

Industrial Structural Change and the Shifts in Comparative Advantages in Globalized Production

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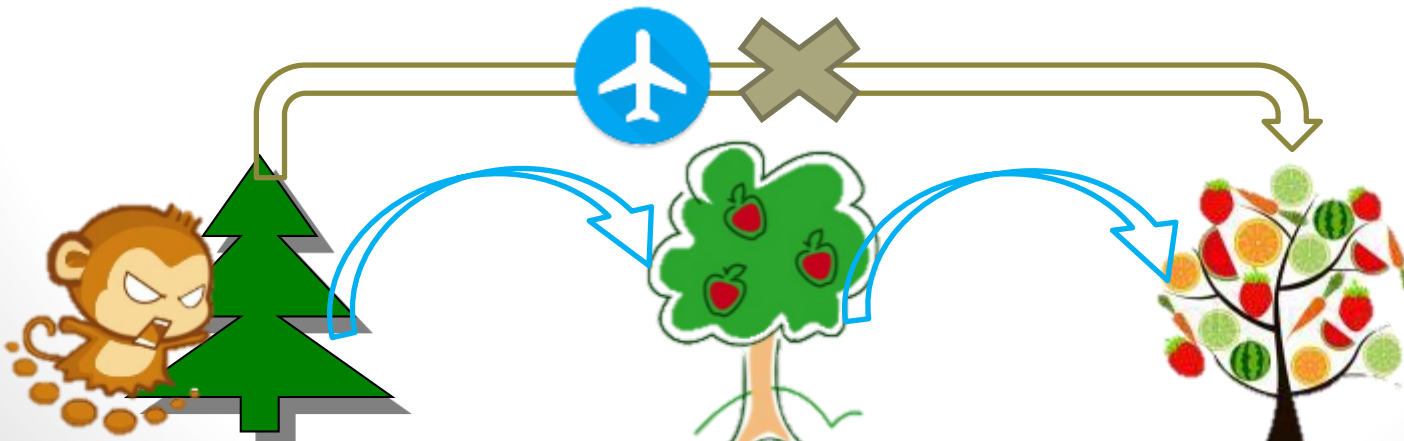
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Structural Upgrading

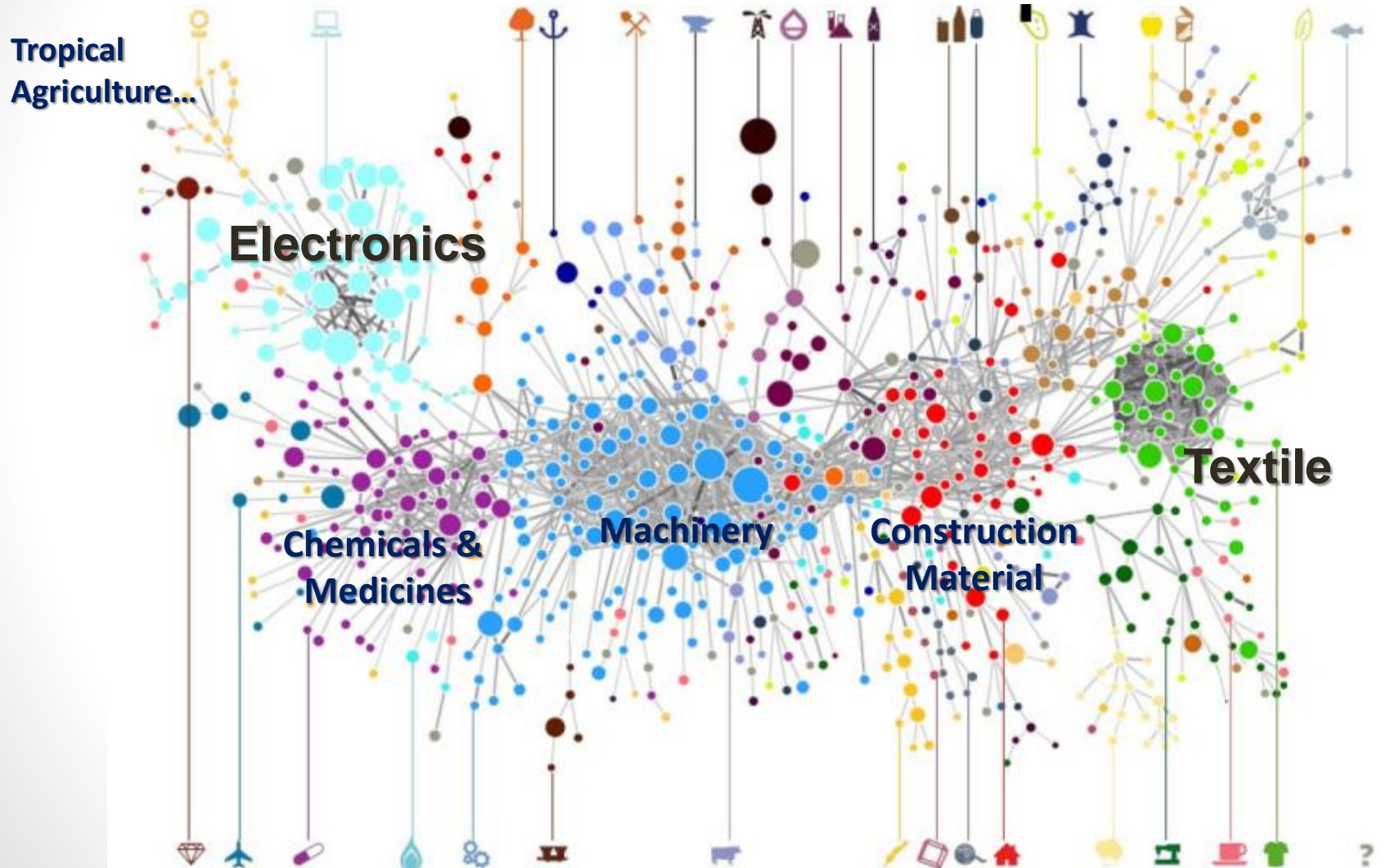
- What is the potential paths for structural upgrading? What can the government do to stimulate the process?
- Classic View: A gradual shift of economic structure across sectors
 - Agriculture -> Light Industry -> Heavy Industry -> Advanced Manufacturing & Services
- Recent: Identification the potential structural upgrading paths
- All focused on *industry* or *products*
 - Challenged in the new paradigm of Globalized Production with Pervasive offshoring and the Specialization at Task Level.

Structural Change, the Old Paradigm

- Gradual Shift of the comparative advantage in Industries/Products.
- “The Product Space”, Hidalgo et al (2007)
 - Structural Change is Path Dependent
 - Future development depends on what you are currently strong at
 - Methodology: Estimate the *relatedness* between products and identify the feasible paths through which a country can upgrade.
- The Jumping Monkey Analogy
 - Trees produce different amounts of fruit
 - Monkeys love the tree providing highest quantity of fruit
 - A monkey can only jump towards new trees that are close enough to the tree that it currently lives in.



The Product Space (Hidalgo et al. 2007, updated version)



Challenge from Globalized Production & Offshoring: A new paradigm for structural upgrading

- The nature of structural change has changed.
 - Actual tasks that take place \neq the goods produced & exported
- Different tasks within the value chain of a single product can be very different. But they may be captured by a same industry code.
 - Electronics industry might mean:

California:	Design & Software
Japan & Korea:	Making Chips
Ireland:	Accounting & Software
China:	Assembly
- Upgrading should be analysed in terms of tasks, structural change in products/industries can give misleading results.

Different industries may share similar tasks

- Under offshoring, relatedness between industries becomes less meaningful.
- Electronics industry highly similar with textile... if it's just assembly...



- Textile in China \approx Electronics in China... Short cut for being successful?
- Electronics in China \neq Electronics in USA. Very different tasks!
- I explore the paths of structural upgrading in a ***task perspective***
 - Measuring the “***relatedness***” between different ***tasks***.
 - “Product Space” Hidalgo et al (2007) -> “***Task Space***”

Measuring Relatedness in Tasks

- Probability of Co-existence in Task's RCA (revealed comparative advantage) as the measure for Relatedness
- $\phi_{x \rightarrow y} = \text{Prob}(RCA_{i,y} > 1 | RCA_{i,x} > 1)$
- $\phi_{x \rightarrow y} = \frac{\text{Number of Countries with } RCA_y > 1 \text{ and } RCA_x > 1}{\text{Number of Countries with } RCA_x > 1}$
- Intuitions:
 - Measurement of Revealed Relatedness
 - Similarity in socio-economic environment nursing both tasks
- Product Relatedness in Hidalgo -> Task Relatedness
 - Gross Export based RCA -> **Value-added Export by each Task**

$$RCA_{i,x} = \frac{VAE_{i,x} / \sum_x VAE_{i,x}}{\sum_i VAE_{i,x} / \sum_{i,x} VAE_{i,x}}$$

From Product based framework to Task Based

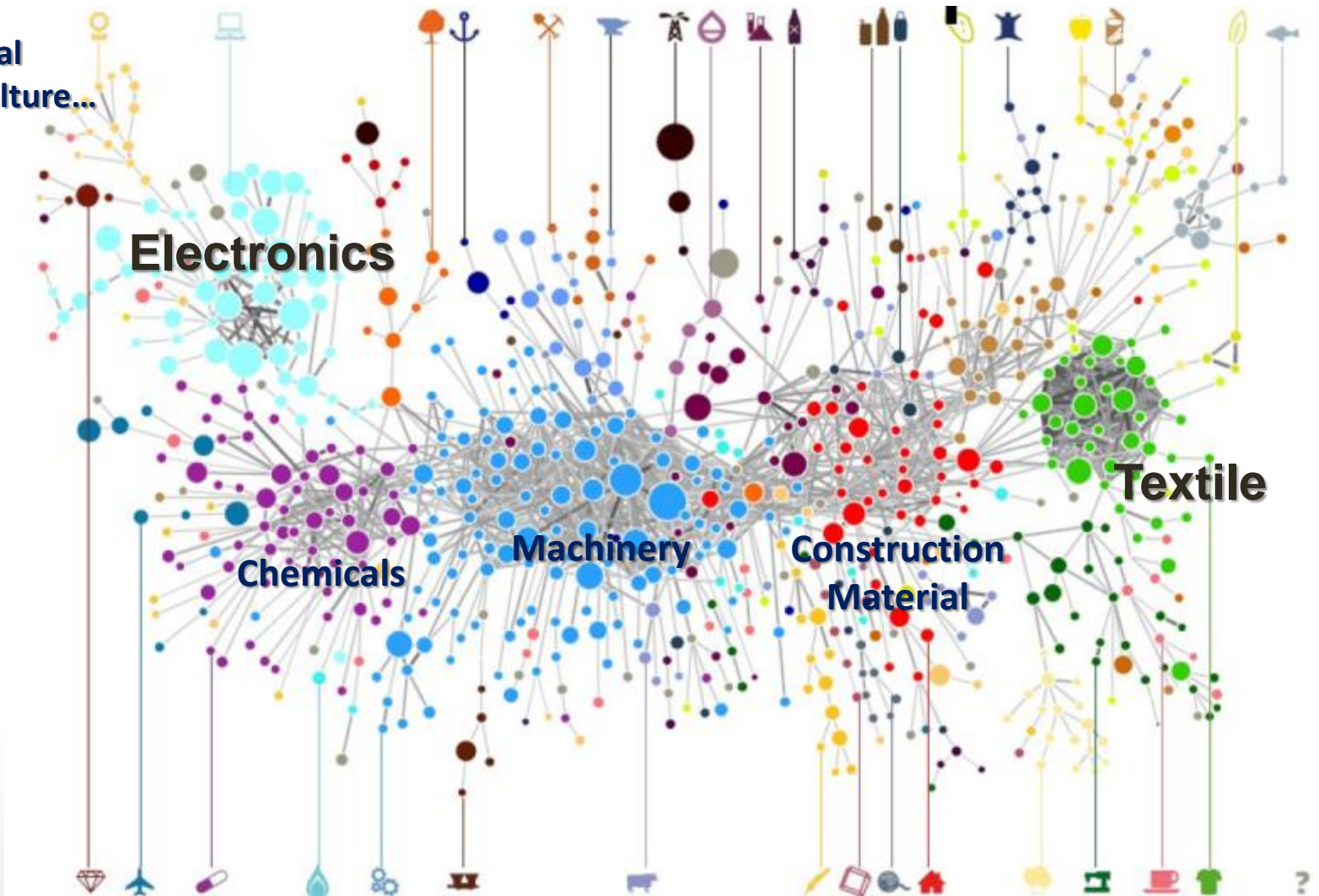
“What have you exported” -> “What did you do”

- Preferable data: Actual Tasks
 - i.e. the exact occupations in each country/industries
 - Not (yet) available. Groningen is currently working on it.
- Definition for a task: Activities in an industry that are performed by labour at different skill levels (low-, medium- and high-skilled)
 - Measuring RCA using *Value-Added Export*: The value added generated by a certain task that is finally absorbed as final use outside of the country.
 - Method: Johnson & Noguera (2014) “Value Added Export”, then decompose into the contribution by different skilled employment.
 - Data Source: World Input-Output Tables (www.wiod.org)
- Two Important Features
 - 1. Exclude Imported Intermediates
 - 2. Include indirectly exported content
 - The first time to analyze the tasks in supportive services sectors and their role in structural change

Structure of Relatedness: Product Space

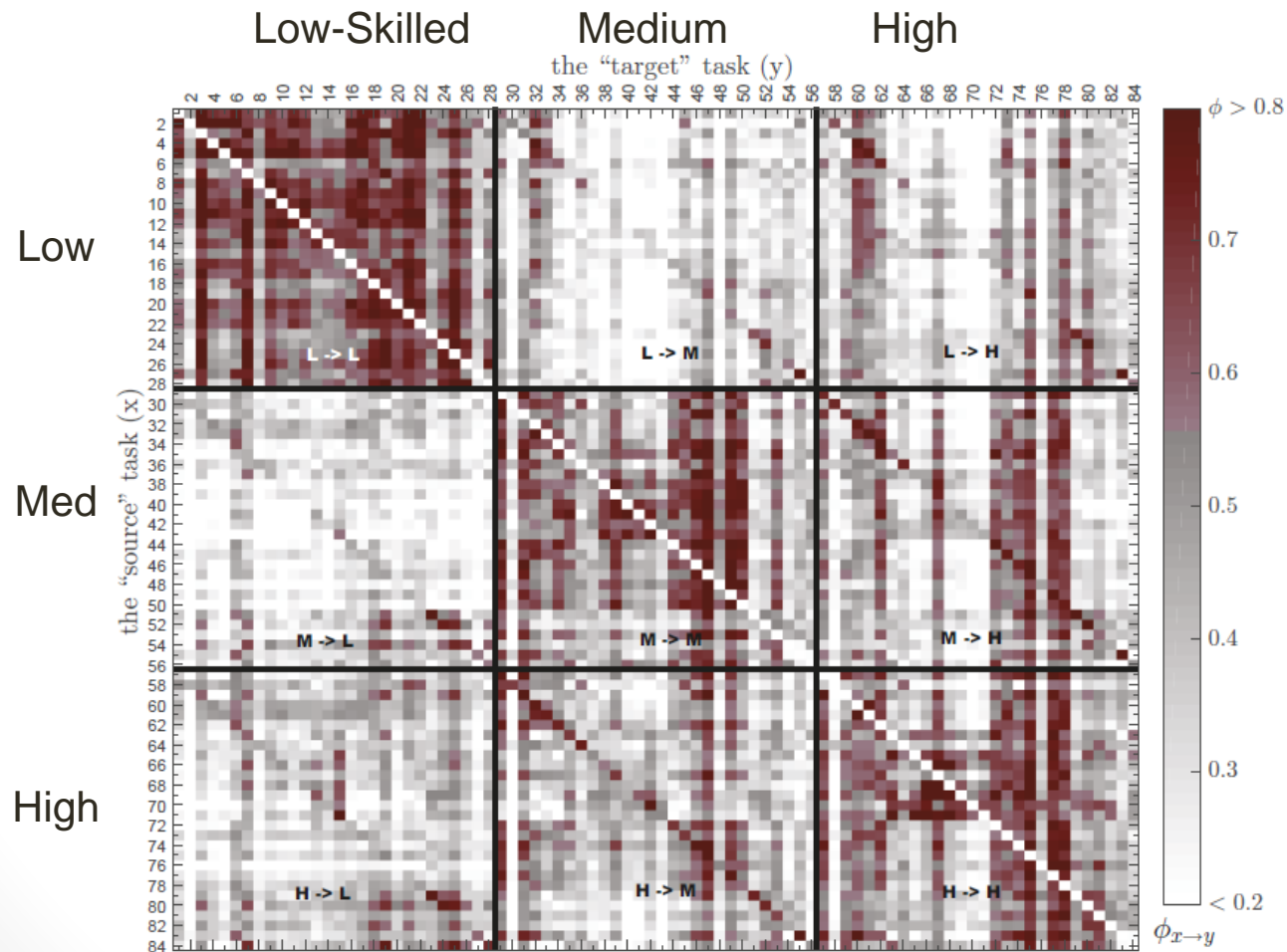
- Products form clusters by Industry

Tropical
Agriculture...

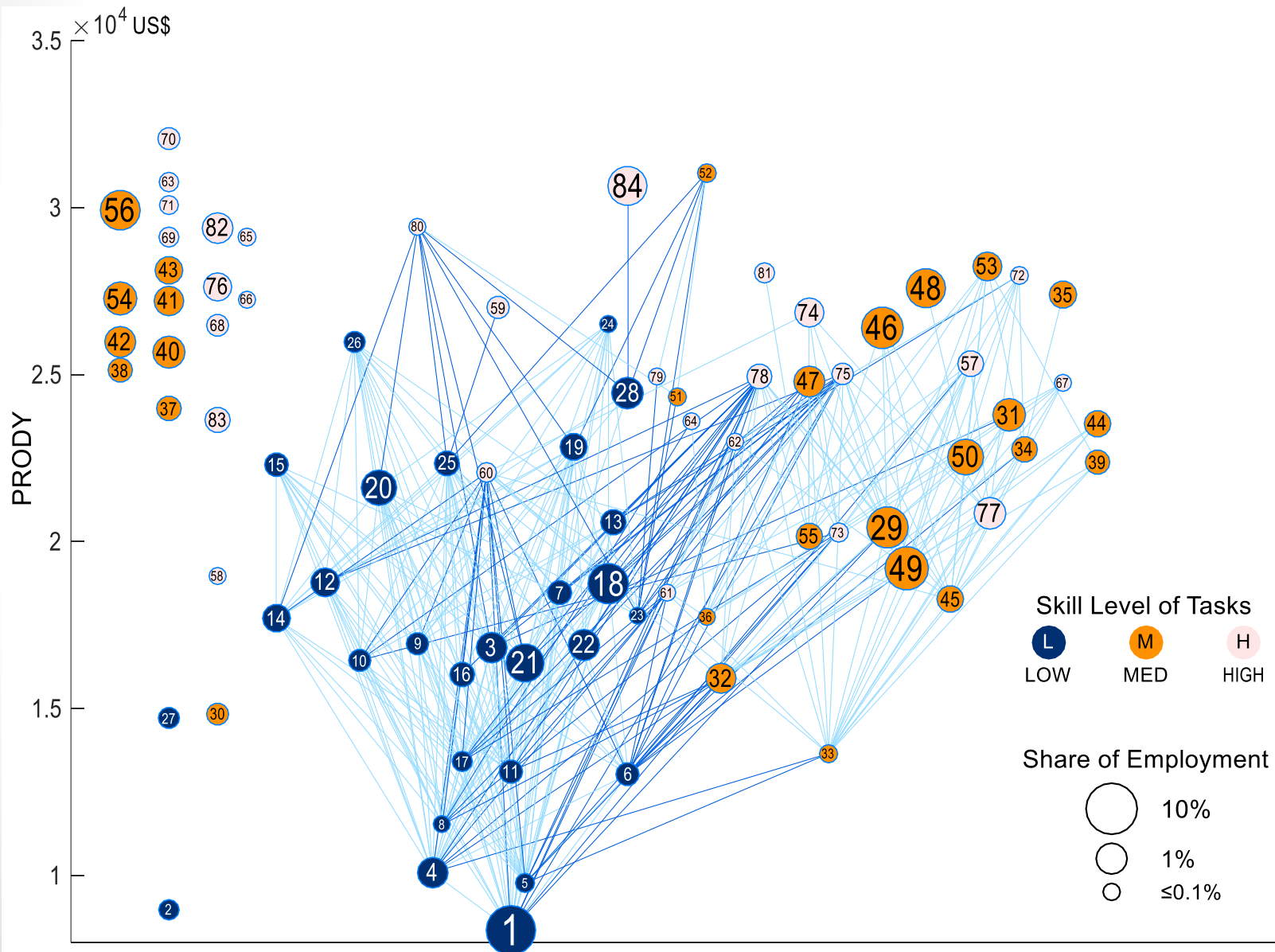


Structure of Relatedness: Task Space

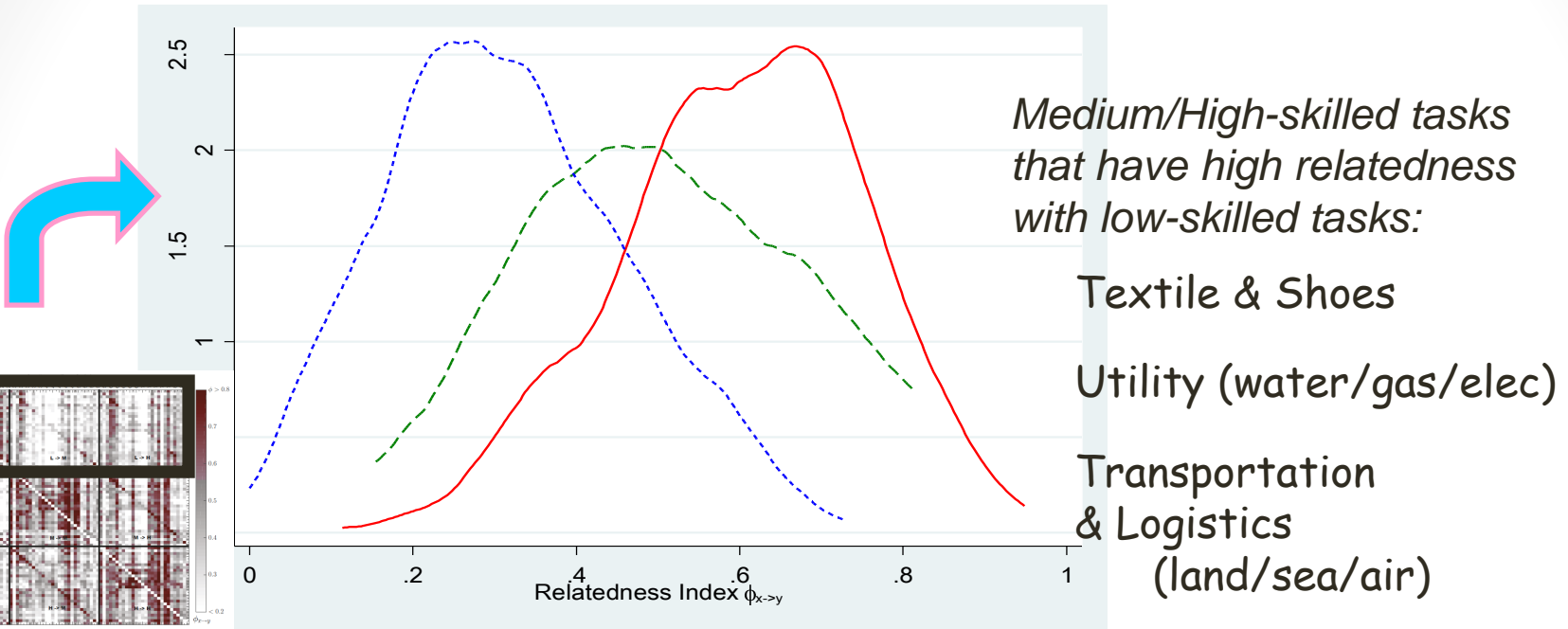
- A task is, in general, more closely related with other tasks at a same skilled level. This is especially the case for low-skilled
- Heatmap of relatedness $\phi_{x \rightarrow y} = \text{Prob}(RCA_{i,y} > 1 | RCA_{i,x} > 1)$



Structure of Relatedness: Task Space



Structure of Relatedness: Task Space



- Relatedness between low-skilled tasks
- - - Upgrading from Low- to medium or high-skilled tasks within an industry
- ... Upgrading from Low- to medium or high-skilled tasks in another industry

Findings from the relatedness structure

- All kinds of low-skilled tasks are highly related.
- “Horizontal upgrading”: Shift low-skilled employment from traditional industries to the global value chains of manufacturing
 - Easy, Large gain gains in the short-run
 - Questionable for the long run: Not opening the door for skill upgrading
- Med/High-skilled tasks in sophisticated manufacturing sectors
 - Most attractive (according to the PRODY index in Hausmann et al)
 - But difficult to enter
- Some medium/high-skilled services highly related with low-skilled tasks
 - Mostly on logistics and utility industries
 - Suggesting a potential complementarity between low-skilled manufacturing activities & international trade

Econometrics Tests: the Role of Relatedness in Determine The direction of Structural Upgrading

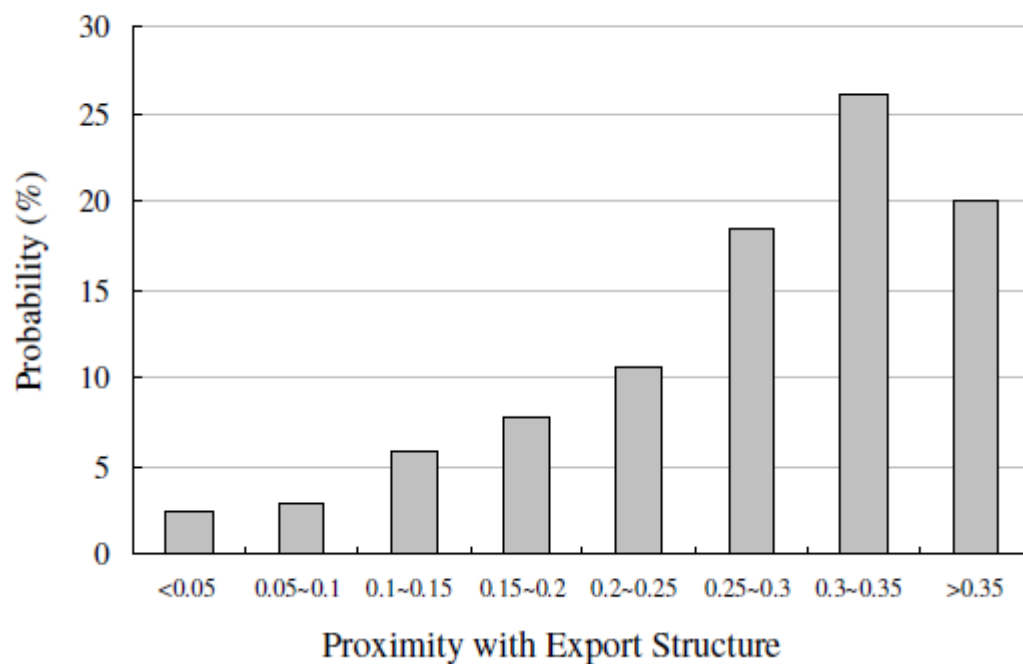
- Estimating the probability that a country develops a new comparative advantage in a certain task, between 1995 & 2007
- ϕ is the (overall) proximity indicator of a new activity with the current comparative advantageous tasks in the country.

I - Main Results

	Baseline		Use ϕ_x^{\max}	Both	Symetric Relatedness		Developing Econ	
	(1)	MEF	(1a)	(1b)	(2)	MEF	(3)	MEF
$\phi_{x,i}$	3.593	0.215		3.948	4.788	0.283	2.767	0.234
	0.625***	0.044***		0.843***	0.807***	0.057***	0.753***	0.067***
$\phi_{x,i}^{\max}$			1.363	-0.353				
			0.418***	0.560				
Potential ₉₅	1.443	0.086	1.625	1.388	1.440	0.085	1.182	0.100
	0.223***	0.013***	0.234***	0.238***	0.222***	0.013***	0.275***	0.022***
RCA ₉₅	3.300	0.198	3.128	3.342	3.289	0.195	3.205	0.271
	0.309***	0.026***	0.307***	0.317***	0.310***	0.026***	0.382***	0.039***
Const.	-3.649		-3.789	-3.506	-3.767		-3.360	
	0.218***		0.307***	0.312***	0.230***		0.261***	
R^2	0.260		0.236	0.260	0.262		0.248	
Obs.	1646		1646	1646	1646		843	
# Positive	131	(7.69%)	131	131	131		77	(9.12%)

Economic significance



Figure 8: Probability of Gaining a Comparative Advantage (95–09)



Does the existence of a Comparative Advantage in Low-skilled task provide “extra help” in upgrading towards higher-skilled?

- No support.

II - Testing Vertical Upgrading

	M&H Tasks, All Observations				M&H Tasks, Developing Countries			
	(4a)	(4b)	(4c)	(4d)	(5a)	(5b)	(5c)	(5d)
$\tilde{\phi}_{x,i}$	4.025	4.246	4.102		2.732	3.222	3.135	
	0.795***	0.815***	0.806***		0.988**	1.040**	1.036**	
Potential ₉₅	1.499	1.615	1.553	1.380	0.989	1.175	1.155	0.973
	0.304***	0.318***	0.318***	0.308***	0.410*	0.432**	0.043**	0.422*
RCA ₉₅	3.159	3.242	3.191	3.149	2.902	2.986	2.939	3.001
	0.347***	0.353***	0.351***	0.343***	0.433***	0.437***	0.434***	0.432***
 RCA _L		-0.069				-0.103		
		0.052				0.068		
 IsRCA _L			-0.076	0.021			-0.232	-0.077
			0.126	0.122			0.177	0.167
Const.	-3.680	-3.701	-3.688	-2.968	-3.170	-3.236	-3.217	-2.675
	0.263***	0.263***	0.263***	0.203***	0.327***	0.333***	0.331***	0.263***
R ²	0.208	0.210	0.208	0.171	0.173	0.180	0.178	0.154
Obs.	1098				541			
# Positive	107	(9.7%)			61	(11.3%)		

Recap & Discussion

- “Task Space” very different from “Product Space”
 - Task highly related with other tasks in other industries at the same skill level
 - Low relatedness between tasks at different skill levels.
- Many developing countries are successful in entering “prestigious industries” (e.g. electronics in various Southeast Asian Countries)
 - But: Perform the low-skilled tasks in global value chain
 - Relatively large gain in the beginning, but may not be sustainable
- “Climbing up the value chain” might be difficult
 - Jarreau and Poncet (2012), Lemoine and Unal-Kesenci (2004)
 - Lee and Tang (2015): Chinese domestic content in electronics export increase, but our data suggest most increase still in low-skilled content
 - Careful choice in entering a global value chain (Lin and Monga’s “latent comparative advantage”, but old paradigm doesn’t work)
- Next Step: Data on Occupation per Industry (coming soon)