



Centre for Risk Studies Research Showcase
23 January 2014

Scenarios for Risk Management: Example of Geo-Political Conflict

Centre for
Risk Studies



UNIVERSITY OF
CAMBRIDGE
Judge Business School

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Can We Understand ...

Various types of emerging risks:



Geopolitical Conflicts



Pandemics



Cyber

And assess their potential to cause:

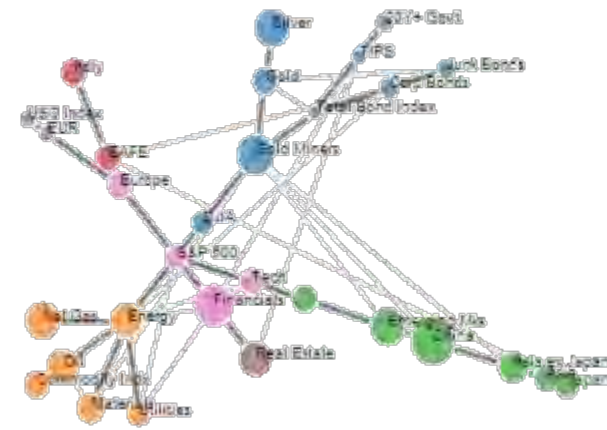
**Underwriting
Losses**



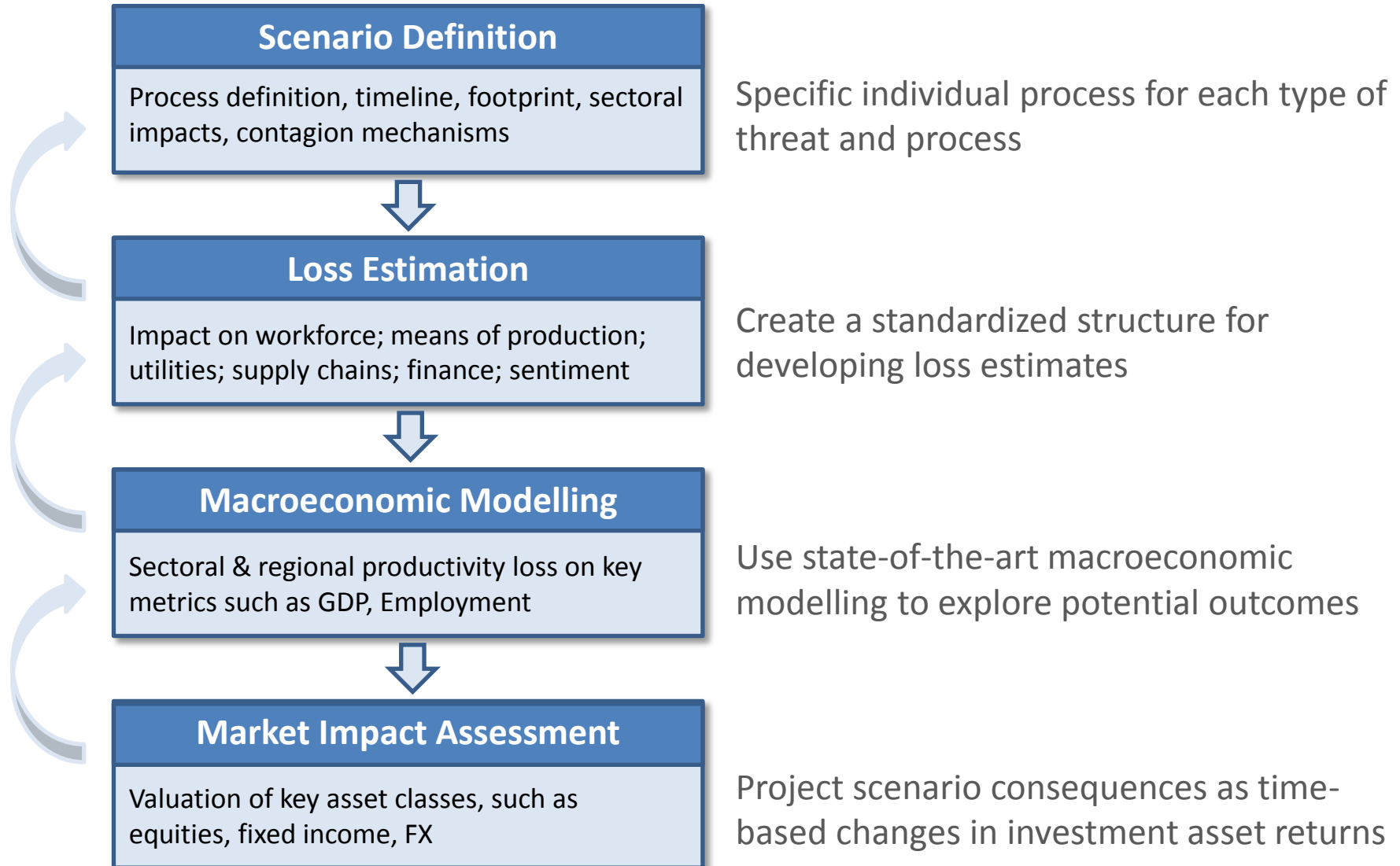
**Non-Underwriting
Operational Impact**



**Investment Portfolio
Impact**



CRS Scenario Development Process



Key Methodological Challenges

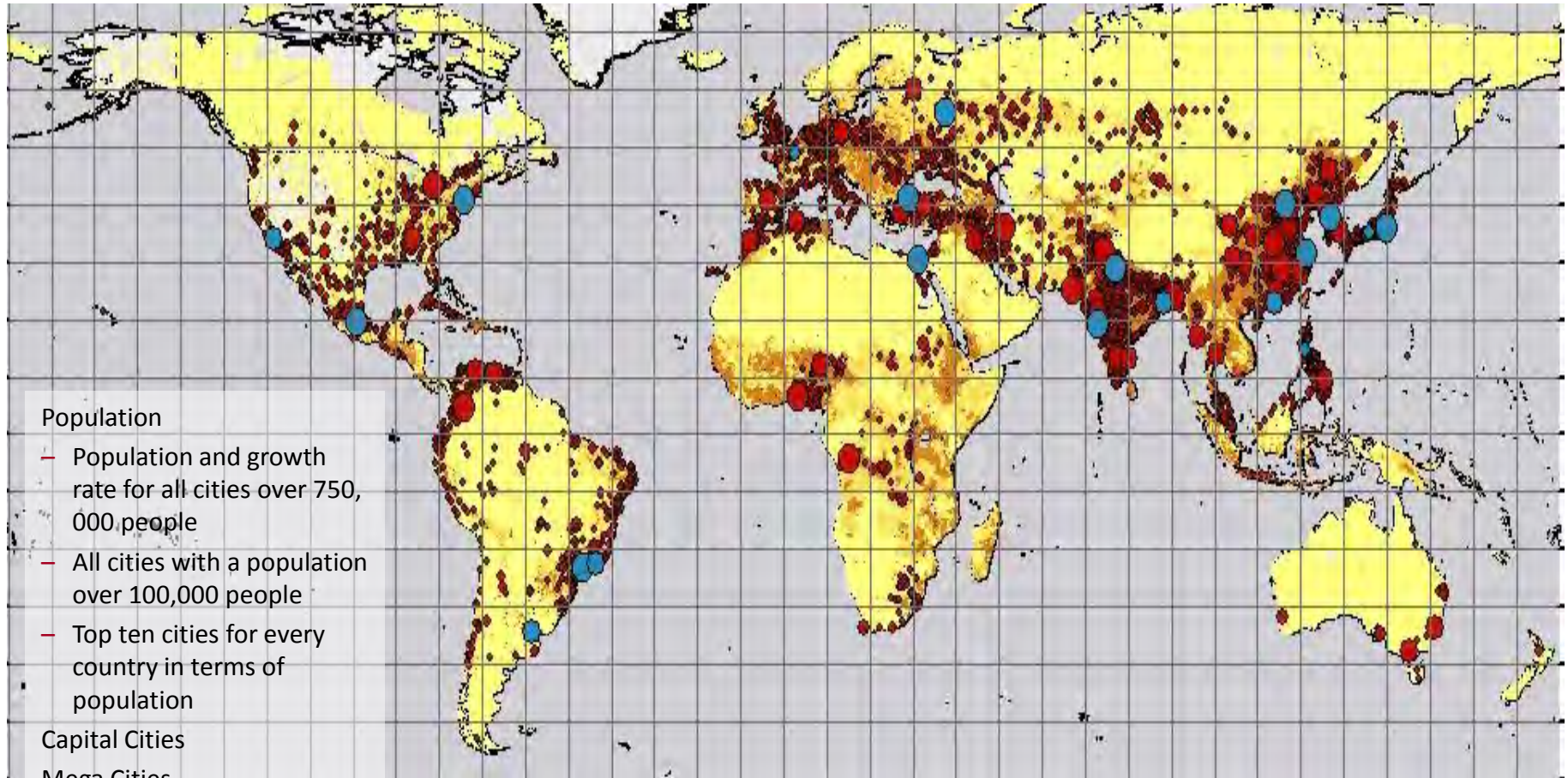
- Can we construct an extreme fictional scenario that is plausible through using evidence-based precedents?
 - Can these scenarios meet the challenge of being useable by businesses and ultimately adopted for use in risk management?
- Can we estimate the losses that would result from extreme events that haven't occurred in today's world?
 - Can we create a robust and transparent estimation process?
- Can we push macroeconomic models outside their comfort zone to model extreme events usefully?
 - How far beyond range of the model's parameterization?
- Can we model the impact of hypotheticals on investment asset classes and portfolios?
 - How useful are asset value 'fundamentals', and how much market sentiment and crisis behaviour do we need to incorporate?

Data Compilation Project

‘Substrate Networks’ – the underlying architecture of the global economy and trade:

- World City Database
- Demographic & economic data for all countries of world
- Inter-country Trade Relationships
- Manufacturing hubs and
- Air Transportation Network
- International Shipping Network
- Transoceanic Telecommunications Network
- Oil & Gas Supply Chain
- Military power structure and bases

World City Database



Population

- Population and growth rate for all cities over 750,000 people
- All cities with a population over 100,000 people
- Top ten cities for every country in terms of population

Capital Cities

Mega Cities

Gross Domestic Product (GDP)

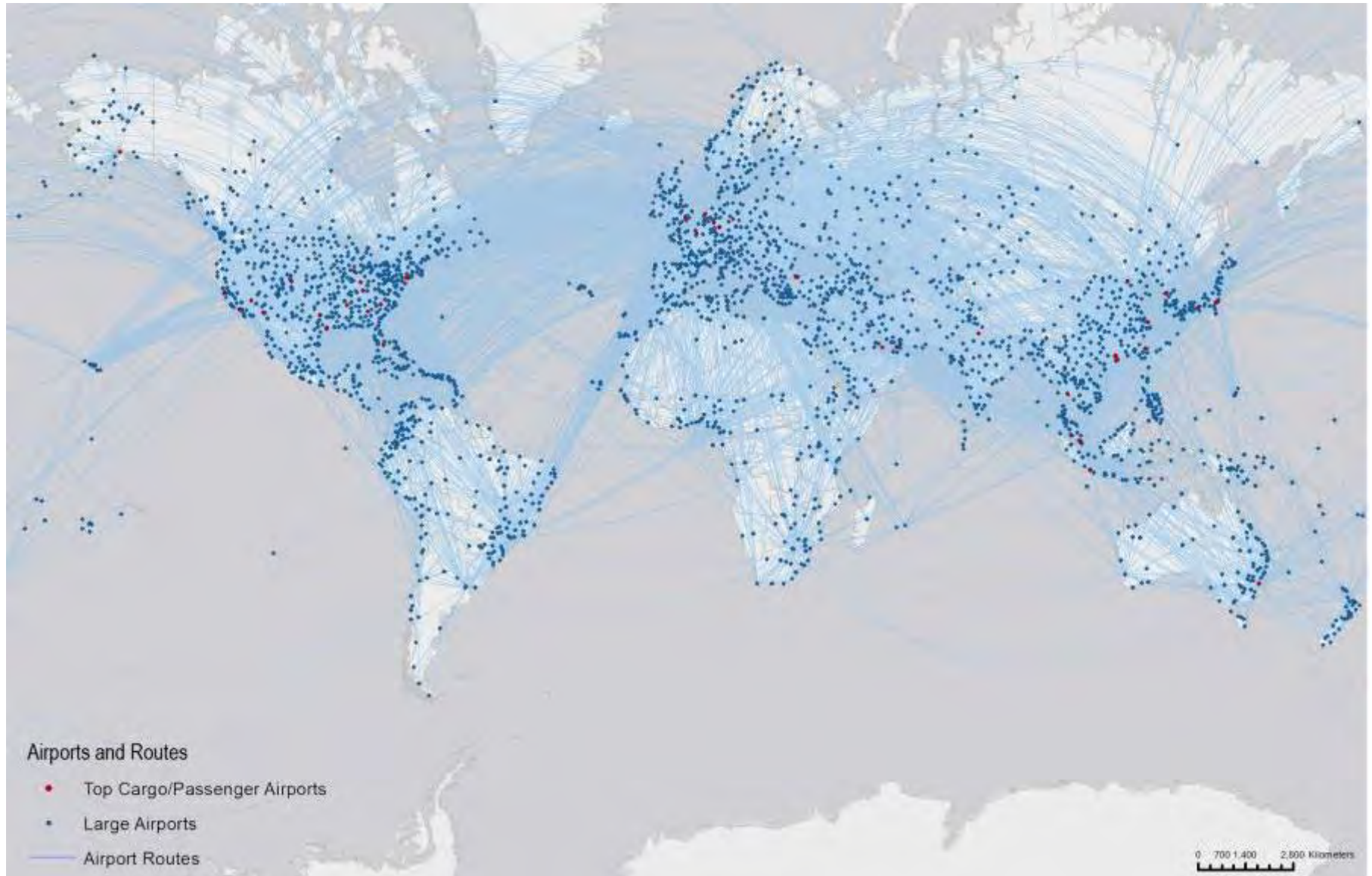
Population demographic – breakdown age and sex



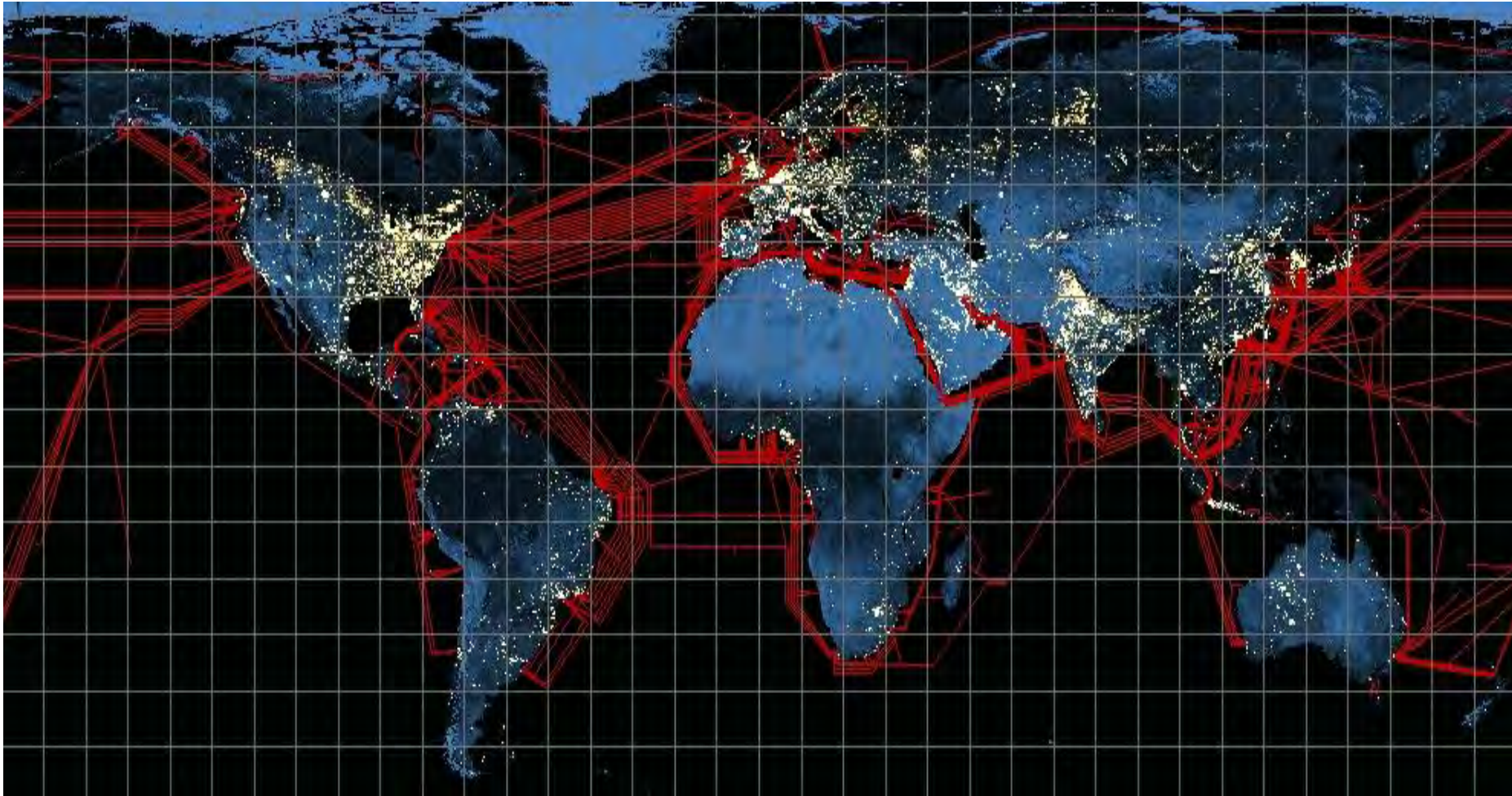
Cities of Our World

Cities with a population over 100,000 people, megacities and population density

Air Transportation Networks of the World

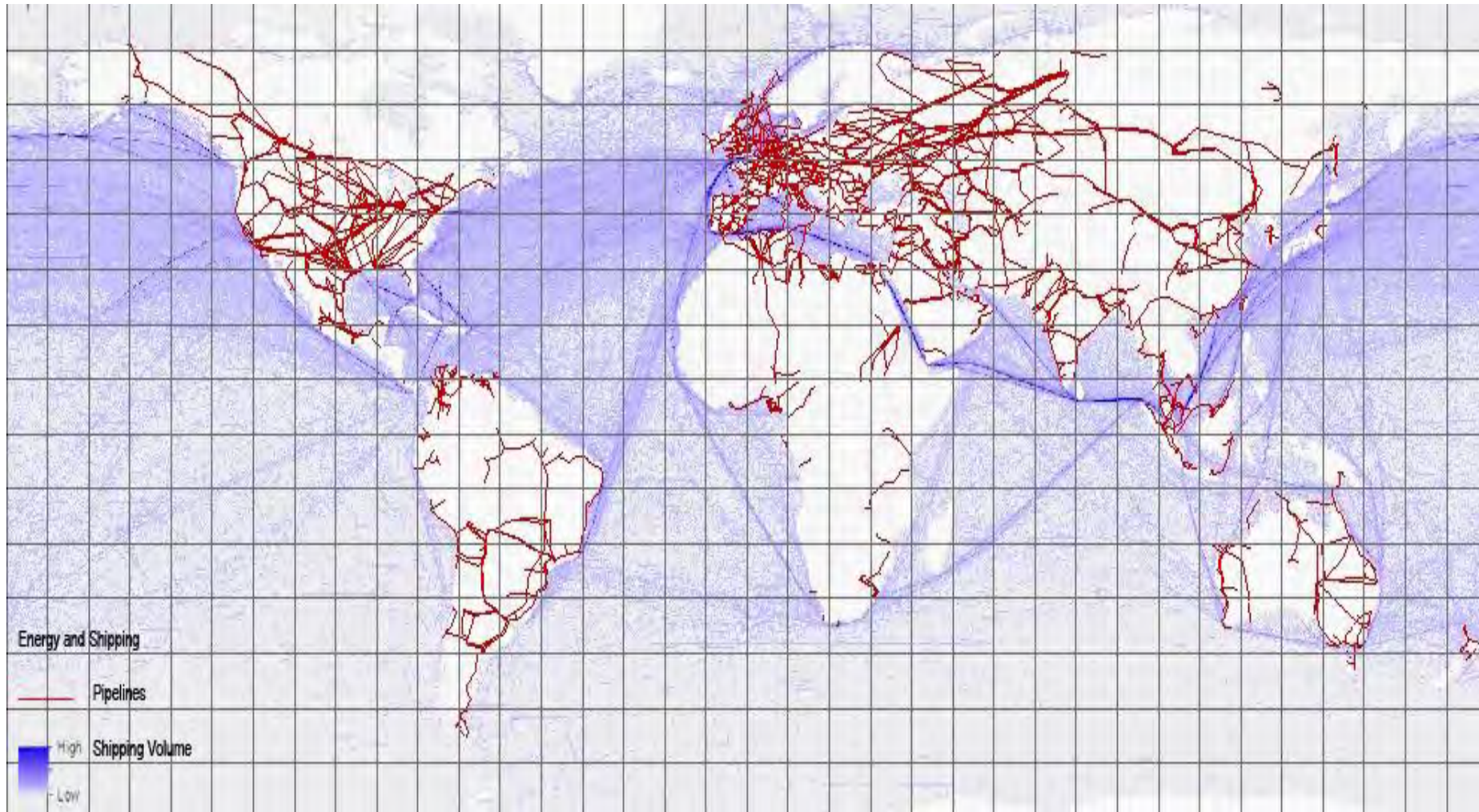


Telecommunications Networks



Submarine Communication Cables and Night-time Lights

Energy Supply Chain



Oil, Gas and Products Pipelines and World Shipping Routes

Geopolitical Conflict

- ‘Wars’ are a standard exclusion in many insurance products
- Insurance companies feel secure that these exclusions protect them from conflict-related losses
- In this project we test this assumption
 - We explore ways that losses might occur that thwart existing exclusions
 - Explore the potential for unexpected losses in lines of business that don’t have war exclusions
- Explore the potential for the event to impact an insurer’s non-underwriting operations
 - Business continuity of operations and systems
 - Investment portfolio impacts

Assessing a 1-in-100 Scenario

- Our scenarios are benchmarked to a standard level of (im)probability
 - 1% annual probability of exceedance (1-in-100)
 - i.e. 99 chances in a hundred something this bad **won't** happen
- Historically there have been two world wars in the past century
 - But we don't believe that a world war is a 1-in-100 scenario
 - All indicators of conflict have diminished significantly in the period of globalized economic interconnectivity
 - Conflict has diminished in an era of 'Pax Americana' – the US as global policeman
- The issue tends to be that people now underestimate the likelihood of conflict (and historically always have)
 - Political scientists believe that the risk of conflict increases when a hegemony state faces the growth of a challenger
 - Our scenario plays this out where China, in flexing its muscles, takes a belligerent stance against Japan, as a proxy for United States, rather than facing down US directly

Taxonomy and Likelihood

	Level 1	Level 2	Level 3	Level 4
Proponents	Conflicts between minor powers – No superpower	One superpower against a minor power	One superpower against an ally or proxy of another superpower	More than two superpowers engage in direct conflict
Polarity	Any	Any	Any	Multipolar
Power Asymmetry	Balanced low level of power	Major asymmetry	Moderate asymmetry	Balanced
Observed Frequency	Several conflicts a decade, and always a minor war somewhere in the world	Expect one or two a decade, as US or allies exert increasing power as global policemen	In modern times, expect only one or two a century as superpowers avoid confronting each other	20 th century history does not apply – globalized economy deters world wars
Current Likelihood	Common (>50% a year)	Occasional (10% a year)	Unlikely (1% a year)	Extremely Unlikely (0.1% a year)
Duration of conflict	Long	Short	Short-Medium	Long
Example	Yugoslav wars Congo wars	'Desert Storm' Iraq; Afghanistan invasion;	US-Vietnam War	WWI WW2

Level Selected
for Scenario

Sino-Japanese Conflict Context

A long historical context for national enmity:

First Sino-Japanese war (1894-1895)

- Japanese imperialist & expansionary policy leads to invasion of China
- Intention to dominate China politically and militarily and to secure other economic resources, particularly food and labour
- China divided between nationalists and communists

Second Sino-Japanese War (1937-1945)

- Skirmish at Lugou (or Marco Polo) bridge soon escalated in a full conflict.
- Invasion of Northern China, inc. Shanghai, Jiangsu and Nanjing
- Concentrated on strategically important urban cities – e.g. Shanghai, Nanjing, Wuhan
- Civilian targets including large scale massacres – e.g. rape of Nanjing and Battle of Shanghai
- Human Cost
 - Estimated 15-20 million casualties
 - 90 million+ refugees created
 - The “rape of Nanking” saw 200-400,000 civilians executed and 20-80,000 women raped
- Economic Cost
 - \$383 billion of property damage
 - \$250 million of defaults on Loans of the Farmers’ Bank of China
 - GDP \$20 (China) and \$8 (Japan) billion lower than pre-war levels
- Political Cost
 - Erosion of support for KMT regime facilitated the rise of Mao and the Communists who defeated Chiang four years later



Scenario Running Ahead of Recent News Events

theguardian

News > World news > China

China sends warplanes into disputed airspace over East China Sea

Air force spokesman says fighter jets have been sent after Japanese and South Korean aircraft flew through disputed area

Jonathan Kaiman, Tania Branigan in Beijing and agencies
theguardian.com, Thursday 28 November 2013 18.56 GMT



A Japanese patrol plane flies over the disputed Senkaku or Diaoyu islands in the East China Sea in 2011. Photograph: Japan Pool/AFP/Getty Images

China has sent warplanes into disputed airspace over the East China Sea after Japanese and South Korean military aircraft flew through the area, the Chinese state news agency reported.

China's air force spokesman Shen Jinke says several fighter jets and an early warning aircraft were sent on normal air patrols in the zone on Thursday. He was quoted by the state news agency Xinhua.

A screenshot of a BBC News Asia webpage. The page features a red header with the BBC logo and navigation links for News, Sport, Weather, iPlayer, TV, and Radio. Below the header, there are regional navigation tabs for Home, World, UK, England, N. Ireland, Scotland, Wales, Business, Politics, Health, Education, and Sci/Env. The main article title is "US carriers urged to comply with China air zone rules", dated 30 November 2013. The article includes a photograph of a US aircraft carrier at sea and text discussing the US stance on China's new air zone rules in the East China Sea. A "Related Stories" section is visible on the right side of the article.

BBC Sign in News Sport Weather iPlayer TV Rad

NEWS ASIA

Home World UK England N. Ireland Scotland Wales Business Politics Health Education Sci/Env
Africa Asia Europe Latin America Middle East US & Canada

30 November 2013 Last updated at 07:26

US carriers urged to comply with China air zone rules

US aircraft may follow several regional carriers complying with China's new rules

The US says it expects its civilian aircraft to observe China's rules in an air defence zone in the East China Sea.

A US **statement** said this did not mean the US accepted China's requirements in the zone covering territory claimed by China, Japan, Taiwan and South Korea.

China wants all aircraft there to file flight plans and identify themselves.

The US, Japan and South Korea say they have flown military aircraft in the area unannounced. But China said it scrambled fighter jets on Friday.

The move was to monitor US and Japanese aircraft in the zone.

'Firm but calm'

The air defence identification zone (ADIZ) covers a vast area of the East China Sea, including a group of islands claimed by Japan, China and Taiwan.

Related Stories

- Experts on China zone
- Why zone raises risk
- Q&A: Islands row

SJ3 Scenario Phases

1. Escalating Tensions

2. Provocation and Posturing

3. Military Incidents

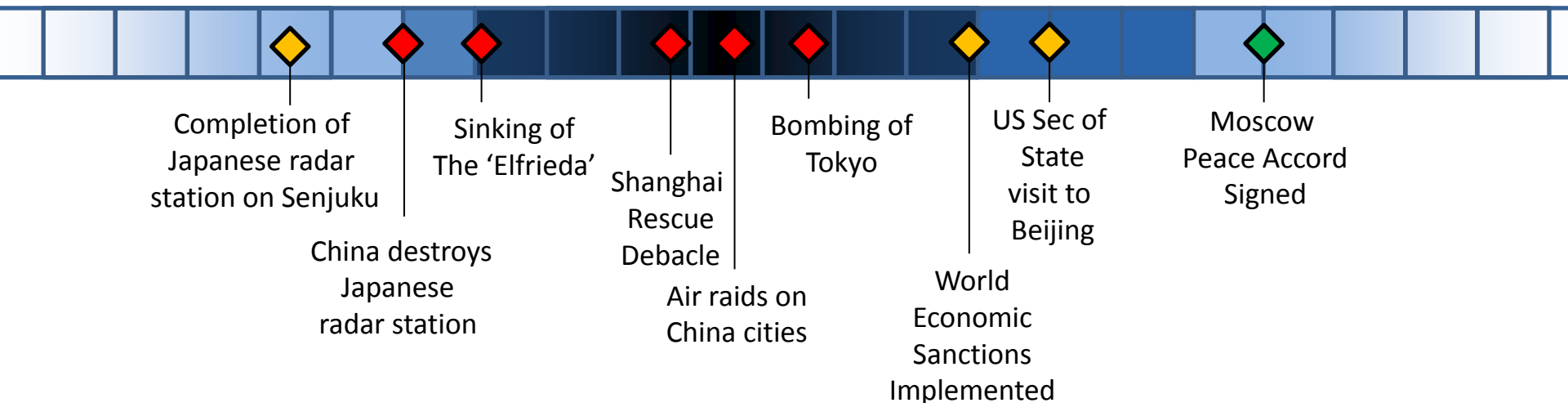
4. All-Out Conflict

5. Stalemate

6. Negotiated Peace

7. Aftermath

Months



SJ3 Scenario Narrative (Fictional)

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Hypothetical News TV & Video International Business Sport Entertainment

Tensions grow in East China Sea

Near miss near disputed islands prompts another diplomatic row

Wednesday, January 8



Tokyo, Japan (2103 GMT – 0503 JST) - Tensions between China and Japan grew yesterday following a skirmish at sea between Japanese fisherman and China's People's Liberation Army Navy.

Set against a backdrop of military modernisation, increased Chinese nationalism, the legacy of the second Sino-Japanese war, and an extreme hunt for natural resources, China and Japan have continued to clash over the islands.

Naval manoeuvres, large-scale war-games, and diplomatic posturing have defined recent tensions. The most recent clash saw Japanese fishermen stray into Chinese waters when fishing near the disputed Senkaku/Diacyu Islands. China's Navy frayed the boat, although no injuries were reported from either side.

Japanese and Chinese coast guards were quickly on the scene but did not engage one another

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Markets panic as China offers ultimatum

FTSE (-3.2%) and Dow (-3.7%) plummet amidst fears of war

Friday, February 21



New York, NY (2251 GMT – 1751 EST) - Financial markets tumbled around the globe as fears grew of armed conflict between China and Japan. China's ultimatum requires Japan to remove all equipment and personnel within seventy-two hours. Failure to do so, Chinese officials state, "will result in swift and appropriate military action".

It is understood that China are not pursuing diplomatic solutions following removal of all non-essential personnel from their embassies in Japan. Compounding fears of war and triggering little drops on markets

Traders suffered heavy losses following announcement of China's ultimatum and suspension of trade.

Anti-Japanese protests have been on-going in all of China's major cities. Western countries have urged citizens to avoid the region

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Japan denies shooting down Flight 583

Beijing to Sydney passenger plane crashes near Japan; 403 dead

Tuesday, March 25



Sydney (2308 GMT – 0808 Aus EST) - A full military air and sea blockade is in force after a Beijing Air 747-400 disappeared from radar shortly after entering Japanese airspace.

Wreckage of the plane, which was travelling from Beijing to Sydney, was found near the Japanese coast line. All 403 passengers and crew are presumed dead. Japanese officials have denied responsibility following China's accusations that a surface-to-air missile brought down the airliner.

The disaster comes only days after an 'Ultra Large Container Vessel' travelling to widespread protests against Japanese people and businesses in

Anti-Japanese protests have escalated following the crash

Recent speculation suggest that a Chinese mine, broke its mooring and drifted into open sea.

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BREAKING NEWS

WAR: Japan bombs China

Japan strikes military and industrial centres in Beijing & Shanghai

Monday, May 12



Beijing (0058 GMT – 0758 CST) - Japanese air and naval forces launched a massive strike against Chinese military targets and key industrial centres in the early hours of Monday morning.

Details are still emerging but it is thought that Beijing and Shanghai were both targeted following the crippling Cyber attack against Tokyo on April 29.

The full wave of attacks, beginning around 01:00 CST, targeted military installations near Beijing and Shanghai. Local witnesses say the second wave of missiles began around 03:00, which targeted some of China's most prolific industrial centres. There are early reports of devastating losses to residential manufacturing areas like Songjiang.

Chinese government officials condemned the attack and have promised "a swift response to Japan's barbarism". Western governments have joined the condemnation but have urged for calm and diplomacy as the world stands on the brink of all out war.

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US-China standoff continues

The US Pacific fleet continues war drills in support of Japan

Thursday, July 24



Singapore (1216 GMT – 1916 SGT) - The Stalemate between US and Chinese forces in the East China Sea continues as both governments claim negotiations are on-going.

Sources inside the US government are adamant that the US is maintaining a peaceful presence to encourage both sides to refrain from further attacks, which have already caused widespread loss and crippled the global economy.

Despite early condemnation, Russia's foreign minister said yesterday, "we support any peace-making efforts, and urge all sides to respect the international boundaries and work together for a swift, peaceful resolution".

US Carrier Group Abraham Lincoln steaming south of Japan

the US are willing to stay engaged in the region. The scale of the intervention and the unprecedented rise in energy prices is costing billions of dollars every week. The presidential press secretary, however, was adamant that this was a human problem and not an economic one. The irony, of course, is that the

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US & Russia press for peace

Retaliation for Japanese 'invasion'

Tuesday, September 18



Singapore (0343 GMT – 1143 SGT) - Air force One touched down in Singapore this morning in a last ditch attempt to negotiate a peaceful resolution between China and Japan.

President Obama urged both sides to refrain from inflammatory action, but reiterated that Japan would be defended at all costs, as per the joint resolution passed in congress. The US, with the support of Australia and India, and the UK, France and Germany, still have its Pacific fleet in position.

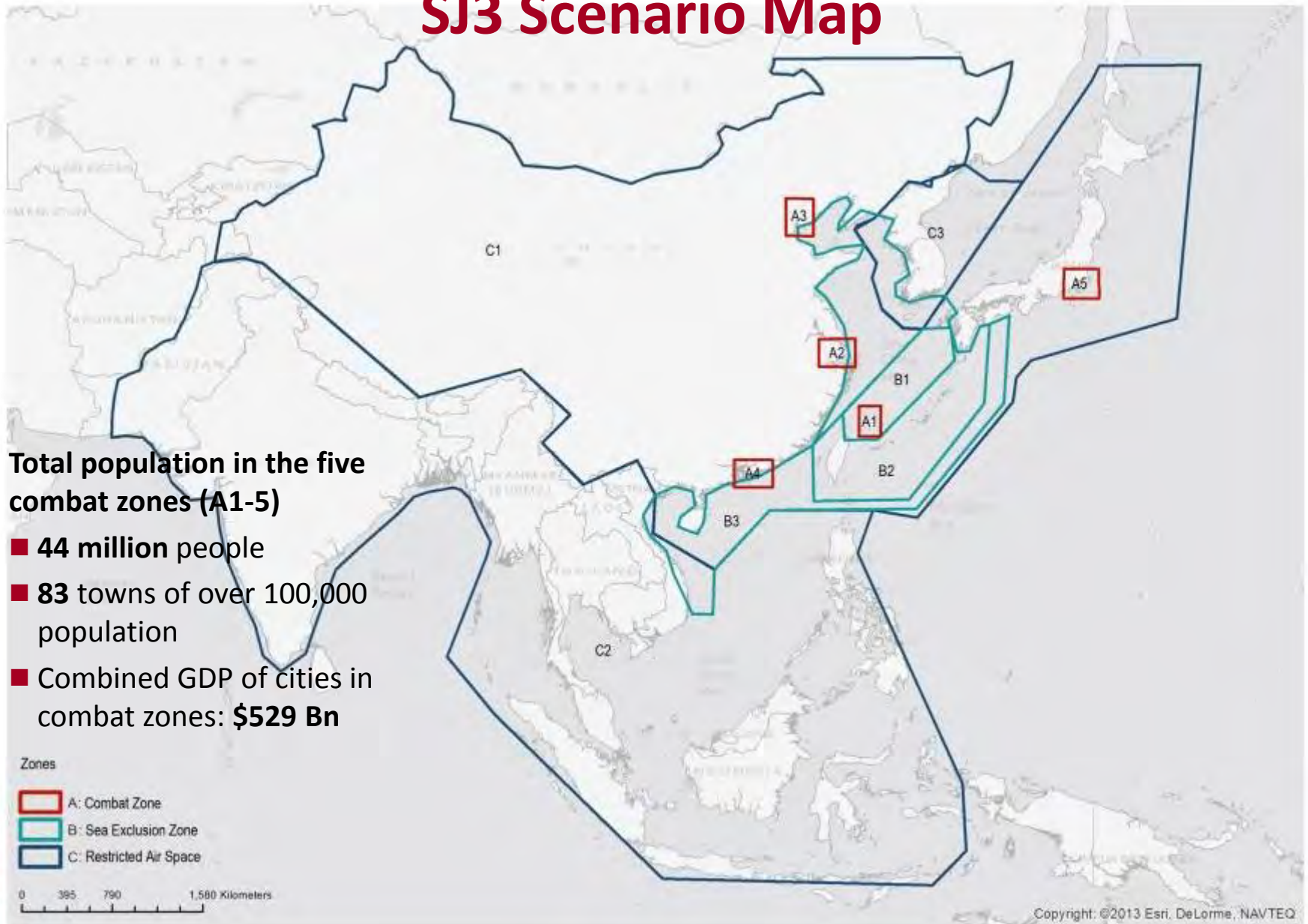
Most significantly, Russia, a historical ally of China, announced that they would not intervene and would assist.

Air Force One taxiing in Singapore where President Obama urges peace

efforts. It is thought that fears of internal economic collapse has left China looking for a peaceful end to hostilities and the return of normal economic activity.

Japan too are thought to be seeking peace as their war efforts and economic capacity have been

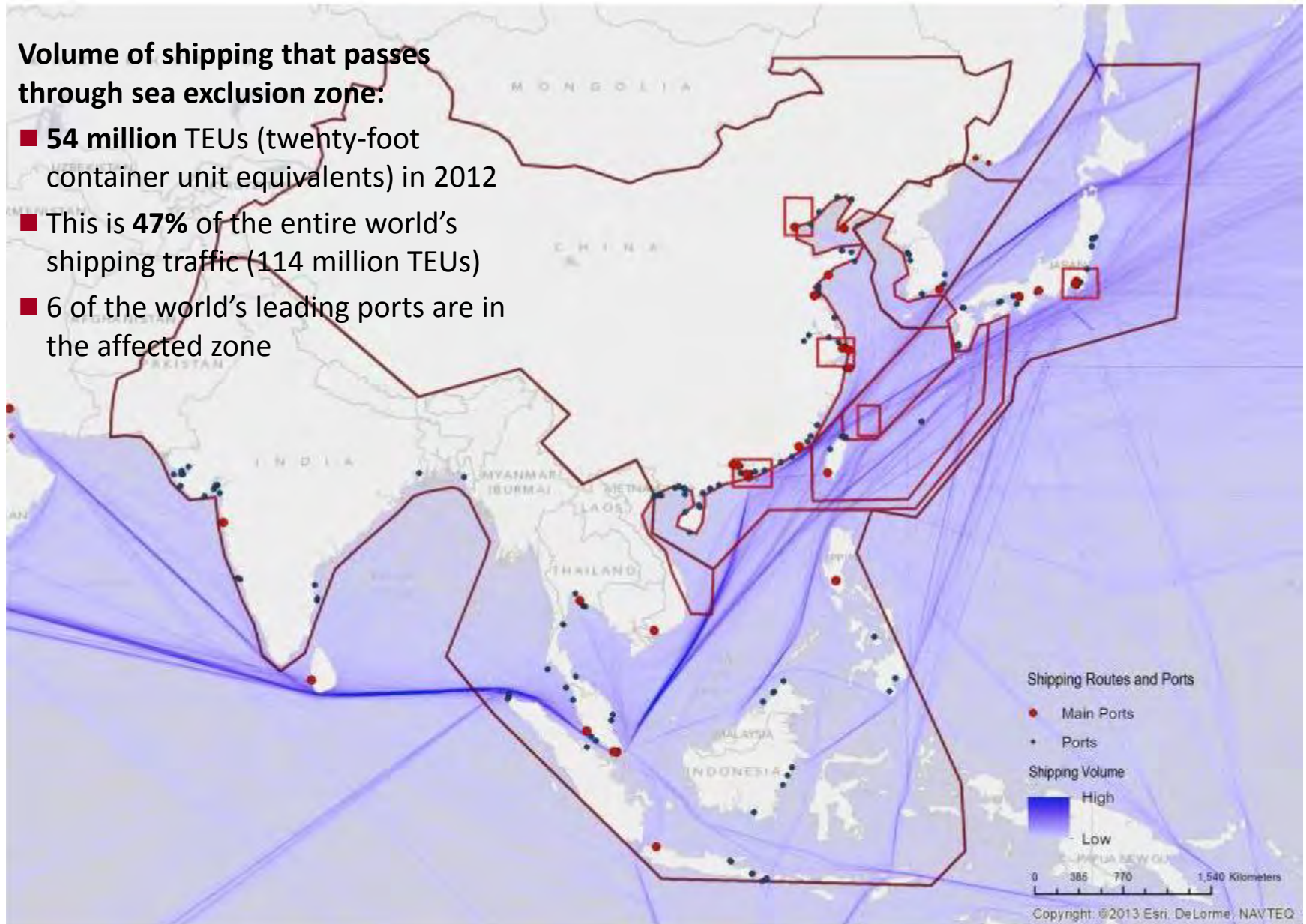
SJ3 Scenario Map



Shipping Lanes Affected by Sea Exclusion Zones

Volume of shipping that passes through sea exclusion zone:

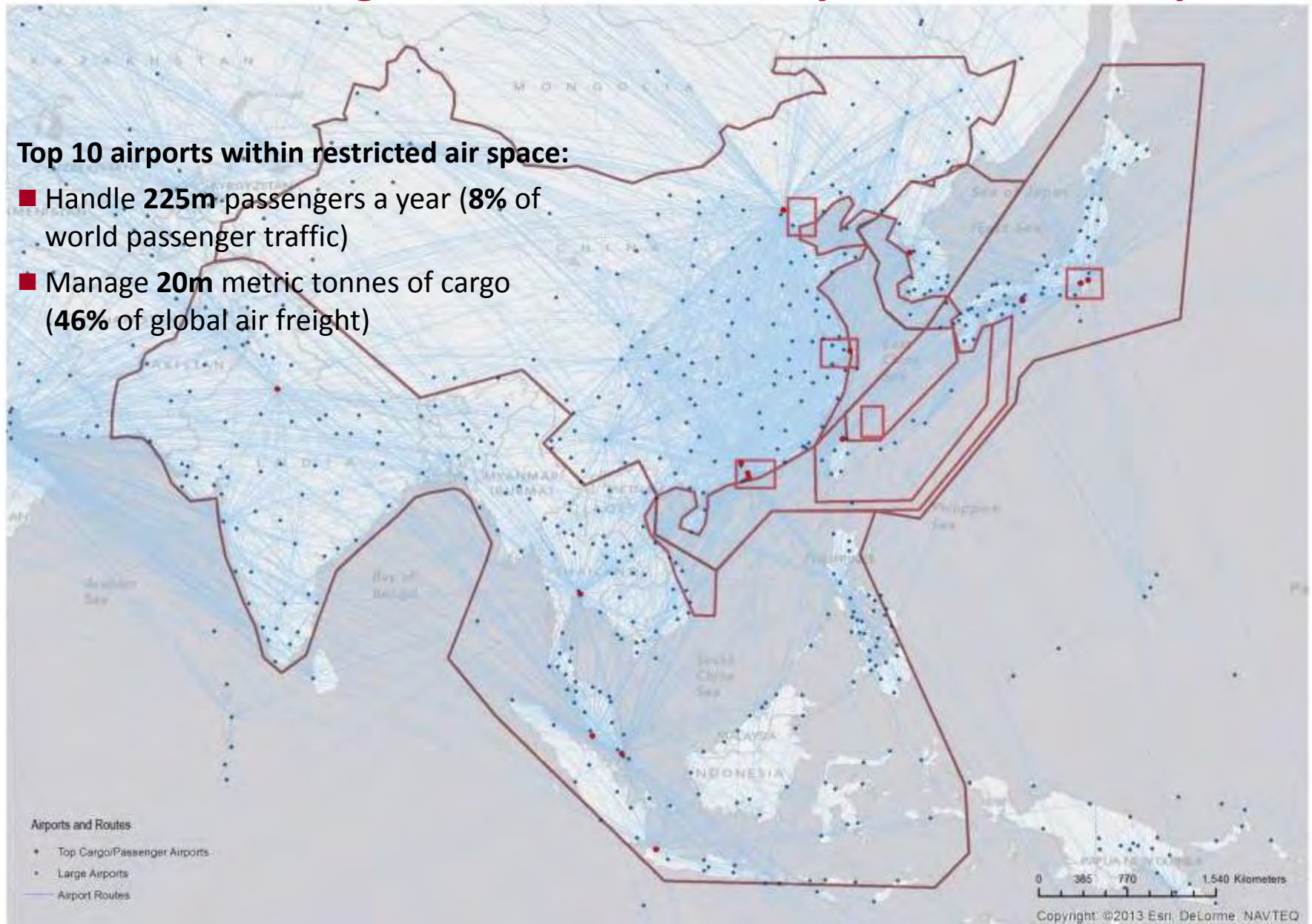
- 54 million TEUs (twenty-foot container unit equivalents) in 2012
- This is **47%** of the entire world's shipping traffic (114 million TEUs)
- 6 of the world's leading ports are in the affected zone



Commercial Flight Routes Affected by Restricted Air Space

Top 10 airports within restricted air space:

- Handle **225m** passengers a year (**8%** of world passenger traffic)
- Manage **20m** metric tonnes of cargo (**46%** of global air freight)



ADIZ vs SJ3 B1 Zone



SJ3 Summary Impacts

	S1	S2	X1
Conflict Duration Period (Market turmoil)	9 months	2 years	5 years
Export trade disruption period	1 year	5 years	5 years
Export trade loss during disruption	50%	70%	90%
Direct Damage Replacement Cost	\$120 Bn		\$500 Bn?
Total Insured Loss	\$40 Bn		\$150 Bn?
Deaths	100,000	250,000	500,000
World GDP Recession Peak	-1%		-3%
Global Recession Duration	18 months		3.5 yrs
Lost global output 2014-2019			\$32 Trillion
Investment Portfolio Impact (Relative to expectation baseline)	-30%		
Duration of Degraded Returns	2.5 yrs		

How Might This Crisis Trigger Another?



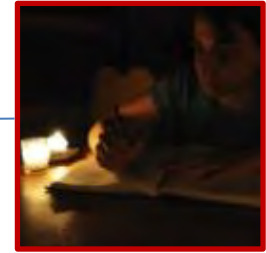
Geopolitical
Conflict



Financial
Crisis



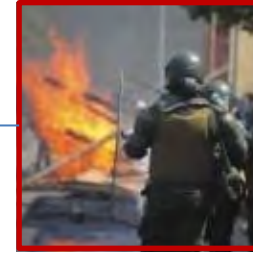
Trade
Disputes



Power
Outages



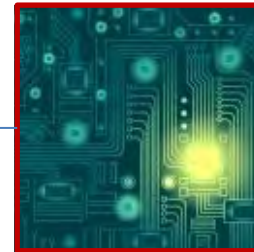
Sovereign
Default



Civil
Unrest



Organized
Crime



Cyber
Catastrophe

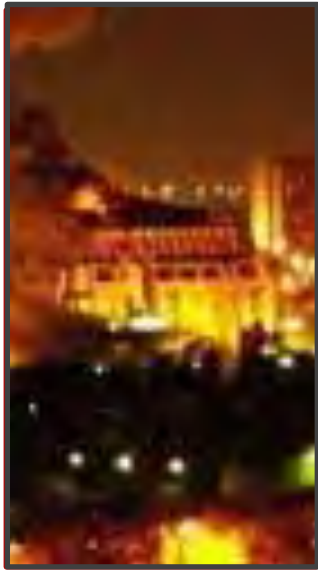


Humanitarian
Crisis

Impact of Military Strike on Shanghai



Historical Loss Precedents for Strategic Bombing



Baghdad 'Shock & Awe'

Iraq War

19 Mar 2003 – 30 April 2003

- 1,700 air sorties
- 504 Cruise missiles
- 6,616 civilian deaths
- Complete destruction of military and government infrastructure
- Bombing responsible for 0.5% mortality in Iraq population



Dresden Bombing, Germany

WWII

13 – 15 February 1945

- 527 US & 722 UK bombers drop 4,000 tons of ordnance
- 15 sq. miles destroyed, inc. 90% of city centre
- Around 25,000 dead
- 23% of industrial buildings 'seriously damaged'
- 78,000 dwellings 'completely destroyed'; 28,000 'uninhabitable'; 65,000 damaged
- 199 factories (136 serious damage; 28 medium damage; 35 light damage)



London Blitz

WWII

7 Sept. 1940 – 21 May 1941

- 40,000 dead
- 100,000+ injured
- 1 million homes destroyed
- London bombed for 57 consecutive nights
- 25% drop in industrial production



Bombing of Tokyo

WWII

17 Nov. 1944 – 15 Aug. 1945

- Incendiary bombs target light industry
- 9-10 Mar, 334 bombers drop 1,700 tons of ordnance
- 16 sq. miles destroyed (280,000+ homes destroyed) 50% of Tokyo
- 100,000 dead / 100,000 injured / 1million homeless
- Industrial output cut by 50%
- Rebuilding focused on roads / transportation
- 27% of the damage but only 11% of rebuilding budget
- 5-7 yrs before economic growth returned

Property Losses

- Buildings and contents damaged during military action
 - Insurance claims excluded under ‘war’ exclusions...
 - Around 1 in 1000 of commercial properties damaged in the ‘Theatre of War’ zones
 - Total of 450,000 properties damaged
 - 300,000 in China
 - 150,000 in Japan
 - High percentage related to global corporations
 - Average loss ratio per damaged property: 50%
- Business interruption
 - Civil emergency clauses
 - Power and utilities loss
- Losses that are less easy to define as war-related losses:
 - Evacuation of personnel
 - Claims for damaged IT infrastructure as a result of attributable cyber attacks during war period
 - Supply Chain insurance
 - Event cancellation



Life, Health, & Workers Comp Insurance Claims

- Civilian corporate deaths & injuries from military action
 - Factories and office buildings targeted in military action
 - Attacks mainly at night to minimize civilian casualties
 - Employees of corporates injured in the raids
- Around 10,000 people killed
- Around 750,000 people injured
 - 75% of casualties in China, 25% in Japan
- Civilian deaths and injuries from riots and hostage taking by crowds
 - High value senior executives in Japanese companies
- Commercial airliner shot down – 350 passengers and crew killed
- Very large exodus of Western business people flee from China and Japan
 - Group life repatriation clauses from evacuation of expatriate executives
- Travel insurance repatriation
- Stress-related health claims resulting from episode

	Injury Classification		Blast Morbidity
1	I1	Minor Injury	80.5%
2	I2	Temporary Incapacity	2.1%
3	I3	Partial Disability Minor	1.9%
4	I4	Partial Disability Major	1.3%
5	I5	Complete Disability	1.5%
6	I6	Fatal	12.7%



Marine, Aviation and Space Losses

Marine

- The 'Elfrieda Smirk' lost at sea
- Ultra Large Container Vessel
- 15,000 containers
- No definitive attribution for sinking

Aviation

- Loss of a commercial 747 aircraft, passengers and crew
- No air force admits shooting it down

Space

- Japanese commercial satellites lost, suspected due to military action

Underwriting Loss: Clash Assessment

Insurance Claims Across Multiple Lines of Business

Claims related to Geopolitical Conflict on insurance exposure in Japan & China

Class	Line of Business	
Property		
	Personal Lines/Homeowner	4
	Personal Contents	4
	Commercial Combined	5
	Construction & Engineering	3
	Commercial Facultative	5
	Binding Authorities	3
Casualty		
	Workers Compensation	5
	Directors & Officers	4
	Financial Lines	4
	General Liability	4
	Healthcare Liability	5
	Professional Lines	4
	Professional Liability	3
Auto		
	Personal Lines	4
	Commercial & Fleet	5

Class	Line of Business	
Marine & Specie		
	Cargo	5
	Marine Hull	5
	Marine Liability	3
	Specie	4
Aerospace		
	Airline	5
	Airport	4
	Aviation Products	3
	General Aviation	2
	Space	4
Energy		
	Downstream	1
	Energy Liability	4
	Onshore Energy & Power	5
	Upstream	3
Specialty		
	Accident & Health	5
	Aquaculture insurance	1
	Contingency - film & event	1
	Equine insurance	1
	Excess & Surplus	0
	Life Insurance	4
	Livestock	3

Class	Line of Business	
Life & Health		
	Life Insurance	5
	Health Insurance	5
	Income Protection	0
	Death & Disability	5
	Hospital Cover	5
Pension and Annuities		
	Standard Annuities	0
	Variable Annuities	0
	Enhanced Annuities	0
	Life Settlements	0
War & Political Risk		
	Kidnap & Ransom	0
	Political Risk	5
	Political Violence & Terrorism	0
	Product Recall	0
	Trade Credit	3
Agriculture		
	Multi-peril crop	3
	Crop hail	0
	Livestock	4
	Forestry	0
	Agriculture	0

Impact on Insurance Claims

Decrease Increase



Direct Damage Costs (\$1)

- Direct replacement cost of built environment damaged in SJ3 (China & Japan) **\$120 Bn**
- P&C Insurance loss in China & Japan **<\$20 Bn**
- Insurance losses in US & Europe **\$8 Bn**
- Healthcare costs & compensations for injury **\$2 Bn**
- Life & Health insurance claims **\$2 Bn**
- **Total Insurance Industry Loss: \$30-40 Bn**

Insurance Claims Surprises...

Political interference in insurance claims settlement

- Chinese government declares ‘war’ exclusion clauses in Western insurance policies invalid
 - A condition of doing future insurance business in China is that Western insurers pay for losses inflicted, to assist with the reconstruction of economy
 - Precedents: US government pressure on insurers to settle claims in “Hurricane” Sandy; Deepwater Horizon compensation

Claims from businesses elsewhere

- Contingent business interruption claims from supply chain failures
- Supply chain insurance
- Event cancellation in US
- Airport business coverages

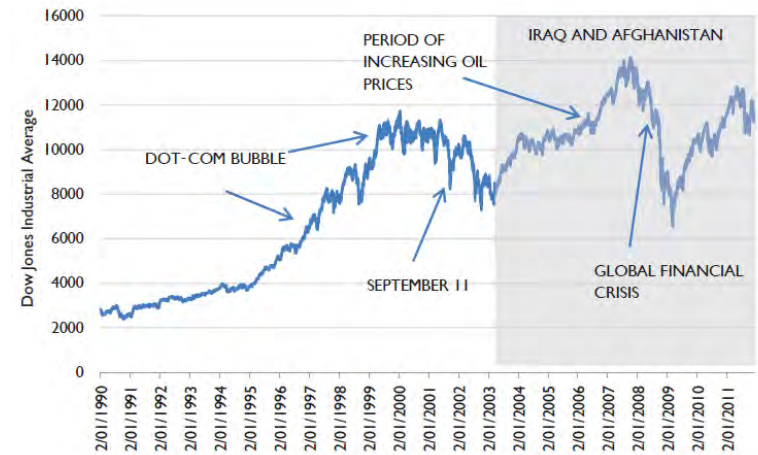
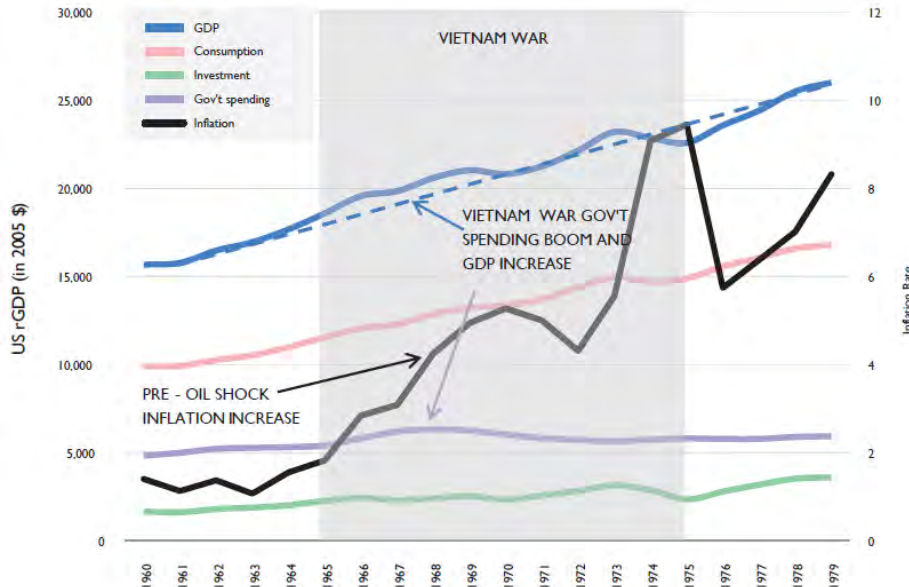
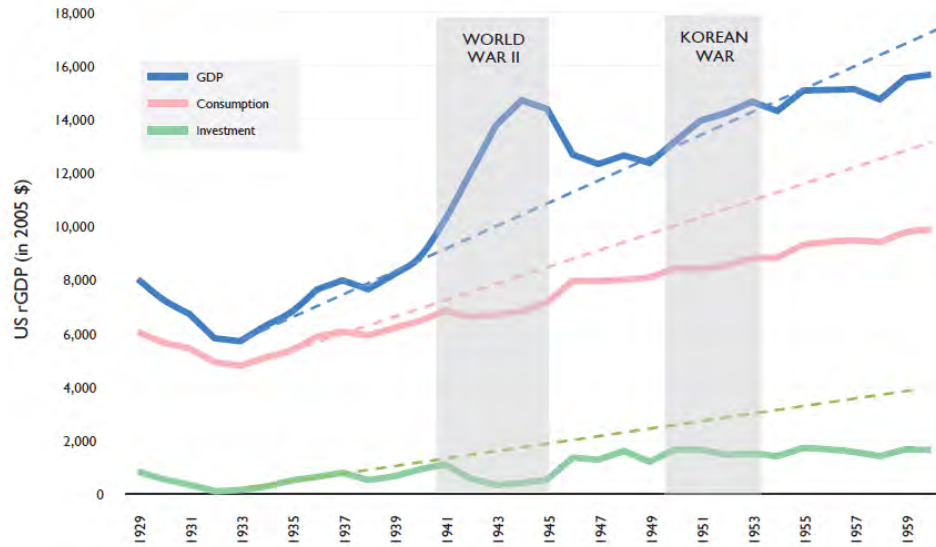
Claims from surprising sources

- Stress-related illnesses in US expatriate employees evacuated from war theatre

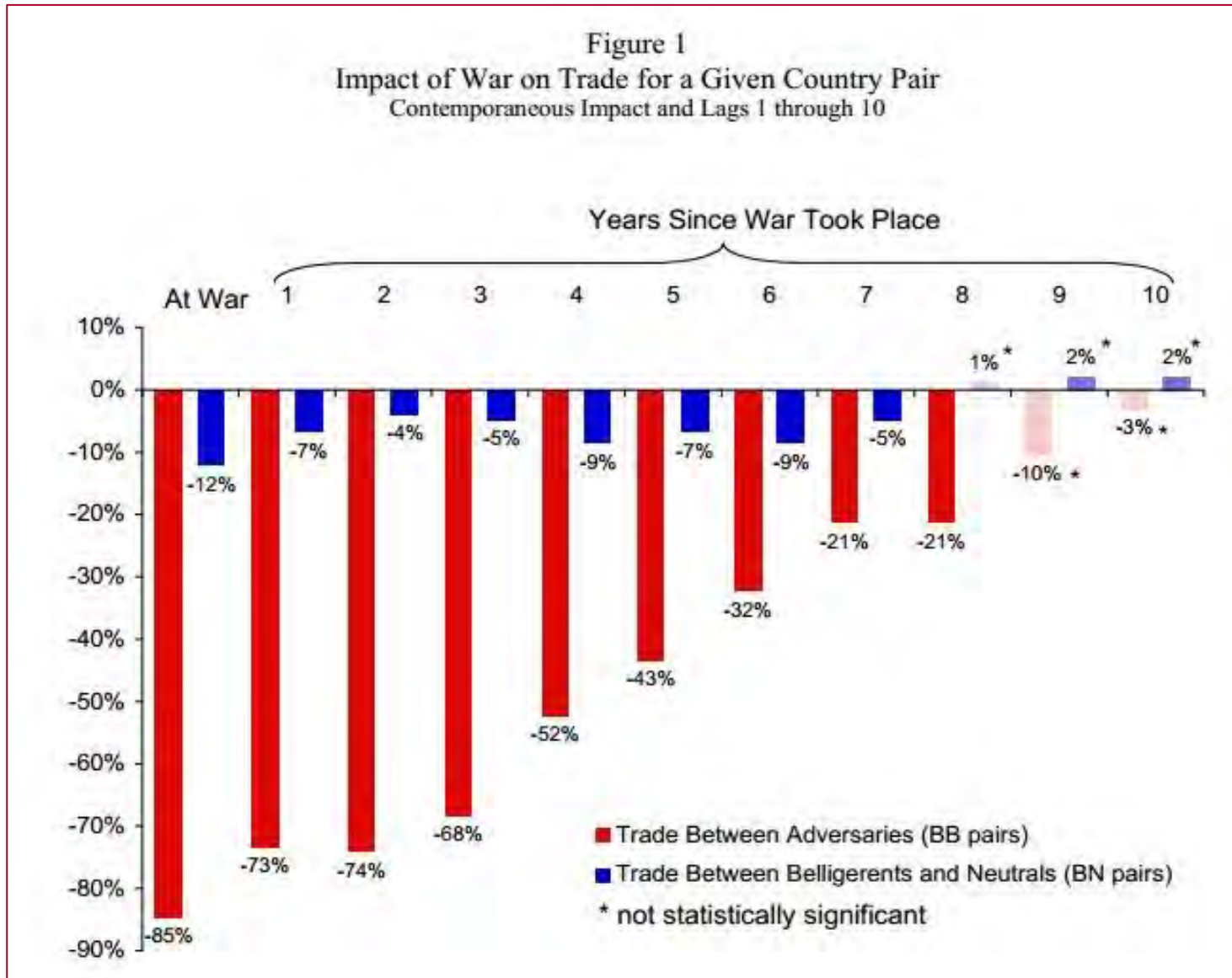
Macroeconomics of War

- Government expenditure increases (short term positive effects)
- Public debt and taxation increase (long term negative effects)
- Inward foreign direct investment is diverted
- Capital flight leads to a devaluation of currency
- Price increases lead to a rise in inflation
- Energy prices increase and are more volatile
- Exports are blocked (SJ3 Scenario)
- Imports are blocked (SJ3 Scenario)
- Destruction of capital assets depress industrial production

Macroeconomic effects of previous wars



Consequences of War: Trade



China Exports

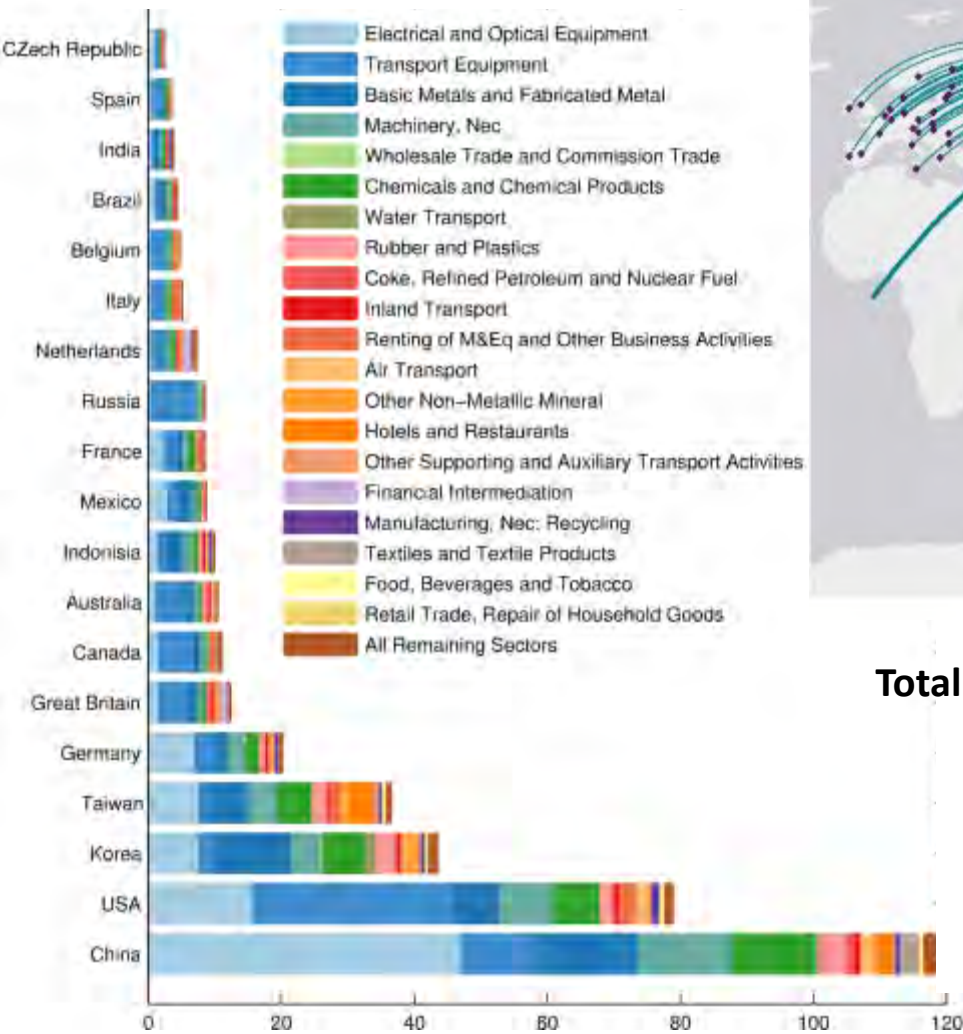


Total value of Chinese exports: \$1.33 Trillion (\$US 2009)

China Export Value by Economic Sector (US\$ Billions 2009)

* Excludes exports to the Rest of World

Japan Exports

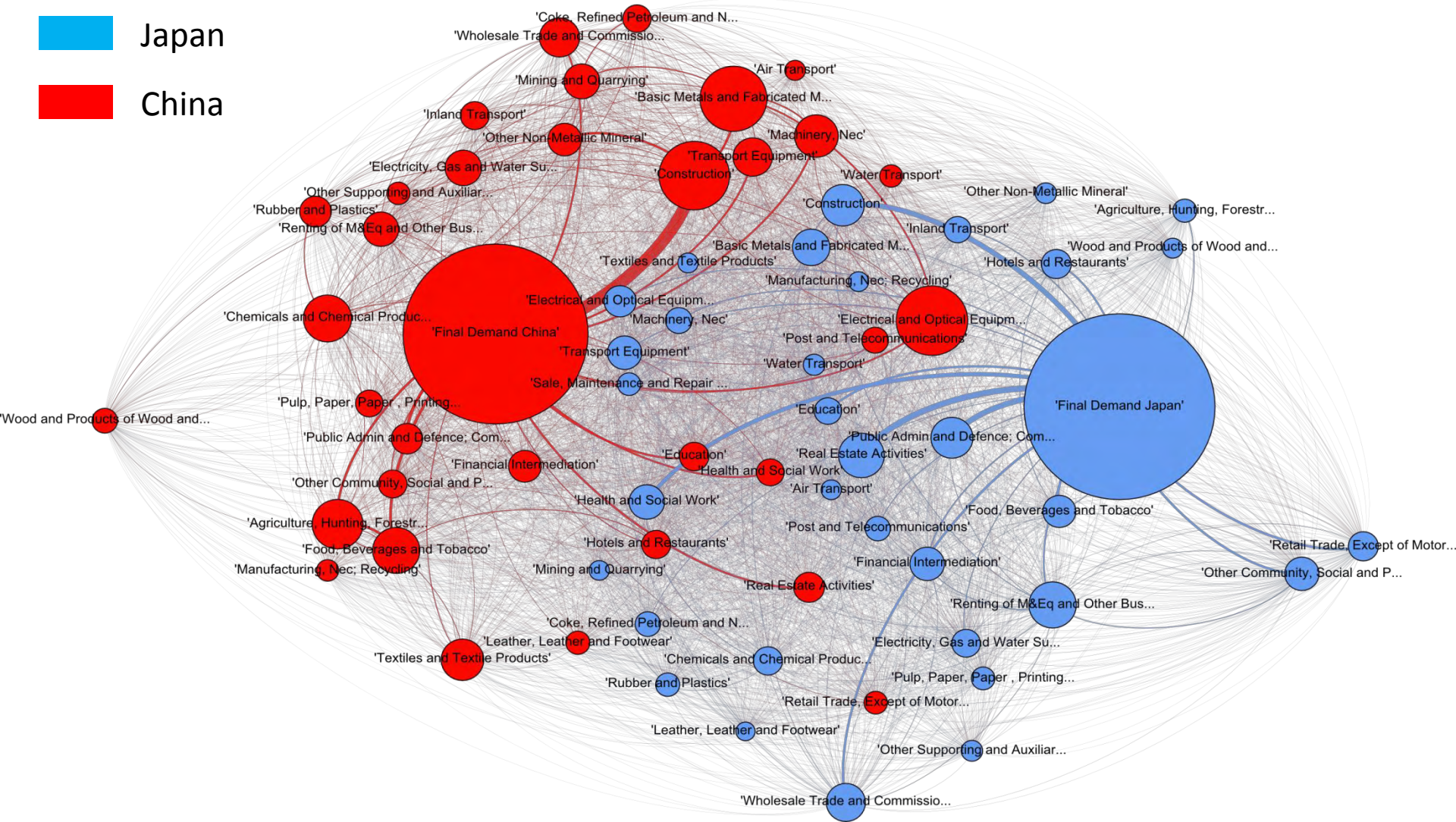


Total value of Chinese exports: \$640 Billion (\$US 2009)

Japan Export Value by Economic Sector (US\$ Billions 2009)

Inter and Intra-trade between Japan and China

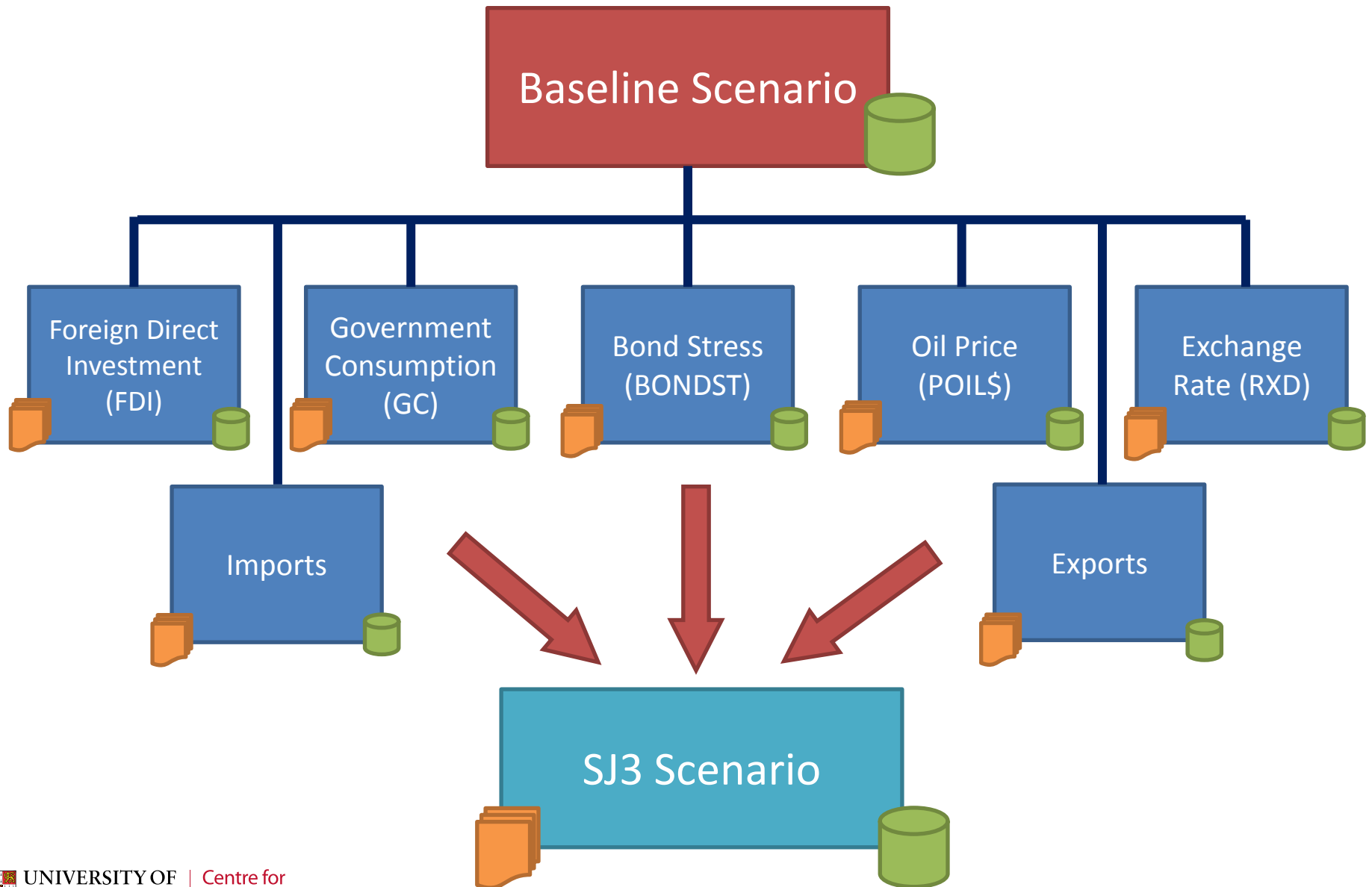
■ Japan
■ China



Oxford Global Economic Model

- Most widely used macroeconomic model
- Collaborative research agreement with Oxford Economics
- General Equilibrium Model (GEM)
- 5 ,10 and 25 year ahead projections
- 47 Economies (headline forecasts for 30 countries)
- Updated with new data monthly
- “Eclectic Model”
 - Keynesian in short run (demand)
 - Monetarist in the long run (supply)
- Cobb-Douglas production function links capital, labour, and total factor productivity.
- Monetary policy endogenised through ‘Taylor Rule’

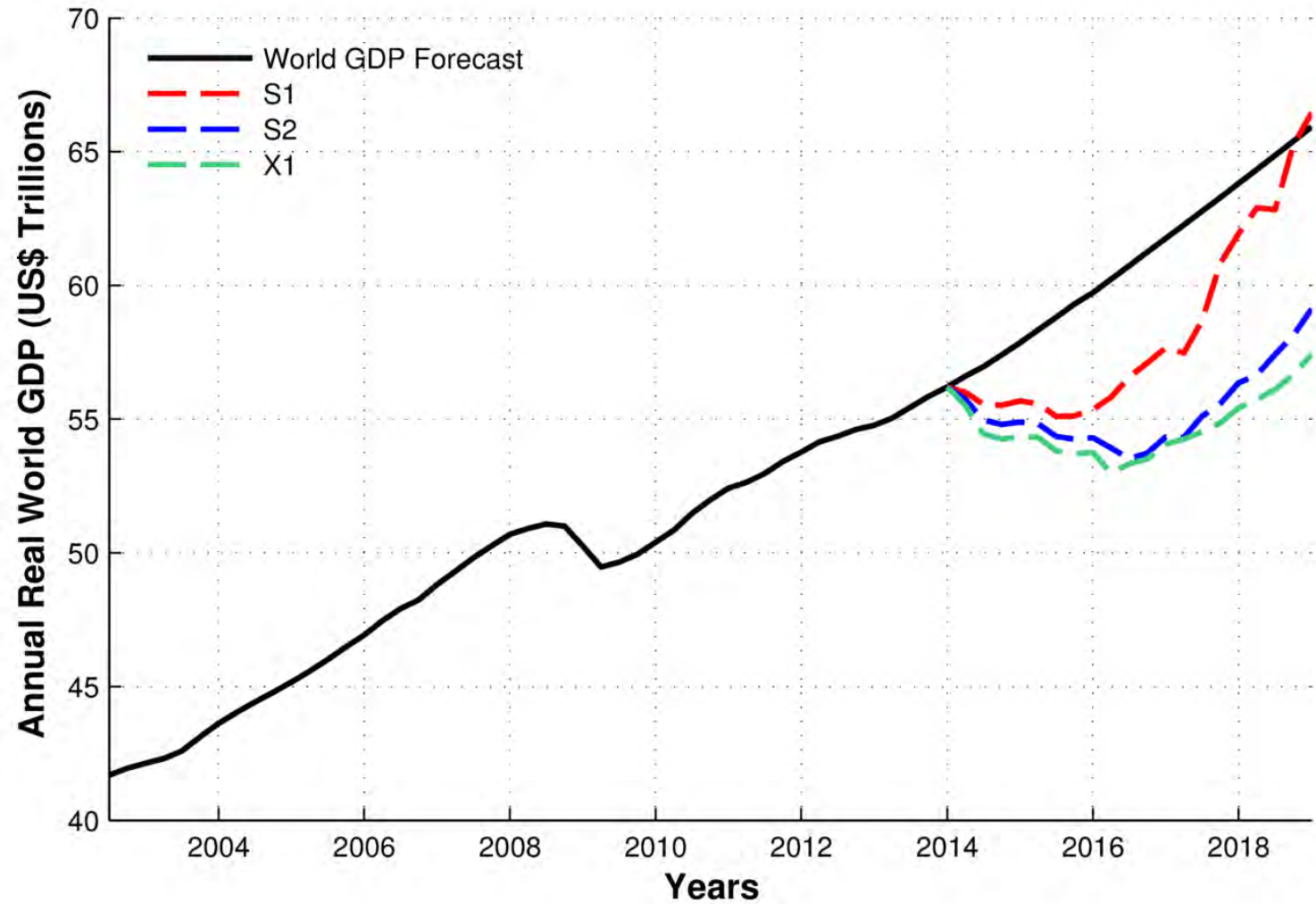
SJ3 Modelling Structure



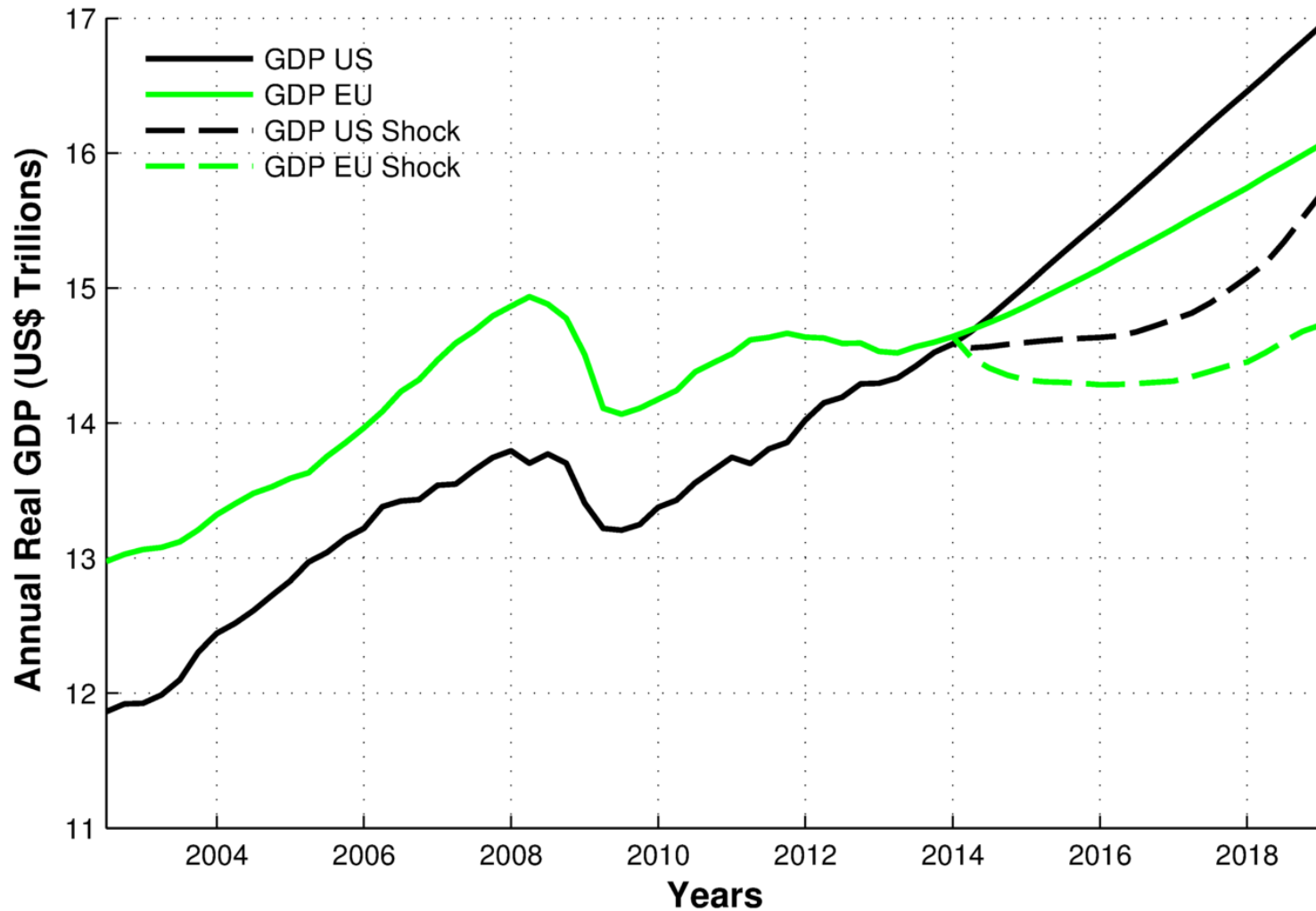
Scenario Summary: Macroeconomic Inputs

Key Variable	Description	S1	S2	X1
FDI	Foreign Direct Investment	2014 (1 yr)	2014-2019 (5 yr)	2014-2019 (5 yr)
		- 70%	-70%	-100%
GC	Government Consumption	2014 (1 yr)	2014-2018 (5 yr)	2014-2019 (5 yr)
		+7%	+7%	+7%
WPO	World Oil Price	2014 (1 yr)	2014-2016 (2 yr)	2014-2019 (5 yr)
		+20%	+30%	+50%
RXD	Exchange Rate to US\$	2014 (1 yr)	2014-2015 (2 yr)	2014-2019 (5 yr)
		+10%	+15%	+20%
X	Total Exports	2014-2015 (2 yr)	2014-2019 (5 yr)	2014-2019 (5 yr)
		-50% (1), - 25% (2)	-70%	-90%
M	Total Imports	2014-2015 (2 yr)	2014-2019 (5 yr)	2014-2019 (5 yr)
		-50% (1), -25% (2)	-70%	-90%

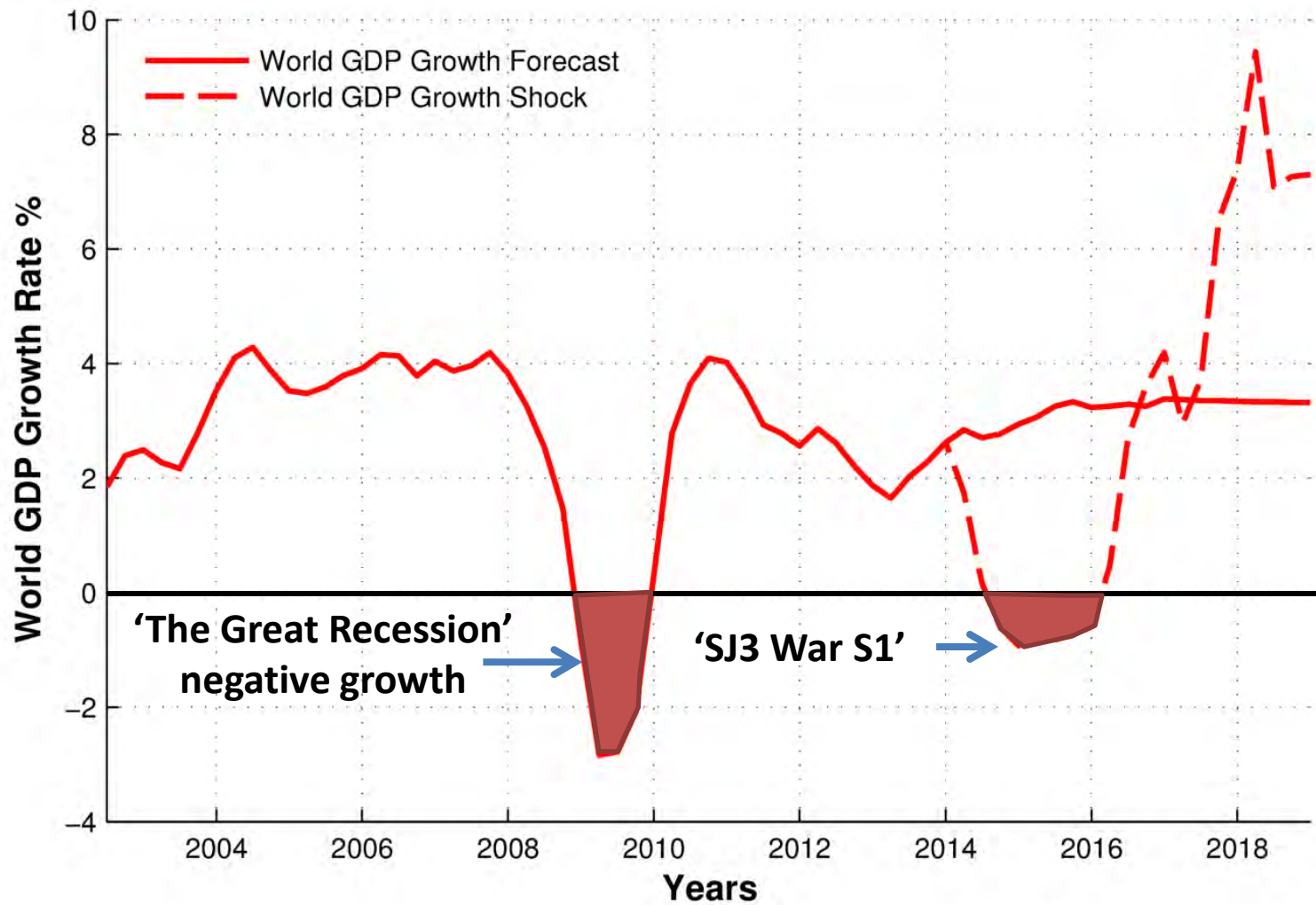
Global GDP Levels



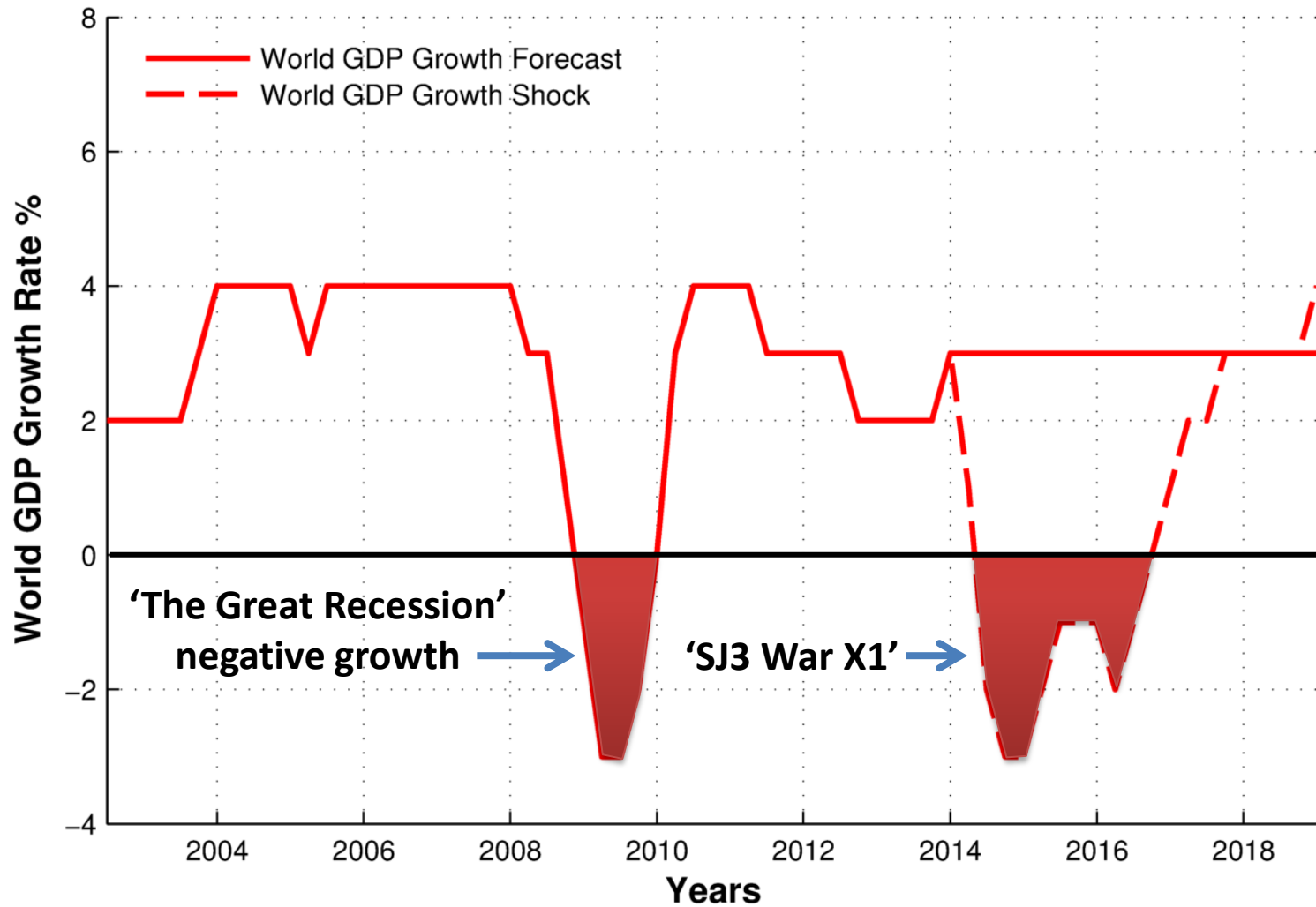
EU and USA GDP Levels (X1)



World GDP Growth Rate (S1)



World GDP Growth Rate (X1)



Macroeconomic Conclusions

- China is hit hardest and recovers fastest
- Japan lags behind China and fails to recover
- Japan growth is hampered by prolonged high inflation
- GDP growth in the EU and USA is slow and protracted
- Global GDP growth bottoms at -3% growth (X1)
- The global recession lasts between 1.5 and 2.5 years
- The global cost of the S13 war is **32.2 Trillion \$US***

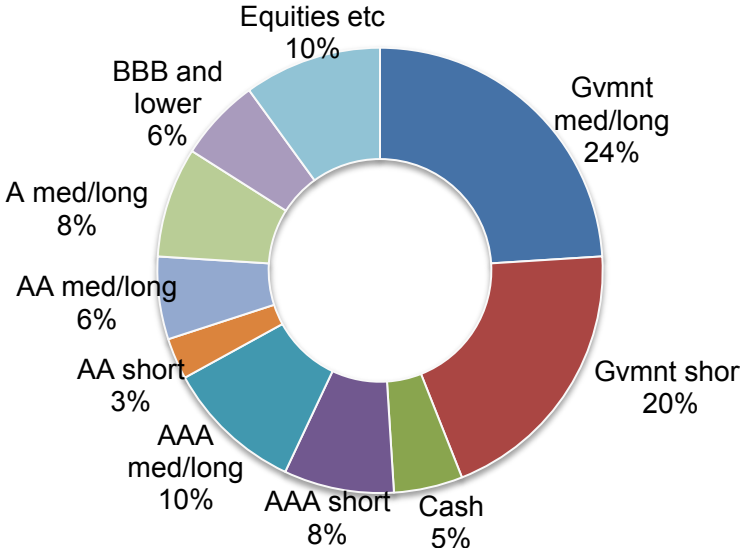
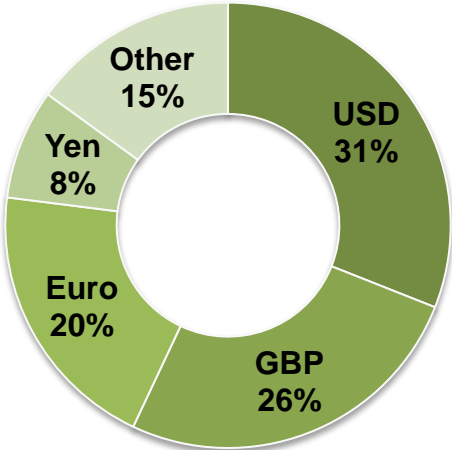
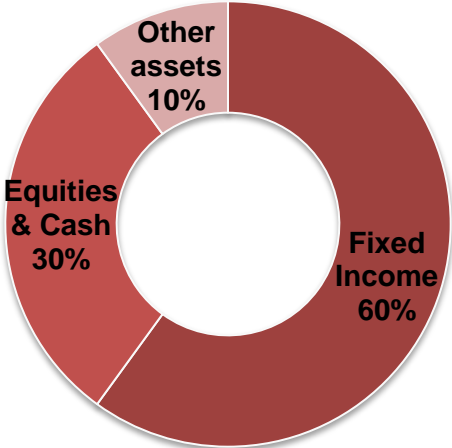
* Estimated from five years of lost global output compared against the counterfactual baseline scenario between 2014-2019

Hypothetical Investment Portfolio of an Insurance Company

Portfolio structure						
	USD	GBP	Euro	Yen	Other	Total
Government med/long	8%	7%	5%	2%	2%	24%
Government short	6%	5%	4%	2%	3%	20%
Cash	2%	1%	1%		1%	5%
AAA short	2%	2%	2%	1%	1%	8%
AAA med/long	4%	3%	1%	1%	1%	10%
AA short	1%	1%	1%			3%
AA med/long	2%	1%	1%		2%	6%
A short						0%
A med/long	2%	2%	2%	2%		8%
BBB and lower	2%	2%	1%		1%	6%
Equities etc	2%	2%	2%		4%	10%
Total	31%	26%	20%	8%	15%	

Focus on

- high quality
- fixed income



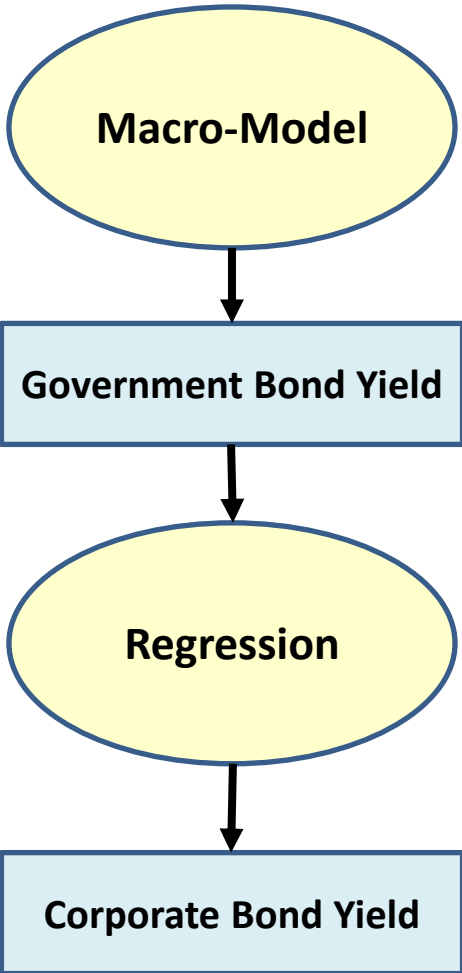
Estimation of Bond Returns

$$\text{return}_t = \text{yield}_t + \text{capital gain}_t$$

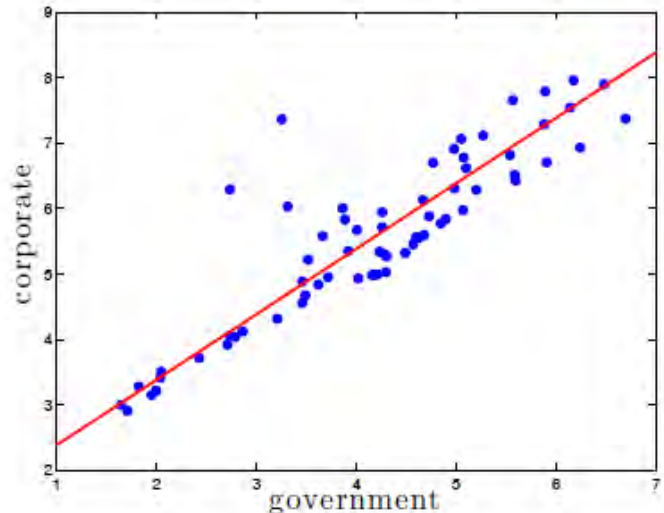
$$\text{yield}_t = \text{gvt}_t + \text{credit spread}$$

$$\text{capital gain}(t) = - D (\text{yield}_t - \text{yield}_{t-1})$$

Credit Spread



Spreads	USD	GBP	Euro	Yen	Other
AAA short	10	10	10	10	10
AAA med/long	33	33	33	33	33
AA short	25	25	25	25	25
AA med/long	52	52	52	52	52
A short	44	44	44	44	44
A med/long	73	73	73	73	73
BBB and lower	250	250	250	250	250



Defaults

Cumulative Historic Default Rates (in percent)

Rating category	Moody's		S&P	
	Muni	Corp	Muni	Corp
Aaa/AAA	0.00	0.52	0.00	0.60
Aa/AA	0.06	0.52	0.00	1.50
A/A	0.03	1.29	0.23	2.91
Baa/BBB	0.13	4.64	0.32	10.29
Ba/BB	2.65	19.12	1.74	29.93
B/B	11.86	43.34	8.48	53.72
Caa-C/CCC-C	16.58	69.18	44.81	69.19
Averages				
Investment grade	0.07	2.09	0.20	4.14
Non-investment grade	4.29	31.37	7.37	42.35
All	0.10	9.70	0.29	12.98

Source: U.S. Municipal Bond Fairness Act, 2008.



Simplifying assumptions

- 1) no defaults on government bonds
- 2) representative default rates for corporate bonds in the baseline scenario
- 3) default is 3 times more likely in the shocked scenario

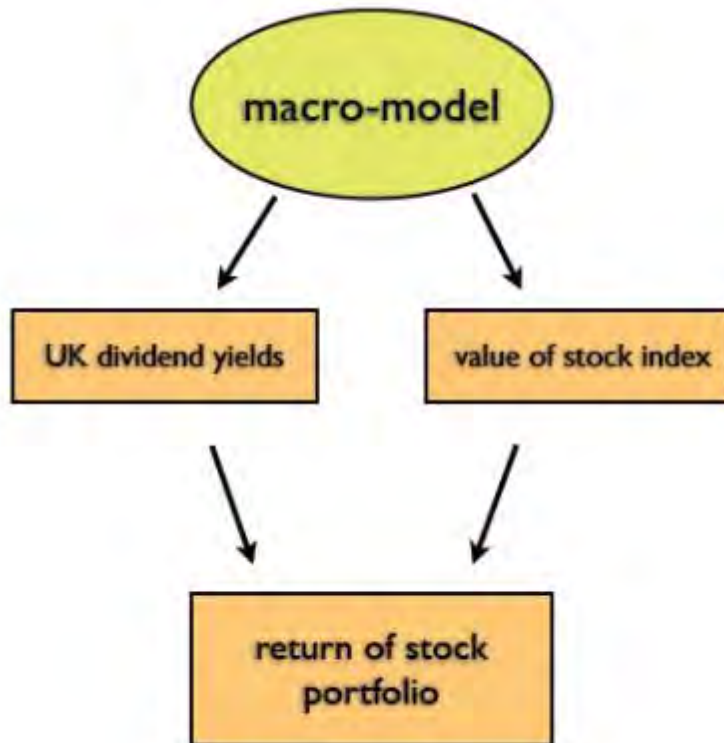
Estimation of Stock Returns

$$\text{return}_t = \text{dividend yield}_t + \text{capital gain}_t$$

$$\text{dividend yield}_t = \text{dividend payment}_t / \text{price}_t$$

$$\begin{aligned} \text{capital gain}_t &= (\text{price}_t - \text{price}_{t-1}) / \text{price}_{t-1} \\ &\sim \log(\text{price}_t) - \log(\text{price}_{t-1}) \end{aligned}$$

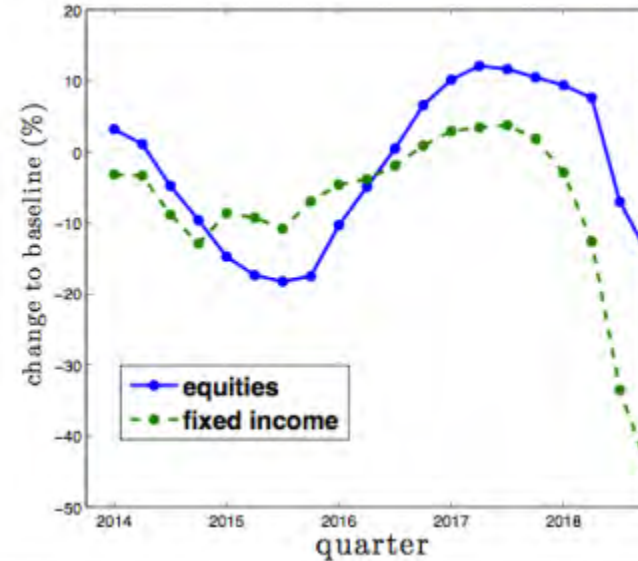
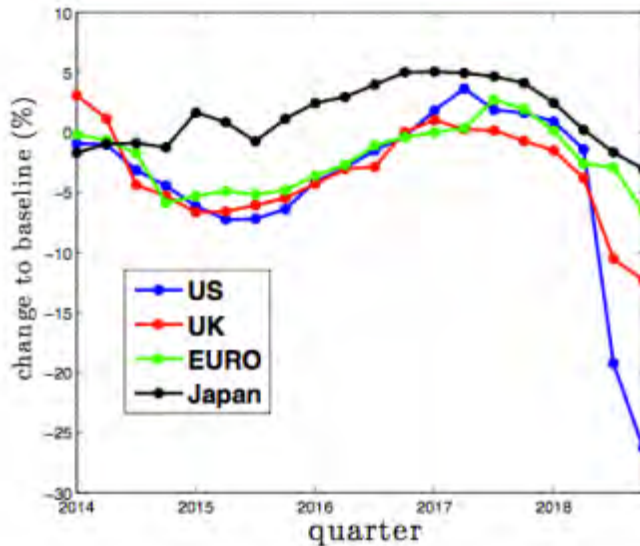
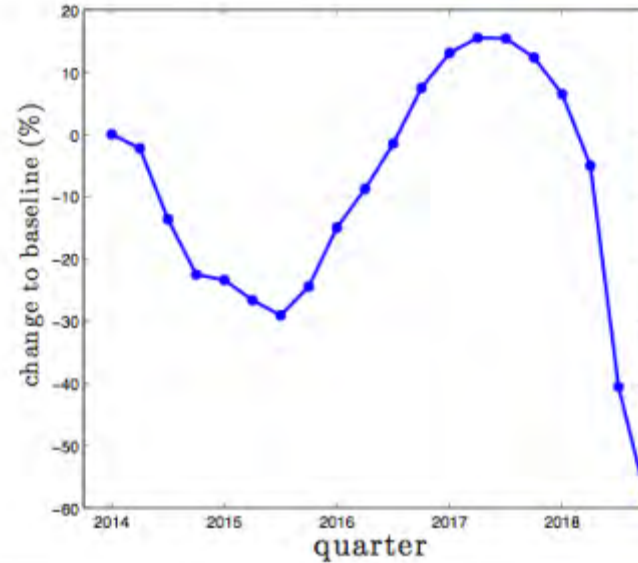
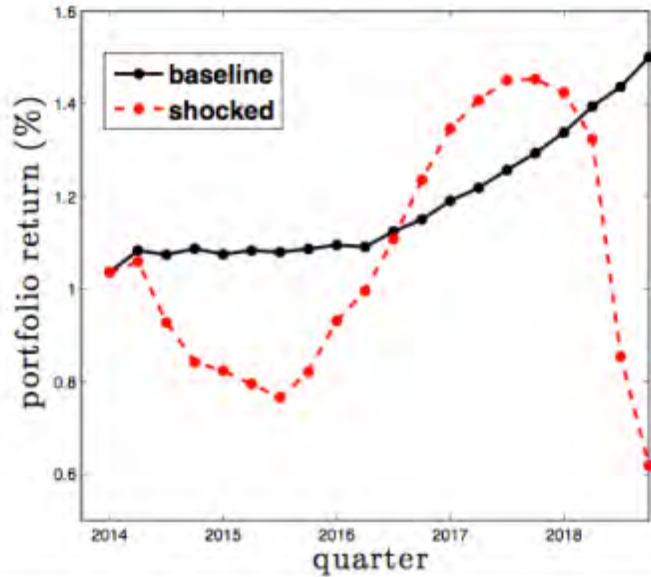
Stock Returns



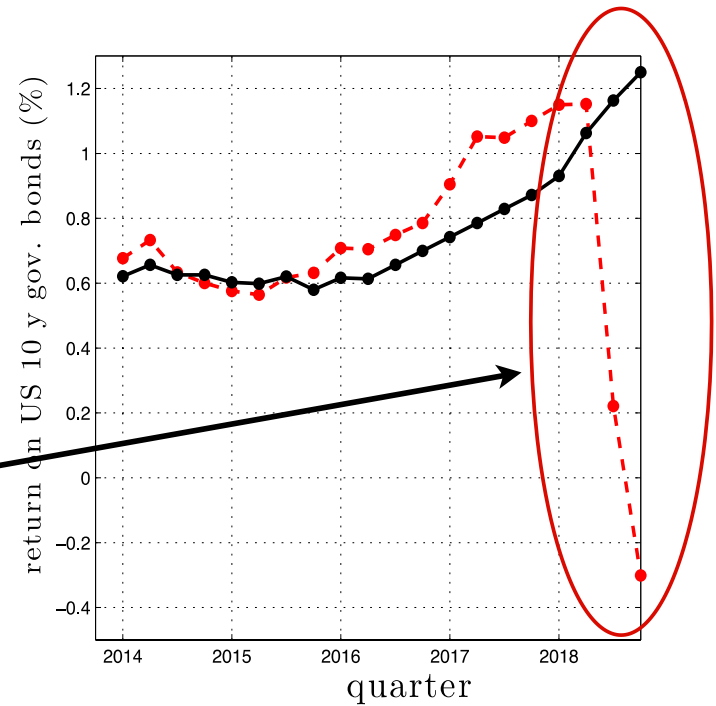
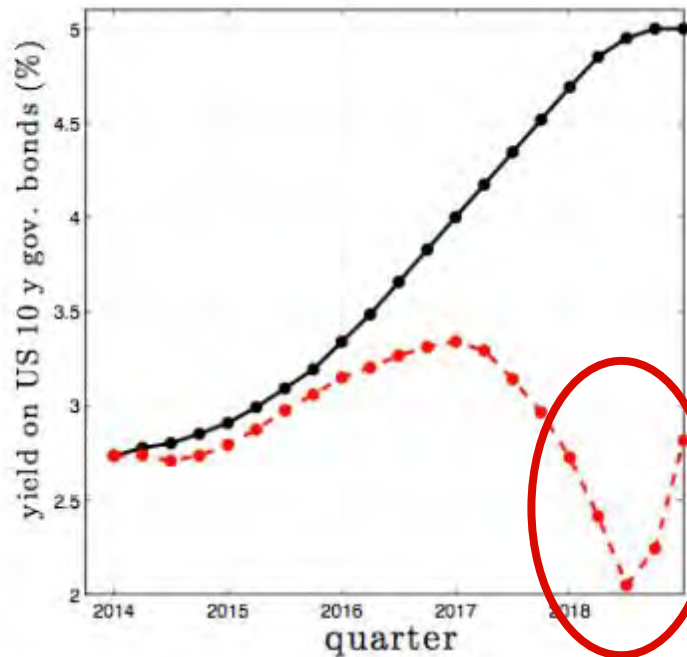
⚠ Simplifying assumptions

- 1) investment in stock indexes
- 2) no dividend payments for Japan in the shocked scenario
- 3) dividend yields for US ~ UK ~ Euro-zone

Portfolio Performance in SJ3 (S1)



US Government Bonds



sudden increase in bond yield
causes sharp drop in bond gain

How is the World Different After SJ3?

- Shift in the structure of the global economy
- SE Asia declines as a manufacturing powerhouse
 - Re-emergence of US & European manufacturing capacity
 - Emergence of new manufacturing centres in Brazil, India etc. & MINT countries
- China ‘wins’ - DeAmericanization of global economy
 - US is seen to have failed as global superpower
 - China emerges as a major military superpower
 - \$ no longer the refuge of ‘flight-to-safety’