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Johannes Tiemer*

The Success of the Nordic Countries as a Blueprint for Small Open Economies

The Nordic countries are often used as role models for good governance in equality, education, sustainability and economic policy, regularly topping quality-of-life rankings.[1] Their high degree of wage equality and their welfare states are cited as reasons for their continued prosperity. While not incorrect, it is not the sole reason for their success in continuously providing citizens with some of the highest standards of living.

Through the 1980s and 1990s, countries like China and South Korea drew attention due to their industrial policies aimed at supporting the build-up of capabilities through establishing national manufacturing and technology champions like Samsung. This strategy – to challenge numerous Western incumbents – worked remarkably well. A similar approach has been employed by the Gulf monarchies.

While not as prominently covered in the media, the prosperity of the Nordic economies is partly owed to the same strategy. Its core revolves around the well-established idea that technological progress drives economic growth in the long run. This paper focuses on empirically assessing technological progress in the Nordic countries and claims that economic prosperity is compatible with many institutional frameworks, the Nordic model being the one that emphasises welfare and civil liberties the most.

Methodological approach

There are many methods to evaluate economic performance, growth and the economic outlook of countries with the help of quantitative data. Those methods can be divided into model-based approaches and index-based methods. The former typically use theoretical models of the economy, parametrised with actual data, to forecast economic growth in the short to medium run. They mostly work with aggregated data and focus on aggregate assessments of the impact of a certain economic policy, for example. The latter are usually quantitative and/or qualitative surveys of economic sentiments, aggregate macro-indicators or official statistics that help forecast the expected economic development. Despite their often lacking foundation in economic theory, as they are purely empirical approaches, index-based methods constitute a comparatively reliable source of qualitative if not quantitative information about the future development of an economy.

Both of these approaches work mainly for the short to medium term. For the strategic development of an economy, only the index approaches are ultimately useful for concrete policy advice, as theoretical models of growth on a macro scale will typically only provide very general suggestions, such as "increasing the formation of human capital will support long term-growth", which can then be tracked through index numbers or official statistics.[2] The key causes of Nordic prosperity and quality of life are often identified as wage equality, high public welfare spending, solid public primary and secondary education, and a relatively homogeneous population. These factors are then paired with low corruption levels, respect for rule of law and an efficient government administration. These features are staples of the recommendations made by international development organisations to help improve the functionality of struggling states and governments worldwide. Most are difficult to apply to existing societies with their own set of traditional beliefs and defined inner structures. Also, while these factors do explain part of the Nordics' success and undoubtedly have a positive impact in the long run, they are framework conditions that catalyse and facilitate technological progress, the ultimate driver of long-term growth.

The economic complexity approach for analysing countries' technological progress, pioneered by César A. Hidalgo[3] and Ricardo Hausmann,[4] builds on the analysis

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1 The Economist: The Secret of Their Success – The Nordic countries are probably the best-governed in the world, The Economist, February 2013.

2 See e.g. D. Romer: Endogenous Growth, in: D. Romer: Advanced Macroeconomics, New York 2011, pp. 101-149.

3 See e.g. C.A. Hidalgo, B. Klinger, A.-L. Barabási, R. Hausmann: The product space conditions the development of nations, in: Science, Vol. 317, No. 5837, 2007, pp. 482-487; and C.A. Hidalgo: Why information grows: The evolution of order, from atoms to economics, New York 2015.

4 R. Hausmann, J. Hwang, D. Rodrik: What you export matters, in: Journal of Economic Growth, Vol. 12, No. 1, 2007, pp. 1-25.

Johannes Tiemer, University of Duisburg-Essen, Germany.

of import and export trade data from the United Nations COMTRADE database, broken down into more than 1200 categories of goods. It treats technology and economic growth as an evolutionary process in the tradition of Nelson and Winter.[5] It takes into account the network structure of international trade to indirectly learn about the structure of the economies constituting the network. The approach is algorithmic and, at its core, employs the concept of revealed comparative advantage (RCA).[6] For a given product category, this concept attributes superior competitiveness to those countries whose share in world trade of this good is larger than their share of world GDP (RCA>1). The economic complexity approach further assumes that the more complex, and thus the more sophisticated, a good is, the fewer countries will be able to produce it. These basic ideas are used to formulate two equations for which a weighted eigenvalue problem is solved.[7] The fixed point solution of this problem yields two vectors whose elements have a straightforward and helpful interpretation.

Starting out from the idea that scarce goods tend to be valuable and more sophisticated, the algorithm yields the Economic Complexity Index (ECI) and the Product Complexity Index (PCI) for each country and each category of goods. The higher the PCI of a category of goods, the more complex and sophisticated the goods are assumed to be. The ECI in turn describes the complexity of a country's productive structure by assessing the degree of sophistication of the country's exports with a large revealed comparative advantage (RCA>1). In quantitative empirical estimation models, the ECI's explanatory power outperforms all traditional predictors of long-term growth, even in combination.[8] The higher a country's ECI, the better its long-term growth perspective, since it produces goods that few other countries are able to produce, which we assume are more technologically advanced goods. Ranking countries by ECI yields a list topped by Germany, Japan, China and Switzerland. Poorer African and Oceanian exporters of raw materials are found at the bottom of the list. That is, the measures yield intuitive and plausible results with superior explanatory power for long-term economic growth as measured by GDP, while presupposing only minimal theory.[9]

Measuring economic complexity

ECI describes the "complexity" of an economy's industrial structure in one number, which is useful to assess growth potential. To analyse an economy and provide policy advice, however, the PCI is more useful. It assigns a number indicating a product category's degree of sophistication. Furthermore, products can be classified by their distance from one another, letting us build a network graph of products, the so-called "product space", where complex products form the centre and simple ones lie on its outskirts. When making policy decisions, e.g. deciding to subsidise or expand a branch of the economy, PCI now makes it possible to check how "far" a good lies from the country's current capabilities as a measure of how difficult it would be to add that good to its portfolio. Weighing this distance with the good's PCI yields the so-called opportunity gain, measuring how much an economy profits from the addition of this product in terms of its ECI. Using the "economic complexity approach" by Hausmann and Hidalgo, specifically the PCI, allows us to evaluate and compare the technological capacity of countries by applying a straightforward method to readily available aggregate data. It enables policymakers to identify product groups that complement a country's production portfolio with regard to its long-term growth potential. Of course, it should certainly not constitute the sole basis for strategic decisions in economic policy, as the method does have some drawbacks. First, its results become less stable if very small countries are included in the dataset, which is why all countries with less than 1.2m inhabitants and less than 1.0bn USD in exports (any year) were excluded.[10] This excludes Iceland from the analysis, leaving Denmark (DNK), Finland (FIN), Norway (NOR) and Sweden (SWE). Second, it has, so far, only been applied to trade in goods, as similar data on trade in services is not available in comparable detail. This skews the numbers in favour of countries strong in manufacturing. Third, it works better for countries at a low to medium complexity level than it does for world leaders in technology, the reason being that the goods categories reflect categories of currently available goods, which are updated considerably more slowly than technological progress in a globalised world.[11] It is therefore unable to distinguish slight differences at the current edge of R&D efforts, as the data do not differentiate between those. Keeping this in mind, using ECI and PCI

5 R.R. Nelson, S.G. Winter: An Evolutionary Theory of Economic Change, Cambridge, MA, 1982.

6 B. Balassa: Trade liberalisation and "revealed" comparative advantage, The Manchester School, 1965, pp. 99-123.

7 The improved version for ECI+/PCI+ described in S. Albeaik, M. Kaltenberg, M. Alsaleh, C.A. Hidalgo: Improving the Economic Complexity Index, MIT, arXiv:1707.05826, 2017; S. Albeaik, M. Kaltenberg, M. Alsaleh, C.A. Hidalgo: 729 new measures of economic complexity, MIT, arXiv:1708.04107, 2017; and A. Tacchella, M. Cristelli, G. Caldarelli, A. Gabrielli, L. Pietronero: A New Metrics for Countries' Fitness and Products' Complexity, Scientific Reports, 2012, is used in this paper.

8 R. Hausmann, C.A. Hidalgo, S. Bustos, M. Coscia, A. Simoes, M.A. Yildirim: The Atlas of Economic Complexity: Mapping Paths to Prosperity, Cambridge, MA, 2013.

9 There is, however, a rich yet accessible theoretical foundation available in C.A. Hidalgo, op. cit.

10 The Comtrade dataset used spans the years 1996 to 2014, containing 144 countries and 1241 product categories.

11 This applies to all systems of trade categorisation like HS92, HS96 and SITC. The calculations for this paper are based on HS92.

Table 1
Stylised facts on the Nordic countries

Country	Year	Real GDP per capita (in 2011 USD)	Population (in millions)	Share of population employed	Export share of GDP	Import share of GDP	Natural resource rents	ECI rank	Complex goods import dependence (PCI)
Denmark	1996	29767	5.25	49.9%	50.3%	48.1%	0.97%	14	0.55
	2014	44423 (+49.2%)	5.65	49.7%	59.6%	58.2%	1.32%	23	-47.88
Finland	1996	25560	5.13	40.7%	48.5%	41.4%	1.49%	18	35.99
	2014	38343 (+50.0%)	5.48	47.4%	46.7%	53.5%	1.51%	29	-13.29
Norway	1996	37366	4.39	49,4%	56.4%	35.2%	13.1%	46	61.77
	2014	78293 (+110%)	5.15	53.4%	55.5%	29.9%	9.0%	59	34.29
Sweden	1996	29845	8.85	46.3%	48.2%	42.2%	0.83%	11	-19.30
	2014	42605 (+42.8%)	9.70	49.0%	52.7%	57.1%	1.0%	13	-40.71
Albania	1996	5667	3.09	30.0%	23.8%	23.8%	1.97%	61	10.27
	2014	11020 (+94.5%)	2.89	30.6%	11.4%	28.7%	5.39%	76	-12.25
Bosnia and Herzegovina	1996	4348	3.81	19.7%	7.3%	28.5%	0.06%	44	-1.18
	2014	10155 (+134%)	3.82	18.0%	23.2%	45.6%	1.49%	45	14.88
Czech Republic	1996	20476	10.3	49.9%	21.3%	25.8%	0.68%	8	20.36
	2014	29187 (+42.5%)	10.5	48.3%	73.1%	74.8%	0.44%	11	12.96
Turkey	1996	11564	59.5	30.4%	6.1%	10.9%	0.55%	35	99.98
	2014	19675 (+70.1%)	77.5	31.7%	14.1%	22.4%	0.59%	24	47.12

Sources: Penn World Table 9.0, World Bank Database, own calculations based on UN Comtrade data.

to analyse the Nordic countries and to compare them to a set of less rich economies yields interesting and intuitive insights that enhance and complement the "traditional" factors for Nordic success. In fact, a recent IMF working paper came to the conclusion that measures based on export sophistication, like ECI and PCI, are the best determinants of long-term growth that are currently available.[12]

Analysis

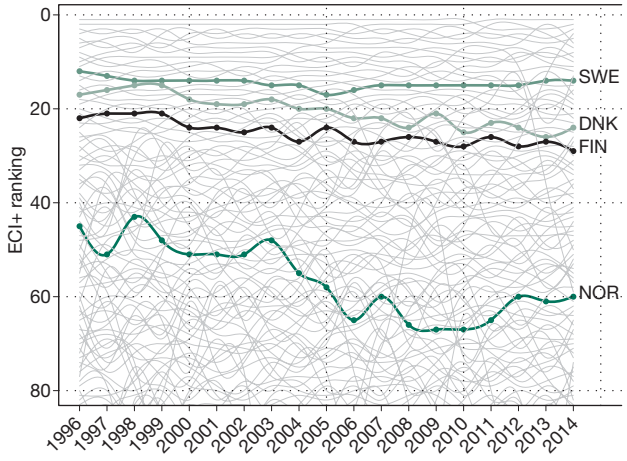
Albania (ALB), Bosnia and Herzegovina (BIH), the Czech Republic (CZE) and Turkey (TUR) are selected, as countries within the western hemisphere with varying levels of wealth, size and economic complexity, to be compared with the four Nordic countries in the dataset. All of these four countries are European, but poorer and less technologically advanced than the Nordic countries. They were selected because they are emerging European economies which could, in principle, strive to emulate the Nordics' development over the last few decades. This analysis almost entirely abstracts from all the standard factors other analyses might concentrate on to focus on the role of technology and industrial structure, the strong point of Hausmann and Hidalgo's economic complexity approach.

A quick look at the aggregate data in Table 1 confirms what one would expect: All countries scored substantial gains in real GDP per capita over the 1996 to 2014 period; additionally, the majority saw their population grow, and their trade shares of GDP increase, which can be attributed to the spread of globalisation and financialisation during that period.

Further, the data shows that the dependence on resource exports is heterogeneous, with Norway and Albania being highly dependent on their resource extraction rents, while the others hover at much lower rates. Finally, labour force participation seems to be significantly larger for the richer countries, while the relative gains in real GDP per capita are larger for countries that started out poorer, i.e. exactly the convergence that one expects from the standard growth theory.

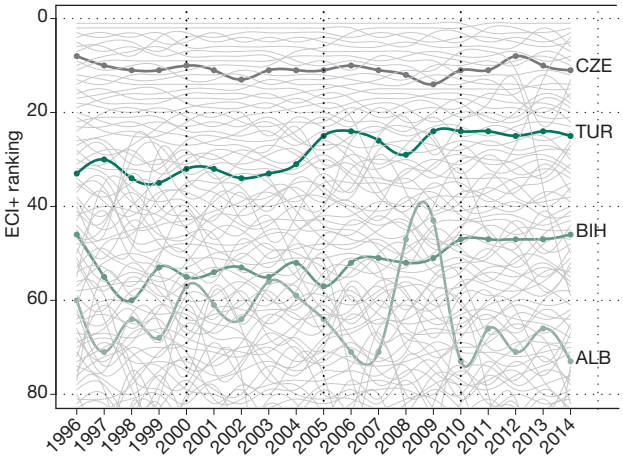
12 R. Cherif, F. Hasanov, L. Wang: Sharp Instrument: A Stab at Identifying the Causes of Economic Growth, International Monetary Fund, 2018.

Figure 1
ECI+ rankings of the Nordic countries from 1996 to 2014 (spline)



Source: CEPII, BACI Database, http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=1.

Figure 2
ECI+ rankings of the comparison countries from 1996 to 2014 (spline)



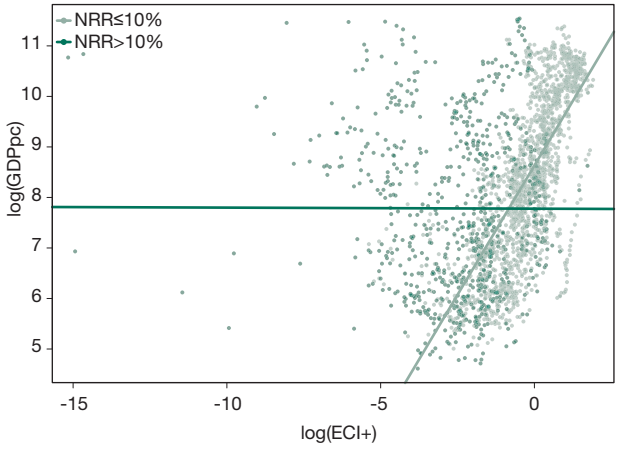
Source: CEPII, BACI Database, http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=1.

When looking at the countries' complexity ranking over time (Figures 1 and 2), the Nordics mostly remain stable in the top third of the ranking, while the comparison countries developed differently. The Czech Republic started out in a favourable position in the top group. Turkey and Bosnia and Herzegovina slightly improved their technological capabilities over time, while Albania stagnated.

Surprisingly, Norway, the richest country, seems to be the technologically least advanced of the Nordics, ranking closer to Albania than to its neighbours. This is because of the high dependency of Norway's (and Albania's) real GDP on natural resource extraction. Especially in Norway, high wages draw a comparatively large part of the workforce towards (comparatively) low-tech activities related to oil and gas extraction.[13] This keeps them from adding to technological diversity in other branches. The same applies to Albania, which exports large amounts of crude oil, chromium and other metal ores. Plotting the improved ECI+ against real GDP per capita (Figure 3) shows how the wealth of economies dependent on resource extraction (dark green) does not vary with their technology level as it does for "normal" economies (light green).

The associated wealth is inexplicable within the economic complexity approach, which seems like a drawback. Actually it is not, as further analysis shows that natural resource exporters exhibit a higher time variance of real GDP per capita and generally possess a worse economic outlook than technology-oriented countries, an insight which is also reflected and analysed in many theoretical concepts like "Dutch disease". "Classical" real business cycle theory states that technology drives the long-term development of wealth. This is what is reflected in this plot. It also drives the efforts of most of the Gulf monarchies to diversify their national business models, shifting away from resource extraction and moving toward services and technology-intensive branches.

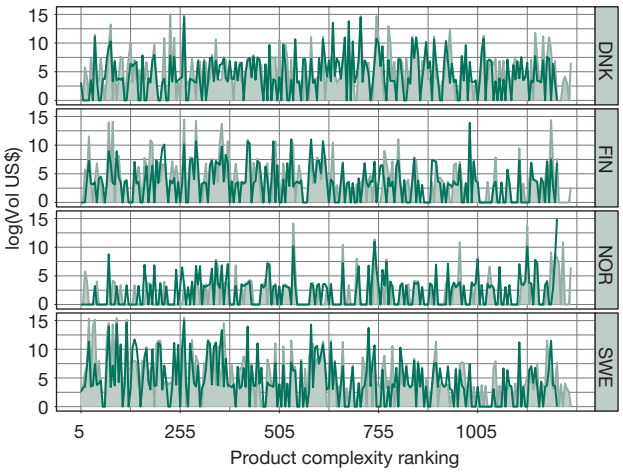
Figure 3
Normal economies versus economies with natural resource rents (NRR) over 10% of GDP



Source: CEPII, BACI Database, http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=1.

13 The drilling equipment may be high tech, and some of it even originates in Norway. For ECI/PCI this is still irrelevant as those measure only the technology level of the goods that are produced and ultimately exported with a revealed comparative advantage (RCA >= 1).

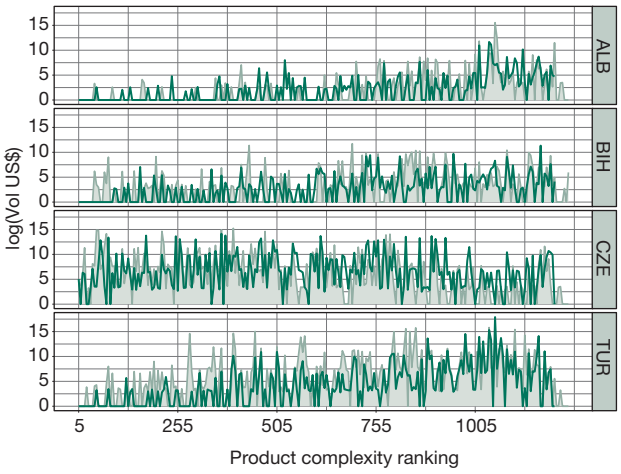
Figure 4
Export spectrum of the Nordic economies



Dark green line: 1996; light green line and fill: 2014.

Source: CEPII, BACI Database, http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=1.

Figure 5
Export spectrum of the comparison economies



Dark green line: 1996; light green line and fill: 2014.

Source: CEPII, BACI Database, http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=1.

Further statistical analysis of the relationship between growth of real GDP per capita and ECI (pictured in Figure 3) shows that it is a superb predictor of long-term growth. In fact, countries who grew successfully in the post-Cold War era, e.g. China, massively tilted their export portfolio towards sophisticated products and consequently enjoyed a steep increase in income, which continues today. These portfolio differences are depicted in trade spectrum graphs (Figures 4-7).

The products at the far left are the most sophisticated, while the simplest are at the far right; the height indicates the value exported. The much sparser spectrum of the Norwegian economy in comparison to the other Nordic countries, which is due to the natural resource effect mentioned above, is apparent. The other three Nordics exhibit a strong and dense portfolio across the board with a visible emphasis on more complex products in Finland and Sweden (remaining relatively stable between 1996 and 2014) and a more balanced spectrum in Denmark. The latter is easily explained by the fact that Denmark has a higher production and export volume of agricultural products than the other countries.[14]

The visible contrast in the export spectrum between the Nordics and the comparison economies is what constitutes the countries' differences in ECI rankings (Figure 5). Albania's and Turkey's reliance on simpler products is clearly visible, as are the efforts of Bosnia and Herzegovina to improve its spectrum on the complex end from 1996 to 2014, as well as the remarkably diverse and complex export structure of the Czech Republic.

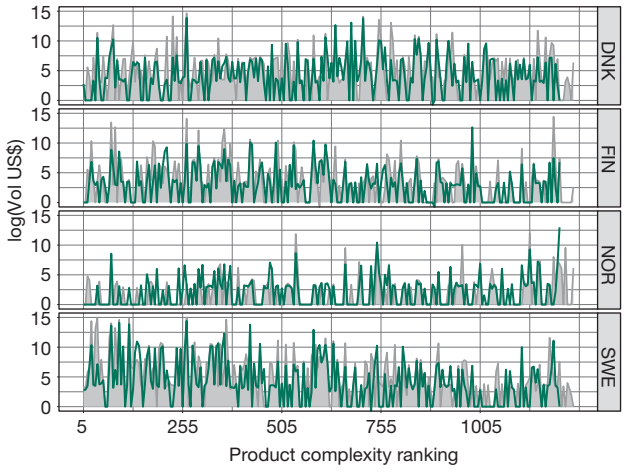
Favourable political framework conditions post-WWII and especially after the Cold War allowed the Nordic countries to profit from globalisation immensely by developing an industrial production structure which is complex and diverse, especially when considering the countries' small populations. Their deep integration in world trade is also visible in the spectrum of imported goods (Figures 6 and 7), although it is not as clear as it is for exports. The complex goods import dependence score is obtained by weighing the imported goods' PCI scores with the import volume, getting the sum total, then subtracting the same score for exports.

While the ECI and the complexity spectrum of exports tell us about the collective market power of the countries' goods, the complex goods import dependency score offers information about a country's dependency on international value chains – relative to what it has to offer – and may be interpreted as a measure of vulnerability. Here, the Nordics really shine, with the exception of Norway, as they are similarly if not more dependent on imports, but more than make up for it by exporting high-tech products.

Through the lens of economic complexity, the success of the Nordics is a result of favourable framework conditions facilitating the building of complex and diverse economies whose major products stem mainly from the sophisticated core of the product space. Those framework conditions enable the small Nordic countries to technologically compete with countries multiple times their size.

14 Incidentally, Danish meat products are market leaders in all of the Nordic countries.

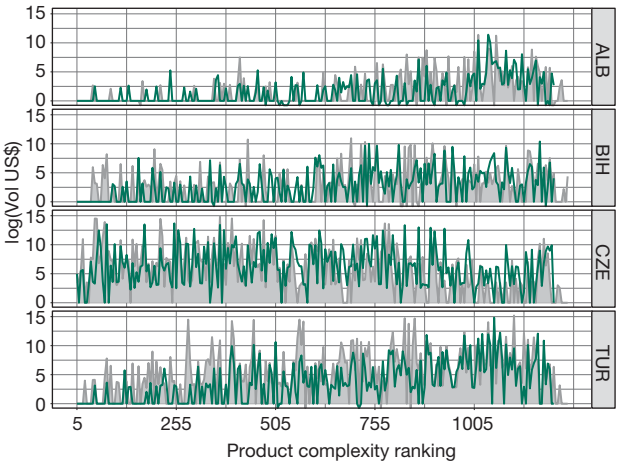
Figure 6
Import spectrum of the Nordic economies



Dark green line: 1996; grey line and fill: 2014.

Source: CEPII, BACI Database, http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=1.

Figure 7
Import spectrum of the comparison economies



Dark green line: 1996; grey line and fill: 2014.

Source: CEPII, BACI Database, http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=1.

Discussion and concluding remarks

To retain their leading position, the Nordics must invest in developing more sophisticated products than competing economies like Turkey. This applies to all complex economies, but constitutes a greater challenge to the Nordic countries with their comparatively small populations. To identify optimal targets for innovation, different data has to be employed. Research teams, e.g. at Oxford University,[15] employ patent data to analyse and potentially forecast technological progress at the current edge. Still, given the comparatively simple method, the insights generated by the economic complexity approach are remarkably helpful in mapping structural advantages and weaknesses of economies and identifying opportunities for development. The method correctly points out the big structural weakness of Norway and Albania, namely their high dependence on natural resource exports. Norwegian policymakers identified this problem early on and implemented the state's pension fund (*Oljefondet*) to use the natural resource rents to invest in the country's future by responsibly investing in international shares and government bonds – which would have been impossible without institutions facilitating and supporting the decision. While the spectrum results are similar for Albania, differences in framework conditions such as administrational efficiency, enforcing the rule of law and containing corruption, will likely prevent a similarly favourable outcome there.

With the "classical determining factors" of economic growth being limiting or enabling framework conditions to technological progress within the economic complexity approach, an analysis of the Nordic countries' productive structure yields insights into how small and emerging economies might emulate their success. The economic complexity approach reframes these classical factors as enablers of successful development, with targeted development of the capabilities needed to produce sophisticated output being what constitutes the actual value. Emerging economies' economic policies should therefore split their efforts between achieving the proper framework conditions and striving to acquire the capabilities to produce and export ever more sophisticated goods. This twofold strategy is neither revolutionary nor novel in what it suggests, but the simplicity and straightforwardness in which the economic complexity approach transparently maps the production side source of the Nordics' success make it a worthwhile and intuitive tool for policymakers to consider.

Finally, there are small countries such as Israel, Singapore and Switzerland that exhibit institutional traits markedly different from those of the Nordics while enjoying a high level of prosperity and complexity. Larger and more authoritarian countries also fare quite well economically without implementing the Nordic model of equality and welfare. The Nordic model is not the only blueprint to follow for economic prosperity; indeed, there are many which are compatible with the economic complexity approach. It is, however, the one blueprint associated with the highest degrees of civil liberties and welfare, which is the core of its uniqueness and appeal.

15 Doyne Farmer, Oxford Martin School, and Neave O'Clery, University of Oxford Mathematical Institute, are working on related approaches.