Uniwersytet Ekonomiczny we Wrocławiu

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New types of risk – challenges to manage (un)known (un)knowns

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MAIN CHANGES ON FINANCIAL MARKETS – LAST 30 YEARS

- Globalization
- Technological progress (computers, telecom)
- Medialization
- Diversity and complexity of financial instruments
- Increase of the value of financial assets comparing to real assets
- Increasing role of financial decisions comparing to production decisions in companies
- Increase of wealth of households
- New types of risk

MAIN DRIVERS OF CHANGES IN LAST 30 YEARS

Political changes

Efficiency growth

Monetary policy – inflation targeting

Institutional changes – deregulation

Increasing wealth

Technological changes

MAIN DRIVERS OF CHANGE IN NEXT YEARS (DECADE OR QUARTER OF CENTURY)

Technological changes

Social and institutional changes

Economic changes

Geopolitics

Demographic changes

TECHNOLOGICAL CHANGES

Big Data

Algo trading

Blockchain technology

Robo advisors

Artificial intelligence

2011 – TOP FIVE RISKS

In view of LIKELIHOOD:

Storms and cyclones; Flooding; Biodiversity loss; Corruption; Climate change

In view of IMPACT:

Fiscal crises; Geopolitical conflict; Climate change; Asset price collapse; Extreme energy price volatility

2018 – TOP FIVE RISKS

In view of LIKELIHOOD:

Extreme weather events; Natural disasters; Cyberattacks; Data fraud and theft; Failure of climate change mitigation and adaptation

In view of IMPACT:

Weapons of mass destruction; Extreme weather events; Natural disasters; Failure of climate change mitigation and adaptation; Water crises

„NEW" TYPES OF RISK

Geopolitical risk

Climate risk

Digital risk

Media risk (headline risk)

Systemic risk

Extreme risk

Model risk (including reporting risk)

RISK MEASUREMENT – BASES

	Loss known	Loss not known
Distribution known	Credit risk	Market risk
Distribution not known	Operational risk	Catastrophe risk

POSSIBLE DECOMPOSITION OF RISK VARIABLE

In negative concept continuous risk variable is often decomposed into frequency and severity „parts”:

$$L = PD \cdot LGD$$

Used for most types of risk (except for market risk)

MARKET RISK MEASUREMENT – SINGLE VARIABLE

Two general approaches:

- **Distribution of risk variable as the main framework**
- **Function of dependence of risk variable on risk factors (also can give distribution of risk variable)**

$$L = f(X_1, X_2, \ldots, X_m)$$

MARKET RISK MEASUREMENT – SINGLE VARIABLE

Two classes of measures:

- **Based on distribution of risk variable**
- **Sensitivity measures**

MARKET RISK MEASUREMENT

Distribution based measures:

- **Volatility measures**
- **Distribution function value**
- **Quantile based measures (e.g. Value at Risk family)**

MARKET RISK MEASUREMENT

Sensitivity measures:

First derivative with regard to risk factor

Sometimes supplemented with second derivative

Examples:

- **Duration and convexity, key rate duration, DV01, PVBP**
- **Beta**
- **Greeks for options**

EXTREME RISK MEASUREMENT

Extreme Value Theory:

Tail distribution can be approximated by Generalized Pareto distribution, then:

$$E(X-u|X>u)=\frac{\beta u}{1-\xi}+\frac{\xi}{1-\xi}u, \qquad \xi<1$$

EXTREME RISK MEASUREMENT

Tail dependence coefficient

$$\lambda_U = \lim_{u \to 1} P(X_2 > G^{-1}(u) \mid X_1 > F^{-1}(u))$$

OTHER APPROACHES IN RISK MEASUREMENT

Scenario analysis

Stress testing and reverse stress testing

MESSAGE

Risk should be evaluated (measured) as „deviations” (negative) from the objective (if there are any)

For example:

- How likely is that the desired retirement capital will be achieved?

- What is the threat that earnings of the company will be lower than planned?

(GEO)POLITICAL RISK

Many different approaches to define and to measure

Subjective judgement plays important role

Examples:

Business Environment Risk Intelligence (BERI) Political Risk Index

Economist Intelligence Unit (EIU) Political Instability Index

EURASIA's Global Political Risk Index

INTERNATIONAL COUNTRY RISK GUIDE – POLITICAL RISK INDEX

Voice and Accountability
- **Military in politics**
- **Democratic accountability**

Political Stability and Absence of Violence
- **Government stability**
- **Internal conflict**
- **External conflict**
- **Ethnic tensions**

Government Effectiveness
- **Bureaucratic quality**

Regulatory Quality
- **Investment profile**

Rule of Law
- **Law and order**

Control of Corruption
- **Corruption**

GEOPOLITICAL RISK – ONE PROPOSAL

Dario Caldora and Matteo Iacoviello, FRB

Definition:

Geopolitical risk as the risk associated with events such as wars, terrorist acts and political tensions that affect the normal and peaceful course of international relations

Proposal – GPR index

GEOPOLITICAL RISK INDEX

GPR index counts the occurrence of words related to geopolitical tensions in leading newspapers

GPR index reflects automated text-search results of the electronical archives of 11 national and international newspapers:

The Boston Globe, Chicago Tribune, The Daily Telegraph, Financial Times, The Globe and Mail, The Guardian, Los Angeles Times, The New York Times, The Times, The Wall Street Journal, The Washington Post

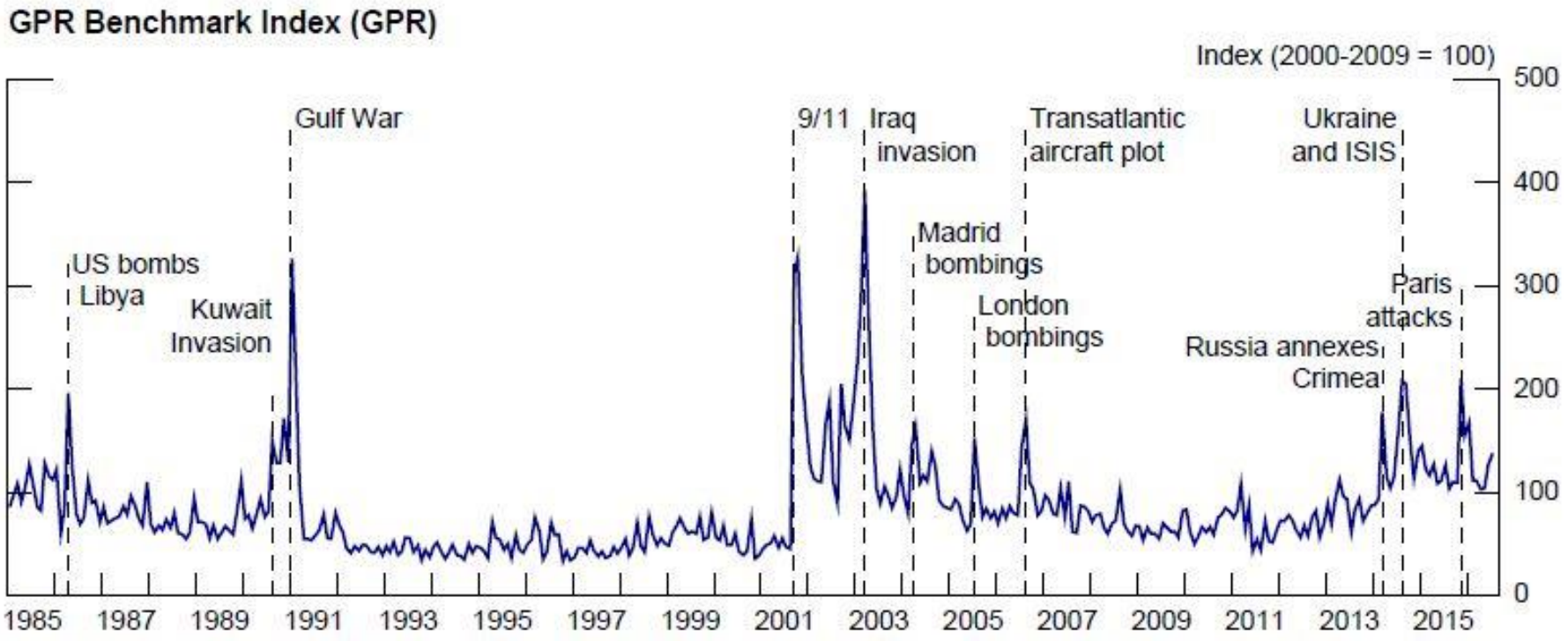
GEOPOLITICAL RISK INDEX

The index is calculated by counting the number of articles related to geopolitical risk in each newspaper and for each month (as a share of the total number of articles). The index is then normalized to average a value of 100 in the 2000-2009 decade

Search categories:

Geopolitical Risks, Bilateral Regional Threats, War or Military Risks, Nuclear Threats, Terrorist Threats, Beginning of War, Life Cost of War, Terrorist Attacks

GEOPOLITICAL RISK INDEX



MODEL RISK

Risk resulted from the deviations of the model from reality

Risk resulted from the errors in the model used in real world

MODEL RISK

Merton (1997):

At times we can lose sight of the ultimate purpose of the models when their mathematics become too interesting. The mathematics of financial models can be applied precisely, but the models are not all precise in their application to the complex real world. Their accuracy as a useful approximation to that world varies significantly across time and place. The models should be applied in practice only tentatively, with careful assessment of their limitations in each application

MODEL RISK – CLASSIFICATION

Uncertainty with regard to the structure of the model

Uncertainty with regard to the parameters of the model

Uncertainty about the application of the model

MODEL RISK – EVALUATION

Justifiability of assumptions

Market analysis

Estimation errors

Sensitivity analysis

Back testing

Stress testing

Scenario analysis

Monte Carlo simulation

MODEL RISK – CONSTRAINTS

Lessons from unmanaged model risk in the past:

- **Robustness to changes of market conditions (LTCM)**
- **Transparency for end user (Enron)**

DRAWBACKS

Investment horizon is shorter

Frequency of transactions is higher

Time of information analysis is shorter

Pressure on short term effect is shorter

Risk management often becomes less professional

CHALLENGES

Interdisciplinary approach

Combination of historical data and forward-looking expectations

Many non quantifiable types of risk (generation of stress scenarios)

Regulations – too less or too much

Education

CHALLENGES

Ultimate recipient of risk is household – transparent solutions

Strategic thinking: changes in economy (sharing economy), job automation, generation Z

THANK YOU !!!!!

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