

20/11/2015

Background

1. Long-term environmental stress: more influence on health than capital
2. Direct effect: damages to 'stock', unit/stage-damage functions; Indirect effect: damages to 'flow' (health effects, inter-industrial/regional linkages), input-output (I-O)
3. PM_{2.5} concentration Beijing 2013: 40 times higher than WHO standard
4. Serious health effect & high population density: high vulnerability

Methodology:

emission-health-economic interdisciplinary research

1. Integrated exposure-response (IER) model

a. mortality: For $z < z_{cf}$ $RR_{IER}(z) = 1$ and For $z \geq z_{cf}$ $RR_{IER}(z) = 1 + \alpha \{1 - \exp[-\gamma(z - z_{cf})^\delta]\}$
 b. $PAF = 1 - 1/RR$
 c. $E = PAF \times B \times P$
 morbidity: $RR = e^{\beta x}$

2. Labor time loss estimation

- a. provincial to labor mortality & morbidity counts
- b. labor to industrial mortality & morbidity counts
- c. industrial labor time loss as indicator for value added change (input for I-O model)

3. Supply-driven I-O model

Industrial implications $x' = i'Z + v'$ or $x' = Bx + v'$ when $G = (I - B)^{-1}$ $x = G'v$ and $\Delta x = \Delta v'G$

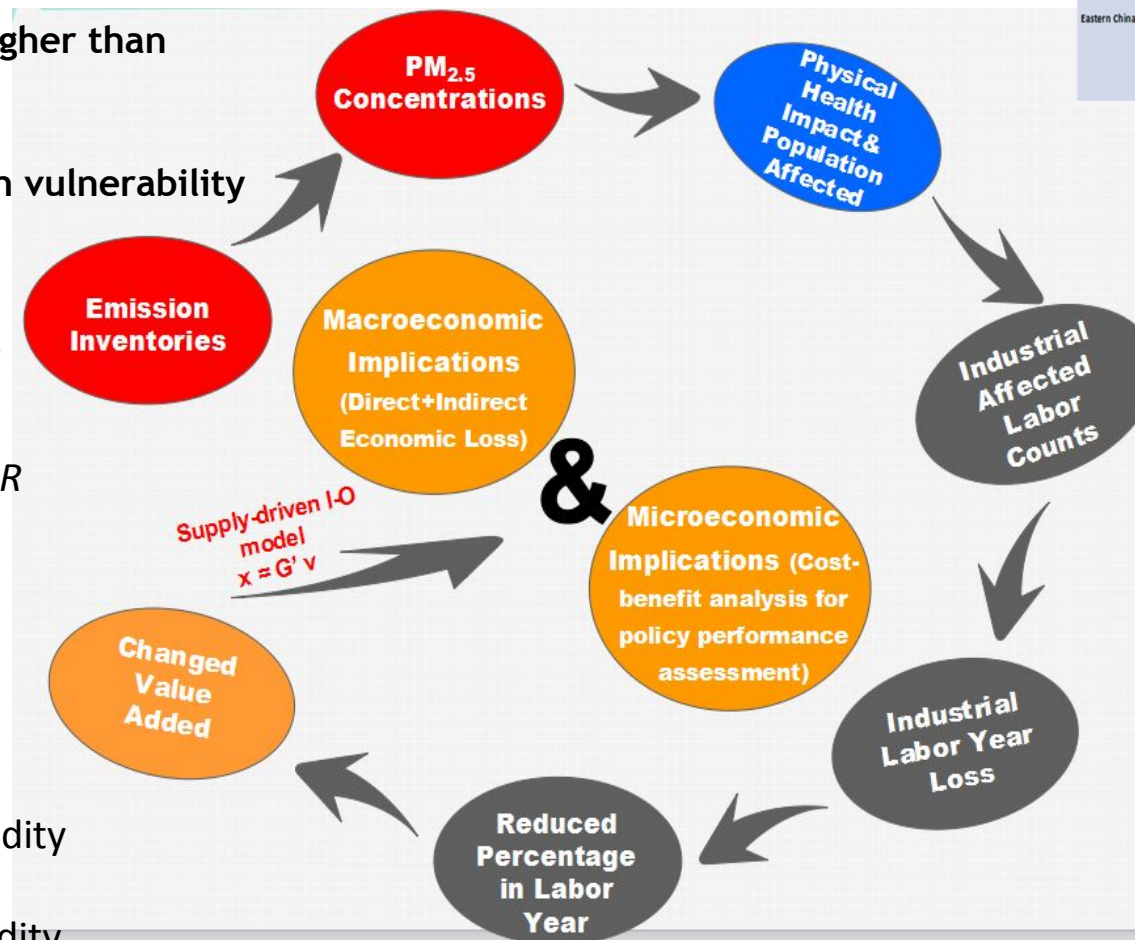
Economic consequence

Findings

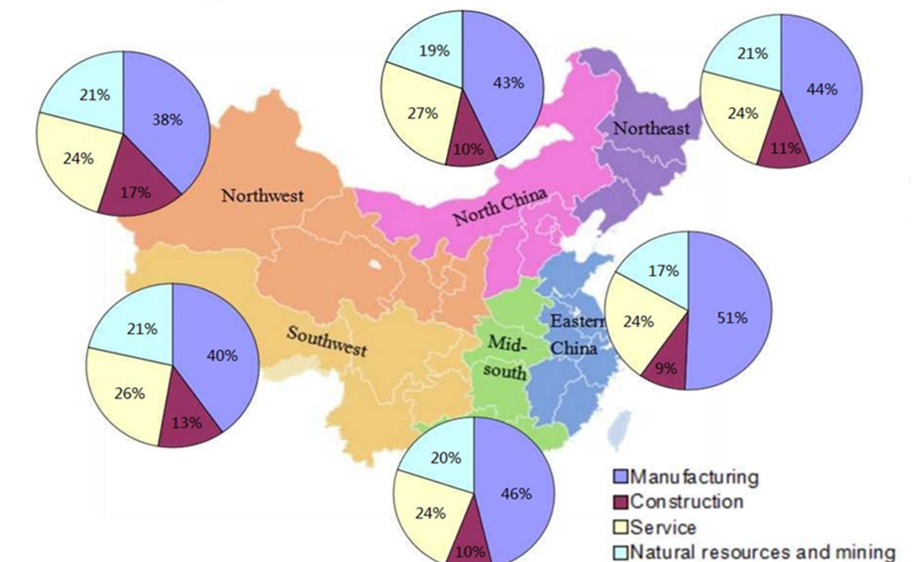
1. Total, regional, provincial economic losses Jiangsu and Shandong provinces suffered most and total economic losses reached **346.26 billion Yuan in 2007, ~1.1% of GDP** and annual GDP for Vietnam in same year

Regions	Location	Province	Provincial Total (Direct+Indirect) Loss (billion Yuan)	Percentage of GDP (%)	Provincial Labor Year Loss (%)	Region of Labor Year Loss (%)	Regional Direct Economic Loss (billion Yuan)	Regional Total (Direct+Indirect) Loss (billion Yuan)	Percentage of GDP (%)
North China	[Map]	Beijing	1179	0.04	0.02				
		Tianjin	8.84	0.03	0.71				
		Hebei	2345	0.07	0.89	2.68	24.00	52.86	0.17
		Shangri	5.77	0.02	0.46				
		Neimenggu	3.01	0.01	0.20				
Northeast	[Map]	Liaoning	1118	0.03	0.39				
		Jilin	4.12	0.01	0.32	0.93	7.96	18.95	0.05
		Heilongjiang	3.85	0.01	0.22				
Eastern China	[Map]	Shanghai	1819	0.06	0.39				
		Jiangsu	5590	0.17	0.67				
		Zhejiang	2384	0.07	0.36				
		Anhui	1079	0.03	0.71	2.58	67.41	115.33	0.35
		Fujian	6.61	0.02	0.25				
		Henan	9.00	0.02	0.33				
		Shandong	4771	0.14	0.84				

2. Manufacturing has greater vulnerability to labor time loss in coastal regions In the Northwest and Southwest, the reduced value added had the greatest impact on the construction sector

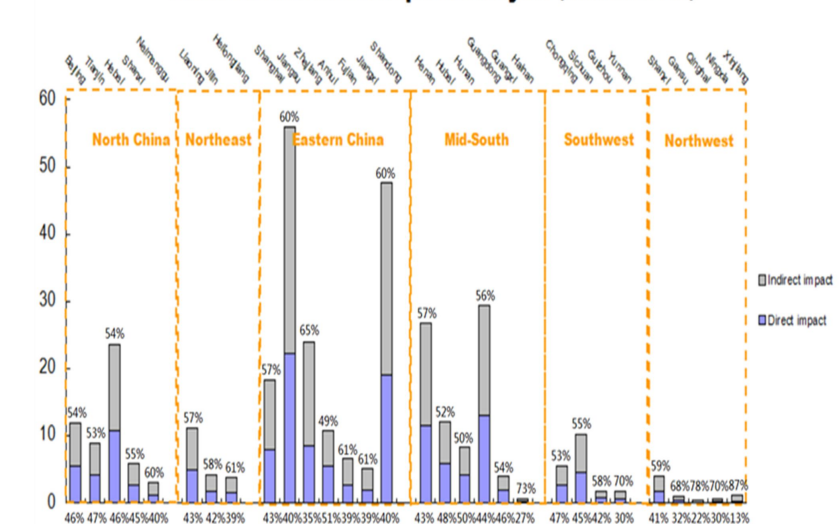


Regional Economic Loss by Sectors - China 2007



3. Indirect economic losses outweigh direct losses across almost all 30 provinces

Direct and Indirect Impact Analysis (billion Yuan)



Policy insights

- a. Indirect economic loss outnumber direct economic loss and thus, it is important to consider inter-industry/regional relationships
- b. It is crucial to consider labor constraints on production capacity, especially in the face of disruptive events with long-term impacts on human health
- c. Integrating risk analysis, impact analysis and dependency analysis is significant for developing effective post-disaster economic recovery strategies and more sustainable policies
- d. Give a favor to current industrial structure reforms, moving towards less-labor intensive sector focus