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SMART SPECIALIZATION STRATEGY AND ITS OPERATIONALIZATION IN THE REGIONAL POLICY: CASE FINLAND

Jari KAIVO-OJA[1], Saku VÄHÄSANTANEN[2], Ari KARPPINEN[3], Teemu HAUKIOJA[4]

[1]Finland Futures Research Centre, Turku School of Economics, University of Turku
[2]Regional Council of Satakunta, Pori, Finland
[3]School of Management, University of Tampere, FI-33014 Tampereen yliopisto, Tampere, Finland
[4]Pori Unit, Turku School of Economics, University of Turku, P.o. Box 170 (Pohjoisranta 11A), FI-28101 Pori, Finland
E-mails: [1]jari.kaivo-oja@utu.fi (corresponding author); [2]saku.vahasantanen@satakunta.fi; [3]ari.karppinen@uta.fi; [4]teemu.haukioja@utu.fi

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Abstract. In the European Union, smart specialization is an important concept in regional policy. Its primary aim is to achieve inclusive and sustainable economic growth. There is a lack of convenient region specific measures to operationalize smart specialization startegies (S3). The purpose of the paper is to find "indices of smart specialization" on a regional level. We propose indices that are based on (1) the rate of industrial diversification, (2) revealed comparative advantage and (3) regions' overall relative specialization. In the empirical part, we analyze smart specialization in Finland using structural data provided by Statistics Finland for seventy sub-regions (LAU1) and 24 sub-industries in manufacturing. These industries are the most important for exports, productivity, and regional economic performance for a small country. The following indices are used in empirical evaluations: Herfindahl-Hirschman Index (HHI) for regional diversity, Balassa-Hoover Index (BHI) for revealed comparative advantage, and Region's Relative Specialization Index (RRSI) for aggregate regional specialization differences. The concept of smart specialization is related to these measures. Index analyses reveal that many growing sub-regions have similar comparative advantages. This means inter-regional synergy, and it enables opportunities for strategic cooperation between regions. To develop smart specialization strategies for Europe's regions, we need these kinds of empirical knowledge-based management tools and planning approaches.

Keywords: smart specialization, Finland, manufacturing, sub-industry, LAU1, Herfindahl-Hirschman index (HHI), Balassa-Hoover index (BHI), revealed comparative advantage, Region's relative specialization index (RRSI).

JEL Classification: B41, C18, C43, D20, D78, F14, F43, F63, H70, I23, I25, I52, L60, L78, N80, O12, O32, O33, R10, R11, R12, R58, Z18.

1. Introduction

The European Union has a cohesion policy which underlines integrated and place-based economic convergence. The general dimensions of National/Regional Research and Innovation Strategies for Smart Specialisation (S3 strategies) are policy support and investments, spatial strengths, competitive advantage and excellence, innovation activities, stakeholders' participation, and experiments and evidence-based policy (European Commission 2014: 1). We focus here on the evidence-based strategy tools for RIS3.

We shall demonstrate the use of some regional planning and management tools, which are suitable for smart specialization (S3) analysis and management. We expect these methods are useful in the regional policy processes of the European Union. The EU regions are facing many challenges of the global economy and global political landscape. The spatial context of our analysis is Finland and its sub-regions (LAU1). Earlier, Karppinen and Vähäsantanen (2015) have studied the resilience of Finnish sub-regions by focusing on manufacturing industries. This means that our analysis can be applied in all the LAU1-level sub-regions in the European Union. There is large and growing literature on the issue of smart specialization (Capello 2014; McCann, Ortega-Argilés 2015; Foray 2015; Gianelle *et al.* 2016). In addition to the EU, also the OECD has paid attention to this issue in its report (OECD 2013). In broader international perspective, smart specialization has been seen a policy relevant topic.

Our framework is closely linked to the mainstream thinking of economics. We emphasize the identification of potential domains of specialization that might be beneficial for the country given its productive assets (Foray 2011). We focus on the industries, the most important element of Quartet Helix, when analysing smart specialization strategy in the regional context. Other key elements of the helix are the academia, the government, and civil society with citizens (see e.g. Foray *et al.* 2009; Foray 2011, 2012, 2014, 2015; Santonen *et al.* 2014; Virkkala *et al.* 2014; S3 Platform 2015; Johnson 2015; McCann, Ortega-Argilés 2015). The principle of comparative advantage[1] and the structure of spatial economic activity have been key topics in the field of regional economics. Our aim is to link these two important approaches to the discussion on smart specialization strategy. This critical aspect of smart specialization has been lacking in many scientific articles, which have analysed and elaborated smart specialization strategy in the European Union (see e.g. Jucevicius, Galbuogiene 2014; Sipilova 2015; Gule 2015; Paliokaite *et al.* 2015; Paliokaite *et al.* 2016; Gheorghiu *et al.* 2016). We shall provide a new empirical tool package for the analysis of smart specialization strategy in the European Union. Measurement of these economic issues is important for the smart specialization strategy in EU-countries and EU-regions (Gianelle *et al.* 2016).

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[1] Comparative advantage is a traditional concept in the field of international trade. We apply the hypothesis of revealed comparative advantage, which is parallel to competitive advantage in a *regional* context (see e.g. Thissen *et al.* 2013: 34–35).

Political decision-makers in European Union are today very interested in key success factors like economic growth, jobs, and investments (see European Commission 2017). These economic success factors are always linked to regional economies in the European Union. The idea of smart specialization can be considered a strategic planning policy instrument. Our motivation is to show how regions in the European Union can analyse the actual contents of smart specialization policy in their local activities. In the practice of regional economic policy, we can improve economic productivity and export success through smart specialization. We argue that smart specialization strategy must be based on the knowledge of basic realities of regional economy and place-based industrial activity/structure.

2. Theoretical framework

In scientific literature, the concepts of innovation, competitive advantage, and spatial development are closely interconnected (Borsekova *et al.* 2016). These concepts have various common features and are the subject of many debates among practioners and academics. This article focuses on competitive advantage and spatial development, but we understand that all kinds of innovation activities are shaping local economies and industries. Current industrial structures and regional competitive advantages are outputs of innovation activities (Fig. 1).

The smart specialization strategy depends on the three key elements described below. If (1) there is not much innovation and R&D activity, if (2) there are not much competitive advantages in local economies, and if (3) spatial development is not effective and economy is not delivering economic growth, welfare, and happiness, the development process is not fully based on smart specialization strategy. Our empirical analysis is focused directly on the measurement of competitive advantage and spatial development. Innovation activities are driving forces for spatial economic growth, but in this article we are focusing on realized competitiveness.

The elements of (1) creative destruction and entrepreneurial discovery (see e.g. Maliranta 2005) and (2) flexible serendipity management can play regenerative roles in spatial development (see e.g. Kakko *et al.* 2016; Roth *et al.* 2017; Gheorghiu *et al.* 2016). These aspects do not eliminate the role of strategic planning in the context of spatial development.

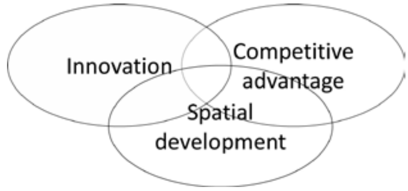

Fig. 1. Interconnections among innovation, competitive advantage, and spatial development (Borsekova *et al.* 2016).

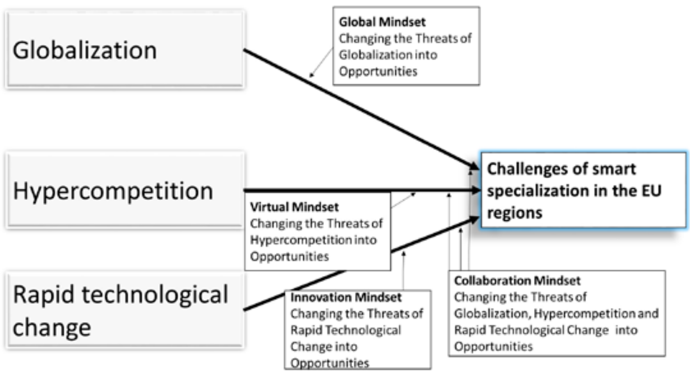

Fig. 2. Framework showing relationships between competitive challenges, mindsets, and smart specialization challenges (modified, see Lahari, Perez-Nordtvedt 2008: 313).

In next sections, we define our empirical analysis tools for the smart specialization strategy. Smart specialization of the EU regions does not happen in a vacuum. Globalization, hypercompetition, and rapid technological changes reshape the conditions of regions and local economies continuously (see Fig. 2 above). Mindsets of local stakeholders play an important role in the formulation of smart specialization strategies (see Lahari, Perez-Nordtvedt 2008; Virkkala *et al.* 2014).

Based on Fig. 2 we can understand that it is important that the mindsets of stakeholders (global mindset, virtual mindset, innovation mindset, and collaboration mindset) correlate with the realities of globalization, hypercompetition, and rapid technological change. Our empirical approach directly supports regional and local reality checks in this respect.

3. Index framework of the study

All the following indices are based on Karppinen and Vähäsantanen (2015).

Herfindahl-Hirschman Index (HHI)

We apply the Herfindahl-Hirchman Index (HHI) to the Finnish sub-region data. Our data includes 71 sub-regions and 24 industrial sectors. The Herfindahl-Hirschman index (HHI) is a commonly accepted measure of market concentration. We are not analyzing market shares but the industry shares of sub-regions. The HHI formula is the following:

$$HHI_s = \sum_{i=1}^{n} \left(\frac{x_i}{x} \right)_s^2 \tag{1}$$

where x_i is the number of employed people in industrial sector (i) and x is total number of people employed in all industrial sectors in region (s) and n is number of industrial sectors (n). HHI-index is calculated as the sum of squared industry shares for each sub-region. In other words, it measures the diversification of industry structure of a sub-region. HHI takes values between [0,1]. The smaller the value, the more diversified region, and vice versa.

Balassa-Hoover Index (BHI)

The key index in this study is the Balassa-Hoover Index (BHI). The formula of BHI is the following:

$$\mathrm{BHI}_{\mathrm{si}} = \frac{\frac{x_{si}}{X_i}}{\frac{x_s}{X}} \tag{2}$$

where x_{si} is the number of employed people in region s and in industry i, (Xs_i/Xi) is corresponding share for all sub-regions. If $\mathrm{BHI}_{\mathrm{si}} \geq 1$, there is revealed comparative advantage in relation to all regions. We use BHI with industrial labor data of Statistics Finland (2017).

Region's Relative Specialization Index (RRSI)

We use RRSI as a measure of comparative specialization of sub-regions. RRSI can be calculated in the following way:

$$(RRSI)_s = \sqrt{(1 - BHI_{i1})^2 + (1 - BHI_{i2})^2 + \ldots + (1 - BHI_{in})^2} \tag{3}$$

The higher the RRS index is the more specialized the structure of manufacturing industry is in the region. If the structure of a region is homogenous, the RRSI obtains value zero. If the RRSI ≠ 0, the industrial structure of a region differs from the country's average. The higher the RRSI value, the more a region is different from the whole country.

4. Empirical demonstrations: case Finland

In this section, we present some empirical results based on smart specialization tools presented above. We focus on key results in the case of Finland. First, we figure out the HHI index for sub-regions in Finland (Fig. 3). This indicator is important for resilience analysis. Small HHI value means stronger resilience potential and higher index numbers mean weaker resilience. The HHI is an indicator of industrial diversity.

From the Figure 3, we can observe that in 2014 the seven most diversified sub-regions in Finland were Kuopio, Turku, Lahti, Helsinki, Tampere, Hämeenlinna and Pori. Except in Helsinki and Tampere, they all have been growth-led sub-regions in the recent recession. The GDP rate of growth in Finland was 2.07% in 2011–2014. Corresponding figures for the sub-regions are: 4.94% in Turku, 4.19% in Hämeenlinna, 3.81% in Jyväskylä, 3.80% in Kuopio, 3.63% in Pori, and 2.27% in Lahti. The rates of GDP growth in Helsinki (1.97%) and in Tampere (1.86%) were slightly less than the average (Statistics Finland 2017). Since the late 2000s Oulu region has been one of the growth centers in Finland due to Nokia and the rapid growth of the ICT-sector. During 2011–2014, its rate of growth (0.53%) deviated 70% from the country average.

The HHI-index tells that the region is the least diversified among the group of large sub-regions.

On the the hand, Salo sub-region was hit by the worst negative rate of growth, –9.04% in 2011–2014. Other sub-regions with negative rates of growth were Porvoo (–7.05%), Loviisa (–5.46%), Ålands Skärgård (–5.25%), Etelä-Pirkanmaa (–4.64%), Sydösterbotten (–0.86%), Raahe (–0.68%), Kouvola (–0.66%), and Äänekoski (–0.26%). From the Figure 3 we can observe that except in Kouvola and Salo, these sub-regions have relatively large values for the HHI, i.e. their industrial structures are less diversified than in average.

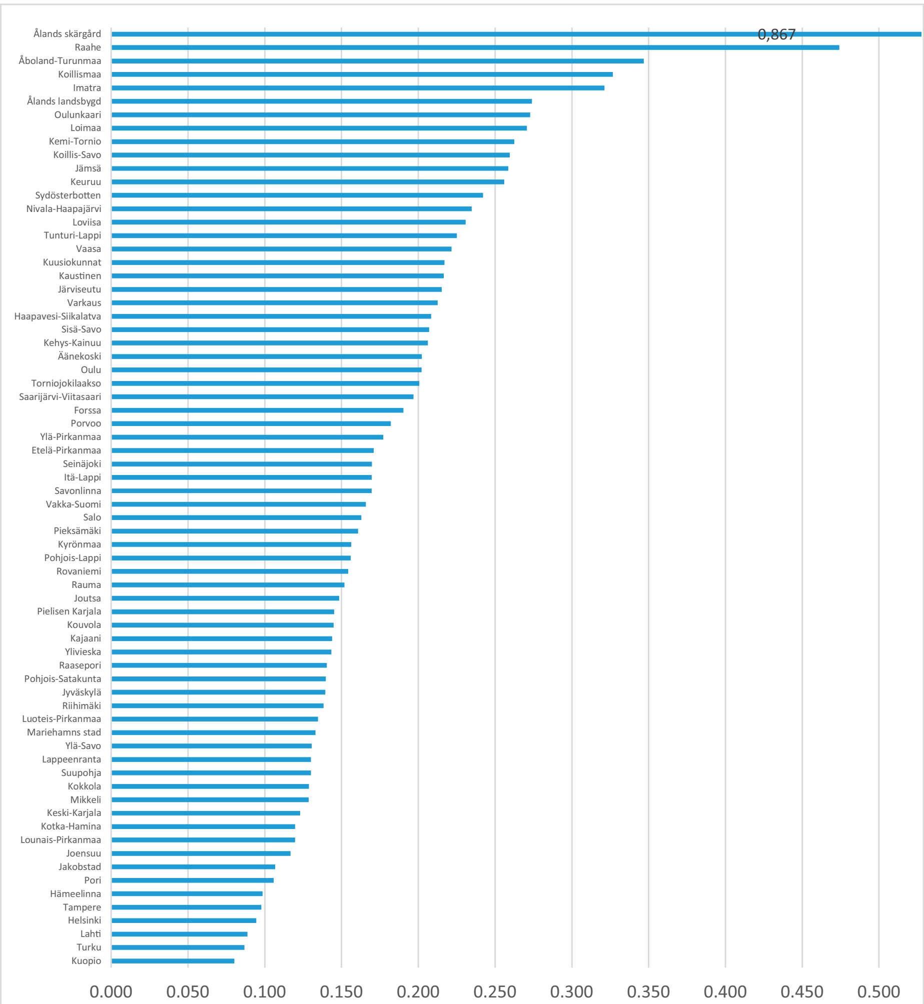

Fig. 3. Herfindahl-Hirschman Index of sub-regions (LAU1) based on the analysis of 24 industrial sectors in Finland, 2014.

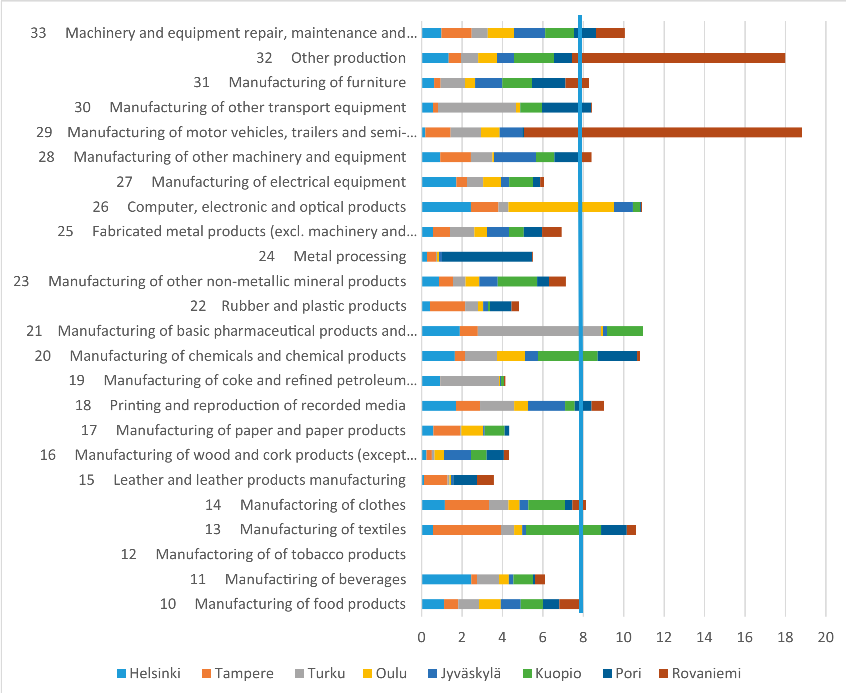

Fig. 4. Balassa-Hoover Index (BHI) of industrial production (24 manufacturing sectors) in some urban sub-regions in Finland, 2014.

Next, we present Balassa-Hoover Index for industrial production (24 manufacturing sectors) in eight urban regions (Fig. 4). With the exception of Oulu, these regions have more diversified industrial structure than in average (see Fig. 3).

In Figure 4, if the BHI values for industries exceed eight then comparative advantage is revealed. 13 such manufacturing industries can be found. As we can see, the BHI values are not evenly distributed among the regions. We can interpret to mean that when the value of BHI > 8, the industries as aggregate reveal comparative advantage, but not necessarily in a specific region. To get this information, we need to inspect Figure 5, where cases for BHI > 1 are exposed.

Few observations can be made.

First, no industry exsits as a source of revealed comparative advantage in all eight regions. Second, three industrial sectors ("Machinery and equipment repair, maintenance and installation", "Manufacturing of furniture", and "Manufacturing of chemicals and chemical products") give impetus to revealed comparative advantage in five regions. This result can be interpreted in terms of smart specialization. One one hand, these five

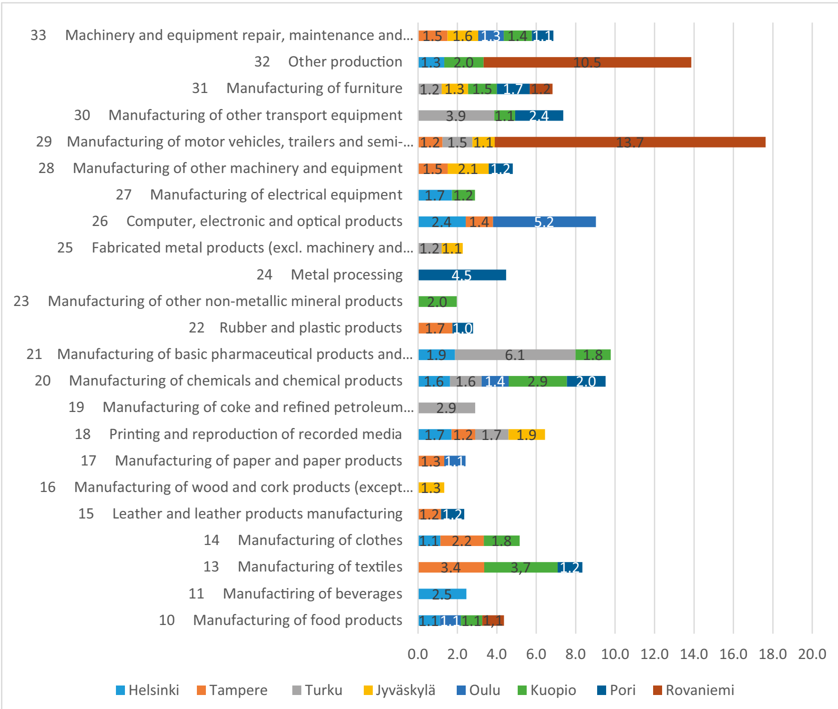

Fig. 5. Revealed comparative advantage (BHI > 1) in industrial sectors for some key Finnish urban sub-regions 2014 (BHI values inside columns)

regions have been successful in competition as compared to the whole country. On the other hand, these five regions have an opportunity to exploit inter-regional synergies. That is, Helsinki, Turku, Oulu, Kuopio and Pori could try to seek strategic alliances to cooperate in activities where synergies can be found; in manufacturing of chemicals and chemical products, for example. Figures 7–9 describe corresponding interregional synergy potentials for all 70 LAU1 regions, and some manufacturing industries.

Third, as we combine the results of Figure 3 and 5, it can be found that less diversified sub-regions Oulu and Rovaniemi (relatively high HHI values) have less revealed comparative advantage in industries. Further, there are some dominating industries in their regional economy: "Computer, electronic and optical products" in Oulu (BHI = 5.2), "Manufacturing of motor vehicles, trailers and semi-trailers" (BHI = 13.7), and unspecified "Other production" in Rovaniemi (BHI = 10.5). Correspondingly, in Helsinki sub-region there are nine manufacturing industries, which belong to revealed comparative advantage sectors, and the range of the BHI value is from 1.1 to 2.5. This kind of information is highly valuable for smart specialization discussions in Finland. Similar smart specialization analysis can be applied to all European subregions and urban centres.

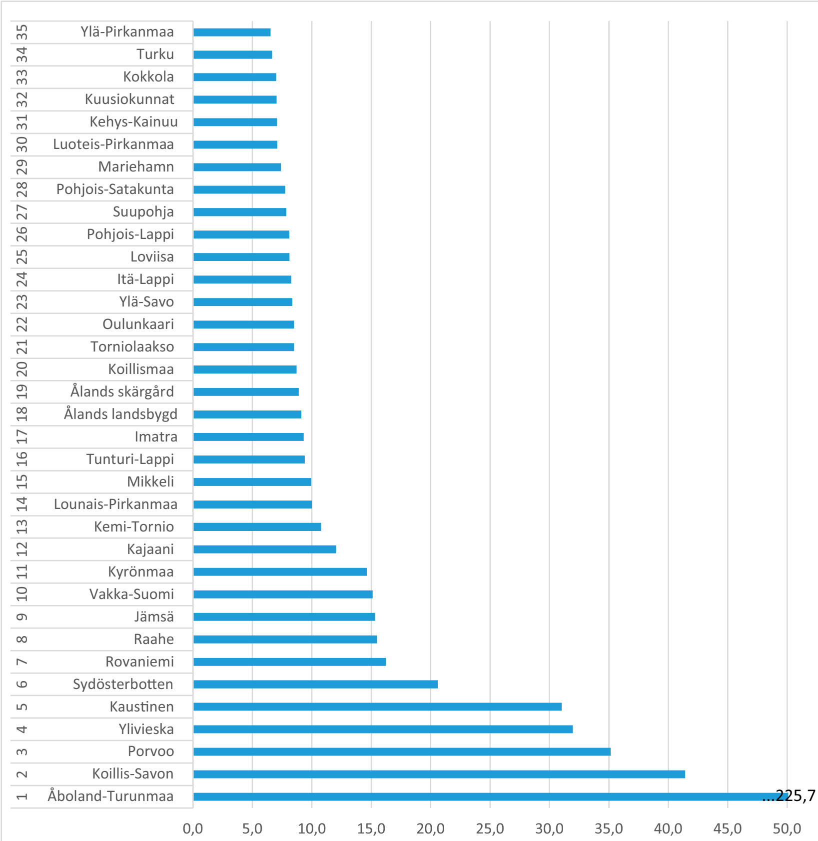

Fig. 6a. RRS Index, 35 sub-regions in Finland, the index number refers to the most specialized sub-region, rankings 1–35, 2014.

In Figures 6a and 6b, we figure out the key findings of the Region's Relative Specilization Index (RRSI) for Finnish sub-regions. The higher the RRS index the more specialized the structure of manufacturing industry is in a region as compared to the whole country (see Equation 3).

The BHI index can be used to industry specific analyses. Instead, the RRS index can be used to measure the specialization intensity of the whole regional economy. The RSS index can also be used to measure the aggregate deviation of specialization from country's avarerage. RSS index analyses can reveal useful information for regional smart specialization strategies. The HHI analysis reflects the risk potential that is embedded in region's economic structure, if it confronts the exogenous economic shocks. Instead, the RRSI analysis reflects regions' risk for exogenous (national or supranational) industrial or regional policy. Therefore, smart specialization policy should be region specific. All Finnish regions are covered in the RRSI analysis in Figures 6a and 6b.

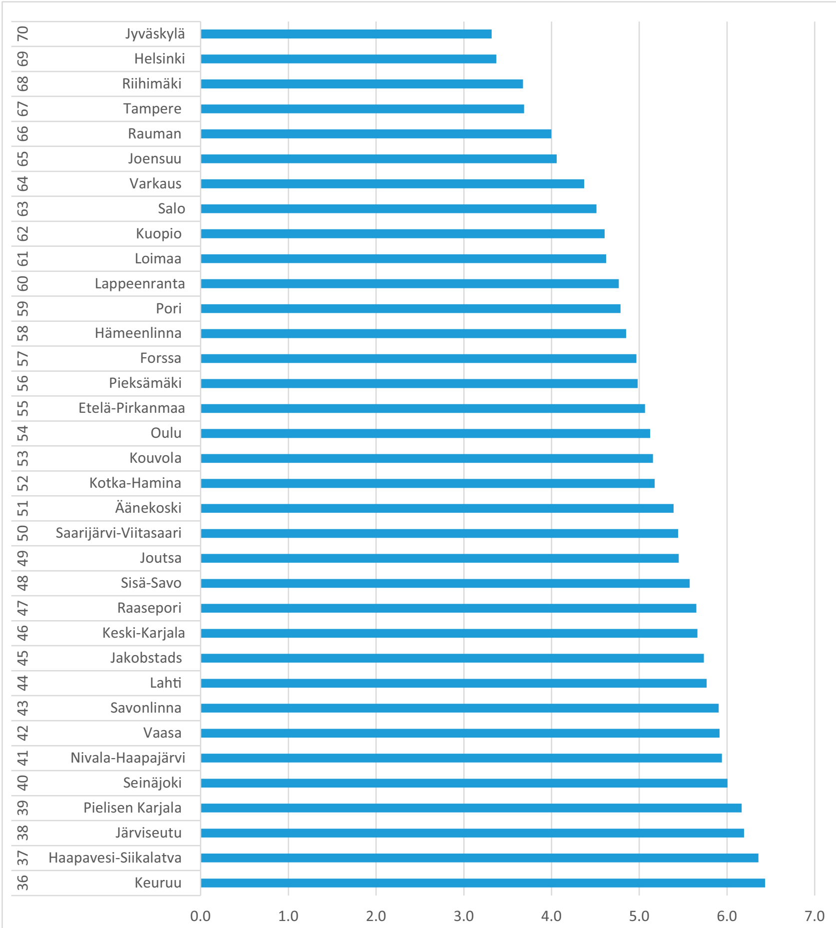

Fig. 6b. RRS Index, 35 sub-regions in Finland, the index number refers to the most specialized sub-region, rankings 36–70, 2014.

The Top 10 sub-regions – Jyväskylä, Helsinki. Riihimäki, Tampere, Rauma, Joensuu, Varkaus, Salo, Kuopio and Loimaa – are similar with the whole country's industrial structure. Turku region is the second in diversification as measured by the HHI, but its RRS index is 34^{th} in the ranking reflecting that its deviation from country's average is notable. This can be explained by relatively large manufacturing of basic pharmaceutical products and pharmaceutical items in Turku region.

Figures 7, 8, and 9 demonstrate the power of our tool package in the context of smart specialization potential. Smart specialization potential is calculated for all 24 industrial sectors. Top 10 subregions are reported in three industries as an example: (1) Manufacturing of food products, (2) Manufacturing of paper and paper products, and (3) Metal processing.

Figure 7 reports the smart specialization potential (measured by Balassa-Hoover Index; revealed comparative advantage) of top 10 sub-regions in the sector “Manufacturing of food products”. These sub-regions may have potential opportunities to exploit horizontal inter-region synergies.

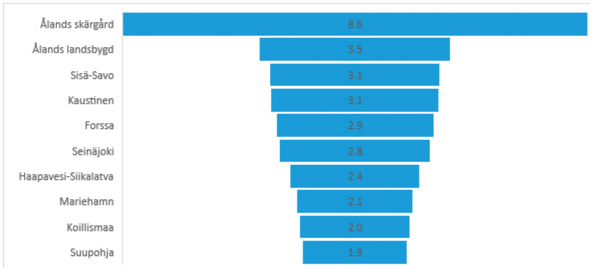

Fig. 7. Manufacturing of food products, smart specialization potential (measured by Balassa-Hoover index) of top 10 subregions in Finland, 2014.

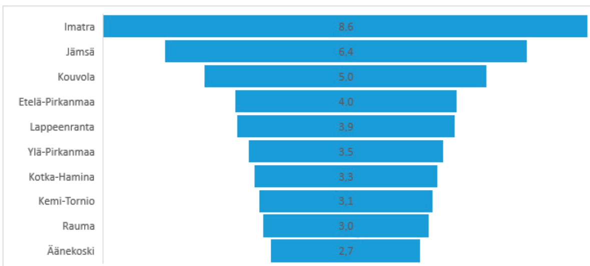

Fig. 8. Manufacturing of paper and paper products, smart specialization potential (measured by Balassa-Hoover index) of top 10 sub-regions in Finland, 2014

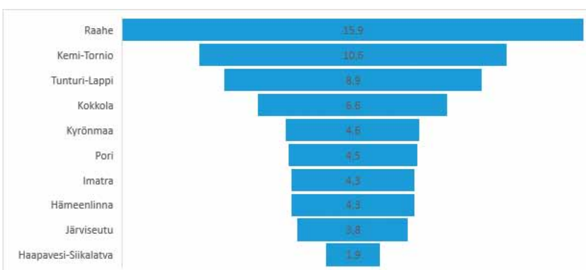

Fig. 9. Metal processing, smart specialization potential (measured by Balassa-Hoover index) of top 10 sub-regions in Finland, 2014

To sum up, for **Ålands** skärgård, **Ålands** landsbygd and Sisä-Savo it might be worthwhile to seek possible strategic alliances to exploit the probable benefits of inter-regional horizontal co-operation in Food Production industry (Fig. 7). For Imatra, Jämsä and Kouvola the same holds in Manufacturing of Paper and paper products, and for Raahe, Kemi and Tunturi-Lappi in Metal processing.

5. Conclusions

In this study we have discussed the smart specialization strategy and its numerical assistance. Empirical analyses are focused on 70 LAU1 regions and 24 manufacturing sector industries (2-digit level) in Finland. Our aim is to demonstrate the power of well-known economic analysis tools in the context of smart specialization strategy (S3). Smart specialization strategy is a regional policy agenda aimed at increasing a country's competitiveness via exploiting intra-region efficiencies and inter-regional synergies. Many of these concepts are well-known for regional practioners, but numerical evaluations of smart specialization are almost absent. We suggest that in the EU it is beneficial to analyze comparative advantages of regions and sub-regions in the context and formulation of smart specialization strategies. Further, empirical index based analyses could help regional and national decision-makers to identify key economic structures and potentials of smart specialization by multifaceted indicator analyses.

We illustrated the power of three key indicators, HHI, BHI, and RRS indices. Already these demonstrations show us that they provide useful information for strategic analyses of smart specialization. Revealed comparative advantage index is a useful tool. Attention needs to be paid also to resilience and diversification of industrial activity in the EU regions and sub-regions. Our analyses reveal the potential benefits of these economic index analyses. There is need to integrate science, technology, and innovation (STI) indicators to regional competitiveness and other economic analyses.

Revealed comparative advantages of sub-regions can be interpreted as outcomes of long-run innovation activities. In future research, this critical link between STI activities with comparative advantages and resilience levels requires further scientific analyses.

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References

Borsekova, K.; Vanova, A.; Vitalisova, K. 2016. *Smart specialization for smart spatial development: innovative strategies for building comparative advantages in tourism in Slovakia*. Socio-Economic Planning Sciences (in press), 1–12.

Capello, R. 2014. Smart specialisation strategy and the new EU Cohesion policy reform: introductory remarks, *Scienze Regionali* 13(1): 5–14. https://doi.org/10.3280/SCRE2014–001001

European Commission. 2014. *National/regional innovation strategies for smart specialisation (RIS3). Cohesion policy 2014–2020* [online], [cited 07 June 2017]. Available from Internet: http://ec.europa.eu/regional_policy/sources/docgener/informat/2014/smart_specialisation_en.pdf

European Commission. 2017. *Priority. Jobs, growth and investment. Stimulating investment for the purpose of job creation* [online], [cited 07 June 2017]. Available from Internet: https://ec.europa.eu/priorities/jobs-growth-and-investment_en

Foray, D.; David P.; Hall, B. 2009. Smart specialisation – the concept, in *Knowledge Economists Policy Brief Nr. 9* [online], [cited 07 June 2017]. Available from Internet: http://ec.europa.eu/invest-in-research/pdf/download_en/kfg_policy_brief_no9.pdf?11111

Foray, D. 2011. Smart specialisation: from academic idea to political instrument, the surprising destiny of a concept and the difficulties involved in its implementation, in *Paper presented at the European Integration Process in the New Regional and Global Settings Conference*, 19–20 October 2011, Warsaw, Poland.

Foray, D. 2012. Economic fundamentals of smart specialisation, *Economies* 83(2): 55–78.

Foray, D. 2014. From smart specialisation to smart specialisation policy, *European Journal of Innovation Management* 17(4): 492–507. https://doi.org/10.1108/EJIM-09–2014–0096

Foray, D. 2015. *Smart specialization. Opportunities and challenges for regional innovation policy*. London: Routledge.

Gheorghiu, R.; Andreescu, L.; Curaj, A. 2016. A foresight toolkit for smart specialization and entrepreneurial discovery, *Futures* 80: 33–44. https://doi.org/10.1016/j.futures.2016.04.001

Gianelle, C.; Kiriakou, D.; Cohen, C; Przeor, M. 2016. *Implementing smart specialisation strategies: a handbook*. European Commission, Joint Research Centre, Directorate B. Growth & Innovation Smart Specialisation Platform. Joint Research Centre. Seville, Spain.

Gule, A. 2015. Analysis of methodological approach to identify smart specialization on the example of Poland, *Procedia – Social and Behavioral Sciences* 213: 817–823. https://doi.org/10.1016/j.sbspro.2015.11.483

Johnson, J. 2015. *Smart specialisation in Ostrobotnia. What, why, how and so what*? [online], [cited 07 June 2017]. Österbottens Förbund. Available from Internet: www.obotnia.fi/assets/1/Regionalutvecklingsenheten/smart-spec/Tema-discussion-smartspecialization-25–5-2015.pdf

Jucevicius, R.; Galbuogiene, A. 2014. Smart specialization: towards the potential application of the concept for the local development, *Procedia – Social and Behavioral Sciences* 156: 141–145. https://doi.org/10.1016/j.sbspro.2014.11.136

Kakko, I.; Kaivo-oja, J.; Mikkelä, K. 2016. How to support and develop the innovation-oriented entrepreneurship in turbulent VUCA-conditions?, in *"Innovation for Development" 2016 Tangerang Salatan Global Innovation Forum*, 20th–23th September 2016, PUSPITEK, Tangerang Selaton City, Banten Province, Indonesia [online], [cited 07 June 2017]. GIF Tangeran Salantan, 119–134. Available from Internet: http://www.slideshare.net/ilkkakakko/how-to-support-and-develop-the-innovationoriented-entrepreneurship-in-turbulent-vuca-conditions

Karppinen, A.; Vähäsantanen, S. 2015. *Suomen seutukuntien taloudellinen kilpailukyky ja resilienssi* (in Finnish only: Economic Competitiveness and Resilience of Finnish sub-regions). University of Turku, Turku School of Economics. Pori Unit, Series A49/2015. Pori.

Lahari, S.; Perez-Nordtvedt, R. R. W. 2008. Will the new competitive landscape cause your firm's decline? It depends on your mindset, *Business Horizons* 51: 311–320. https://doi.org/10.1016/j.bushor.2008.02.004

Maliranta, M. 2005. R&D, international trade and creative destruction – empirical findings from finnish manufacturing industries, *Journal of Industry, Competition and Trade* 5(1): 27–58. https://doi.org/10.1007/s10842–005–0989–0

McCann, P.; Ortega-Argilés, R. 2015. Smart specialization, regional growth and applications to European Union cohesion policy, *Regional Studies* 49(8): 1291–1302. https://doi.org/10.1080/00343404.2013.799769

OECD. 2013. *Innovation-driven growth: the role of smart specialisation*. Paris: OECD Publishing.

Paliokaite, A.; Martinaitis, Z.; Reimeris, R. 2015. Foresight methods for smart specialization strategy development in Lithuania, *Technological Forecasting and Social Change* 101: 185–199. https://doi.org/10.1016/j.techfore.2015.04.008

Paliokaite, A.; Martinaitis, Z.; Sarpong, D. 2016. Implementing smart specialization roadmaps in Lithuania: lost in translation?, *Technological Forecasting and Social Change* 110: 143–152. https://doi.org/10.1016/j.techfore.2016.01.005

Roth, S.; Melkonyan, A.; Kaivo-oja, J.; Manke, B.; Dana, L-P. 2017. Interfunctional business models. Map grid for an uncharted quadrant of the Blue Ocean, *International Journal of Entrepreneurial Venturing,* forthcoming [online], [cited 07 June 2017]. Available from Internet: https://ssrn.com/abstract=2896832

Santonen, T.; Kaivo-oja, J.; Suomala, J. 2014. The next steps in developing the triple helix model: a brief introduction to national open innovation system (NOIS) paradigm, *Journal of Systemics, Cybernetics, and Informatics (JSCI)* 12(7): 74–82.

S3 Platform. 2015. *What is smart specialisation?* [online], [cited 07 June 2017]. Available from Internet: http://s3platform.jrc.ec.europa.eu/home

Sipilova, V. 2015. When regional growth does not benefit from high-tech specialization? Explaining the experience of Latvian regions?, *Procedia Economics and Finance* 30: 863–875. https://doi.org/10.1016/S2212–5671(15)01336–2

Statistics Finland. 2017. *Regional account statistics 2000–2015* [online], [cited 21 March 2017]. Available from Internet: http://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin__kan__altp/?tablelist=true#_ga=1.169395877.502038858.1487697945

Thissen, M.; van Oort, F.; Diodata, D.; Ruijs, A. 2013. *Regional competitiveness and specialization in Europe*: *place-based development in international networks (new horizons in regional science)*. Cheltenham, UK: Edward Elgar. https://doi.org/10.4337/9781782545163

Virkkala, S.; Mäenpää, A.; Mariussen, Å. (Eds.). 2014. *The Ostrobothnian model of smart specialisation* [online], [cited 07 June 2017]. Proceedings of the University of Vaasa, Reports 196. Available from Internet: http://www.uva.fi/materiaali/pdf/isbn_978–952–476–577–0.pdf

Jari KAIVO-OJA, PhD, Research director, Adjunct professor, Finland Futures Research Centre, Turku School of Economics, University of Turku. His scientific interests are regional and national foresight systems, corporate and technology foresight, futures studies, innovation management, global foresight and international futures research. He has worked for the European Commission in the FP6, in the FP7 and in the Horizon 2020. He has worked in projects with the European Foundation, the Eurostat, the Nordic Innovation Centre and the European Parliament. Research director Jari Kaivo-oja has published more than 150 articles in academic journals and books.

Teemu HAUKIOJA, PhD, Assistant Professor in University of Turku, Turku School of Economics, Pori Unit. His scientific interests are economic growth, and sustainable development. He is the author and co-author of several scientific papers and book chapters that have been published in refereed journals and books. He holds a PhD in Economics from Turku School of Economics.

Ari KARPPINEN, M.Sc. Econ., University instructor, University of Tampere, Faculty of Management. His scientific interests are in the fields of regional economics and development and multinational enterprises. He is the author and co-author of several scientific papers.

Saku VÄHÄSANTANEN, M. Sc. Econ., Regional Advisor at Regional Council of Satakunta. His scientific interests are focused on regional economy, regional competitiveness and resilience. He is the author and co-author in numerous studies about regional economy and business cycles. He has been a project researcher at the University of Turku, Pori Unit, but his current work at regional council concentrates on regional development and studies.