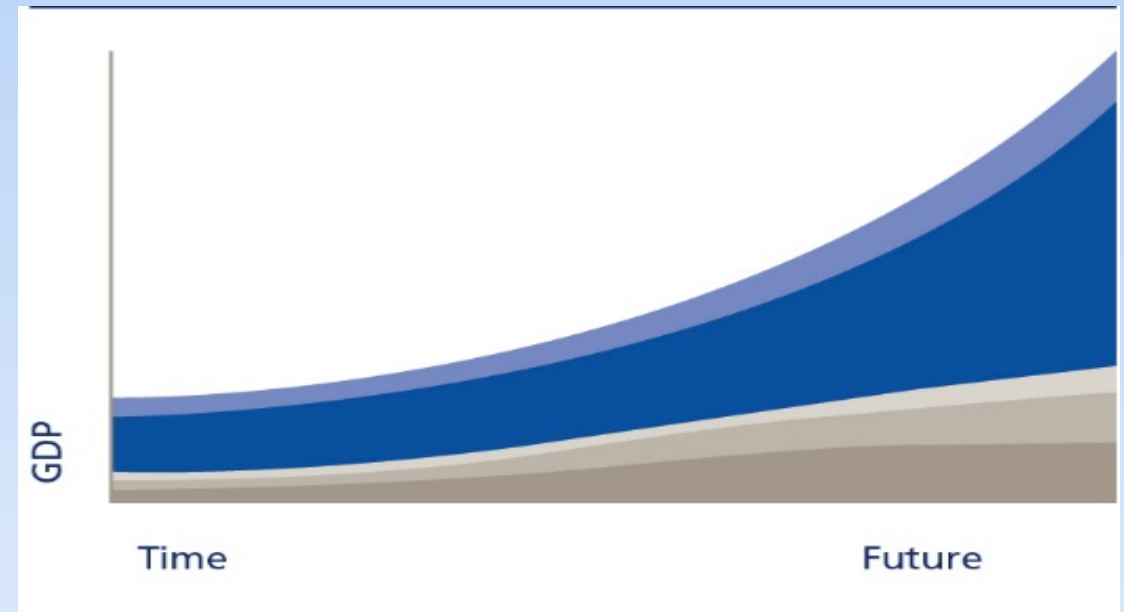




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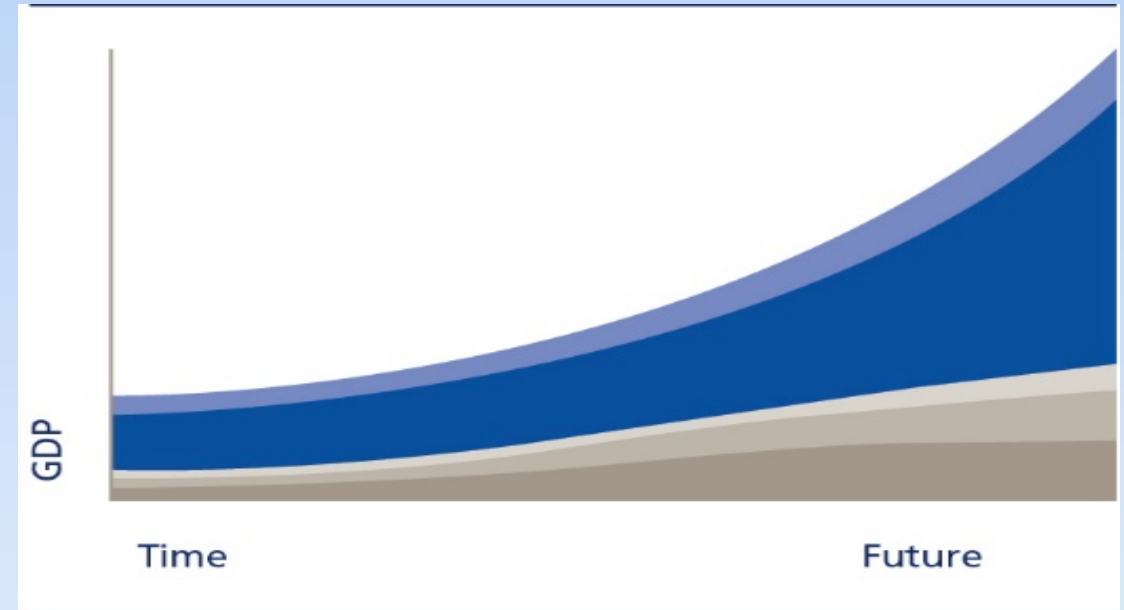
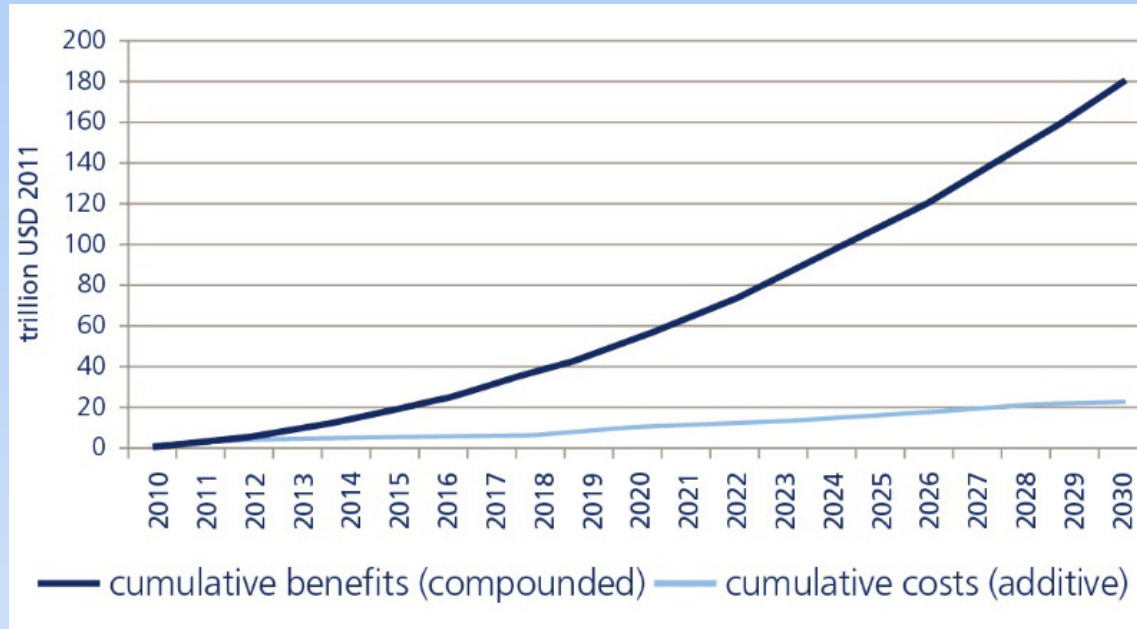


Forecast Cyber Costs and Benefits: Annual totals, high-income countries



“It is the trend that matters ... look at the shape.” Dan Geer

Forecast Cyber Costs and Benefits: Annual totals, high-income countries

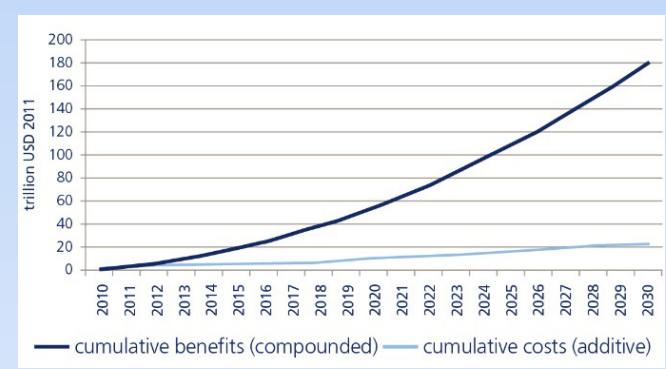
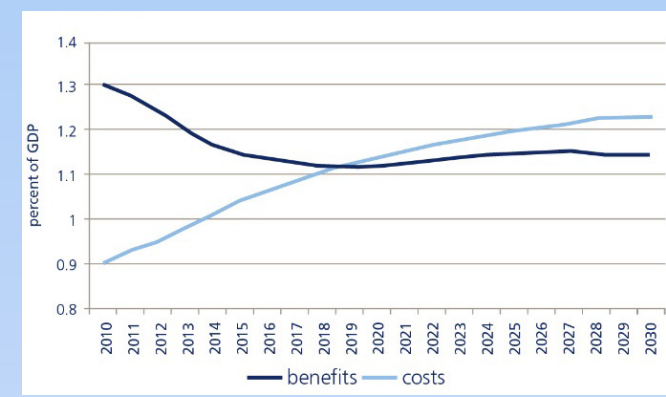


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Initial Conclusion – With *Very Limited Data*

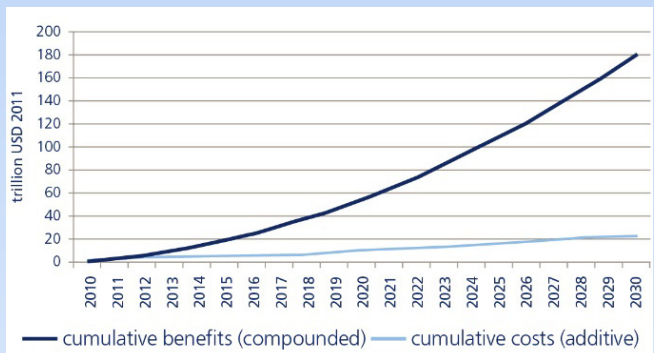
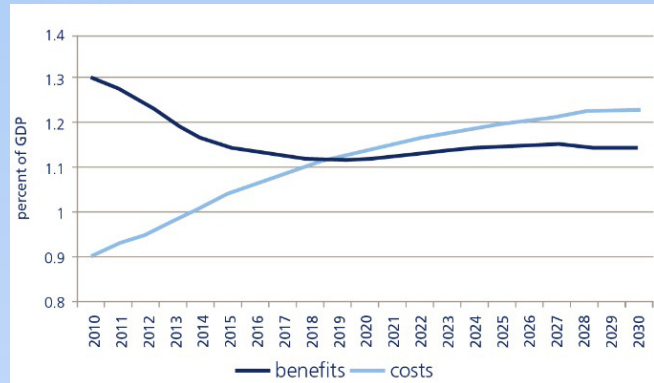
- An inversion where annual risks of being connected outweigh the benefits is not just theoretically possible but actually may have already happened in high-income nations and may happen in five years globally
- Fortunately, benefits from ICT investments continue to accumulate ... so your children *should* enjoy a better Internet than we do today





Initial Conclusion – With *Very Limited Data*

- An inversion where annual risks of being connected outweigh the benefits is not just theoretically possible but actually may have already happened in high-income nations and may have happened in five years globally
- Fortunately, benefits from ICT investments continue to accumulate ... so your children *should* enjoy a better Internet than we do today
- **Unless the trends change, a discontinuity where the future looks much different than the past**



Recommendations

- For policymakers
 - Cautiously push new technologies: ensure benefits outpace cost
 - Downside: increases dependence on inherently risky technologies
 - Work to get defense better than offense
 - Work at scale, drastically reduce costs, remove entire classes of attacks
 - Be stewards of a sustainable cyberspace
- For risk managers
 - Start hedging your long position in connected IT
 - Continue emphasis on resilience in an increasingly dangerous world
 - Consider worst-case futures in business plans
 - Separate business plans for different Internet blocs
 - Prevent rising costs from swamping digitally dependent strategies



You are Critical to Managing Cyber Risk

Cybersecurity requires Controls, Audits, and Accountability



My Observations

- The scale of this challenge is awesome
- Our clients and your covered agencies all feel that cybersecurity is just a cost center; we must remind them of the benefit not just the risk
- Because of security concerns, opportunity costs are growing larger as agencies and commercial companies are passing on or waiting longer to adopt new, innovative technology
- Companies and governments are “long” on cyber reliance with almost no hedge. Spending on security must go up
- The future seems inconsistent with the military mentality that cyber is “a domain to dominate;” we must change that mentality
- State conflict in the digital arena is different from any precedent, as the states don’t have a monopoly on the force, at least the defensive force
- ISACs are sprouting and growing and sharing information without legislation. Although it is important to share information, info sharing is a solution that doesn’t scale, so it is not as relevant in the long term
- Slow, manual patching is dumb
- Access controls are exceedingly important
- Tech investment is needed, as is investment in professional development

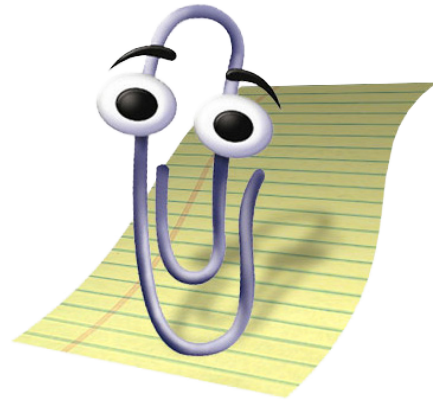


Final Points

- What should auditors be doing to get ready for the future?
- What skillsets will they need?
- The new FISMA – assess the effectiveness of controls, not just compliance with procedures, use DHS as a resource, and know your own limitations
 1. Invest in tools, resources, training, and education
 2. In-house your auditing of policies, procedures, and managerial controls
 3. Outsource your tech controls, tech monitoring, effectiveness metrics, and innovation efforts
 4. While info sharing is not sexy to long term strategy folks, coordination across agencies and sharing among state, local, federal and private partners is critical



QUESTIONS?





BACKUP SLIDES



Curveballs

What discontinuities could tip us towards more extreme future?

1. General **improvements in global governance** (UN, G20, ICANN, etc) which reduces costs and increases benefits
2. **Conflict or collaboration between US and China** which reduces costs and increases benefits
3. Keep benefits booming with **major new disruptive technology** sub-waves (cloud, quantum computing, Internet of Things, artificial intelligence)
4. **Disruptive offensive technology** gives attackers supremacy so costs rise suddenly and dramatically
5. **Disruptive defensive technology** gives defenders the edge reducing costs



Cyber Benefits

1. ICT sector size (value added) – leaving out of analysis
2. Productivity and GDP growth – general magnitude (up to about 20% of growth); *compounded*
3. Consumer surplus (up to about 40% of growth); *compounded*

Cyber Costs

1. Spending on risk mitigation – U.S. high at about 0.5% of GDP
2. Cost of adverse cyber events – U.S. high at about 0.68% of GDP
3. Opportunity cost – using regression and above as level of no cost

High “Awesomeness of the Internet”

- Strong defense, weak offense
- High trust
- Extensive usage
- Secure Internet is global right

Government-Dominated Internet

- No longer a single global Internet
- National internets have very different characteristics
- High protectionist barriers, sovereign borders
- Technological elite serve the state
- Companies forced to accept backdoors, monitoring

Private-Sector Dominated Internet

- Single global Internet
- Internet similar regardless of nation
- Minimal barriers and borders
- Technological elite defy the state
- Companies lockout and outfox the state

Low “Awesomeness of the Internet”

- Strong offense, weak defense
- Low trust
- Declining usage
- Secure Internet is luxury good

High "Awesomeness of the Internet"



Government- Dominated Internet

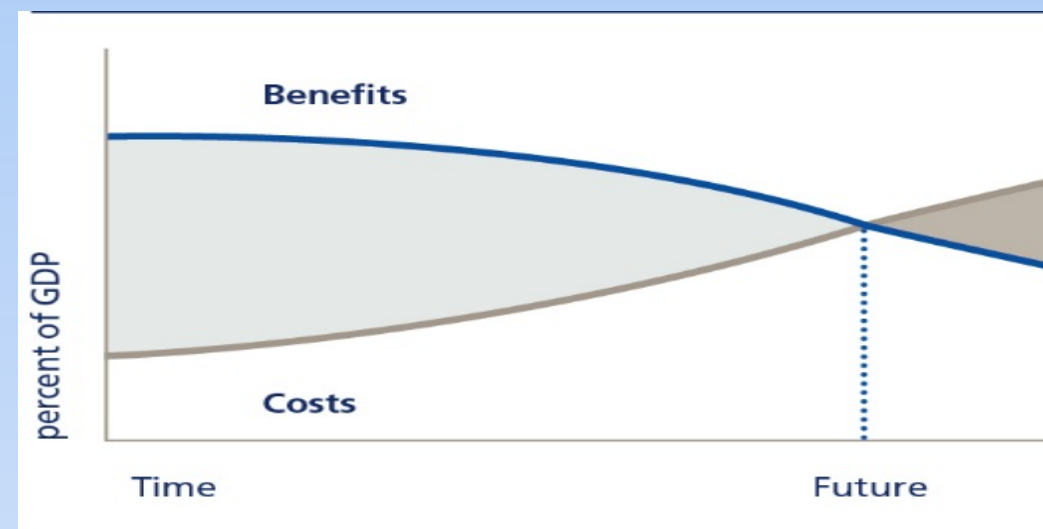


Low "Awesomeness of the Internet"



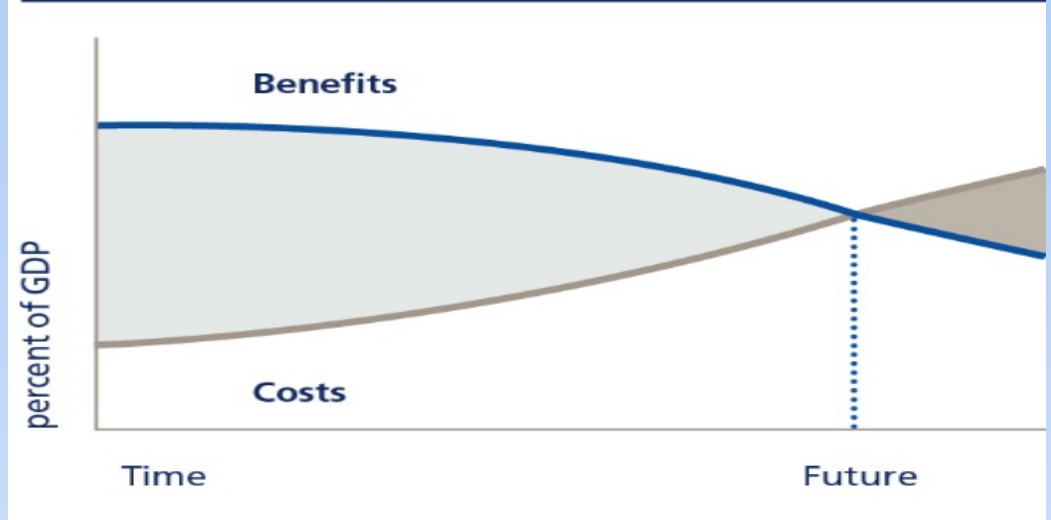
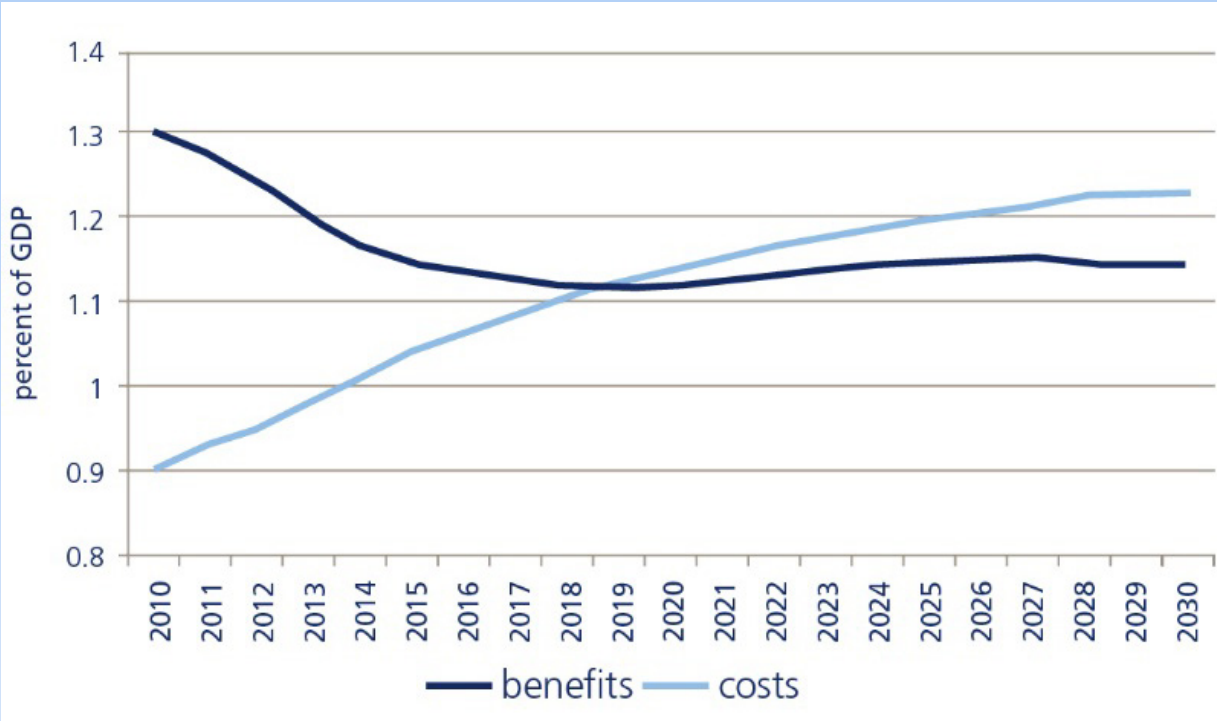
Private-Sector Dominated Internet

Forecast Annual Cyber Costs and Benefits



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Where Does This All Lead?

Two Main Axes of Uncertainty

High “Awesomeness of the Internet”



Government- Dominated Internet



Private-Sector Dominated Internet



Low “Awesomeness of the Internet”

- Amazing benefits, low risks
- Strong defense, weak offense
- Benefits spread equally to all people
- High trust and extensive usage
- Secure Internet is global right



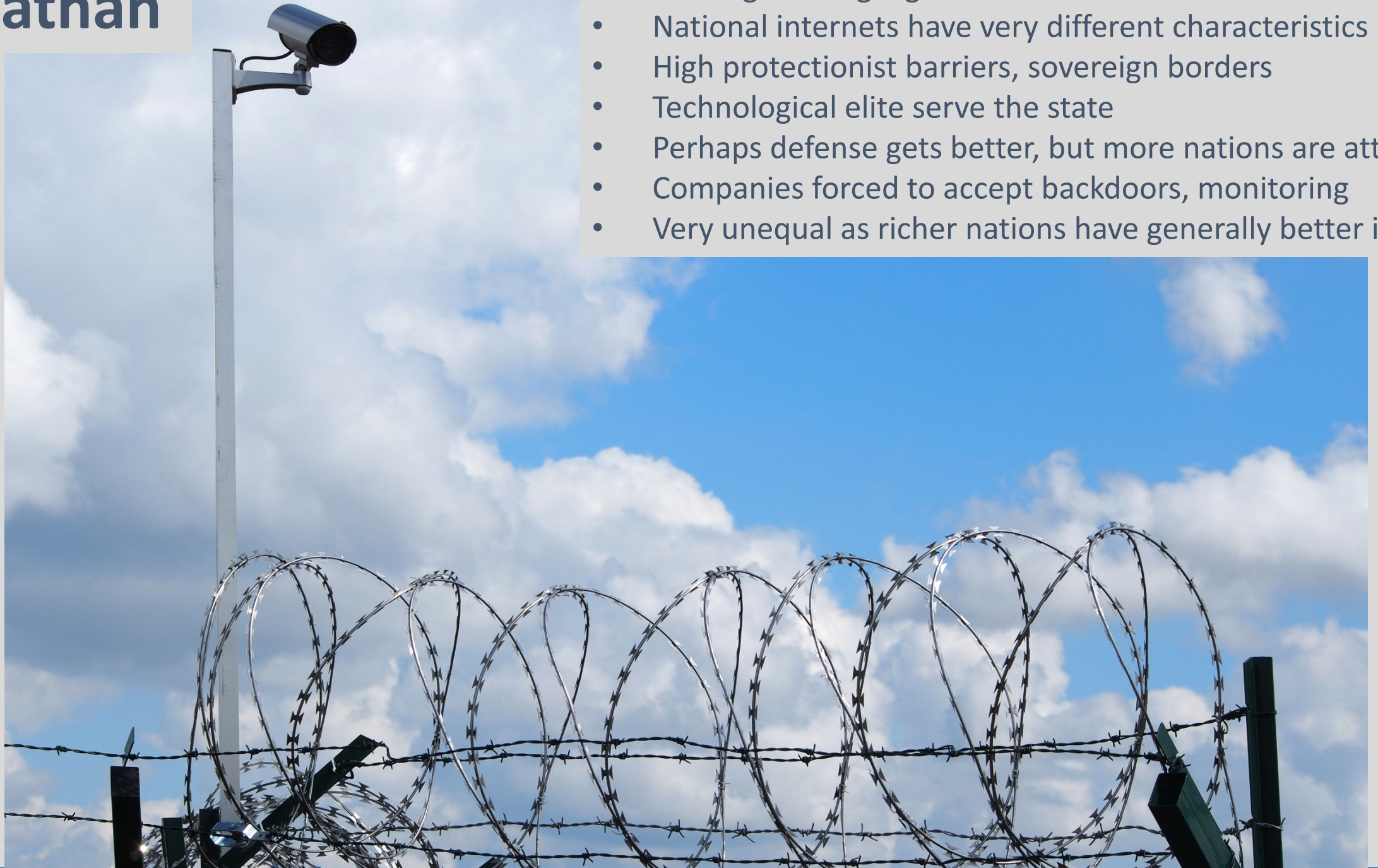
Clockwork Orange

- Strong offense, weak defense
- Any neighborhood is or can quickly become overrun
- Low trust and declining usage
- Secure Internet is a luxury good



Leviathan

- No longer a single global Internet
- National internets have very different characteristics
- High protectionist barriers, sovereign borders
- Technological elite serve the state
- Perhaps defense gets better, but more nations are attacking
- Companies forced to accept backdoors, monitoring
- Very unequal as richer nations have generally better internet



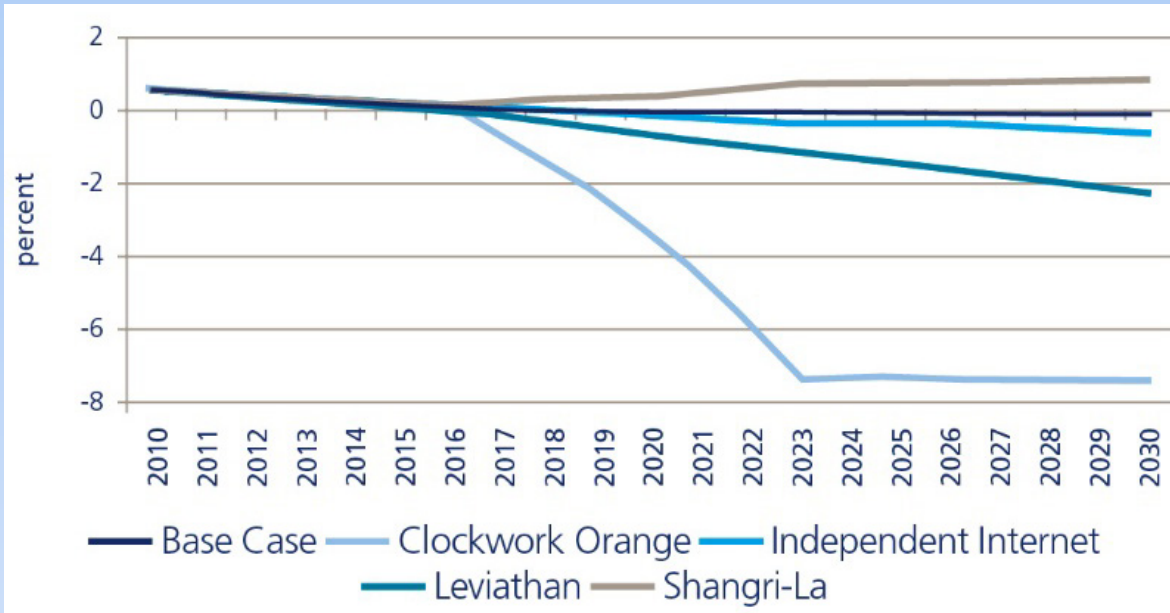
Independent Internet



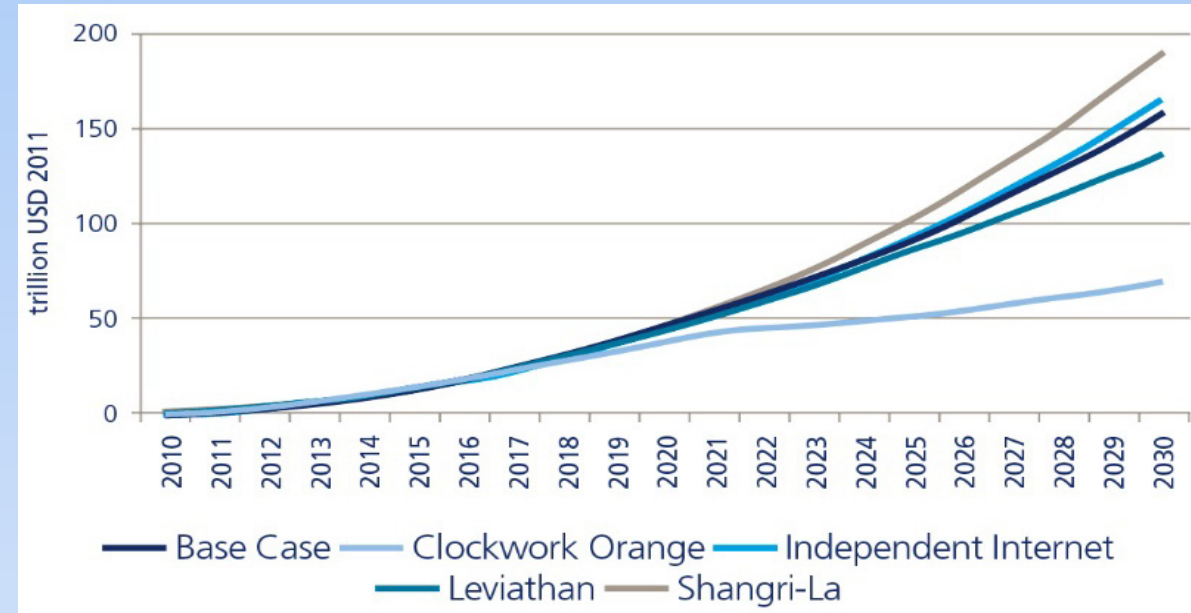
- Single global Internet which is similar regardless of national boundaries
- Minimal barriers and borders
- Technological elite defy and consistently outfox the state
- Defense might be better, but companies have access to personal data
- Governments derive their just powers from the consent of the governed. You have neither solicited nor received ours ...
- Your legal concepts of property, expression, identity, movement, and context do not apply to us. They are all based on matter, and there is no matter here...

From John Perry Barlow, 1996: <https://projects.eff.org/~barlow/Declaration-Final.html>

Two Possible Futures...



Net Annual Benefits and Costs of Base Case, Shangri-La, and Clockwork Orange



Cumulative Annual Benefits and Costs of Base Case, Shangri-La, and Clockwork Orange

Potential loss of \$30 trillion of potential net economic benefit to 2030