The Political Economy of Economic Complexity: Theory, Data, Methods

Section 4
Applications & discussion

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EAEPE Pre-Conference
September 11-12 2019

Outline

1. General introduction & motivation: drivers of economic development
2. Introducing the *Economic Complexity Index* (ECI)
   - 2.1 Historical genesis
   - 2.2 How to compute economic complexity
   - 2.3 Theories underlying economic complexity
   - 2.4 Advantages and critiques of the measure
3. Practice: using data from the Atlas of Economic Complexity
4. **Selected applications**
5. Outlook: using economic complexity in your own research

Selected applications of the complexity measures

- Here we may discuss three very different applications to provide you with an idea of what you can do
  1. Hidalgo and Hausmann (2009): the `original' study on complexity and development
     - Teaches us how to use the various iteration results of the method of reflections
  2. Hartmann et al. (2017): linking complexity with inequality
     - Teaches us how to apply the method in new contexts
  3. Gräbner et al. (2017) on polarization in Europe
     - Teaches us how we can use the ECI as one among many other ingredients in our studies
- At the end we also discuss how you can use the PCI to derive a *measure for technological directedness*

Hidalgo and Hausmann 2009: The building blocks of economic complexity

What do the authors do?

- Introduce the idea of complexity as a measure for person bytes
- Introduce the method of reflections

Why is it interesting & relevant?

- Shows usefulness of the $k_{p,x}$ and $k_{c,x}$ measures, irrespective of the ECI
- Relates *complexity* to more conventional measures, such as input variety
- Demonstrates the predictive power of economic complexity

When should you read it?

- When you look for a short & concise introduction to the general idea
- When you want to know how most non-economists get introduced to the concept
- Since it comes with low time investment I generally recommend it to everybody interested in development

Hartmann et al. (2017): Linking Economic Complexity, Institutions, and Income Inequality

What do the authors do?

- Develop a complement to the ECI that serves as a predictor for *inequality* rather than wealth
- Argue that economic complexity is a *negative* predictor for income inequality

Why is it interesting & relevant?

- Shows how the CAD can go beyond growth and wealth
- Provides for a somehow surprising results: higher complexity $\rightarrow$ lower inequality
  - Disclaimer: I don't buy these results

When should you read it?

- When you are interested in inequality
- When you work on the role of technological change for inequality and growth
- When you are interested in constructing new indicators

Gräbner et al. (2019): Structural change in times of increasing openness

What do the authors do?

- Study how increases in economic openness affect development trajectories in the European Union
- Provide for an inductive and deductive typology of countries that all react differently to openness
- Investigate the reasons for why some countries react different to increased openness than others

Why is it interesting & relevant?

- The authors use *product* complexity (not as the main ingredient, but as one aspect among many others)
- A measure for the directedness of technological change is produced, which might be of broader interest

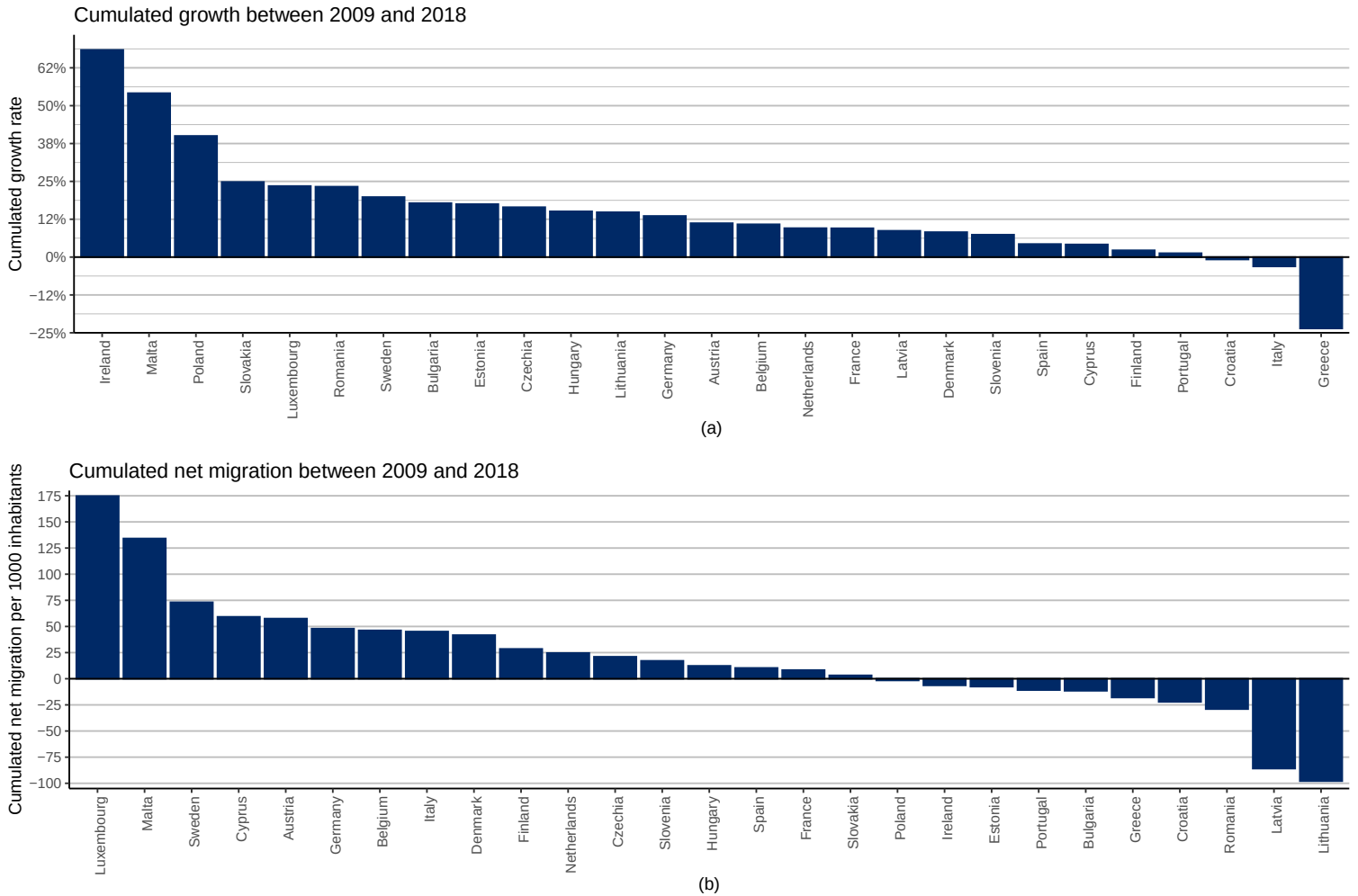
When should you read it?

- When you are interested how complexity can be used as an independent variable in empirical work
- When you work on international polarization and/or economic openness

Using the PCI to study technological change in the EU

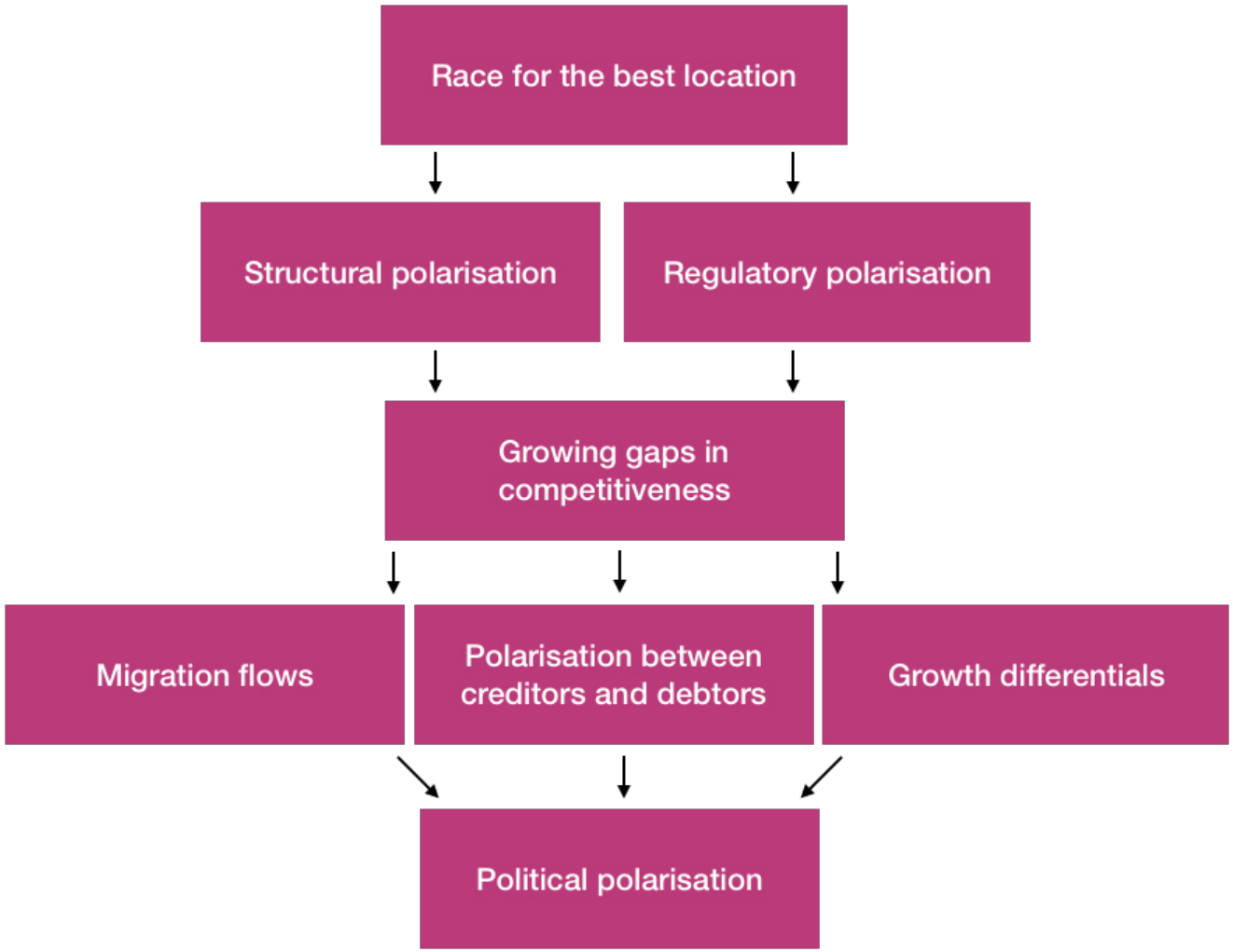
- We now discuss how we can use the PCI to derive a measure for technological directedness
- Such measure can help us to shed light on polarization processes in the European Union
    - See Kapeller, Gräbner, and Heimberger (2019) for the general politico-economic analysis and Gräbner et al. (2019) for the introduction of the measure
- This way we also want to understand how the complexity measures could be embedded into a broader politico-economic analysis

Polarization in the EU



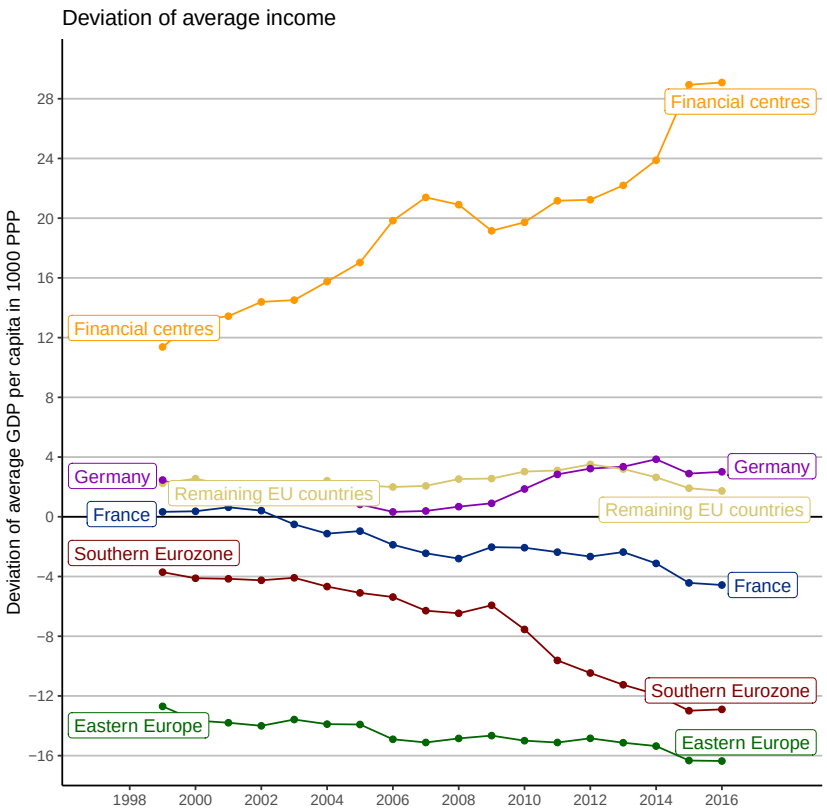
Source: Kapeller, Gräbner, and Heimberger (2019, p. 5)

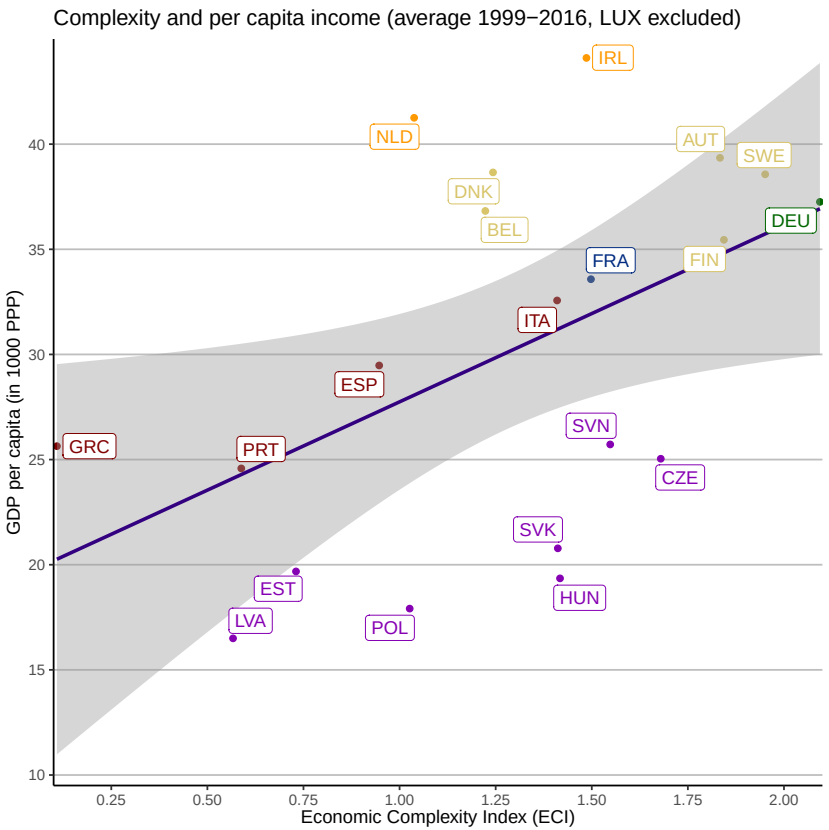
The general framework



Source: Kapeller, Gräbner, and Heimberger (2019, p. 8)

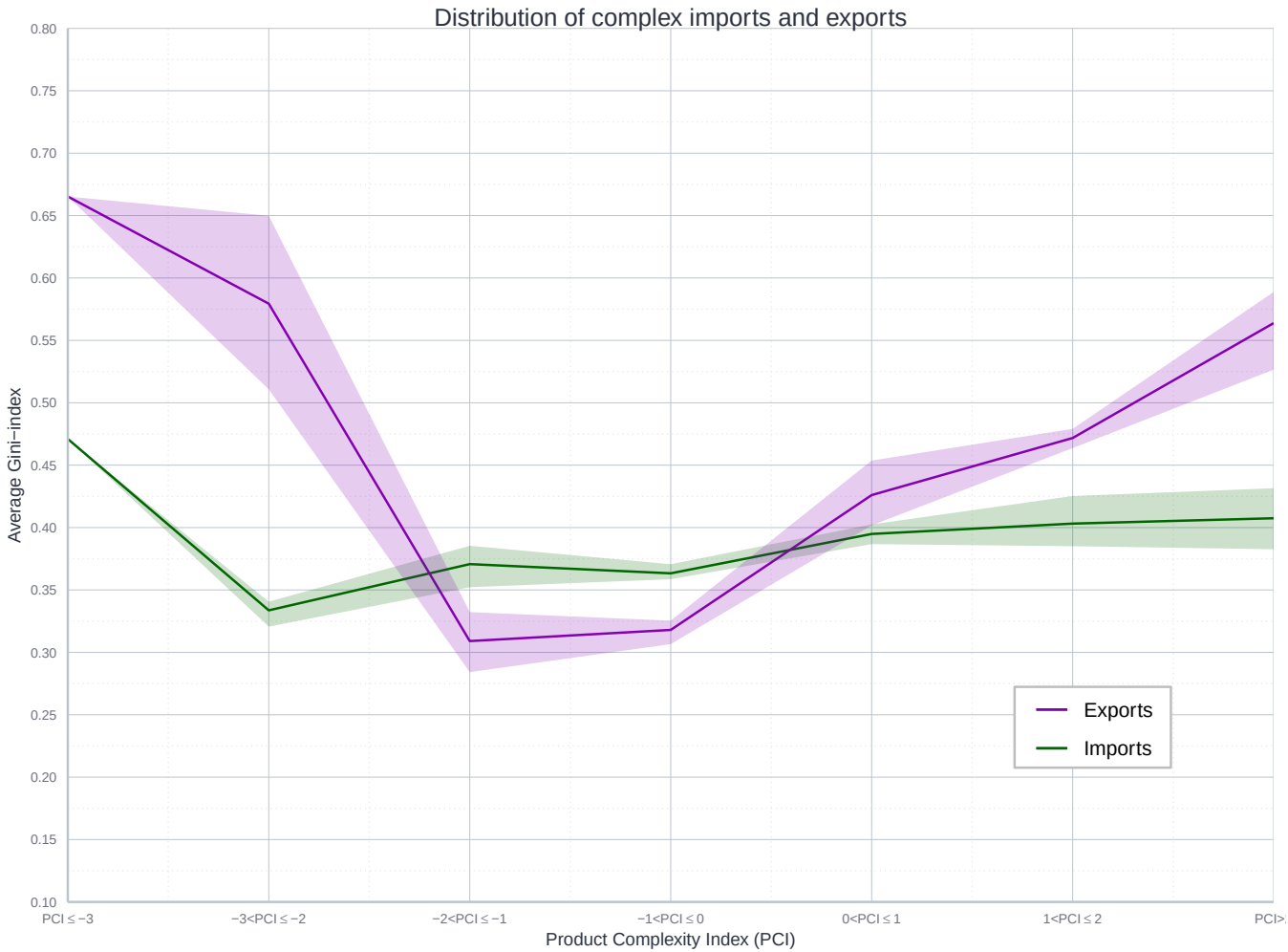
The explanatory role of the ECI in the EU





Source: Kapeller, Gräbner, and Heimberger (2019, p. 19)

The composition of export baskets in the EU



Source: Kapeller, Gräbner, and Heimberger (2019, p. 23)

A measure of technological directedness

- Our argument in the study is that technological capabilities are unevenly distributed in Europe
- As long as this remains the case, we cannot expect a convergence taking place
- To see whether we observe a convergence of technological capabilities, we study the technological directedness of the countries
- To this end we study the composition of their export baskets:
- We compare trade volumes on the SITC-V2 4-digit product level over two time periods
    - 1995-1999 (pre-Eurozone and pre-crisis)
    - 2010-2014 (post-Eurozone and post -crisis)

- For each country, we regress the log of the positive and negative difference in the value of exports on the average
- Then we weight the observations according to the share of the product in the country's export-basket in 2012-2014.
    - We want to put more weight on currently important products
- Formally, take P_c^+ as the set of products for which country c has increased its exports in 2010-2014 as compared to 1995-1999 and $\phi_{c,i} = 1$ if $i \in P_c^+$ and zero otherwise.
- We then estimate the following two equations for each country:

$$\log\left(\sum_{t=2010}^{2014} \phi_{c,i}\pi_{c,i,t} - \sum_{t=1995}^{1999} \phi_{c,i}\pi_{c,i,t}\right) = \beta_c^+ \overline{\text{PCI}}_{c,i} + \epsilon_{c,i} \quad \forall i \in P_c^+ \qquad (1)$$

- And for the products with shrinking volume:

$$\log\left(\sum_{t=1995}^{1999}(1-\phi_{c,i})\pi_{c,i,t}-\sum_{t=2010}^{2014}(1-\phi_{c,i})\pi_{c,i,t}\right)=\beta_c^{-}\overline{\mathrm{PCI}}_{c,i}+\epsilon_{c,i}\quad\forall i\notin P_c^{+} \tag{2}$$

- With:

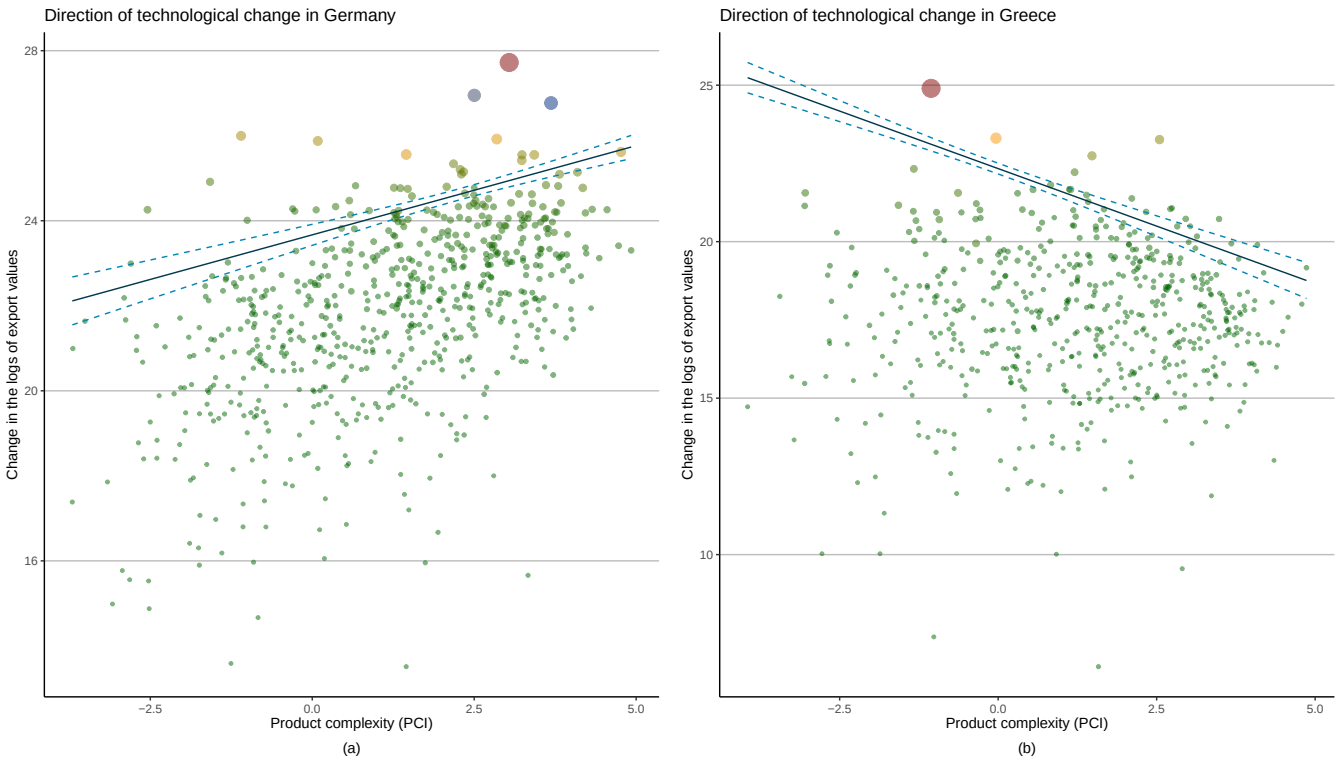
$$\overline{\mathrm{PCI}}_{c,i}=\sum_t\left[\frac{\pi_{c,i,t}}{\sum_t\pi_{c,i,t}}\mathrm{PCI}_{i,t}\right] \tag{3}$$

- $\pi_{c,i,t}$ is the total export of product i by country c in period $t \in (\{1995,...,1999\},\{2010,...,2014\})$
- The weights are given by:

$$\omega_{c,i}=\frac{\sum_t\pi_{c,i,t}}{\sum_i\sum_t\pi_{c,i,t}} \tag{4}$$

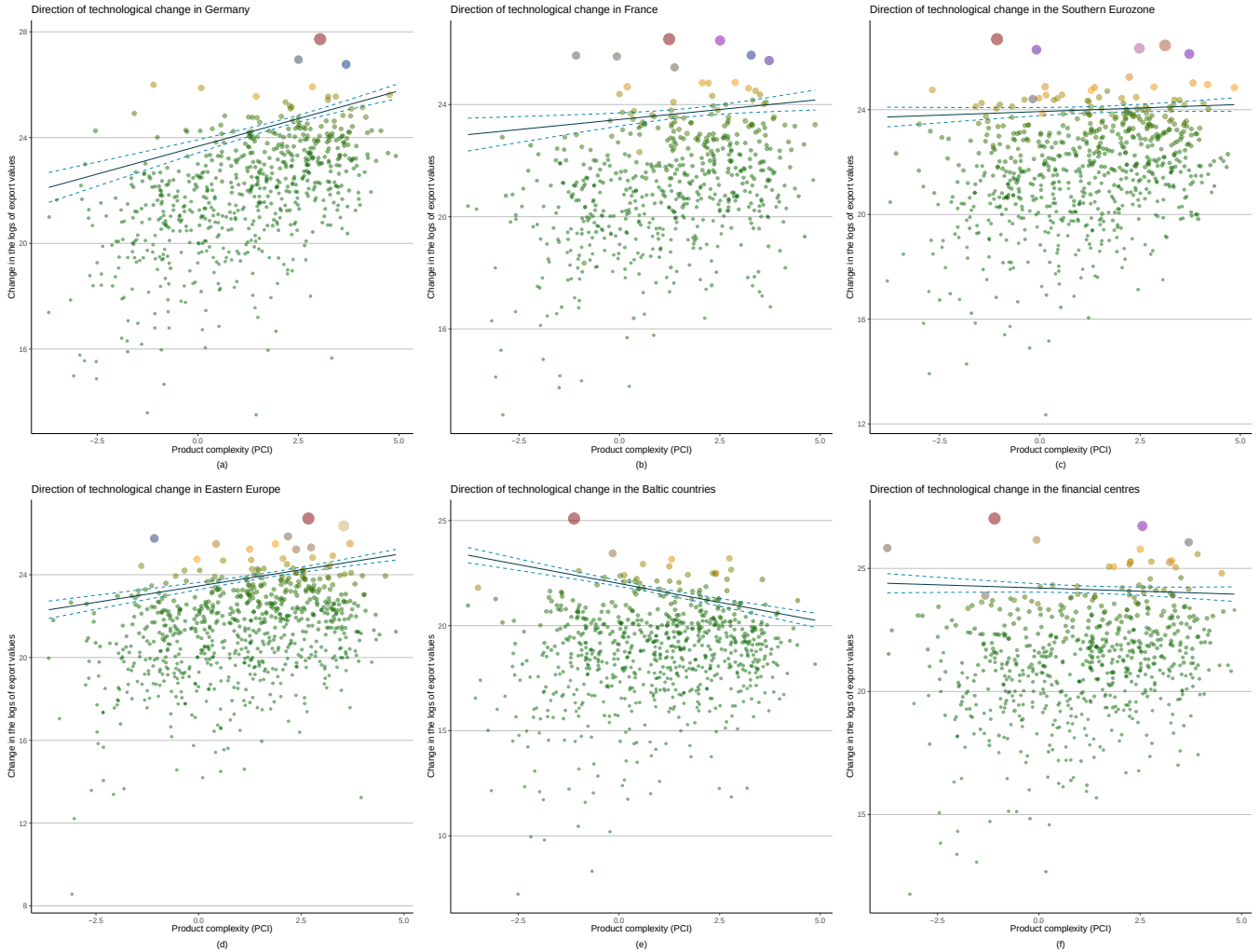
- This way, we obtain two estimates for each country, $\hat{\beta}_c^{+}$ and $\hat{\beta}_c^{-}$
- The weighted average of which can be used as a measure for technological directedness

Expanding products in Germany and Greece



Source: Gräbner et al. (2019, p. 16)

Comparing country groups in the EU



Source: Kapeller, Gräbner, and Heimberger (2019, p. 26)

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Summary of the talk I

- The talk introduced the concept of *Economic Complexity* as developed by Cesar Hidalgo and Ricardo Hausman
- Its concept forms a high level theory of economic development
- The fundamental determinant for a country's wellbeing is its the amount of collective information information
- This crucially depends on the diversity of know-how and the ability/willingness of citizens to collaborate with each other
- The fundamental measures are the *Economic Complexity Index* and the *Product Complexity Index*
  - The ECI measures the collective technological capabilities in a country
  - The PCI measures the amount of technological capabilities necessary to manufacture the product
  - Both can also be used independently

Summary of the talk I

- The measures are largely inductive, and there is no full-fledged theory underlying it
- There are clear affinities to evolutionary geography and economics, but not well elaborated
- There are some clear shortcomings: exclusive reliance on trade data or lack of underlying theory
- At the same time, the empirical performance is good and it helps to identify surprising patterns

Proposal for discussion questions

- Considering the other high level development theories in the beginning, how does economic complexity relate to them?
  - Marx: focus on possession of capital, power distribution & underdevelopment
  - EE: focus on disequilibrium, ideas and entrepreneurial spirit
  - Feminist Econ: focus on gender, norms & power, and the need for societal transformation
  - Structuralism: focus on the distribution of technological capabilities, the interrelatedness between core and peripheries & the need for structural change
- How does it relate to the approaches you have been using in your own research so far?

References I

Claudius Gräbner et al. “Is Europe disintegrating? Macroeconomic divergence, structural polarization, trade and fragility”. In: *ICAE Working Paper* 64 (July 2017).

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