Economic Integration and Structural Change

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Main Questions

- What characterizes structural change?
  - i.e. how does the allocation of resources across sectors change with development?
  - This is a classic question in economics, going back at least to Kuznets (1966)
- What determines structural change?
  - What forces affect changes in sectoral structure?
  - Also a classic question (Chenery, Robinson and Syrquin, 1984)
- These issues are of renewed policy relevance:
  - Effect (?) of China's emergence on US and EU manufacturing employment
  - Renewed calls for an "industrial policy" in developing countries

A Robust Fact on Structural Change

- Countries go through stages of diversification
  - Imbs and Wacziarg (2003).
- Stages are relevant over and beyond AGR - MFG - SER transition.
- Non monotonicity intriguing - and unexplained

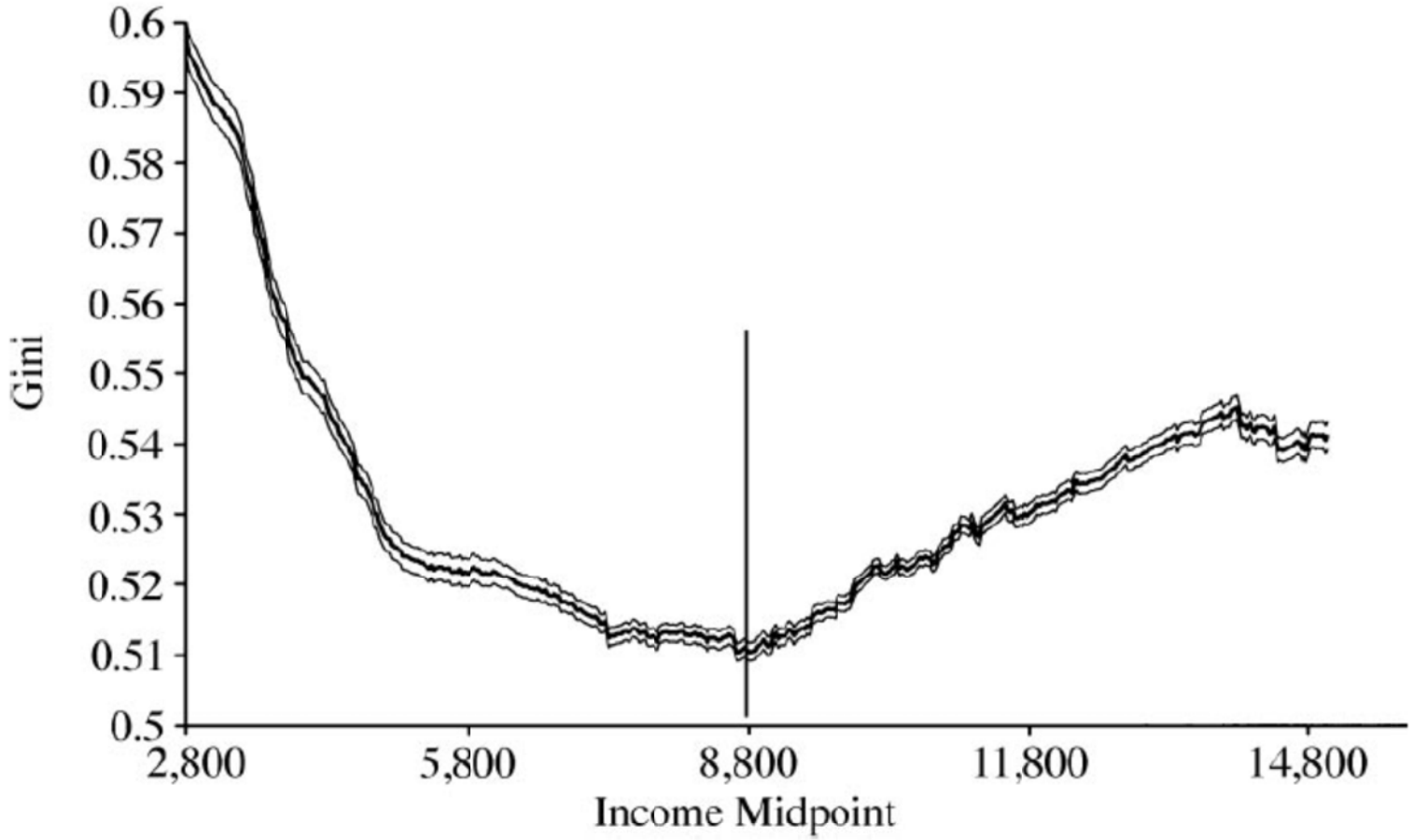


FIGURE 2. ESTIMATED CURVE (NONPARAMETRIC)—GINI INDEX—UNIDO 3-DIGIT EMPLOYMENT DATA

Starting point

- The Specialization / diversification of economic activity is the outcome of economic integration
- Structural change reflects two dimensions of economic integration: local (intranational) vs. global (international) integration.
- Integration has a local component - which is usually overlooked.
- Structural change is the result of *both* local and global economic integration. The local dimension is key.
- Local dimension key in a (very) large literature: Krugman (1991), Krugman and Venables (1995), Desmet and Rossi-Hansberg (2011). But no implications on aggregate structural change.

What We Find

- Sectoral diversification in early stages of development is accompanied by geographic agglomeration and "structural divergence".
- The range of activities expands and factors are allocated increasingly equally across sectors (diversification). New sectors localize in specific, agglomerated regions (agglomeration). Regions become increasingly different in terms of what they produce (divergence).

- Sectoral concentration in later stages of development is accompanied by geographic dis-agglomeration and "structural convergence".
- The reduced range of activities (specialization) is produced across all regions (dis-agglomeration). The location of activity does not seem to matter as much. Regions become increasingly similar (convergence).

Sectors and Regions

	Region 1		Region 2	
Time	Sector 1	Sector 2	Sector 1	Sector 2
1 (initial)	1	0	1	0
2 (intermediate)	1	0	0	1
3 (developed)	0	1	0	1

Time	Country-level Specialization	Regional Agglomeration	Regional Dissimilarity
1 (initial)	1	0.5	0
2 (intermediate)	0.5	1	1
3 (developed)	1	0.5	0

How We Interpret It

- Low income countries tend to be autarkic - both intra- and inter-nationally. Regions that form the country tend to themselves be autarkic .
- As local barriers to trade fall (roads, railroads, infrastructure), regions specialize in different activities. Country diversifies, Activity agglomerates geographically - and regions become structurally different. (Stage I)

- Integration proceeds to international borders (trade liberalizations, free trade areas, WTO membership, lower tariffs, infrastucture for international trade).
- The country's constituent regions tend to *all* specialize in the country's comparative advantage. Activity dis-agglomerates geographically - and the country specializes. Regions become structurally similar. (Stage II)
- **NB:** Areas composed of countries trading with each other become diversified, as they are constituted of countries specialized in different activities. Activity agglomerates at country level, Trading countries diverge structurally.

How We Verify It (1)

- Introduce three measures (specialization, agglomeration, dissimilarity), computed on unique datasets on sectoral information at sub-national level.
- Simple Ricardian story where goods market integration implies patterns of specialization, agglomeration, dissimilarity.
- Presence of non-tradable goods implies weaker patterns. U- and hump shapes should be most pronounced on sub-samples focused on traded goods only.
- Check predictions in data on sectoral information at regional level. Perform splits between traded / non-traded sectors. Especially in developing (India, China) countries. Then check in international panel.

How We Verify It (2)

- European integration. High-income countries: stage I is completed. Diversified countries composed of agglomerated regions.
- With European integration, each country should go through stage II: all regions in one country should produce the same range of goods, each country should specialize, as activity dis-agglomerates and regions become similar.
- **NB:** Europe *as a whole* should go through stage I: countries specialize in different activities, so that Europe diversifies as its constituent countries agglomerate.

The Indices: Sectoral Specialization

- Simple Herfindahl index of sectoral specialization:

$$S_{it}^{H} = \sum_{s} \left(\frac{\sum_{j} Y_{ijst}}{\sum_{s} \sum_{j} Y_{ijst}} \right)^{2}$$

country i, region j, sector s, time t. Y_{ijst} a measure of economic activity - employment or output.

The Indices: Regional Agglomeration

- Analogous definition. Regional Herfindahl:

$$A_{ist}^{H} = \sum_{j} \left(\frac{Y_{ijst}}{\sum_{j} Y_{ijst}} \right)^{2}$$

  Captures the allocation of sector s across the regions j that constitute country i.

- Require sectoral information at sub-national level. Computed sector by sector and aggregated using (time-varying) weight of sector in overall economy, $\left(\sum_{j} Y_{ijst}\right) / \left(\sum_{s} \sum_{j} Y_{ijst}\right)$.

The Indices: Regional Dis-similarity

- Dissimilarity between regions is captured by an average of bilateral differences in sectoral shares. For all pairs of regions j and k in country i, compute:

$$D_{ist} = \frac{2}{J(J-1)} \sum_{j<k} \left| \frac{Y_{ijst}}{\sum_s Y_{ijst}} - \frac{Y_{ikst}}{\sum_s Y_{ikst}} \right|$$

  where J is the total number of regions in country i.

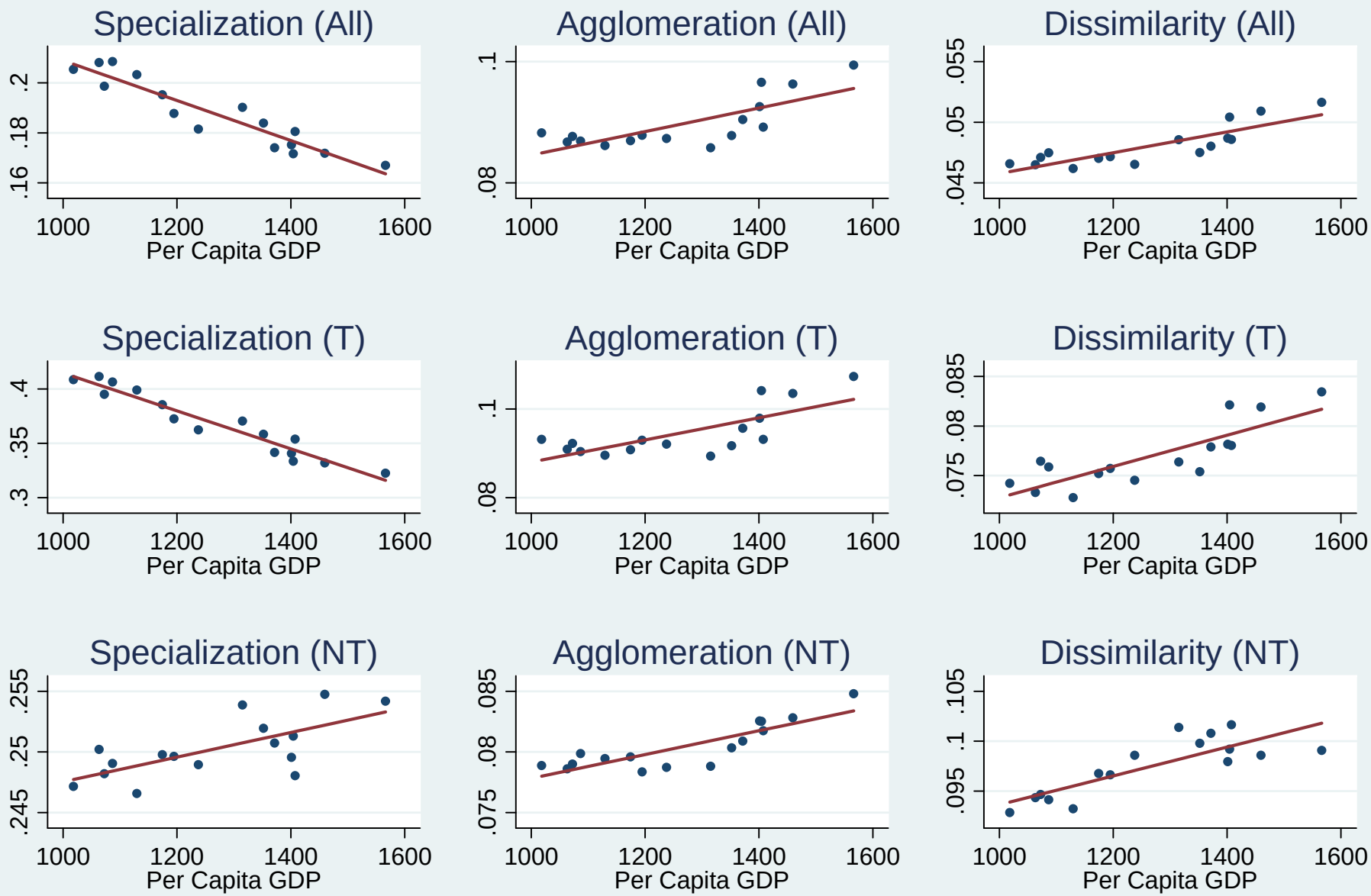
- Require sectoral information at sub-national level. Computed sector by sector: aggregated arithmetically, since dissimilarity between two regions can be high even if they are specialized in sectors that are small at country level:

$$D_{it} = \frac{1}{S} \sum_s D_{ist}$$

Plan

- India, China, USA
- Census (employment) data - 28 countries, concentrated on (19) developing economies. Decennal data (T=3).
- National agencies (real value added) data - 14 countries, concentrated on (9) developed economies. Yearly data (T=15)
- European countries individually – and then Europe as a whole.

Figure 3: India

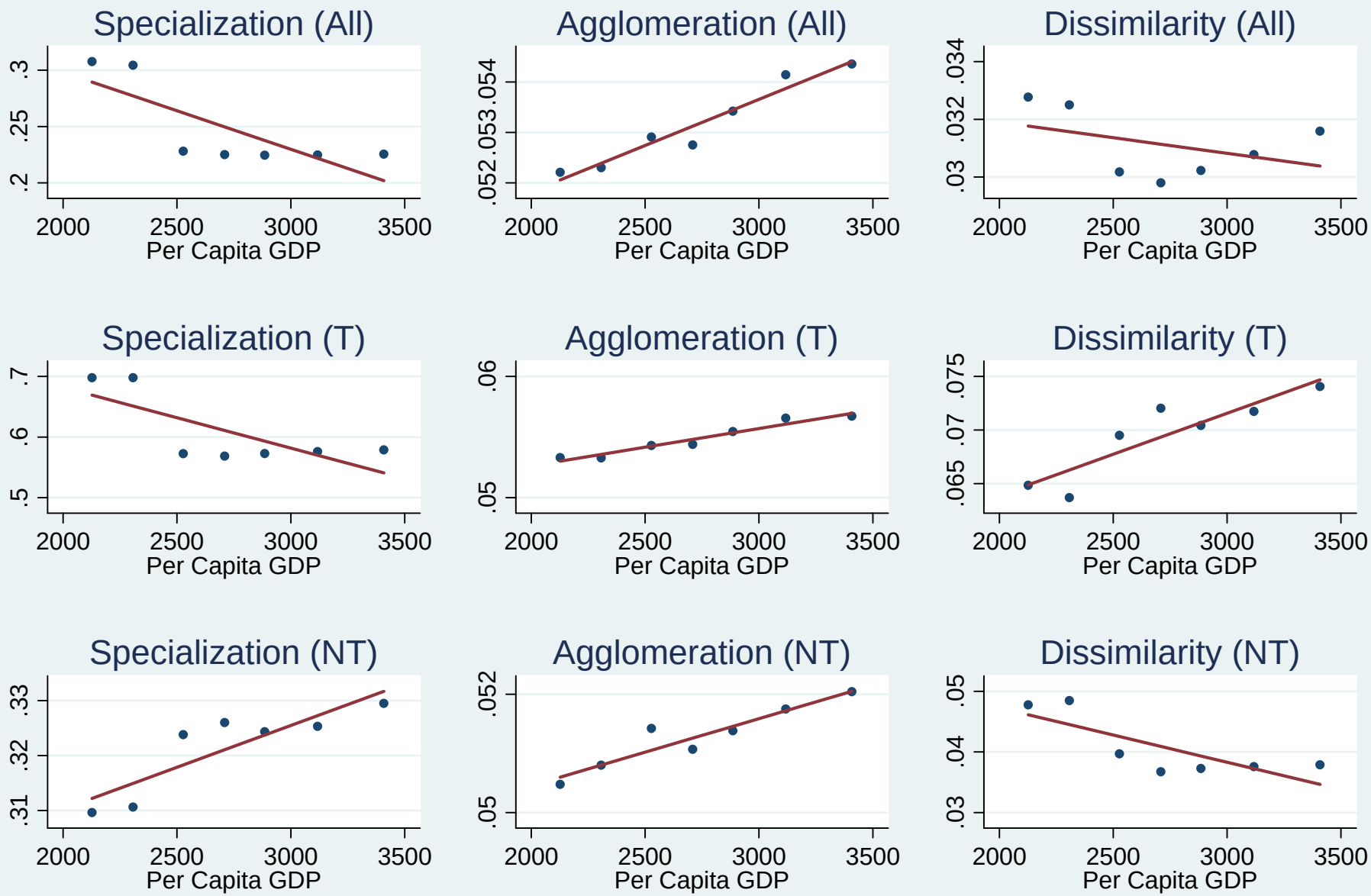


India

- Table 3: India

	Specialization	Agglomeration	Dissimilarity
	All	All	All
pcGDP	-80.10^{***}	19.40^{***}	8.57^{***}
	(-10.34)	(4.42)	(6.11)
Obs.	16	16	16
	T	T	T
pcGDP	-174.10^{***}	25.01^{***}	15.70^{***}
	(-13.98)	(4.09)	(5.46)
Obs.	16	16	16
	NT	NT	NT
pcGDP	10.20^{***}	9.83^{***}	14.40^{***}
	(3.56)	(5.98)	(5.39)
Obs.	16	16	16

Figure 4: China

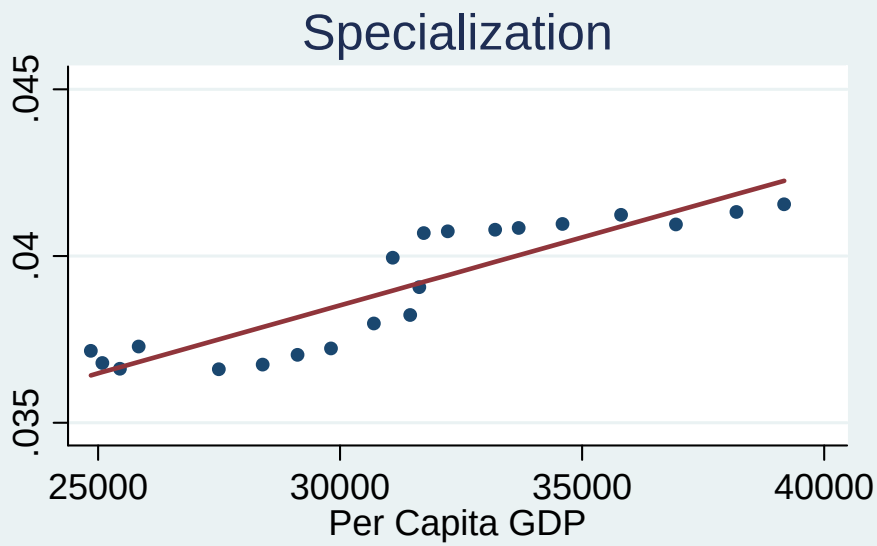


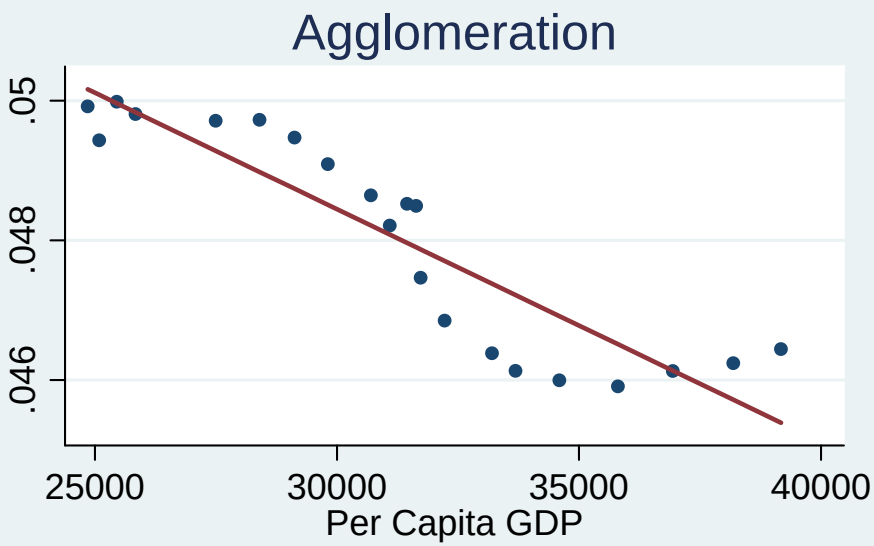
China

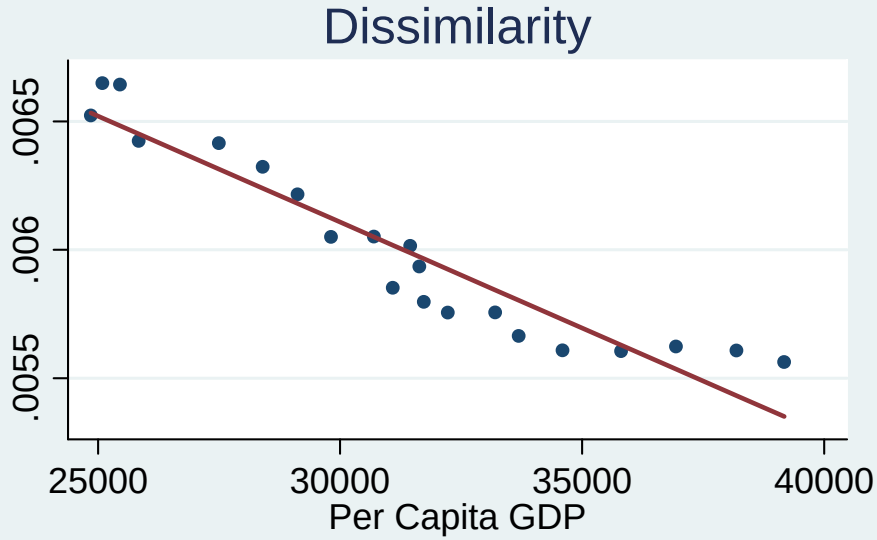
- Table 4: China

	Specialization	Agglomeration	Dissimilarity
	All	All	All
pcGDP	-68.30^{**}	1.83^{***}	-1.08
	(-2.82)	(8.85)	(-1.01)
Obs.	7	7	7
	T	T	T
pcGDP	-100.10^{*}	3.07^{***}	7.65^{***}
	(-2.48)	(9.33)	(4.54)
Obs.	7	7	7
	NT	NT	NT
pcGDP	15.20^{***}	1.13^{***}	-8.97^{**}
	(3.98)	(6.36)	(-2.89)
Obs.	7	7	7

Figure 5: USA





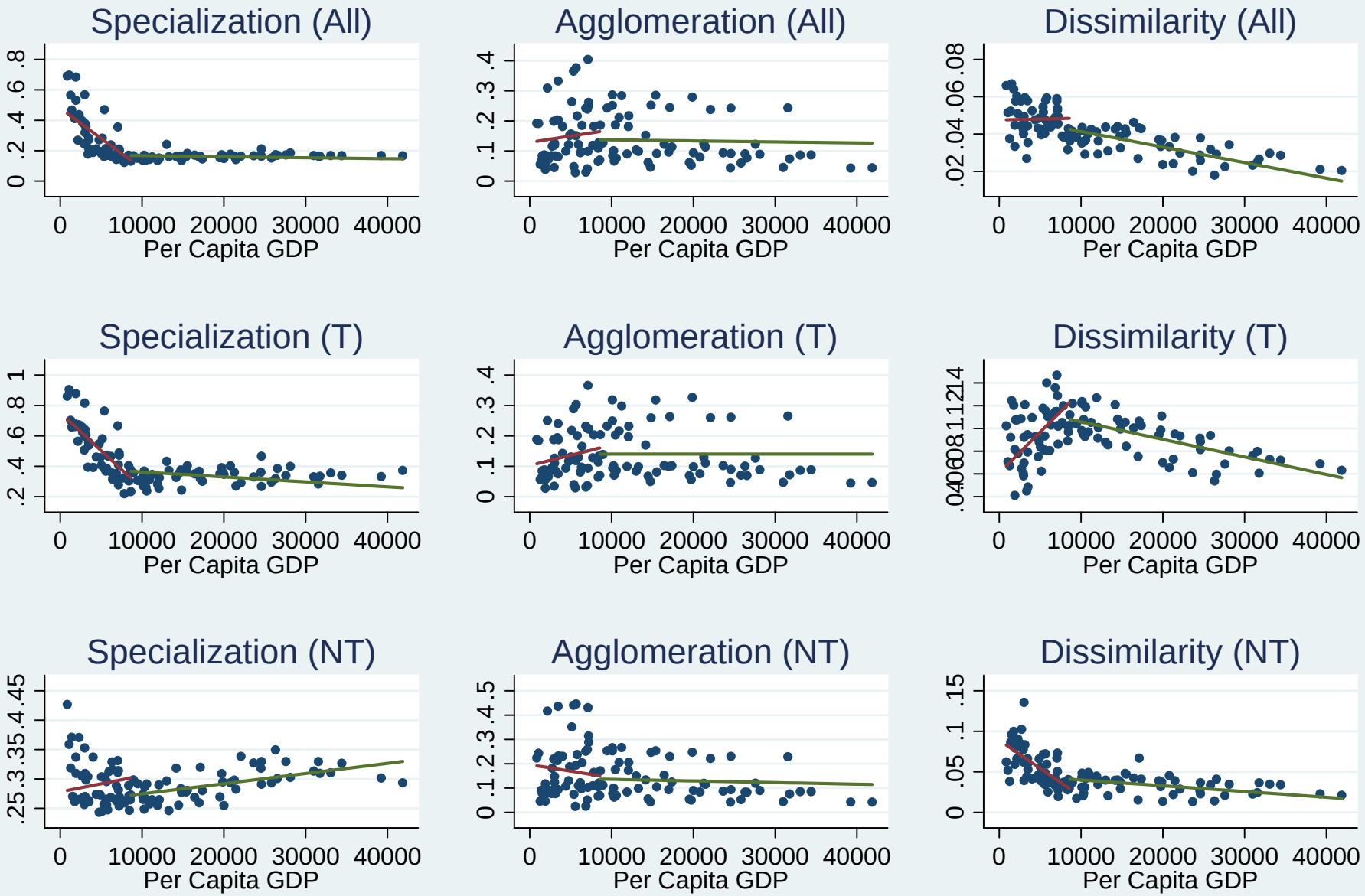


USA

- Table 5: USA

	Specialization	Agglomeration	Dissimilarity
pcGDP	0.407^{***}	-0.333^{***}	-0.083^{***}
	(8.68)	(9.35)	(−12.83)
Obs.	21	21	21

Figure 6: IPUMS



Are these significant?

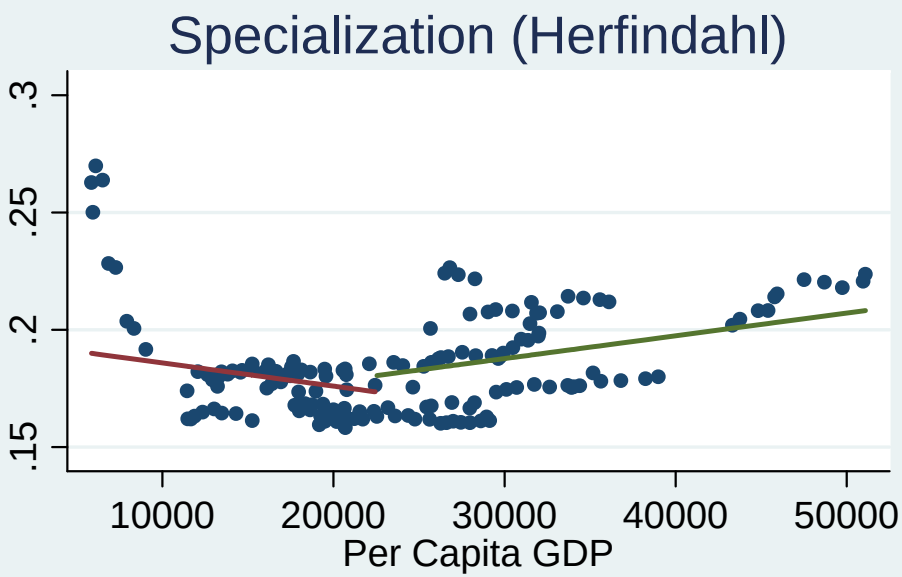
- Table 6: IPUMS - International Data

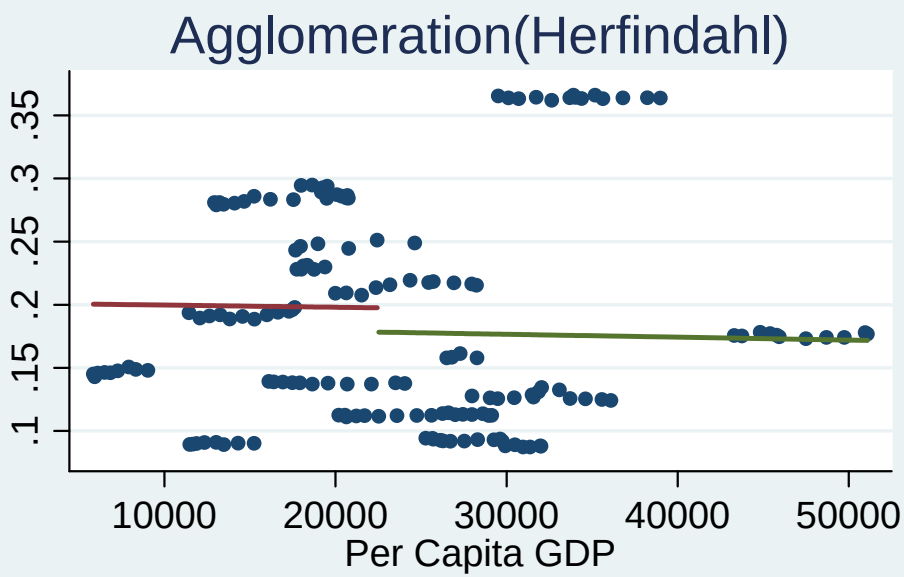
	Specialization	Agglomeration	Dissimilarity
	All	All	All
Low	-39.80^{***}	4.18^{***}	0.100
	(-11.71)	(2.78)	(0.16)
High	-0.648	-0.340	-0.834^{***}
	(-1.50)	(-0.86)	(-10.23)
	T	T	T
Low	-49.80^{***}	6.73^{***}	7.19^{***}
	(-12.38)	(3.95)	(6.64)
High	-3.27^{***}	0.006	-1.54^{***}
	(-3.96)	(0.01)	(-9.02)
	NT	NT	NT
Low	2.73	-5.34^{***}	-6.93^{***}
	(1.20)	(-3.50)	(-4.16)
High	1.73^{***}	-0.067^{*}	-0.712^{***}
	(3.26)	(-1.74)	(-4.18)
Obs.	51	51	51

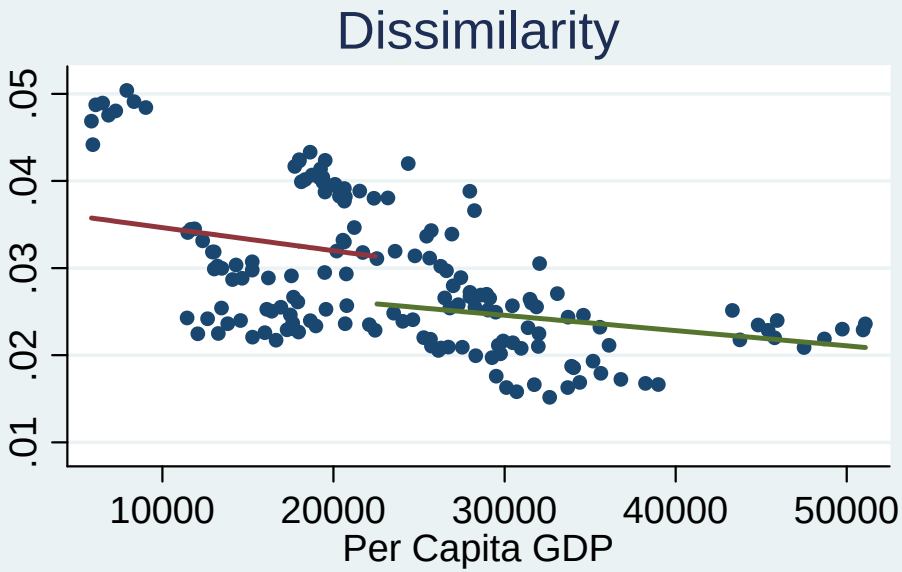
European Countries

- The European Statistical Agency (Eurostat) collects regional employment data for member and accession countries.
- Data are available for a maximum of 14 countries, at one-digit level.
- Year coverage varies from country to country - so does the number of regions. Data are rectangular over time within each country. Estimation has country fixed effects. Maximum coverage 1992-2008.

Figure 1: Eurostat - 14 countries







Eurostat - Regional Data

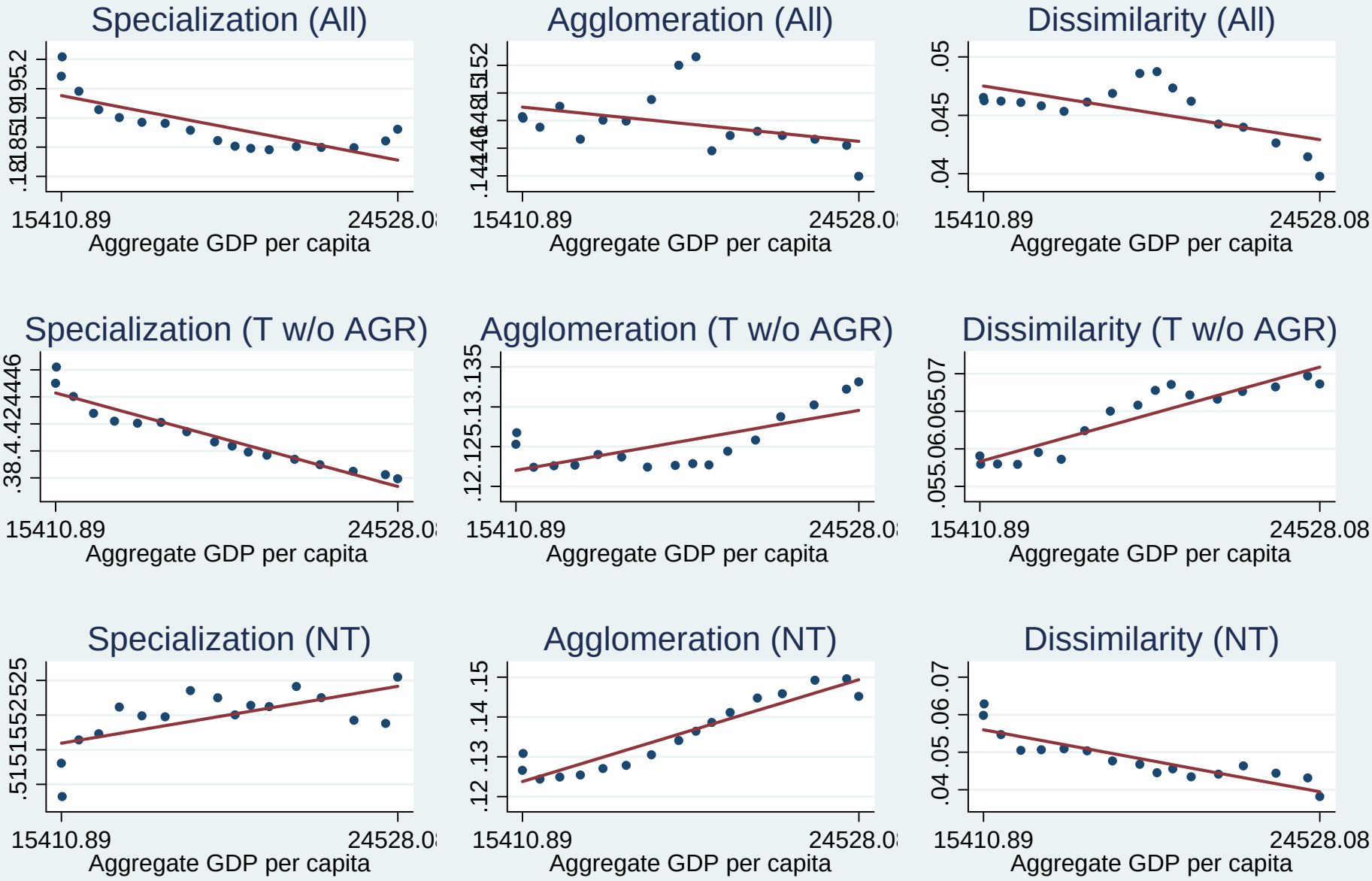
- Table 1: Eurostat - Regional Data

	Specialization	Agglomeration	Dissimilarity
Low	-0.987	-0.173	-0.265^{***}
	(-1.40)	(-0.61)	(-2.76)
High	0.970^{***}	-0.229^{**}	-0.175^{**}
	(6.07)	(-2.39)	(-2.18)
Obs.	81	81	81

The European Union

- Stage II: European countries are specializing, each country's regions are dis-agglomerating and becoming similar. Conjecture is this happens as they integrate globally - with the rest of the Union.
- Thus, the Union as a whole should be diversifying, as its constituent countries specialize in different activities. Activity should agglomerate at country level within the Union - and countries should become dissimilar.
- Can construct an economic area formed by integrating European countries - these are countries that integrate *with each other*, and so a relevant area.

Figure 2: ILO - EU 14 Countries



ILO

- Table 2: ILO - Sectoral Data

	Specialization	Agglomeration	Dissimilarity
	All	All	All
EU pcGDP	-1.21^{***}	-0.272	-0.505^{***}
	(-4.86)	(-1.64)	(-3.28)
Obs.	17	17	17
	T w/oAGR	T w/oAGR	T w/oAGR
EU pcGDP	-7.60^{***}	0.826^{***}	1.38^{***}
	(-13.11)	(3.84)	(9.51)
Obs.	17	17	17
	NT	NT	NT
EU pcGDP	0.901^{***}	2.81^{***}	-1.81^{***}
	(3.31)	(10.79)	(-7.37)
Obs.	17	17	17

Conclusion

- Proposed a mechanism that explains jointly structural change, geographic agglomeration and regional convergence in sectoral structure.
- Structural change is a proximate symptom of economic integration. The local dimension is essential.
- "Diversification" reflects domestic integration. "Specialization" reflects international integration (and regional convergence). The stages of structural change reflect the balance between the two.
- From a policy standpoint:

1. Stage I: diversification associated with infrastructure investment for local integration.
2. Stage II: industrial policies aiming at preserving diversification should have strong local dimension.