Centre for Risk Studies

5th Risk Summit: Special Topics Seminar

A System of Systems Approach for Understanding Risk

Andrew Skelton Risk Researcher



A System of Systems Approach

Global communications system

Global environmental system

Global production system

Global financial system

Global society

Global transportation system



A System of Systems Approach











Mining and extraction

Infrastructure supply chains?



Food supply chains?

Global Production System: Top-Down Data

Data source: Eora Multi-Regional Input-Output Database (see Lenzen et al. 2012)



Brazil Latin America US Canada UK France Germany Spain Italy Western Europe Eastern Europe & FSU China India South East Asia Japan Australia Western Pacific Middle East & N. Africa Sub-Saharan Africa

160,000 transactions among 400 domestic sectors

USA

JPN

exports

to USA

160,000 transactions: 400 sectors exporting to 400 sectors

> 160,000 transactions among 400 domestic sectors

Time series 1990-2011 187 countries, 16,000 sectors in total >250m data points per year

JPN

National GDP (nominal USD)

\$10 trn

Global Supply Chains in IO Data



Global Production System: Bottom-Up Data



Linking Levels by Stochastic Disaggregation

Global production system



UNIVERSITY OF CAMBRIDGE Judge Business School

Centre for Risk Studies Each enterprise characterised as a set of segments which map to specific countries & sectors

Interdependence between enterprise segments and the wider economy is treated stochastically to reflect uncertainty over inputs and outputs

Approach provides a Multi-Enterprise Multi-Regional Input-Output (MEMRIO) modelling framework

Can be used to explore the propagation of shocks through the global supply chains of major enterprises

Global Financial System



Bottom-up major bank network

Image: IMF Working Paper 11/74 Data source: BIS



Centre for Risk Studies 0

A System of Systems Approach

Global production system



Global communications system Global environmental system Loans / deposits Stock / dividends **Global society Global transportation** system

Global financial system





Centre for **Risk Studies**



Andrew Skelton as858@cam.ac.uk