

# Evidence base for place-based innovation - quantitative analyses for smart specialisation *(Mapping economic and innovation potential)*

Hugo Hollanders

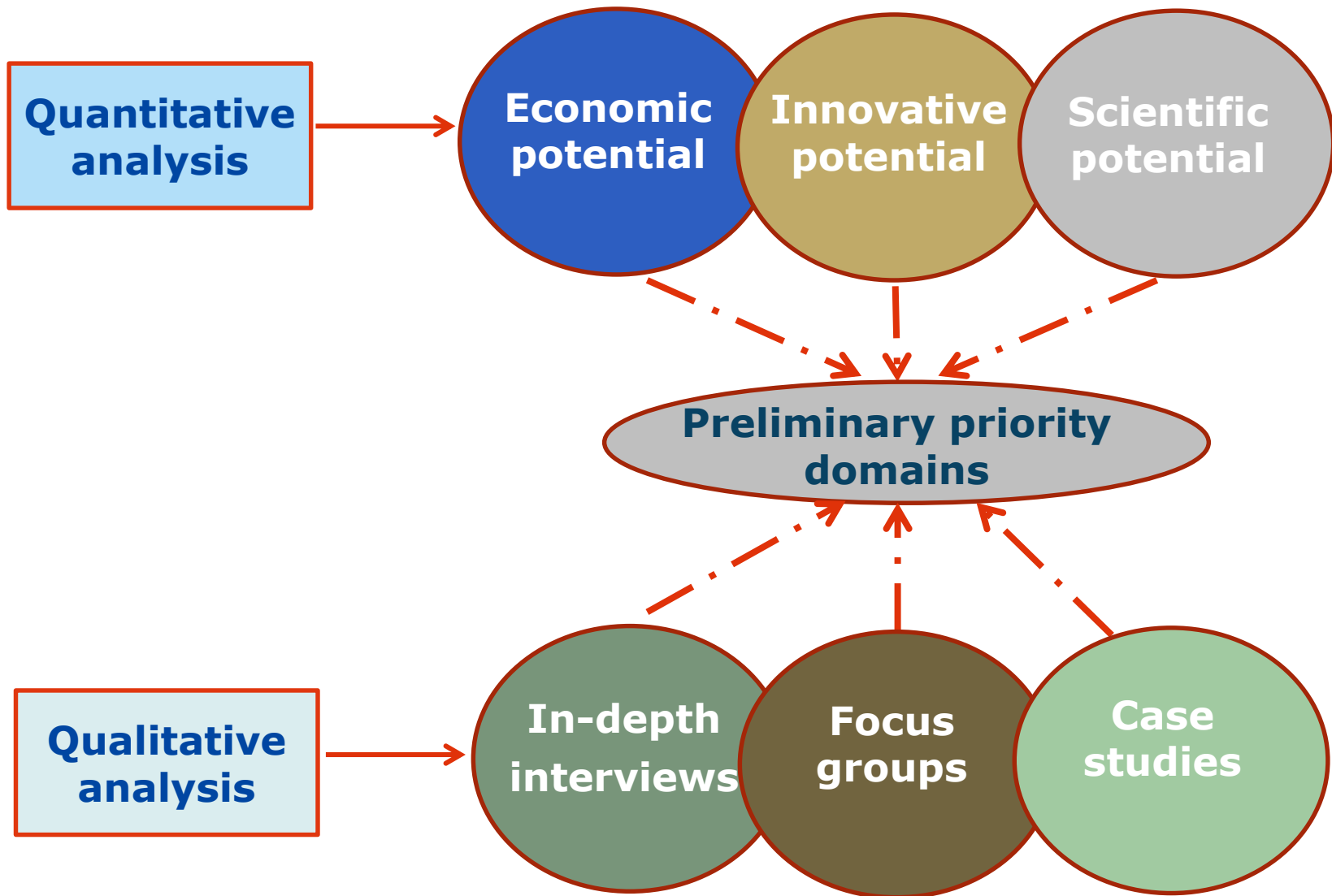
Maastricht University

Workshop: Smart Specialisation and  
Entrepreneurial Discovery Process

19-20 March 2019, Kiev



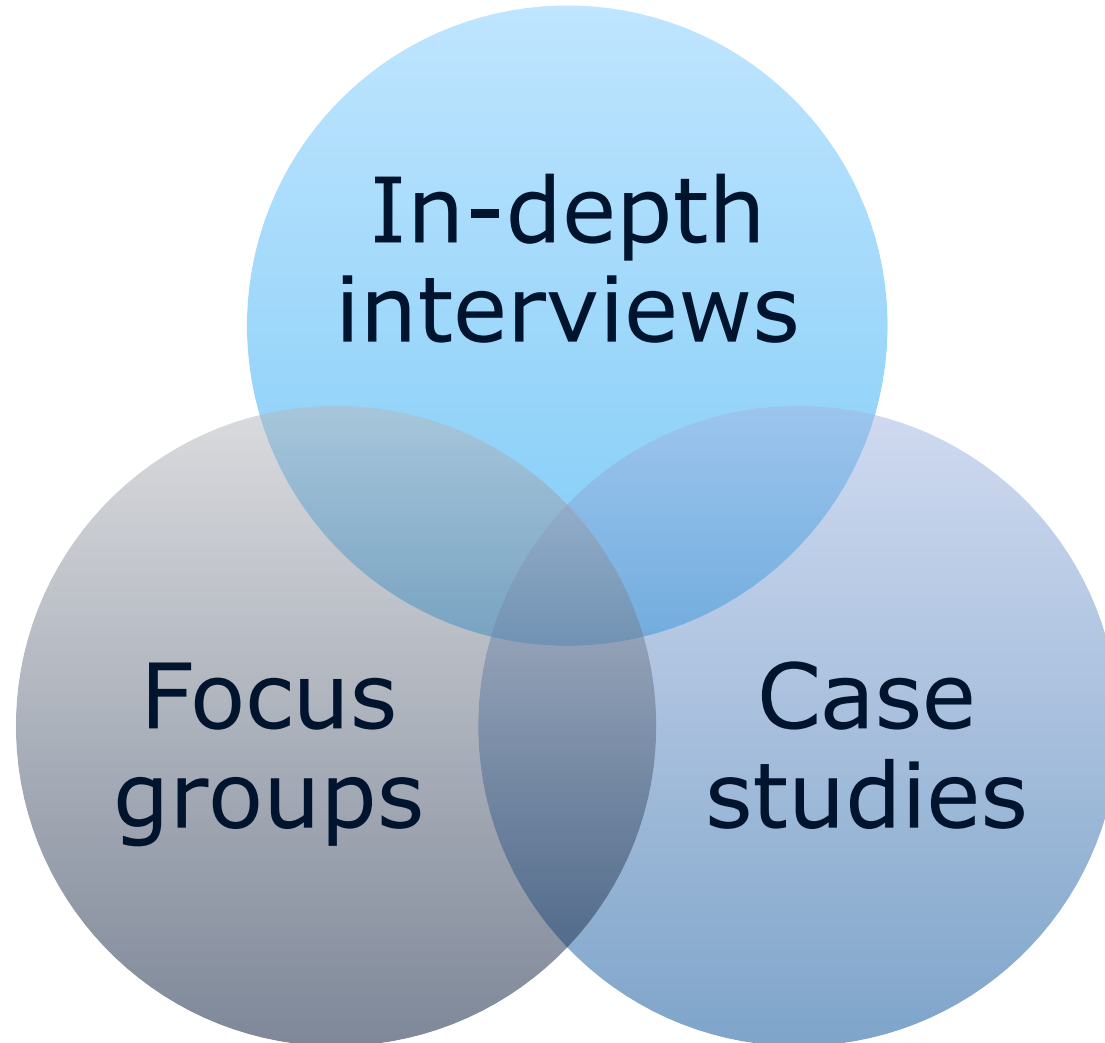
# S3 Analytical Framework



# Quantitative analysis

Type of potential	Indicator	Disagg-regation	Data source
Economic potential	<p><b>Specialisation, growth dynamics and relative importance of industrial subsectors</b> based on:</p> <ul style="list-style-type: none"> <li>• Employment</li> <li>• Value added/Turnover</li> <li>• Number of companies</li> </ul> <p><b>International competitiveness</b> based on:</p> <ul style="list-style-type: none"> <li>• Main product groups in exports</li> <li>• Revealed comparative advantage in exports</li> </ul>	NACE rev. 3 or 4 digit, 5-10 year period, regionalised (NUTS2 level)	<p><b>Preferred source:</b></p> <ul style="list-style-type: none"> <li>• National Statistics Office</li> </ul> <p><b>Alternative source:</b></p> <ul style="list-style-type: none"> <li>• ORBIS database</li> <li>• World Bank WITS database</li> <li>• MIT Observatory of Economic Complexity</li> <li>• ILO database</li> </ul>
Innovative potential	<p><b>Community Innovation Survey indicators</b></p> <ul style="list-style-type: none"> <li>• Share of innovative companies</li> <li>• BERD</li> <li>• Types of innovation</li> <li>• Cooperation in innovative activities</li> </ul> <p><b>Education profiles:</b></p> <ul style="list-style-type: none"> <li>• Number of students/graduates at vocational schools</li> <li>• Number of students/graduates at HEI</li> <li>• STEM graduates</li> </ul>	NACE rev. 3 or 4 digit, 5-10 year period, regionalised (NUTS2 level)	<p><b>Preferred source:</b></p> <ul style="list-style-type: none"> <li>• National Statistics Office</li> </ul> <p><b>Alternative source:</b></p> <ul style="list-style-type: none"> <li>• Innovation indicators from World Bank Enterprise Surveys</li> <li>• ETF skills mapping analyses</li> </ul>
Scientific potential	<p><b>Main strengths in science and technology</b></p> <ul style="list-style-type: none"> <li>• Main specialisations in scientific publications</li> <li>• Main specialisations in patents</li> <li>• R&amp;D employment</li> </ul>	IPC subclasses and science fields	<p><b>Preferred source:</b></p> <ul style="list-style-type: none"> <li>• SCOPUS/Web of Science</li> <li>• EPO/WIPO/National Patent Office</li> </ul> <p><b>Alternative source:</b></p> <ul style="list-style-type: none"> <li>• SCIMAGO database</li> <li>• UNESCO Institute for Statistics</li> </ul>

# Qualitative analysis



# Why do we need an evidence base?

“Access to data is critical for evidence-informed policies. Data are a precondition for the development of innovative businesses, creating growth, boosting productivity, promoting innovation, transforming public services and ... improving citizens’ quality of life”

*JRC: “Supporting an Innovation Agenda for the Western Balkans - Tools and Methodologies”*

# The need for mapping regions' potential

- Policies are better equipped to tackle underlying challenges and achieve relevant objectives if they are strongly rooted in evidence
- In the case of place-based innovation, they should be grounded in a detailed diagnosis of the economic, innovative and scientific (E&I&S) potential of countries and regions

# Smart specialisation mapping

- Research, development and innovation activities are possible sources of transformation of key and emerging economic sectors
- The ability to analyse relevant combinations of potentials and strengths (economic, innovative and scientific) is a crucial element of the smart specialisation approach

# Objectives of mapping E&I&S potential

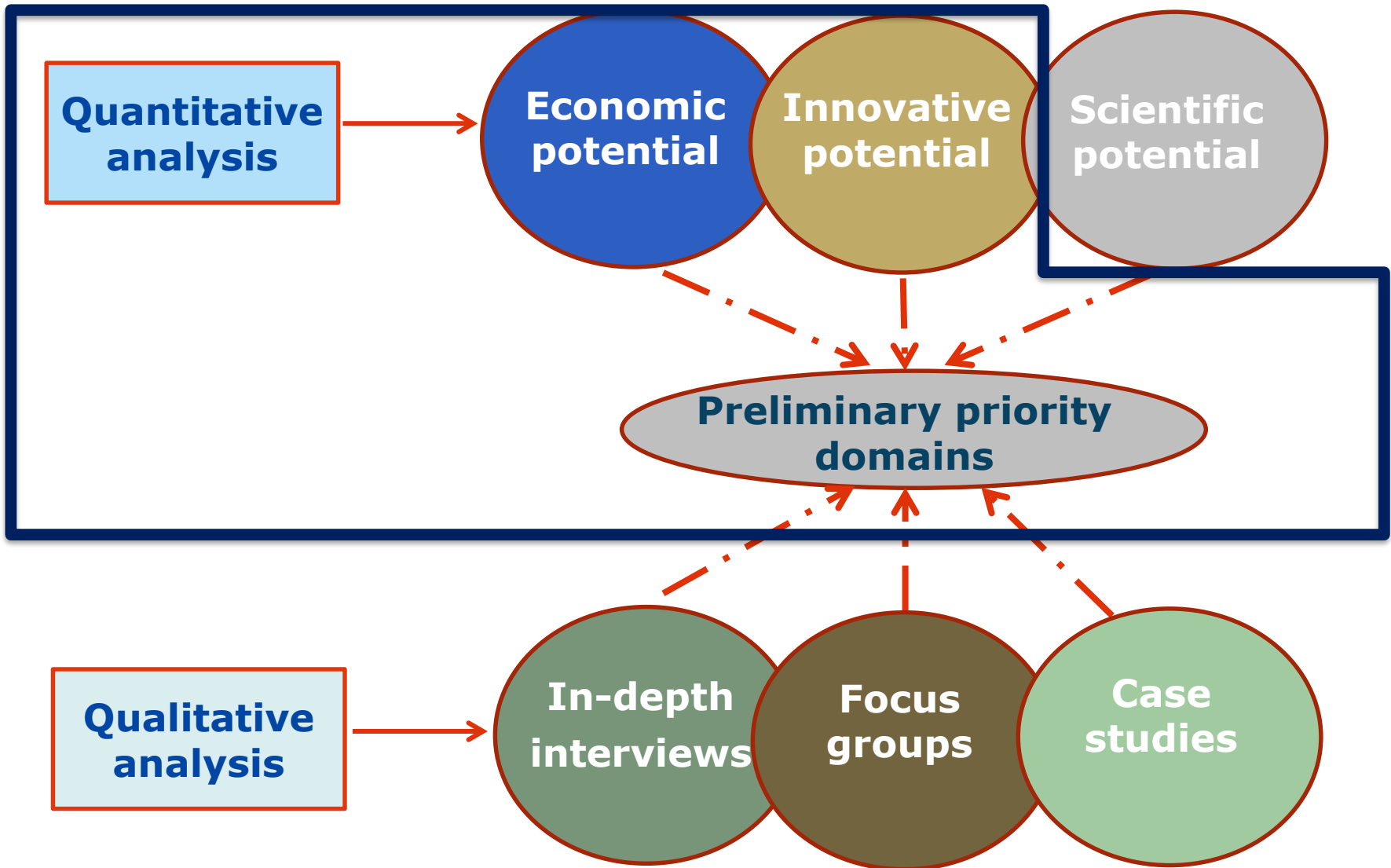
- The diagnosis of E&I&S potential results in a set of preliminary priority domains that are based on matching strengths in terms of critical mass of economic activities, innovative companies and research excellence
- As part of the analysis is based on ‘hard’ statistical data, it needs to be interpreted with the help of experts and key stakeholders



# Examples of mapping studies

- Serbia (2017)
- Republic of Moldova (2017, updated in 2018)
- Montenegro (2018)
- 6 Western Balkan countries (2018) (economic mapping only based on Orbis data)
- Ukraine (2018), 3 regions: Kharkiv, Odessa, Zaporizhzhia

# This presentation will focus on



# Key indicators mapping Economic potential

Indicator	Disaggregation	Data source
<p>Economic data on subsectors:</p> <ul style="list-style-type: none"><li>• Number of enterprises</li><li>• Employment</li><li>• Turnover</li><li>• Value added</li><li>• Wages</li></ul> <p><i>International competitiveness:</i></p> <ul style="list-style-type: none"><li>• <i>Exports</i></li></ul>	<ul style="list-style-type: none"><li>• NACE Rev. 2, 3 or 4 digit</li><li>• 5-10 year period</li><li>• Regionalised (NUTS2 level)</li></ul>	<p>Preferred source:</p> <ul style="list-style-type: none"><li>• National Statistics Office</li></ul>

# Key indicators mapping Innovative potential

Indicator	Disaggregation	Data source
<p>Innovation survey:</p> <ul style="list-style-type: none"><li>• Share of innovative companies</li><li>• Types of innovation</li></ul> <p>R&amp;D survey:</p> <ul style="list-style-type: none"><li>• BERD (business R&amp;D spending)</li></ul>	<ul style="list-style-type: none"><li>• NACE Rev. 2, 3 or 4 digit</li><li>• 5-10 year period</li><li>• Regionalised (NUTS2 level)</li></ul>	<p>Preferred source:</p> <ul style="list-style-type: none"><li>• National Statistics Office</li></ul>

# NACE Statistical classification of economic activities: An example

- Section C: Manufacturing
  - 27 Manufacture of electrical equipment
    - Nine 3-digit industries
      - 27.3 Manufacture of wiring and wiring devices
        - 27.31 Manufacture of fibre optic cables
        - 27.32 Manufacture of other electronic and electric wires and cables
        - 27.33 Manufacture of wiring devices

# Ukraine: mapping for 3 regions



Kharkiv, Odesa, Zaporizhzhia



# Economic potential – Available data

- For all Ukrainian regions
  - NACE 4-digit B-E (Industry), 2012-2016
    - Number of firms
    - Volume of goods sold (Turnover)
    - Number of employees
- Exports for 3 pilot regions
  - SITC 4-digit, 2012-2016
  - Data not available by NACE



# Economic potential – Methodology

- Degree of specialisation
  - Measures if, in relative terms, an industry is more important for the region
- Critical mass
  - Absolute size of an industry matters, too small industries have a small economic impact
- Growth
  - Growing industries are more likely to drive economic transformation

# Degree of specialisation

Calculated as:  $LQ_x = (e_x / e) / (E_x / E)$

$LQ_x$  : Location Quotient for sector x in region

$e_x$  : employment in sector x in region

$e$  : total employment in region

$E_x$  : employment in sector x in country

$E$  : total employment in country

$LQ_x > 1$ : above average specialisation

# Critical mass / Growth

Critical mass:

Calculated as:  $CM_x = e_x / e$

$e_x$  : employment in sector x in region

e : total employment in region

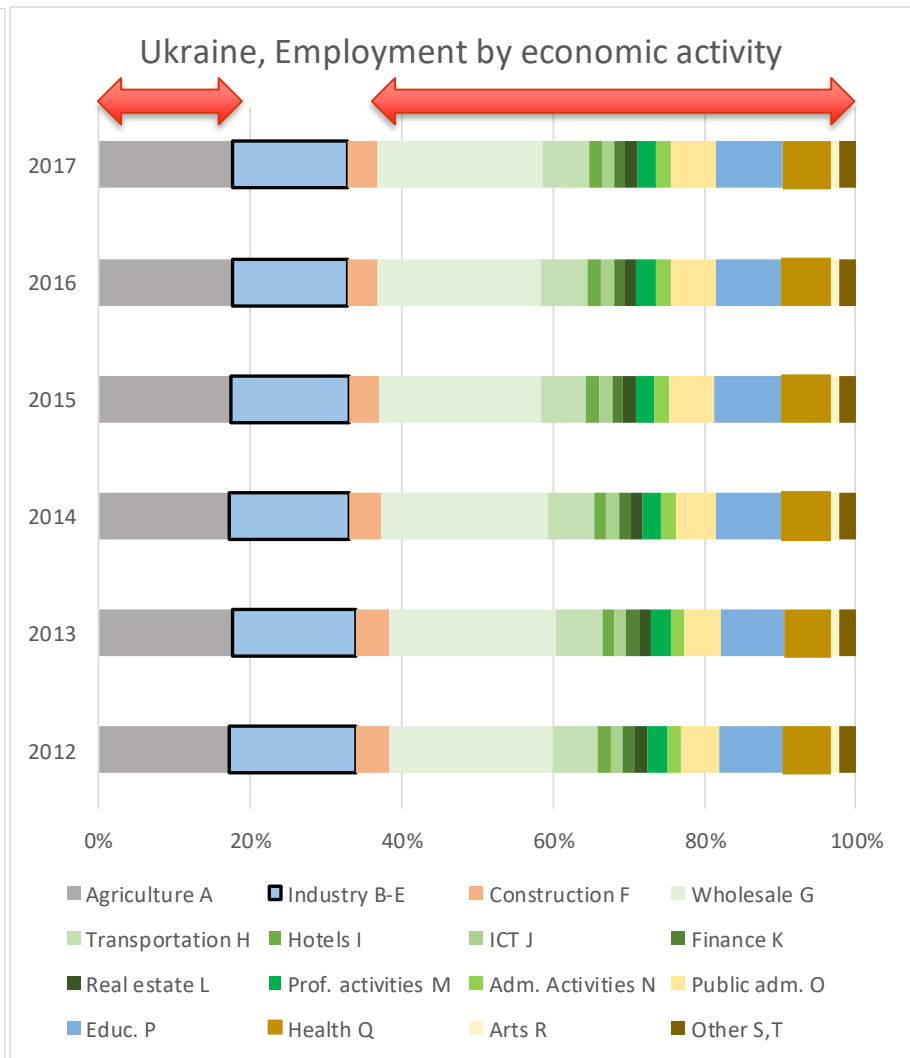
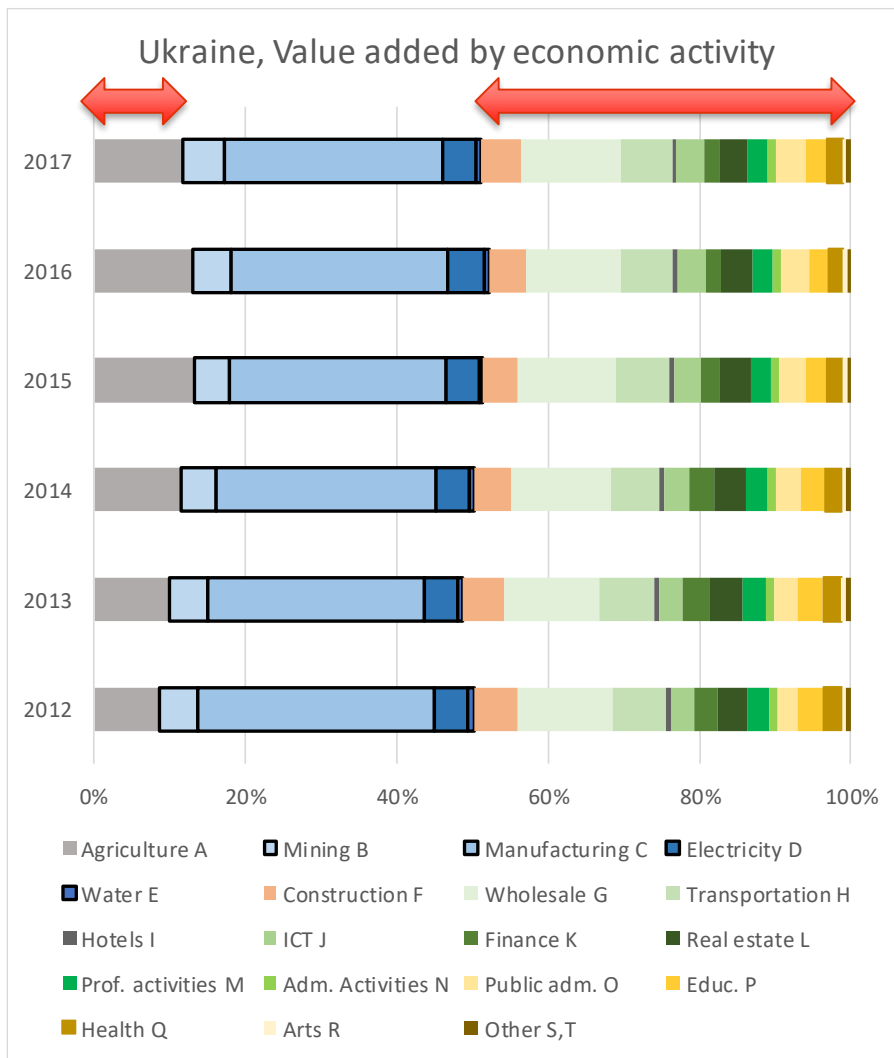
Growth:

Calculated as %-change of employment  
between 2012 and 2016

# Economic potential – Data issues

- No data for Agriculture (NACE A)
- No data for Services (NACE G-N)
- No data for Wages (needed to calculate estimate for labour productivity)

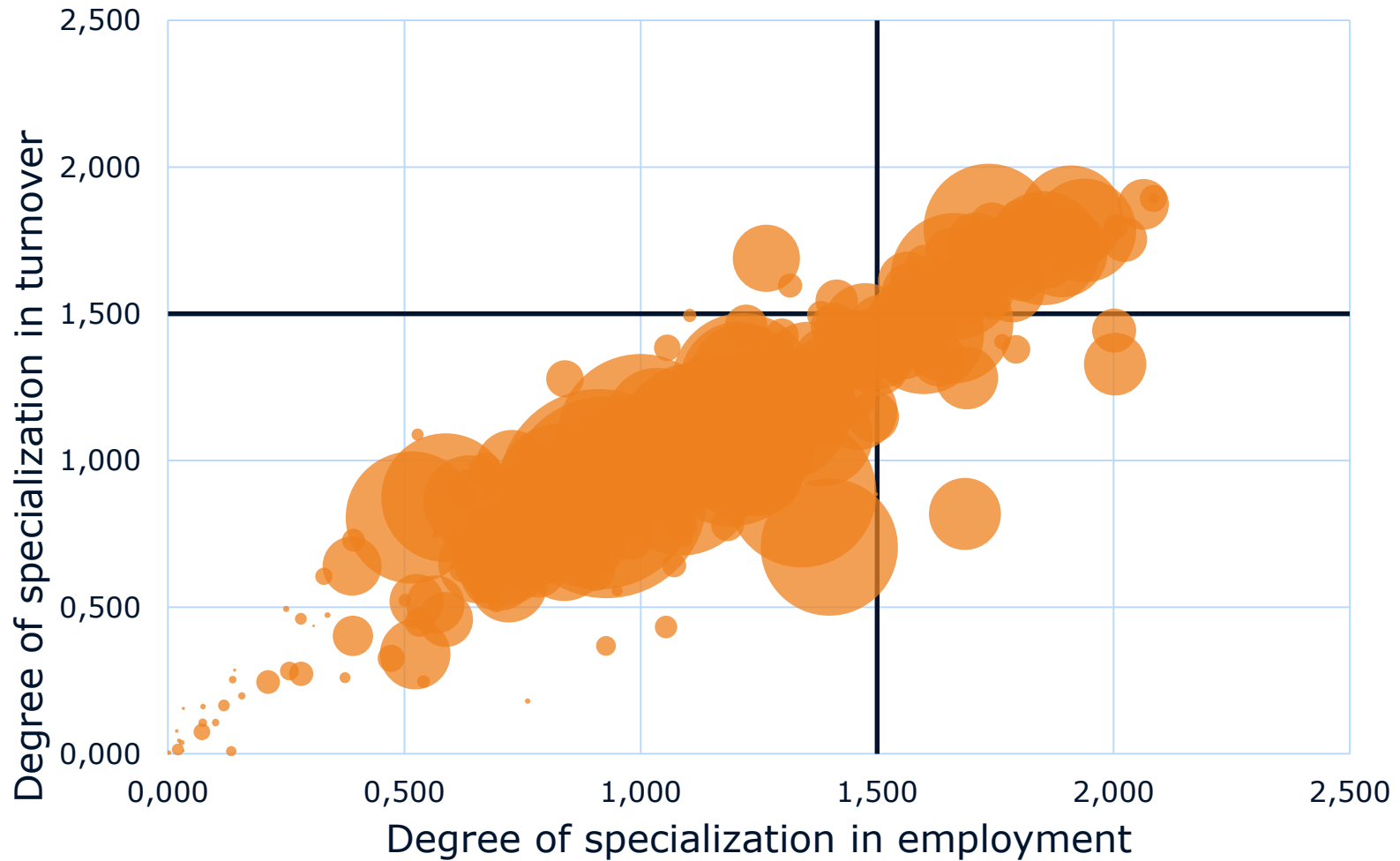
# Data for large share of economy missing



# Economic potential – Selection criteria

- Employment:
  - Specialisation (LQ) > 1.5
  - & Size > 1.5%
  - for at least 4 out of 5 years
  - & Growth > 50%
- Turnover:
  - Specialisation (LQ) > 1.5
  - & Size > 1.5%
  - for at least 4 out of 5 years
  - & Growth > 75%

# Example: Industries with current strengths (1)



Size of the bubble measures the relative size of the industry in the economy

## Example: Industries with current strengths (2)



Size of the bubble measures the relative size of the industry in the economy



## Example: Industries with current strengths (3)



Size of the bubble measures the relative size of the industry in the economy



# Innovation potential – Available data (1)

- Type of innovation, 2014, 2016, all regions
  - NACE 4-digit B-E (Industry)
    - Share of firms that introduced:
      - Product innovation (P)
      - Process innovation (P)
      - Marketing innovation (M)
      - Organisational innovation (O)

# Innovation potential – Available data (2)

- Innovation activities, 2012-2015, all regions
  - NACE 4-digit B-E (Industry)
    - Share of firm that invest in:
      - Internal R&D
      - External R&D
      - Machinery, equipment, software
      - Acquiring external know-how
      - Education and staff training
      - Market introduction of innovation
      - Other types of innovation

# Innovation potential – Data issues

- No data for Agriculture (NACE A)
- No data for Services (NACE G-N)
- No data for share of firms with at least one type of innovation
- No data on absolute number of firms with one or a specific type of innovation
- Limited coverage for innovation activities (will not be used)

# Firms with at least one type of innovation

- No data
- Data estimated
  - Combine economic data on number of firms with innovation survey data on share of different types of innovators
  - Calculate absolute number for P P M O
  - Calculate total number of PPMO innovators as:  $P^{.95} + P^{.95} + M^{.95} + O^{.95}$  (*overlap between types, estimate will introduce an error*)
  - Calculate share of PPMO innovators

# Innovation potential – Selection criteria

- “Innovative firms” (PPMO innovators, at least one innovation):

Specialisation (LQ) > 1.5  
& Size > 1.5%  
for both years

# Number of 'specialised industries' – Kharkiv

	Turnover	Employees	Innovation
NACE 4-digit	7	6	3
NACE 3-digit	9	8	10
NACE 2-digit	9	10	10
NACE 1-digit	0	0	3
Total	25	24	26

- After manual deselection (overlapping NACE levels) : **35 industries**



# Number of 'specialised industries' – Odesa

	Turnover	Employees	Innovation
NACE 4-digit	5	8	9
NACE 3-digit	9	8	9
NACE 2-digit	6	8	4
NACE 1-digit	0	0	0
Total	20	24	22

- After manual deselection (overlapping NACE levels) : **36 industries**

# Number of 'specialised industries' – Zaporizhzhia

	Turnover	Employees	Innovation
NACE 4-digit	3	4	5
NACE 3-digit	4	5	7
NACE 2-digit	4	5	2
NACE 1-digit	0	0	2
Total	11	14	17

- After manual deselection (overlapping NACE levels) : **18 industries**

# Kharkiv



- 10 Manufacture of food products
  - 10.6 Manufacture of grain mill products, starches and starch products
  - 10.7 Manufacture of bakery and farinaceous products
  - 10.8 Manufacture of other food products
- 13 Manufacture of textiles
  - 13.9 Manufacture of other textiles
- 14 Manufacture of wearing apparel
  - 14.1 Manufacture of wearing apparel, except fur apparel
- 18 Printing and reproduction of recorded media
  - 18.1 Printing and service activities related to printing

# Kharkiv



- 20 Manufacture of chemicals and chemical products
  - 20.1 Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms
  - 20.4 Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
- 21 Manufacture of basic pharmaceutical products and pharmaceutical preparations
- 22 Manufacture of rubber and plastic products
  - 22.2 Manufacture of plastic products
- 26 Manufacture of computer, electronic and optical products
- 27 Manufacture of electrical equipment
  - 27.1 Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus

# Kharkiv



- 28 Manufacture of machinery and equipment n.e.c.
  - 28.1 Manufacture of general-purpose machinery
    - 28.11 Manufacture of engines and turbines, except aircraft, vehicle and cycle engines
  - 28.2 Manufacture of other general-purpose machinery
  - 28.3 Manufacture of agricultural and forestry machinery
  - 28.9 Manufacture of other special-purpose machinery
- 30 Manufacture of other transport equipment
  - 30.3 Manufacture of air and spacecraft and related machinery
  - 30.4 Manufacture of military fighting vehicles

# Kharkiv



- 31 Manufacture of furniture
  - 31.01 Manufacture of office and shop furniture
- 32 Other manufacturing
- 35 Electricity, gas, steam and air conditioning supply
  - 35.3 Steam and air conditioning supply
- 36 Water collection, treatment and supply
- 38 Waste collection, treatment and disposal activities; materials recovery

# Odesa



- 10.13 Production of meat and poultry meat products
- 10.3 Processing and preserving of fruit and vegetables
- 10.4 Manufacture of vegetable and animal oils and fats
- 10.5 Manufacture of dairy products
  - 10.51 Operation of dairies and cheese making
  - 10.61 Manufacture of grain mill products
- 10.7 Manufacture of bakery and farinaceous products
  - 10.71 Manufacture of bread; manufacture of fresh pastry goods and cakes
- 11 Manufacture of beverages
  - 11.01 Distilling, rectifying and blending of spirits
  - 11.02 Manufacture of wine from grape

# Odesa



- 15 Manufacture of leather and related products
- 18 Printing and reproduction of recorded media
  - 18.1 Printing and service activities related to printing
  - 18.12 Other printing
- 20 Manufacture of chemicals and chemical products
  - 20.1 Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms
    - 20.15 Manufacture of fertilisers and nitrogen compounds
  - 20.4 Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
    - 20.41 Manufacture of soap and detergents, cleaning and polishing preparations



# Odesa



- 22 Manufacture of rubber and plastic products
  - 22.2 Manufacture of plastic products
    - 22.22 Manufacture of plastic packing goods
  - 23.6 Manufacture of articles of concrete, cement and plaster
- 25 Manufacture of fabricated metal products, except machinery and equipment
  - 25.9 Manufacture of other fabricated metal products
- 27 Manufacture of electrical equipment
  - 27.1 Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus
  - 27.3 Manufacture of wiring and wiring devices

# Odesa



- 28.2 Manufacture of other general-purpose machinery
- 32 Other manufacturing
  - 32.5 Manufacture of medical and dental instruments and supplies
- 33 Repair and installation of machinery and equipment
  - 33.1 Repair of fabricated metal products, machinery and equipment
  - 35.3 Steam and air conditioning supply
- 38 Waste collection, treatment and disposal activities; materials recovery

# Zaporizhzhia



- 10.1 Processing and preserving of meat and production of meat products
- 10.4 Manufacture of vegetable and animal oils and fats
  - 10.41 Manufacture of oils and fats
- 10.7 Manufacture of bakery and farinaceous products
- 11 Manufacture of beverages
  - 23.2 Manufacture of refractory products
- 24 Manufacture of basic metals
  - 24.1 Manufacture of basic iron and steel and of ferro-alloys
  - 25.9 Manufacture of other fabricated metal products
- 26 Manufacture of computer, electronic and optical products
  - 26.5 Manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks

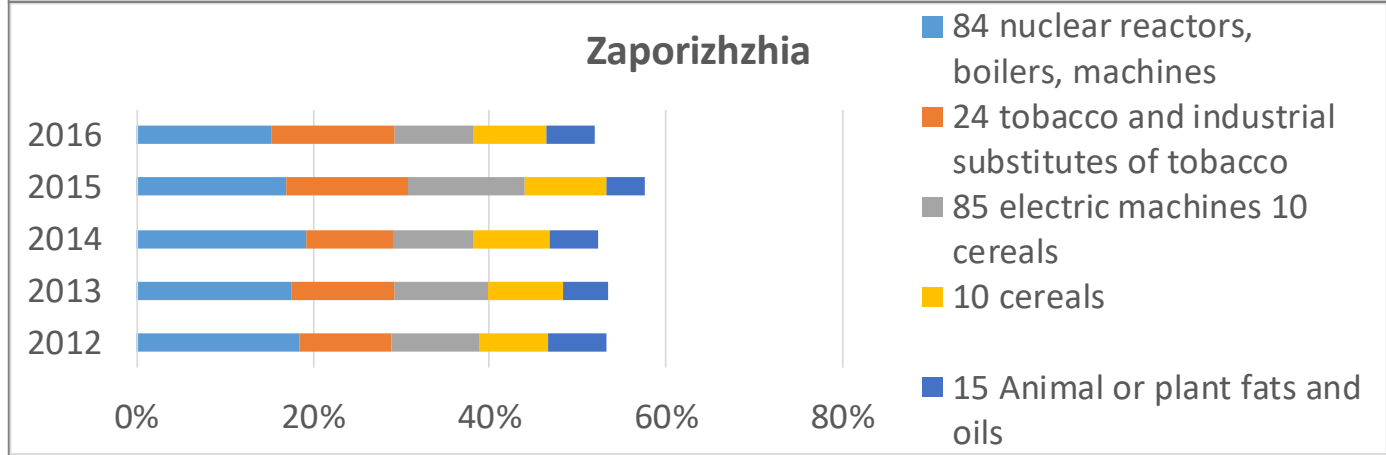
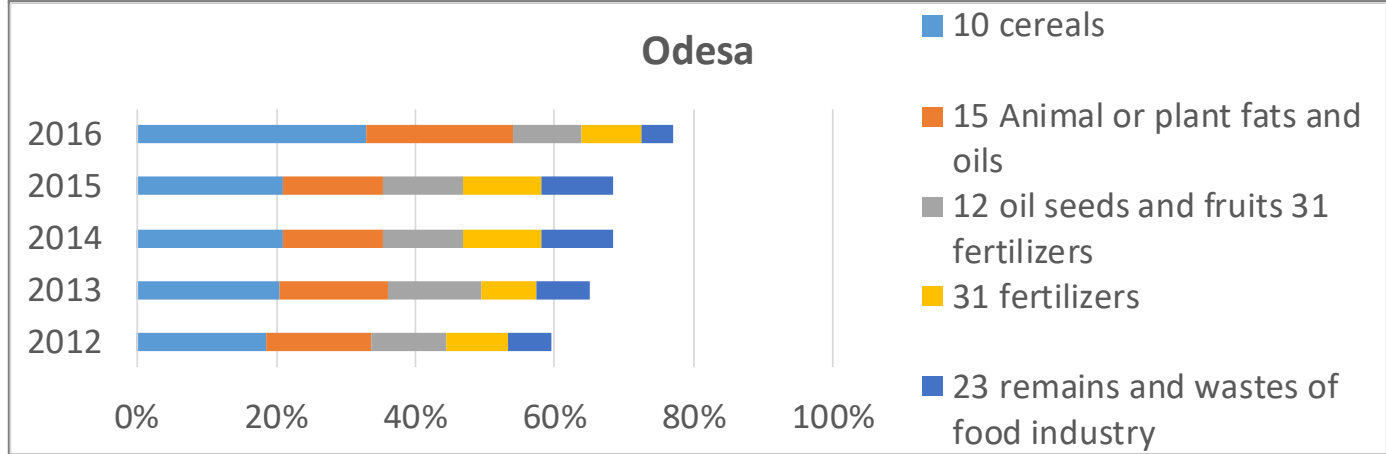
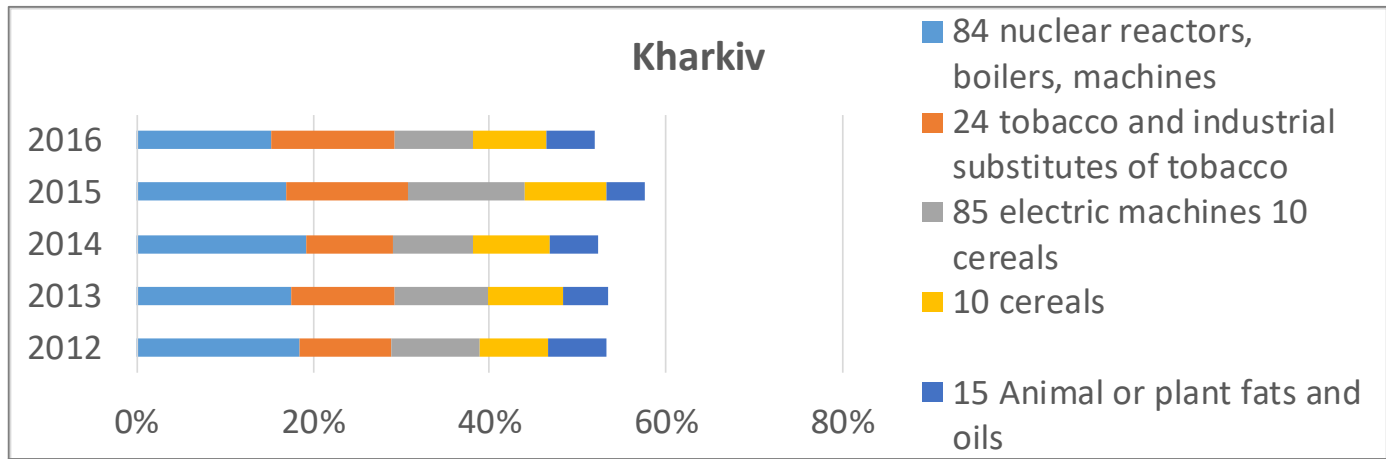
# Zaporizhzhia



- 27 Manufacture of electrical equipment
  - 27.1 Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus
  - 27.3 Manufacture of wiring and wiring devices
- 30 Manufacture of other transport equipment
  - 30.3 Manufacture of air and spacecraft and related machinery
- 35 Electricity, gas, steam and air conditioning supply
  - 35.11 Production of electricity

# Possible use of export data

- SITC (Standard International Trade Classification) 4-digit data available for the 3 pilot regions for 2012-2016
- Export data could be of interest as they signal the presence of competitive industries
- However:
  - Data are by SITC classification, which is not easily transferred to NACE
  - Exports are not relevant for all industries, in particular not for so-called local industries
  - Exports are concentrated in a few industries only



# Exports– Selection criteria

Specialisation (LQ) > 1.5 & Size > 1.5%  
for at least 4 out of 5 years  
& Growth > 75%

=> Almost no SITC 2-digit category selected

'Relaxed' selection criteria

Specialisation (LQ) > 1.5 & Size > 1.5%  
for at least 4 out of 5 years

OR

Growth > 75% & Average Size > 1.5%

# Results - Kharkiv

- 19 preparations of grains
- 24 tobacco and industrial substitutes of tobacco
- 39 plastics and polymeric materials
- 69 ceramic products
- 84 nuclear reactors, boilers, machines
- 85 electric machines
- 87 ground transport facilities excluding railway
- 90 optical, cinematographic apparatus
- 94 furniture



# Results - Odesa

- 05 other animal products
- 10 cereals
- 12 oil seeds and fruits
- 22 alcoholic and non-alcoholic beverages, vinegar
- 23 remains and wastes of food industry
- 28 inorganic chemicals
- 31 fertilizers

# Results - Zaporizhzhia

- 10 cereals
- 26 ores, slags, ashes
- 72 ferrous metals
- 81 other base metals
- 84 nuclear reactors, boilers, machines

# Issues for discussion

- Which data to use?
  - Economic data
    - Wages => productivity
    - Exports? How to link to NACE?
  - Innovation data?
    - Differentiate between Product and Business process innovators?
    - Also data on R&D expenditures?
- Which thresholds to use?

# To be continued

- Tomorrow's statistical workshop
  - More details on methodology