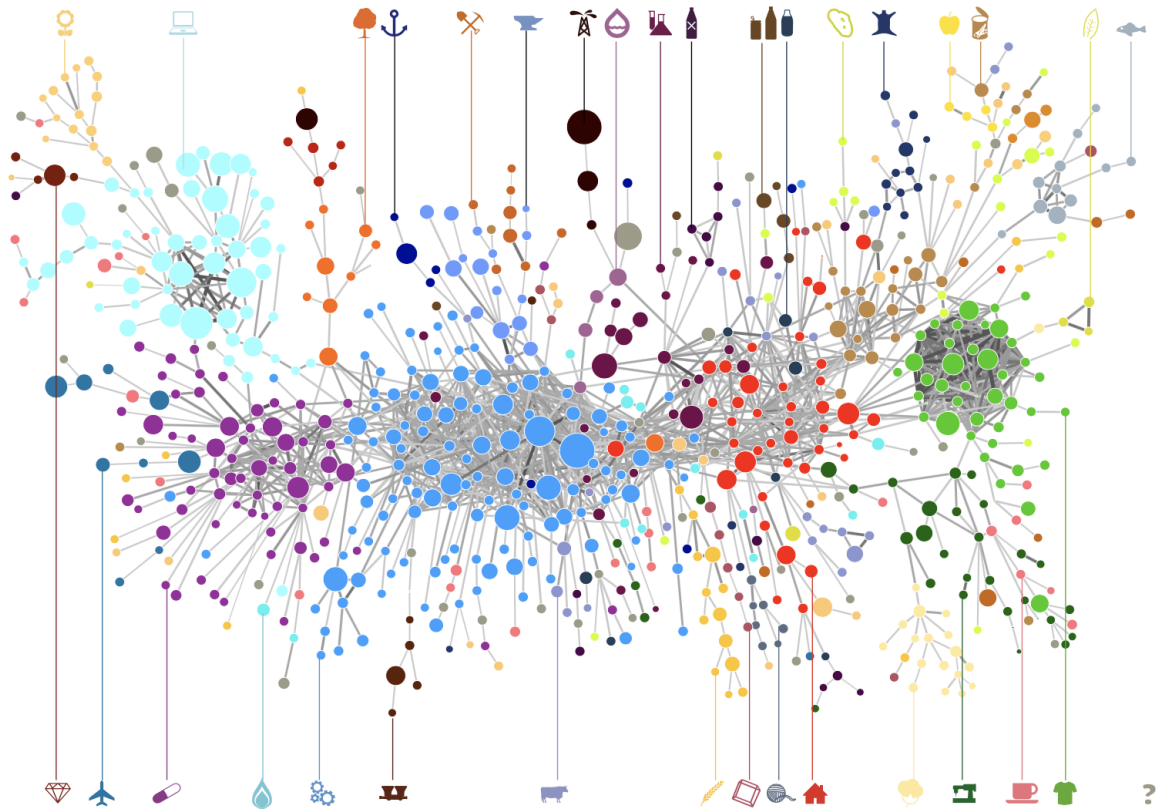




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Optimal Industry Development Strategy Using Economic and Product Complexity

Denmark

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The Economic Complexity Lab - Columbia University

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Optimal Industry Development Strategy for Denmark

0. Executive Summary

In this report, we aim to uncover the economic path Denmark went through during the period from 2013 to 2021. Specifically, we dive into the topic through a macroeconomic overview of Denmark from the perspective of Gross Domestic Product (GDP) and Economic Complexity Index (ECI), which reflect countries' production capability and production structure, respectively. We find that during the period of our interest, Denmark demonstrated a moderate level of economic growth with an average annual GDP growth rate of 3.57% between 2013 and 2018 and 4.66% between 2019 and 2021, concurrent with a decrease in economic complexity as compared with other major developed economies.

The lack of progress during the period, we believe, can be partially explained through analysis of the economic and product complexity structure of Denmark on the industry group level. The product classification system we adopt allows us to measure the realized industry development for various industry groups and to observe that Denmark consistently relied on developing the Food and Preparations, Wood Products, and Chemicals industries in 2013-2018 and High-complexity products and Chemical Manufacturing in 2019-2021.

Based on our analysis of the opportunity gain and a sensitivity analysis of major industry groups, Denmark could have furthered its gains by prioritizing High-Complexity Products and Transportation in 2018. Three years later, in 2021, its focus again should have been aligned to Transportation, which is consistently underdeveloped. We further note that Denmark has a slightly mismatched development strategy that indicates an average (compared to other developed economies) level of structural optimality on the complexity level, having an adjusted R-square of around 4.8% in 2018 and a lower score of 2.4% in 2021, demonstrating degradation in development. Since a significant positive correlation exists between five-year GDP growth and the structural optimality index of an economy as we define and calculate, Denmark indeed has a suboptimal growth experience as compared with fast-growing economies both on a regional scale and on a global scale, and has the potential to further its economic gains through industrial structure optimization as suggested in the paper.

The three years following showed a significant improvement in Denmark's economic growth, boosting its position on the global scale. Although its GDP did not drop significantly during the pandemic, its ECI fell, similar to its peer countries. Its current strategy still has the viable potential, however, we recommend the following to increase its performance and optimize its structure further.

1. Report Overview

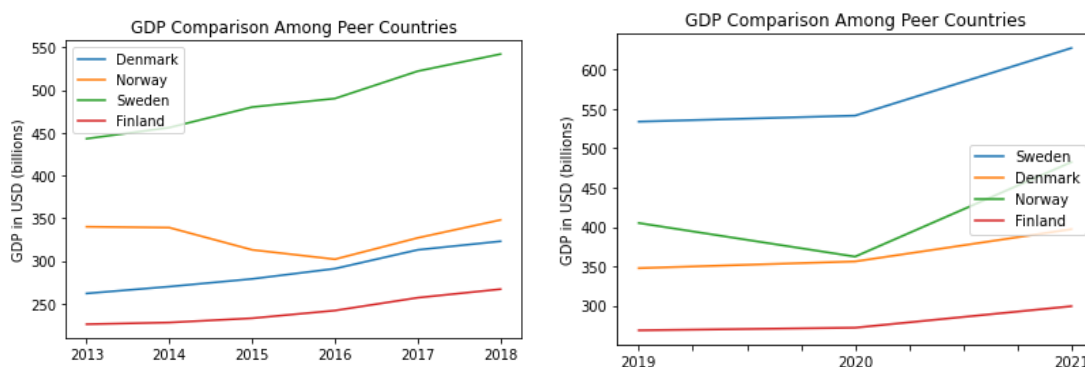
In this report, we aim to uncover the economic path Denmark went through during the period from 2019 to 2021, before and after the COVID pandemic, compared to its performance from 2013 to 2018, before and after the COVID-19 pandemic. Specifically, we dive into the topic through a macroeconomic overview of Denmark from the perspective of Gross Domestic Product (GDP) and Economic Complexity Index (ECI), which reflect countries' production capability and production structure, respectively. We then analyze the industrial framework and changes of Denmark during the period based on quantitative measures such as Product Complexity Index (PCI) and Product Family Complexity Index (PfCI), followed by a detailed analysis of how such changes have matched with development strategies as quantitatively measured by opportunity gains on an industry-level. We conclude our report with macro-level results and predictions of Denmark, as deduced from regression models we have established on a global scale, which take into account countries' stances in their product space.

2. Macroeconomic Results

2.1 GDP Ranking and Changes

Figure 1a illustrates the time-series GDP results for Denmark and three of its peer countries (Norway, Sweden, Finland) from 2013-2018. Denmark displays consistent, upward growth over the period, which is similar to Finland and Sweden, but different from the volatile, up-and-down GDP growth of Norway. Denmark stands out as it leads in average annual GDP growth rate among its peers; its AAGR of 3.57% is clearly above that of Norway (0.54%), Sweden (3.44%), and Finland (2.84%).

Figure 1b shows the GDP levels for Denmark and the same peer countries from 2019 to 2021. Similar to the other countries, Denmark's GDP was largely unaffected by the pandemic in 2020 while experiencing growth in the aftermath. Over these three years, Denmark's average annual GDP growth rate (4.66%) is slightly lower than others, such as Norway (7.55%) and Sweden (5.77%) but higher than Finland (3.76%).



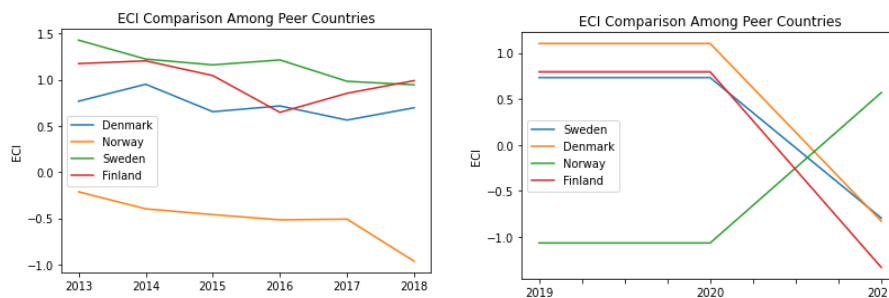
Figures 1a and 1b. GDP Comparison Among Peer Countries (left: 2013-2018; right: 2019-2021)

2.2 ECI Ranking and Changes

The Economic Complexity Index (ECI), as defined by Ricardo Hausmann and Cesar Hidalgo in 2009 to explain the knowledge accumulated in a country's population, is illustrated in Figures 2a and 2b.

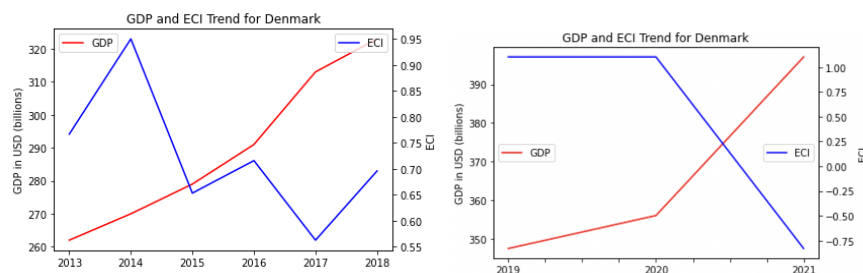
As shown, Denmark exhibits a small decrease in production capability from 2013 to 2018. However, this decrease (-9.25%) is noticeably lower than that of Norway (-351.33%), Sweden (-33.82%), and Finland (-15.68%). Denmark clearly shows strong economic fundamentals over the period, as it has the highest GDP growth rate and highest ECI percent change compared to its peers.

The comparable countries maintained a small change in ECI level between 2019 and 2020, with a sharp change between 2020 and 2021. Denmark exhibits a large decline in production capability in 2021 to levels not seen prior, with disruptions due to the pandemic being the primary reason. Denmark has seen a -175% decrease in its ECI, which is a milder decrease than Sweden (-209%) and Finland (-267%) but smaller than Norway's increase (153%).



Figures 2a and 2b. ECI Comparison Among Peer Countries (left: 2013-2018; right: 2019-2021)

Figure 3a and 3b offers a further comparison of GDP Growth and ECI over the time span from 2013 to 2021 for Denmark. The steady increase in GDP growth during the period from 2013 to 2018 is accompanied by a volatile eventual decrease in ECI (though ECI seems to rebound near the end of the period). Similarly, between 2019-2021, the decrease in ECI is accompanied by steady increases in GDP. The results show that the economic growth experienced by Denmark during the period from 2013 to 2018 is not very consistent with the predictions by ECI (the most egregious contrast can be seen by the fact that 2016-17 had the highest GDP growth rate but had a sharp ECI decrease) and that Denmark had not yet effectively developed a competitive product space that helps to accumulate complicated knowledge and technology. In order to provide a more concrete answer to why this has happened, we will dive into an analysis of Denmark's production structure and its product space designs in the next few chapters.



Figures 3a and 3b. GDP Growth and ECI for Denmark (left: 2013-2018; right: 2019-2021)

3. Production Analysis

3.1 Product Categorization

Our main data source in this research is the UN Comtrade Website (<https://comtrade.un.org>), which provides us with valuable information on countries' export values on an annual basis, including highly specific export data for more than 5000 categories of products. In order to have a holistic vision of the product space of a country, however, a level of categorization is required. Products in our data source are labelled from 010000-999999, with the first two-digits representing a general category to which the product belongs. Based on the 99 categories as extracted from the label, we further group the products into 18 most widely-accepted industries, as summarized in Table 1.

Note that the High-complexity Products industry group is not a distinct industry but rather an aggregated industry that encompasses the most complicated products from the most technologically-advanced industries (as measured by PCI). This industry serves as an indicator for us to quantitatively evaluate how well a country has performed in developing cutting-edge technologies and closing its technical gap with advanced economies, which has become a topic of wide concern today. Indeed, when we rank the 18 categories based on PfCI (an equivalent concept of PCI as calculated based on the 18 categorized product groups), the High-complexity Products industry has the highest PfCI among all industry groups.

Category	Description
Animals and By-products	All kinds of meat, livestock and related by-products
Vegetables, Fruits and Plants	All kinds of plants, edible vegetables and fruits
Food and Preparations	Edible preparations, raw cooking materials and appliances
Clothing and Accessories	All kinds of fabrics, filament, clothing and accessories
Textiles	All kinds of textile articles and related products
Wood Products	Book, paper and other elementary products related to wood
Metals	Mining of all sorts of raw Metals
Refined and Processed Stones	Refined or processed stone products such as pearl and ceramics
Energy Drilling and Mining	Mining industry for energy, minerals, stone materials, etc.
Daily Instruments	Basic daily instruments such as sport requisites, timing and measuring tools
Raw Manufacturing	Basic products made from plastic, rubber, leather, etc.
Chemical Manufacturing	Advanced chemical products and pharmaceutical products
Chemicals	Raw chemical materials and by-products
Machinery and Construction	Machinery and mechanical appliances, including electrical equipment
Transportation	Vehicles and locomotives including aircraft, ship, railway, etc.
Weapons	Explosives, arms and ammunition
Services and Utilities	Financial, business, legal, communication, travel Services and Utilities, etc.
High-complexity Products	Agglomeration of advanced products with highest PCIs

Table 1: Categorization of Products

We further observe a positive correlation between the GDP and the export of High-complexity Products. A higher adjusted R-square exists between GDP and High-complexity Products exports, indicating that more successful economics, as measured by GDP, tend to be those that are capable of producing and exporting High-complexity Products as we define them. The Figure 3 and 4 show the OLS results in a universe of 107 and 21 typical countries respectively.

	High-complexity Products	Food and Preparations	Animals and By-products
Adj.R-squared	0.075	0.006	0.002
F-statistic	9.556	1.638	1.175
No. Observations	107	107	107

Figure 3: OLS Regression Results of GDP against Percentage Volume of Exports

	High-complexity Products	Food and Preparations	Animals and By-products
Adj.R-squared	0.149	0.003	-0.012
F-statistic	4.510	1.059	0.7542
No. Observations	21	21	21

Figure 4: OLS Regression Results of GDP against Volume of Percentage Exports

3.2 Realized Industry Development

Based on the product categorization aforementioned, we aim to capture Denmark's realized industry production strategy between 2013 and 2021 on a complexity level. In Hausmann and Hidalgo (2009), distance is defined to be a measure of how far a country is from a certain product not in its product space. We extend this concept to all product groups and quantify how technically equipped a country is to develop the corresponding product groups. In other words, the shorter the distance between a country and a product group, the more capable a country is in developing products within that group. Defining this net distance change as the Realized Industry Development (RID), our export data allow us to calculate and compare RID of US and the 18 product groups in 2021 and 2018 through the difference, where a positive RID indicates a shortening of the distance (i.e., advancement of the industry), and a negative RID indicates the reverse. It is notable that the number of industries with positive RID has decreased from 18 to 3 between 2018 and 2021.

Category	RID	Category	RID
Vegetables, Fruits and Plants	0.073309	Transportation	-0.039024
High-complexity Products	0.130528	Chemicals	-0.022977
Raw Manufacturing	0.139548	Weapons	-0.019933
Machinery and Construction	0.150904	Precious Stones	-0.016684
Transportation	0.165554	Raw Manufacturing	-0.015055
Daily Instruments	0.180294	Energy Drilling and Mining	-0.013741
Textile	0.195276	Clothing and Accessories	-0.011724
Chemical Manufacturing	0.197113	Daily Instruments	-0.008331
Energy Drilling and Mining	0.205589	Textile	-0.007838
Clothing and Accessories	0.224440	Machinery and Construction	-0.005552
Precious Stones	0.225014	Vegetables, Fruits and Plants	-0.005226
Animals and By-products	0.233188	Food and Preparations	-0.001989
Metals	0.238248	Wood Products	-0.000887
Services and Utilities	0.246079	Services and Utilities	-0.000852
Weapons	0.246255	Metals	-0.000161
Chemicals	0.248633	Animals and By-products	0.002421
Wood Products	0.249983	Chemical Manufacturing	0.005988
Food and Preparations	0.260373	High-complexity Products	0.007291

Table 3. Realized Industry Development (RID) of Denmark (2018 on left, 2021 on right)

3.3 Regional and Global Comparison

Tables 4a-4b below summarize how the production strategy adopted by Denmark compares with selected leading economies in the world across different years, as measured in RID. Leading economies such as France, the United States and Germany gave a considerable level of attention to more advanced product groups such as Weapons and High-Complexity Products in 2018 and Services and Utilities, Precious Stones, and High-Complexity Products in 2021.

Ranking	France	the UK	Germany
1	High-complexity Products	Services and Utilities	High-complexity Products
2	Chemical Manufacturing	Weapons	Transportation
3	Daily Instruments	Raw Manufacturing	Wood Products
4	Animals and By-products	Precious Stones	Metals
5	Food and Preparations	Animals and By-products	Food and Preparations

Table 4a. RID Comparison across Leading Economies (2018)

Ranking	France	the UK	Germany
1	Services and Utilities	Precious Stones	Daily Instruments
2	Precious Stones	High-complexity Products	Transportation
3	High-complexity Products	Services and Utilities	Chemicals
4	Energy Drilling and Mining	Energy Drilling and Mining	Chemical Manufacturing
5	Machinery and Construction	Wood Products	Clothing and Accessories

Table 4b. RID Comparison across Leading Economies (2021)

Tables 4c-4d further examine Denmark's development strategy against those of emerging economies on a global scale. Reasonably, emerging economies such as China, South Korea, and Singapore, have devoted the majority of their efforts to intermediate industry groups, showing drastic shifts in strategies over the course of three years.

Ranking	China	South Korea	Singapore
1	High-complexity Products	Transportation	Transportation
2	Transportation	Textile	High-complexity Products
3	Machinery and Construction	High-complexity Products	Precious Stones
4	Energy Drilling and Mining	Chemical Manufacturing	Daily Instruments
5	Daily Instruments	Machinery and Construction	Services and Utilities

Table 4c. RID Comparison across Emerging Economies (2018)

Ranking	China	South Korea	Singapore
1	Chemicals	Chemicals	Weapons
2	Daily Instruments	Daily Instruments	Energy Drilling and Mining
3	Transportation	Transportation	Transportation
4	Raw Manufacturing	Textile	Machinery and Construction
5	Weapons	Raw Manufacturing	High-complexity Products

Table 4d. RID Comparison across Emerging Economies (2021)

4. Product Space Design

4.1 Suggested Development Vector

As aforementioned, distance gives us an idea of how far each new product is from a country's current mix of exports. As defined in Hausmann and Hidalgo (2009), distance is "the

weighted proportion of products connected to goods p that country c is not exporting, i.e., $MCP=0$.” Based on this definition, the distance between a country and any product that the country is currently exporting (i.e., the country is a significant exporter in the product as compared to global average) is zero. Similarly, opportunity gain quantifies the contribution of a new product in terms of opening up the doors to more and more complex products. Intuitively, a product that a country is currently exporting (i.e., $MCP=1$) has an opportunity gain of zero. And unreasonable investment on certain product p would lead to a relative decrement in export of more profitable products, and therefore lead to a negative opportunity gain of product p . The opportunity gain is not the only estimator of a country’s level of economic development. However, among countries with comparable economics strength, those having higher ECI, or in other words, more reasonable economics structures are often in better shape.

Ranking	Singapore	United Kingdom	Sweden	Denmark
1	Chemicals	Transportation	Energy Drilling and Mining	Energy Drilling and Mining
2	Transportation	High-complexity Products	Animals and By-products	Precious Stones
3	High-complexity Products	Daily Instruments	Chemical Manufacturing	Wood Products
4	Services and Utilities	Textile	Raw Manufacturing	Weapons
5	Machinery and Construction	Weapons	Wood Products	Textile
6	Daily Instruments	Chemicals	Metals	Metals
7	Weapons	Food and Preparations	Machinery and Construction	Animals and By-products
8	Textile	Chemical Manufacturing	High-complexity Products	Vegetables, Fruits and Plants
9	Chemical Manufacturing	Machinery and Construction	Services and Utilities	Food and Preparations
10	Raw Manufacturing	Precious Stones	Vegetables, Fruits and Plants	Chemical Manufacturing
11	Clothing and Accessories	Services and Utilities	Weapons	Raw Manufacturing
12	Metals	Clothing and Accessories	Precious Stones	Clothing and Accessories
13	Wood Products	Raw Manufacturing	Textile	Machinery and Construction
14	Precious Stones	Energy Drilling and Mining	Clothing and Accessories	Daily Instruments
15	Animals and By-products	Vegetables, Fruits and Plants	Food and Preparations	Services and Utilities
16	Food and Preparations	Metals	Chemicals	Chemicals
17	Energy Drilling and Mining	Wood Products	Daily Instruments	Transportation
18	Vegetables, Fruits and Plants	Animals and By-products	Transportation	High-complexity Products
ECI	2.751108815	0.922251037	1.427489164	0.767096953

Table 5a. Opportunity Gain Ranking on a Comparable Scale (2013)

Ranking	Singapore	United Kingdom	Sweden	Denmark
1	Energy Drilling and Mining	Food and Preparations	Energy Drilling and Mining	Transportation
2	Chemicals	Chemical Manufacturing	Clothing and Accessories	Textile
3	Machinery and Construction	Machinery and Construction	Textile	Weapons
4	Transportation	Precious Stones	Vegetables, Fruits and Plants	Chemicals
5	High-complexity Products	High-complexity Products	Animals and By-products	Animals and By-products
6	Services and Utilities	Services and Utilities	Chemical Manufacturing	Food and Preparations
7	Weapons	Textile	Raw Manufacturing	Chemical Manufacturing
8	Textile	Chemicals	Wood Products	Clothing and Accessories
9	Precious Stones	Weapons	Metals	Machinery and Construction
10	Chemical Manufacturing	Clothing and Accessories	Machinery and Construction	Daily Instruments
11	Clothing and Accessories	Energy Drilling and Mining	Weapons	Services and Utilities
12	Daily Instruments	Daily Instruments	High-complexity Products	High-complexity Products
13	Animals and By-products	Animals and By-products	Precious Stones	Precious Stones
14	Metals	Vegetables, Fruits and Plants	Chemicals	Energy Drilling and Mining
15	Raw Manufacturing	Raw Manufacturing	Food and Preparations	Vegetables, Fruits and Plants
16	Wood Products	Wood Products	Services and Utilities	Raw Manufacturing
17	Vegetables, Fruits and Plants	Metals	Daily Instruments	Metals
18	Food and Preparations	Transportation	Transportation	Wood Products
ECI	2.112887919	1.305220903	0.944644245	0.6961299

Table 5b. Opportunity Gain Ranking on a Comparable Scale (2018)

Ranking	Norway	Finland	Sweden	Denmark
1	Transportation	Wood Products	Animals and By-products	Vegetables, Fruits and Plants
2	Chemicals	Metals	Chemical Manufacturing	Textile
3	Daily Instruments	Daily Instruments	Wood Products	Weapons
4	High-complexity Products	High-complexity Products	Metals	Animals and By-products
5	Machinery and Construction	Services and Utilities	Weapons	Food and Preparations
6	Chemical Manufacturing	Chemicals	High-complexity Products	Chemical Manufacturing
7	Weapons	Machinery and Construction	Services and Utilities	Clothing and Accessories
8	Raw Manufacturing	Weapons	Energy Drilling and Mining	Daily Instruments
9	Wood Products	Transportation	Transportation	High-complexity Products
10	Precious Stones	Raw Manufacturing	Machinery and Construction	Services and Utilities
11	Textile	Textile	Textile	Wood Products
12	Animals and By-products	Chemical Manufacturing	Daily Instruments	Energy Drilling and Mining
13	Energy Drilling and Mining	Clothing and Accessories	Raw Manufacturing	Precious Stones
14	Metals	Precious Stones	Clothing and Accessories	Machinery and Construction
15	Services and Utilities	Energy Drilling and Mining	Chemicals	Transportation
16	Clothing and Accessories	Animals and By-products	Precious Stones	Raw Manufacturing
17	Vegetables, Fruits and Plants	Food and Preparations	Food and Preparations	Metals
18	Food and Preparations	Vegetables, Fruits and Plants	Vegetables, Fruits and Plants	Chemicals

Table 5c. Opportunity Gain Ranking on a Comparable Scale (2021)

We define the ranking of opportunity gain for a country c , as the Suggested Development Vector (SDV) of c . Tables 5a-5c summarize how the SDV of Denmark compares with a selected group of regional and leading economies in the world, with the industry groups ranked in decreasing order of significance. We focus on SDV results for 2018 because they give the most accurate snapshot of complexity for global comparison in the absence of the irregular effects of the COVID-19 pandemic observed in 2021.

Dark blue indicates positive opportunity gain, light blue indicates zero opportunity gains, and white indicates negative opportunity gains. The result shows that leading countries barely have any industries with positive opportunity gain. In other words, those countries are already in the most stable and efficient economic structure. Without the necessity of economic transition, those countries merely need to maintain a steady and balanced economic development. In contrast, less developed countries have nearly half of industries with positive opportunity gain, and share common interests in industrial manufacturing and High-complexity Products industries. It can be concluded that Denmark shares the characters of a less developed country as compared with the world's leading economies and other major economies in Europe, with a premature economics structure that leans towards basic to intermediate level industries.

Ranking	Thailand	Italy	Spain	United Arab Emirates
1	Animals and By-products	Energy Drilling and Mining	Energy Drilling and Mining	High-complexity Products
2	Food and Preparations	Precious Stones	Precious Stones	Transportation
3	Chemicals	Vegetables, Fruits and Plants	Weapons	Machinery and Construction
4	Raw Manufacturing	Animals and By-products	Textile	Daily Instruments
5	Textile	Food and Preparations	Chemicals	Chemicals
6	Machinery and Construction	Chemical Manufacturing	Daily Instruments	Weapons
7	Transportation	Raw Manufacturing	Animals and By-products	Textile
8	High-complexity Products	Wood Products	Vegetables, Fruits and Plants	Chemical Manufacturing
9	Energy Drilling and Mining	Clothing and Accessories	Food and Preparations	Raw Manufacturing
10	Vegetables, Fruits and Plants	Textile	Chemical Manufacturing	Energy Drilling and Mining
11	Precious Stones	Metals	Raw Manufacturing	Precious Stones
12	Weapons	Machinery and Construction	Wood Products	Services and Utilities
13	Clothing and Accessories	Daily Instruments	Clothing and Accessories	Metals
14	Services and Utilities	High-complexity Products	Metals	Clothing and Accessories
15	Wood Products	Weapons	Transportation	Wood Products
16	Metals	Chemicals	Services and Utilities	Animals and By-products
17	Chemical Manufacturing	Services and Utilities	Machinery and Construction	Vegetables, Fruits and Plants
18	Daily Instruments	Transportation	High-complexity Products	Food and Preparations
ECI	1.68914409	1.179705915	0.45830144	-0.734459148

Table 6: SDV of Other Typical Countries 2013

4.2 Budgeted Industry Development Strategy and Interpretation

The optimal budgeted industry development strategy aims to solve the most efficient allocations under the budgeted constraint of different situations of heuristic total export growth. In order to obtain such an allocation portfolio, we formulate an optimization problem as the following:

$$\begin{aligned} & \text{Max}_{x \in \mathbf{R}^{|P|}} \left(\frac{k(x) - \langle k(x) \rangle}{stdev(k(x))} \right)_C \\ & \text{Subject to} \\ & \sum_{p \in P} x_p \leq B \\ & x \succcurlyeq 0 \end{aligned}$$

where $k(x)$ is the second largest eigenvector of $M_{CC'}$ after adding x to the original export vector, C is the country that we are interested in, P is the product space, B is the heuristic budget.

If we can solve this problem, then we can know what the largest ECI that a country can improve to. Accordingly, the optimal solution x^* that we obtain here is exactly our optimal allocation. However, the biggest problem is that the objective function is not convex. Therefore, we cannot apply the classical tools for convex optimization on this problem. In order to solve this problem, our idea is to use greedy algorithm. The way that we apply greedy algorithm is that firstly we separate the total budget into k equal parts, and then for the first equal part we try to search for the product that can optimize our objective function by iterating through each $p \in P$. After we find the optimal product p for this equal part, we add the amount back to the export value of this product p and update the ECI for this country. If we observe that ECI does not change after iterating all the products, then we can add up one more equal part to invest. Until we find there is an ECI increment, we add the amount now to that product. The rest equal parts can be done in the same way.

However, as is known to all, greedy algorithm is a kind of local search algorithm, which is pretty possible to run into a local minimum. Therefore, for local search algorithms, one typical way is to keep it away from the local minimum is to enhance the vision of the algorithm by looking more steps forward. In our setting, whenever we obtain an increment of ECI, we mark down the required amount of export growth. Simultaneously, we continue searching for the next ECI increment point, compare the ratios of these two possibilities and pick the largest one. The ratio is defined as the following:

$$Ratio(p) = \frac{ECI_p - ECI_0}{||x_p - x_0||_1}$$

where ECI_p is just the ECI of the country after adding some amount of export increment to product p , which is exactly the amount that is able to make ECI change. Also, we can express it in the way of $||x_p - x_0||_1$.

In this way, we can obtain a further sighted greedy algorithm. Also, the number of parts that we would like to separate the budget into also matters. In order to solve this problem, we added a stabilizer on top of the enhanced greedy algorithm, by running the algorithm for different numbers of parts and selecting the portfolio with the largest ECI increment and most complex economic structure.

Besides, it is quite common that there is a surplus for the budget. To deal with the surplus, we just add it to the product which needs the least amount of dollar to make $M_{cp} = 1$, (i.e., the smallest amount of required export increase).

Interpretation:

For the purpose of a clear explanation of the line charts, we try to label all the products in Table 7. Please refer to this table when trying to understand the investment trajectories in the line charts.

Label	Product Names
1	Animal and By-products
2	Vegetables, Fruits and Plants
3	Food and Preparations
4	Energy Drilling and Mining
5	Chemicals
6	Chemical Manufacturing
7	Raw Manufacturing
8	Wood Products
9	Clothing and Accessories
10	Textile
11	Metals
12	Machinery and Construction
13	Transportation
14	Weapons
15	Daily Instruments
16	Precious Stones
17	High-complexity Products
18	Services and Utilities

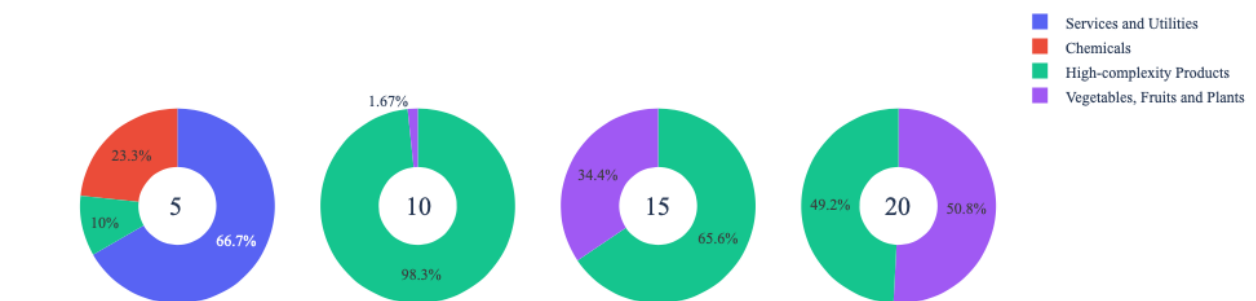
Table 7. Products Labeling

Figures 4a-4c show an economic panel for Denmark in 2013, 2018, and 2021. We can see that for different percentages of heuristic total export growth, the ECIs of Denmark actually have different increments.

For 2013, overall, with a 5 percent growth in export, the ECI of Denmark starts growing from around 0.77 and ends at around 1.04. However, with a much larger amount of budget, such as 10, 15, and 20 percent growth, Denmark's ECI can actually achieve a much higher level, namely around 1.50.

For the case of 5 percent growth in export, services and utilities, chemicals are main components of the portfolio. For the case of 10, 15 and 20 percent increment budgets, we realize that the development trajectories are in a similar pattern, mainly consisting of vegetables, fruits, and plants and high-complexity products. Similar to other developed countries, Denmark also has a relatively sparse solution, which can be reasoned by its pretty well-rounded economic structure. However, from the ECI improvement trajectories, we observe that most of the increments are resulted by high-complexity products, meaning that increasing investment in the development of high-complexity products can help improve the economic complexity structure of the country to a great extent. Additionally, Denmark can also focus on the development of vegetables, fruits, and plants, which can be beneficial for the production of other industries.

Denmark ECI Growth Optimization Result



Denmark ECI Increment

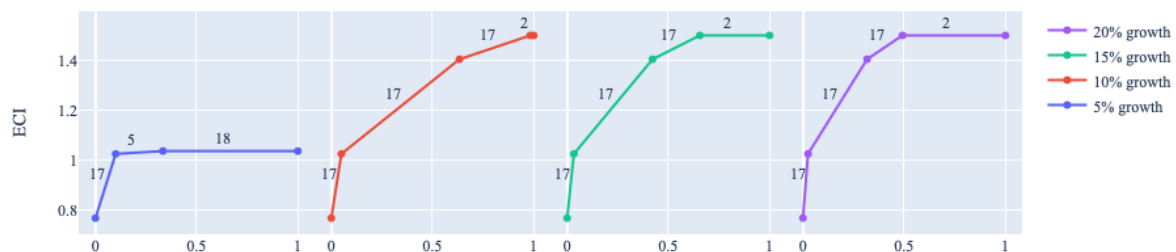


Figure 8a. Greedy-Based ECI Improvement Results of Denmark with Different Budgets (2013)

Denmark (2013)					
Original ECI	0.76				
Heuristic Export Growth	5%	10%	15%	20%	
Vegetables, Fruits and Plants	0.00E+00	4.08E+08	8.42E+09	1.49E+10	
Chemicals	1.71E+09	0.00E+00	0.00E+00	0.00E+00	
High-complexity Products	7.34E+08	2.40E+10	1.60E+10	1.44E+10	
Services and Utilities	4.89E+09	0.00E+00	0.00E+00	0.00E+00	
Increased ECI	1.04	1.50	1.50	1.50	

Table 8a. Portfolio of Denmark (2013)

For further suggestions on Denmark's development in the future. We also offer the optimization result based on export data in 2018. Below is the economic panel for Denmark in 2018. We can see that there is a similar pattern for the ECI improvement trajectories, which is that the improvements in 10, 15 and 20 percent export growth are similar, and all of them are greater than the one in 5 percent growth. Again, since Denmark is a pretty

developed economic entity, the optimization result is very sparse and there are not so many suggestions for future development in terms of ECI improvement. With 5 percent growth in export, vegetables, fruits, and plants remains as the main component for ECI improvement, but as the budgets become larger, it becomes less important or even replaced by transportation and high-complexity products. A more detailed numerical representation of the portfolio is shown in Table 9.

Denmark ECI Growth Optimization Result

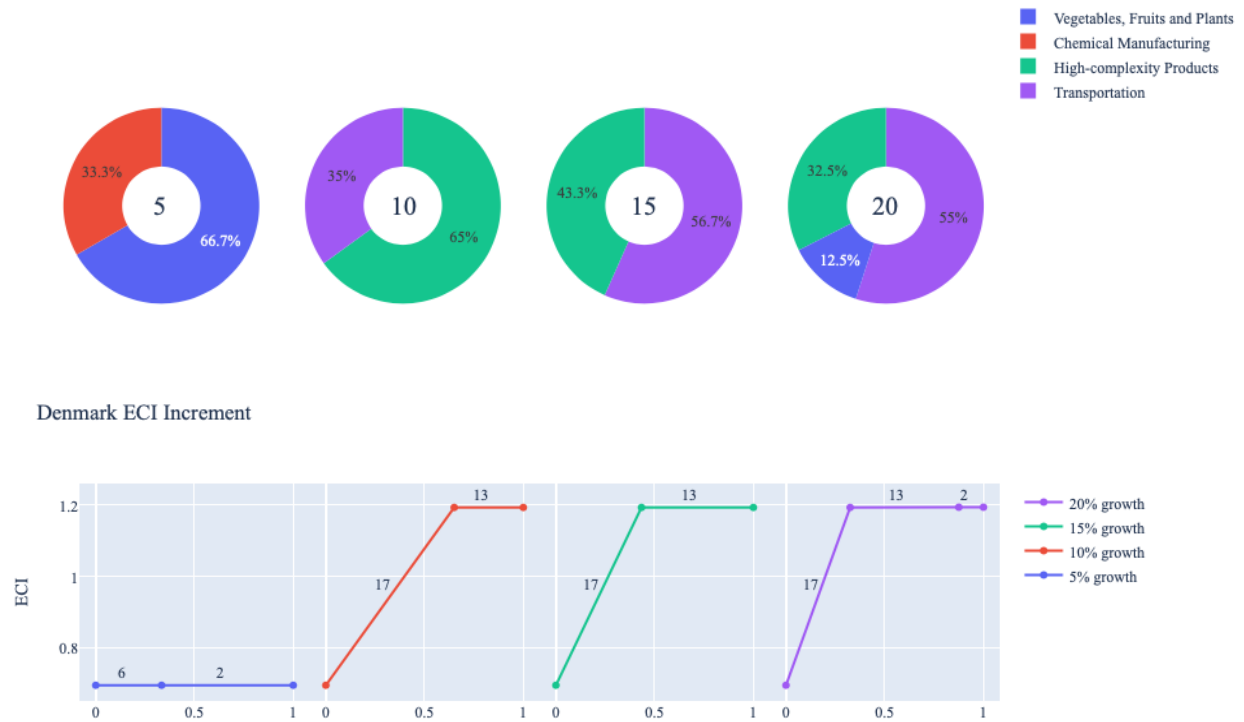


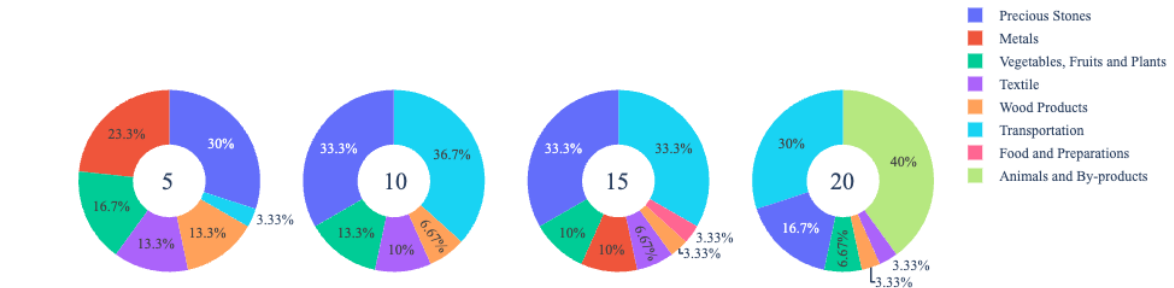
Figure 4b. Greedy-Based ECI Improvement Results of Denmark with Different Budgets (2018)

Original ECI	Denmark (2018)				
	5%	10%	15%	20%	0.7
Heuristic Export Growth					
Vegetables, Fruits and Plants	4.90E+09	0.00E+00	0.00E+00	3.68E+09	
Chemical Manufacturing	2.45E+09	0.00E+00	0.00E+00	0.00E+00	
Transportation	0.00E+00	5.15E+09	1.25E+10	1.62E+10	
High-complexity Products	0.00E+00	9.56E+09	9.56E+09	9.56E+09	
Increased ECI	0.70	1.19	1.19	1.19	

Table 8b. Portfolio of Denmark (2018)

To compare with the performance in 2013 and 2018, we also re-examine suggested strategies for 2021. For 2021, a 5 percent increase in export would emphasize Precious Stones, followed by Transportation for 10% and 15% and Animal and By-products for 20% export growth. These strategies go in line with the suggested trajectories based on ECI. Interestingly, the recommended post-pandemic economic response is to invest heavily in lower complexity sectors. This can be interpreted as the need to reinforce the fundamental industries as a result of supply chain and global trade disruptions. A more detailed numerical representation of the portfolio for Denmark is shown in Table 8c.

Denmark ECI Growth Optimization Result



Denmark ECI Increment

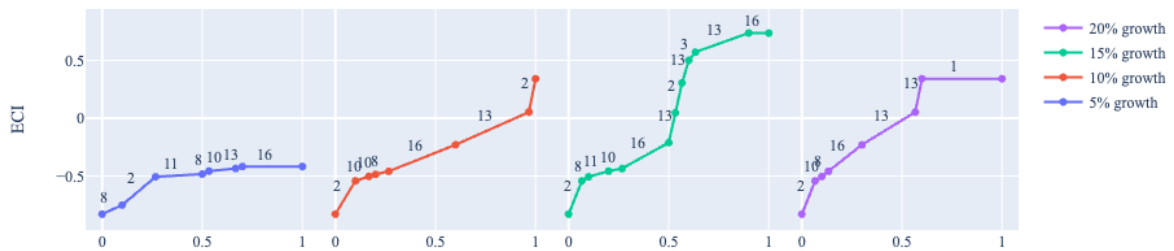


Figure 8c. Greedy-Based ECI Improvement Results of Denmark with Different Budgets (2021)

Original ECI	Denmark (2021)			
	-0.83			
Heuristic Export Growth	5%	10%	15%	20%
Animals and By-products	0.00E+00	0.00E+00	0.00E+00	1.46E+10
Vegetables, Fruits and Plants	1.30E+09	2.30E+09	4.77E+09	2.44E+09
Food and Preparations	0.00E+00	0.00E+00	1.59E+09	0.00E+00
Wood Products	1.04E+09	1.15E+09	1.59E+09	1.22E+09
Textile	1.04E+09	1.72E+09	3.18E+09	1.22E+09
Metals	1.83E+09	0.00E+00	4.77E+09	0.00E+00
Transportation	2.61E+08	6.31E+09	1.59E+10	1.10E+10
Precious Stones	2.35E+09	5.74E+09	1.59E+10	6.09E+09
Increased ECI	-0.42	0.34	0.74	0.34

Table 8c. Portfolio of Denmark (2021)

4.3 Sensitivity Analysis and Contingency Strategy

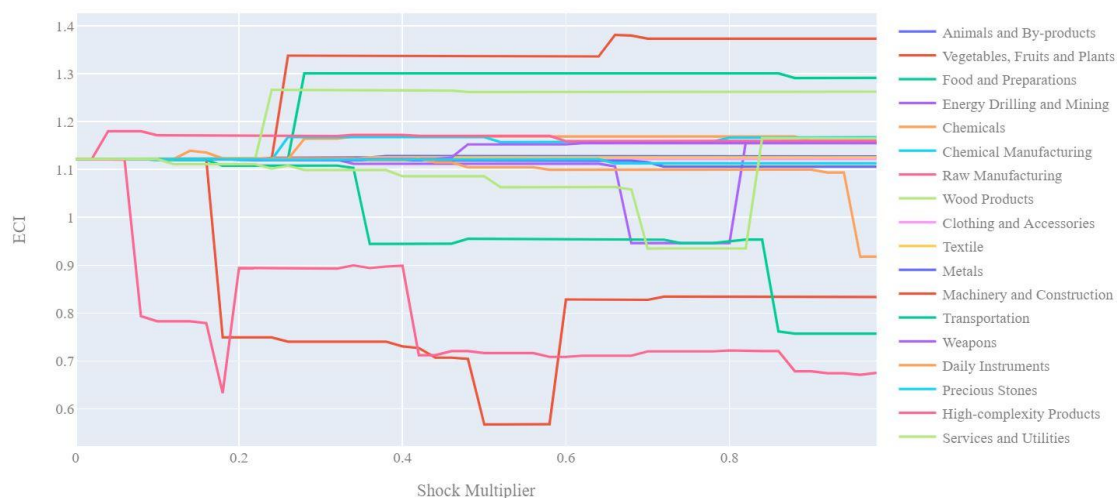
In the following section our broad aim is to understand how sensitive Denmark is to changes in export in various industries. While the Economic Complexity Index has been shown to contain valuable information about the economic strength/capacity of a country, little has been said as to the stability of the measure itself. We seek to uncover the main drivers of stability under a country's ECI score and better understand longer-term projections for ECI growth. Additionally, gaining an intuition on the industries that are bolstering an economy

and the industries that offer the greatest return per unit of investment is best done through visualization of industry specific sensitivity. To this end, we have developed two categories of sensitivity analysis.

ECI Sensitivity Graph

Firstly, in order to assess the effect particular industries have on each respective country, we developed ECI Sensitivity graphs. We use shocking methodology to increment or decrement an industry's export level by a certain percentage and recalculate the ECI all else being equal. While freezing the export dynamics of the rest of the world and enacting an instantaneous shock in export for a particular industry and country may not reflect real-life dynamics, what it does offer us is an understanding of a country's level of dependency on an industry in the context of ECI. The shocking is done in small percentage increments in order to smooth out the resulting curve. Additionally, a recurring theme one will see is that for most industries, a breaking point occurs where the ECI either jumps upwards or downwards, creating a hockey stick shape rather than a linear trend. While the inflection point may not be accurate in context of real life, comparing the various inflection points across industries can give us valuable insight.

The graphs are formulated as follows: There are four ECI Sensitivity graphs. The first two represent data from 2018. The first chart shows positive shocking in which export numbers are shocked upwards per industry. The X-axis is in terms of percentage shock per current dollar value of export. The Y-axis is the recalculated ECI level post-shocking. The second chart follows the same format except the X-axis represents negative shocking. In other words, exports for each industry are decremented and the ECI is accordingly recomputed. The final two sensitivity graphs show the same results using 2013 data. Below is an example of an ECI sensitivity graph.



Example 2018 (Incremental ECI Sensitivity)

SDV sensitivity

Secondly, we analyze the sensitivity of the SDV to changes in export levels. The goal is to understand how export level changes for a particular industry can affect the marginal opportunity gain for other industries. We will be using specifically High Complexity Products and Food and Preparations as our base industries. We will be increasing or decreasing the absolute export level in both of these industries and observing the effects on the SDV.

When the opportunity gain of an industry is negative, the SDV sensitivity approximates how an over-development of the industry jeopardizes the economic structure of a country. When the opportunity gain of the industry is zero, the SDV sensitivity determines whether the further development of the industry shapes the country with a better economic structure and predicts how the SDV would change accordingly. Specifically, as we reduce the export of such an industry to 25%-50% of its original value, a few other industries originally with negative opportunity gain could likely become profitable.

Similar to the ECI sensitivity graphs above, we will be shocking export of High Complexity Products and Food and Preparations in small percentage increments. A new SDV, represented by a new column in the charts, is recorded only when a certain level of shock changes the structure of the SDV. In effect we are incrementing or decrementing export levels of two industries until the marginal opportunity gain of any industry changes in category (positive, negative, or neutral). Below is an example of a SDV Sensitivity chart with Positive Shocking. Industries with positive marginal opportunity gain are colored blue, neutral is colored white and negative is colored red.

	0.0%	10.0%	30.0%	50.0%	80.0%	100.0%	120.0%
0	Vegetables, Fruits and Plants	Vegetables, Fruits and Plants	Vegetables, Fruits and Plants	Chemicals	Chemicals	Chemicals	Machinery and Construction
1	Daily Instruments	Daily Instruments	Daily Instruments	Services and Utilities	Services and Utilities	Daily Instruments	Chemicals
2	Weapons	Weapons	Weapons	Textile	Textile	Textile	Daily Instruments
3	Transportation	Transportation	Transportation	Weapons	Daily Instruments	Services and Utilities	Services and Utilities
4	Machinery and Construction	Machinery and Construction	Machinery and Construction	Transportation	High-complexity Products	Transportation	Transportation
5	Metals	Metals	High-complexity Products	Machinery and Construction	Transportation	Chemical Manufacturing	Textile
6	High-complexity Products	High-complexity Products	Chemicals	High-complexity Products	Machinery and Construction	Weapons	Chemical Manufacturing
7	Chemicals	Services and Utilities	Services and Utilities	Daily Instruments	Chemical Manufacturing	High-complexity Products	Weapons
8	Services and Utilities	Chemicals	Textile	Chemical Manufacturing	Weapons	Machinery and Construction	High-complexity Products
9	Textile	Textile	Chemical Manufacturing	Precious Stones	Clothing and Accessories	Clothing and Accessories	Clothing and Accessories
10	Chemical Manufacturing	Chemical Manufacturing	Precious Stones	Clothing and Accessories	Precious Stones	Precious Stones	Raw Manufacturing
11	Precious Stones	Precious Stones	Clothing and Accessories	Vegetables, Fruits and Plants	Raw Manufacturing	Raw Manufacturing	Precious Stones
12	Clothing and Accessories	Clothing and Accessories	Raw Manufacturing	Raw Manufacturing	Wood Products	Metals	Wood Products
13	Raw Manufacturing	Raw Manufacturing	Metals	Metals	Metals	Wood Products	Metals
14	Energy Drilling and Mining	Energy Drilling and Mining	Energy Drilling and Mining	Wood Products	Energy Drilling and Mining	Energy Drilling and Mining	Energy Drilling and Mining
15	Wood Products	Wood Products	Wood Products	Energy Drilling and Mining	Animals and By-products	Animals and By-products	Animals and By-products
16	Animals and By-products	Animals and By-products	Animals and By-products	Animals and By-products	Vegetables, Fruits and Plants	Food and Preparations	Food and Preparations
17	Food and Preparations	Food and Preparations	Food and Preparations	Food and Preparations	Food and Preparations	Vegetables, Fruits and Plants	Vegetables, Fruits and Plants
ECI	2.261503667	2.520234671	3.08896214	3.452901685	4.299466299	4.439916975	5.069638102

Example High-complexity Products 2018 (Incremental SDV Sensitivity)

4.3 Sensitivity Analysis Results and Interpretation

We examine Denmark's ECI Decremental and Incremental Sensitivity Charts for 2021. An increase in High-Complexity Products will lead to the highest change in ECI, followed by Transportation and Chemicals. The strong sensitivity effect of manipulating the High-Complexity Products and Transportation category remains consistent with previous years. For the negative shock cases, Food and Preparations becomes most impactful,

consistent with past years which suggest that decreases in the export would lead to an increase in ECI.

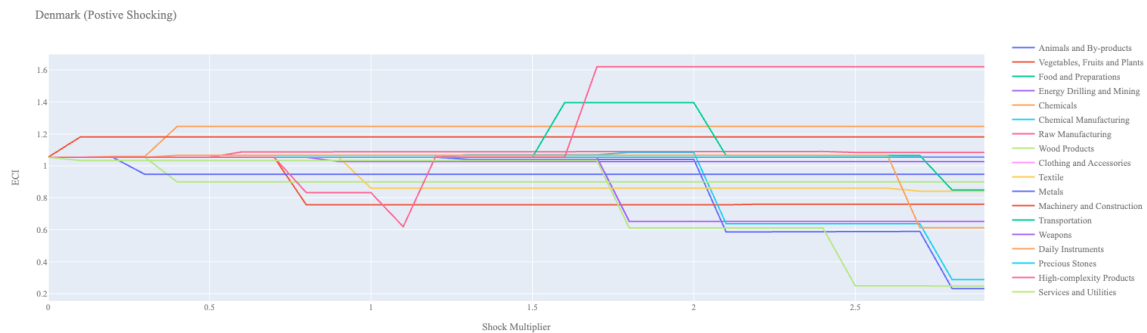


Figure 6a. Incremental ECI Sensitivity for Denmark (2021)

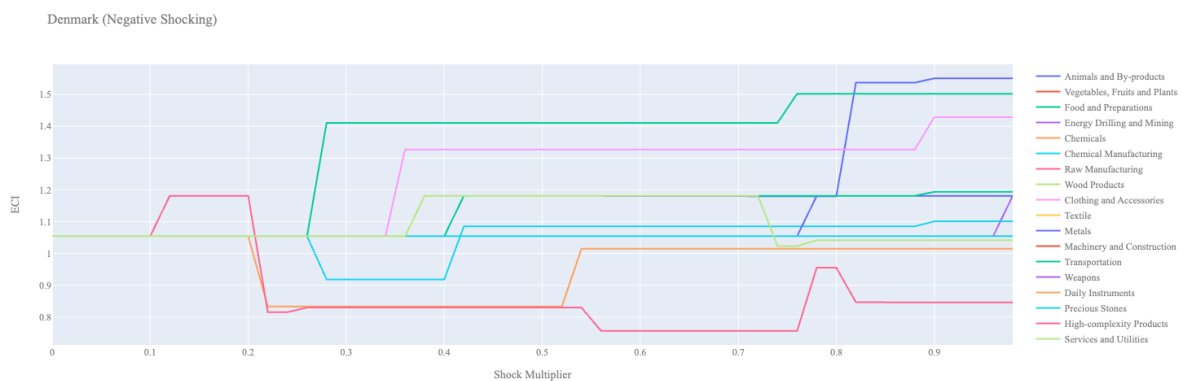
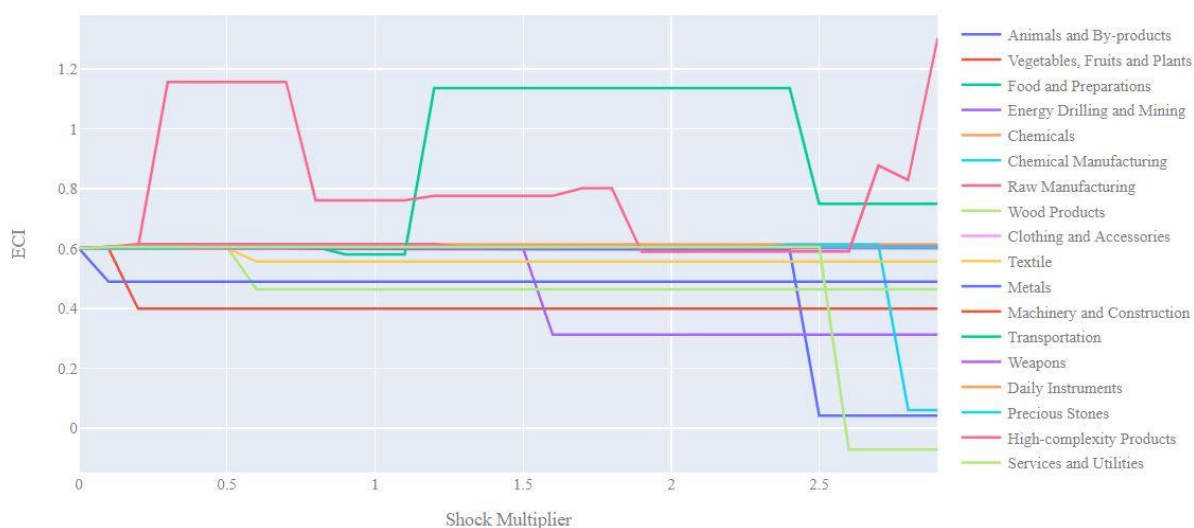


Figure 6b. Decremental ECI Sensitivity for Denmark (2021)

Below is Denmark's 2018 ECI Sensitivity Charts. Firstly in the positive chart, we notice immediately that increases in High Complexity Product, Transportation lead to higher ECI scores. In general Denmark is slightly prone to small decreases in ECI with increases in all other industries.

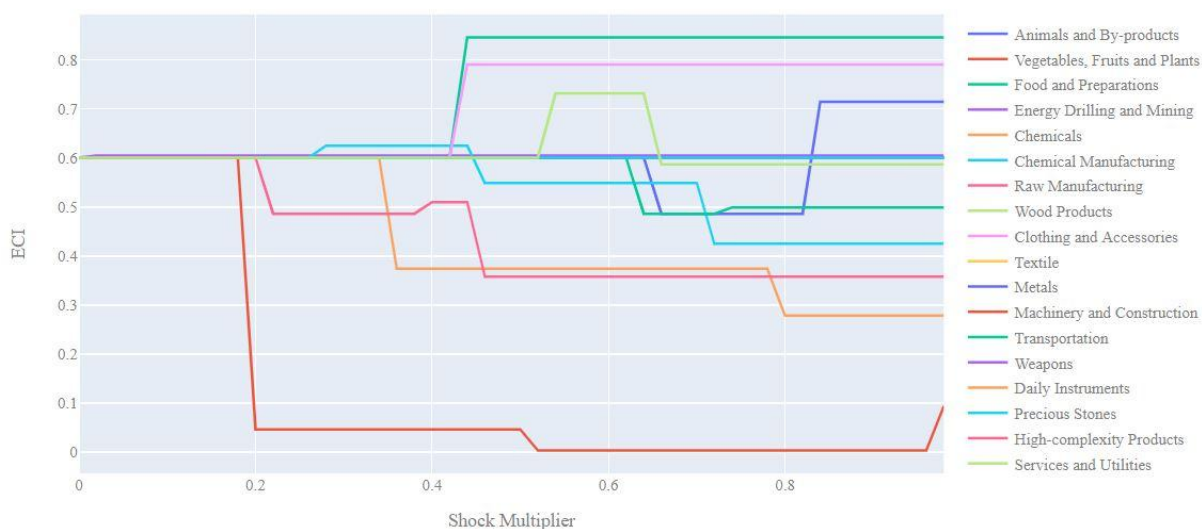
Next we consider Denmark's 2018 Negative Shock chart. Immediately we see that decreases in the export of Food and Preparations, as well as Clothing and Accessories could be quite beneficial for Denmark's ECI score. Also of note is that Denmark is very sensitive to drawdowns in Machinery, which can bring the ECI near zero with less than a 20% drawdown.

Denmark (Postive Shocking)



Denmark 2018 (Incremental ECI Sensitivity)

Denmark (Negative Shocking)

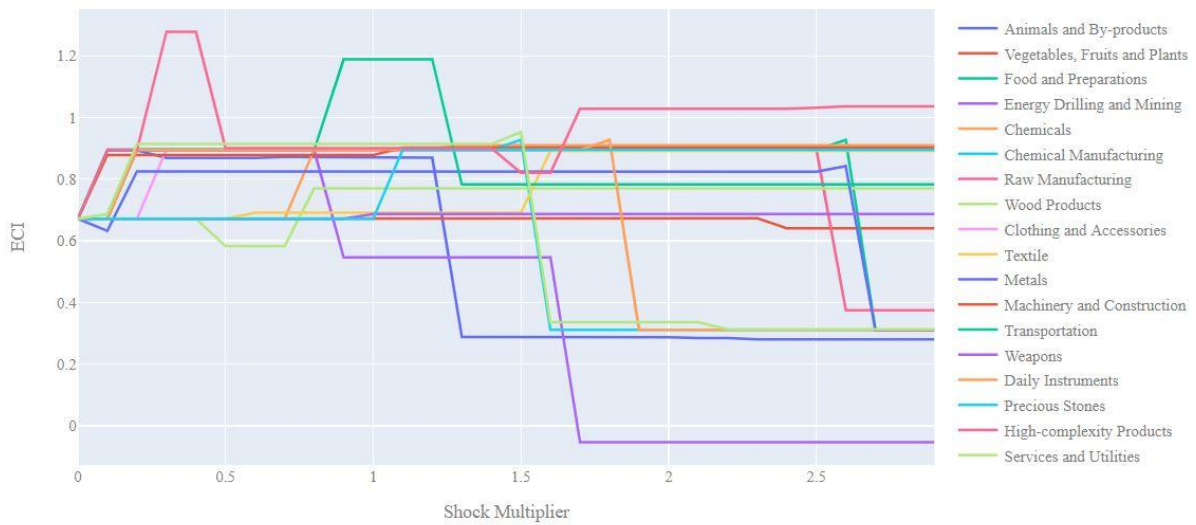


Denmark 2018 (Decremental ECI Sensitivity)

Next we consider the 2013 ECI Sensitivity graphs. We see that in the positive shocking case, the landscape of ECI sensitivity has not altered significantly over the five year period. High complexity products and Transportation seem to offer slight increases in ECI. Again, increases in export in all other industries lead to slight decreases in ECI score.

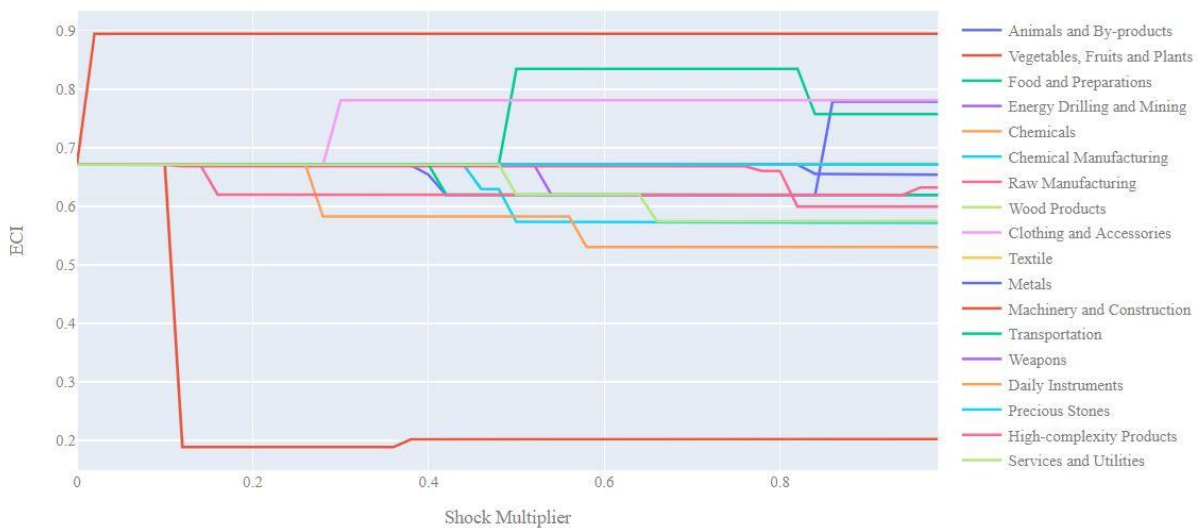
In the 2013 negative shocking case, we see that again Denmark is very sensitive to drawdowns in Machinery. Additionally we see that decrease in exposure to Vegetables, Fruits and Plants seem to offer an immediate increase in ECI score.

Denmark (Postive Shocking)



Denmark 2013 (Incremental ECI Sensitivity)

Denmark (Negative Shocking)



Denmark 2013 (Decremental ECI Sensitivity)

Below we see the SDV sensitivity charts for High Complexity Products. Denmark's SDV is quite sensitive to changes in High Complexity products and we see that a similar mix of industries have positive opportunity gain as we increase the export of High Complexity Products. Decreasing the export of High Complexity products leads to a very similar composition of positive opportunities for Denmark.

Denmark's SDV seems to be generally insensitive to changes in export of Food and Preparations suggesting that this is not a key industry for the country.

	0.0%	30.0%	80.0%	190.0%
0	Vegetables, Fruits and Plants	Vegetables, Fruits and Plants	Vegetables, Fruits and Plants	Vegetables, Fruits and Plants
1	High-complexity Products	Services and Utilities	Machinery and Construction	Machinery and Construction
2	Transportation	Machinery and Construction	Services and Utilities	Transportation
3	Services and Utilities	Food and Preparations	Food and Preparations	Services and Utilities
4	Food and Preparations	Chemical Manufacturing	Chemical Manufacturing	High-complexity Products
5	Chemical Manufacturing	High-complexity Products	High-complexity Products	Food and Preparations
6	Clothing and Accessories	Clothing and Accessories	Clothing and Accessories	Chemical Manufacturing
7	Machinery and Construction	Daily Instruments	Daily Instruments	Clothing and Accessories
8	Daily Instruments	Animals and By-products	Animals and By-products	Animals and By-products
9	Animals and By-products	Chemicals	Transportation	Chemicals
10	Chemicals	Transportation	Chemicals	Daily Instruments
11	Textile	Textile	Textile	Textile
12	Weapons	Weapons	Weapons	Weapons
13	Precious Stones	Precious Stones	Raw Manufacturing	Raw Manufacturing
14	Raw Manufacturing	Raw Manufacturing	Precious Stones	Precious Stones
15	Metals	Metals	Metals	Metals
16	Energy Drilling and Mining	Energy Drilling and Mining	Wood Products	Wood Products
17	Wood Products	Wood Products	Energy Drilling and Mining	Energy Drilling and Mining
ECI	0.600988513	1.156887718	0.760779671	0.589753076

Denmark High-complexity Products 2018 (Incremental SDV Sensitivity)

	-0.0%	-22.0%	-40.0%	-46.0%
0	Vegetables, Fruits and Plants	Vegetables, Fruits and Plants	Vegetables, Fruits and Plants	High-complexity Products
1	High-complexity Products	High-complexity Products	Services and Utilities	Transportation
2	Transportation	Services and Utilities	Metals	Chemicals
3	Services and Utilities	Metals	Food and Preparations	Weapons
4	Food and Preparations	Food and Preparations	Chemical Manufacturing	Services and Utilities
5	Chemical Manufacturing	Chemical Manufacturing	Raw Manufacturing	Vegetables, Fruits and Plants
6	Clothing and Accessories	Clothing and Accessories	Clothing and Accessories	Food and Preparations
7	Machinery and Construction	Machinery and Construction	Machinery and Construction	Chemical Manufacturing
8	Daily Instruments	Daily Instruments	Daily Instruments	Raw Manufacturing
9	Animals and By-products	Animals and By-products	Animals and By-products	Clothing and Accessories
10	Chemicals	Transportation	High-complexity Products	Metals
11	Textile	Chemicals	Transportation	Machinery and Construction
12	Weapons	Textile	Chemicals	Daily Instruments
13	Precious Stones	Weapons	Textile	Animals and By-products
14	Raw Manufacturing	Precious Stones	Weapons	Textile
15	Metals	Raw Manufacturing	Precious Stones	Precious Stones
16	Energy Drilling and Mining	Energy Drilling and Mining	Energy Drilling and Mining	Energy Drilling and Mining
17	Wood Products	Wood Products	Wood Products	Wood Products
ECI	0.600988513	0.486441913	0.510128798	0.358114389

Denmark High-complexity Products 2018 (Decremental SDV Sensitivity)

	0.0%
0	Vegetables, Fruits and Plants
1	High-complexity Products
2	Transportation
3	Services and Utilities
4	Food and Preparations
5	Chemical Manufacturing
6	Clothing and Accessories
7	Machinery and Construction
8	Daily Instruments
9	Animals and By-products
10	Chemicals
11	Textile
12	Weapons
13	Precious Stones
14	Raw Manufacturing
15	Metals
16	Energy Drilling and Mining
17	Wood Products
ECI	0.600988513

Denmark Food and Preparations 2018 (Incremental SDV Sensitivity)

	-0.0%	-44.0%
0	Vegetables, Fruits and Plants	Vegetables, Fruits and Plants
1	High-complexity Products	High-complexity Products
2	Transportation	Transportation
3	Services and Utilities	Services and Utilities
4	Food and Preparations	Machinery and Construction
5	Chemical Manufacturing	Chemical Manufacturing
6	Clothing and Accessories	Clothing and Accessories
7	Machinery and Construction	Daily Instruments
8	Daily Instruments	Animals and By-products
9	Animals and By-products	Chemicals
10	Chemicals	Textile
11	Textile	Weapons
12	Weapons	Raw Manufacturing
13	Precious Stones	Precious Stones
14	Raw Manufacturing	Metals
15	Metals	Energy Drilling and Mining
16	Energy Drilling and Mining	Wood Products
17	Wood Products	Food and Preparations
ECI	0.600988513	0.846210396

Denmark Food and Preparations 2018 (Decremental SDV Sensitivity)

4.4 Contingency Strategy

Decreasing export of each industry in Denmark's current production space by 60% respectively, we derive the contingency strategy shown below.

	0	1	2
Animals and By-products	Vegetables, Fruits and Plants	High-complexity Products	Services and Utilities
Vegetables, Fruits and Plants	Vegetables, Fruits and Plants	High-complexity Products	Transportation
Food and Preparations	Vegetables, Fruits and Plants	High-complexity Products	Transportation
Energy Drilling and Mining	Vegetables, Fruits and Plants	High-complexity Products	Transportation
Chemicals	Vegetables, Fruits and Plants	High-complexity Products	Transportation
Chemical Manufacturing	Vegetables, Fruits and Plants	High-complexity Products	Transportation
Raw Manufacturing	Vegetables, Fruits and Plants	High-complexity Products	Transportation
Wood Products	Vegetables, Fruits and Plants	High-complexity Products	Transportation
Clothing and Accessories	Vegetables, Fruits and Plants	High-complexity Products	Transportation
Textile	Vegetables, Fruits and Plants	High-complexity Products	Transportation
Metals	Vegetables, Fruits and Plants	High-complexity Products	Transportation
Machinery and Construction	Vegetables, Fruits and Plants	High-complexity Products	Machinery and Construction
Transportation	Vegetables, Fruits and Plants	High-complexity Products	Services and Utilities
Weapons	Vegetables, Fruits and Plants	High-complexity Products	Transportation
Daily Instruments	Vegetables, Fruits and Plants	High-complexity Products	Transportation
Precious Stones	Vegetables, Fruits and Plants	High-complexity Products	Transportation
High-complexity Products	High-complexity Products	Transportation	Chemicals
Services and Utilities	Vegetables, Fruits and Plants	High-complexity Products	Transportation

Denmark Contingency Strategy 2018

5. Macro-level Predictions

5.1 Structural Optimality Index

Indeed, such choice of prioritization has proven to be a significant factor in deciding the economic outcomes of countries. In order to quantitatively evaluate how effective our development strategies are and how deviations from the suggested developmental path will lead to suboptimal growth results, we define the measure – Structural Optimality Index (SOI) – on a country level as the Adjusted R-Square obtained from regressing the country’s realized industry development over the suggested development strategy. Both strategies are quantified in nature, with the realized development represented by export increase in every major industry group and the suggested development strategy represented by the opportunity gains of developing the corresponding industry groups as calculated in previous sections. The adjusted R-square from the regression thus provides us with a quantified measure of how the development path adopted by the country has fitted with/differed from calculations on a complexity level.

After obtaining this measure for all countries in our database, we further regress countries’ five-year economic growth, which is defined as the percent increase in GDP (USD), over their SOI. Figure 6 illustrates the regression output, which shows a strong positive correlation between countries’ SOI and their five-year GDP growth, significant at the 1% level and achieving an adjusted R^2 of 4.5%. In other words, the more a country develops as suggested by calculations on a complexity level, the better economic outcomes it achieves.

Table 18: OLS Regression Results	
Dep. Variable: GDP	F-Statistic: 5.963
R²: 0.054	Prob (F-Stat): 0.0163
Adj R²: 0.045	No. Observations: 106

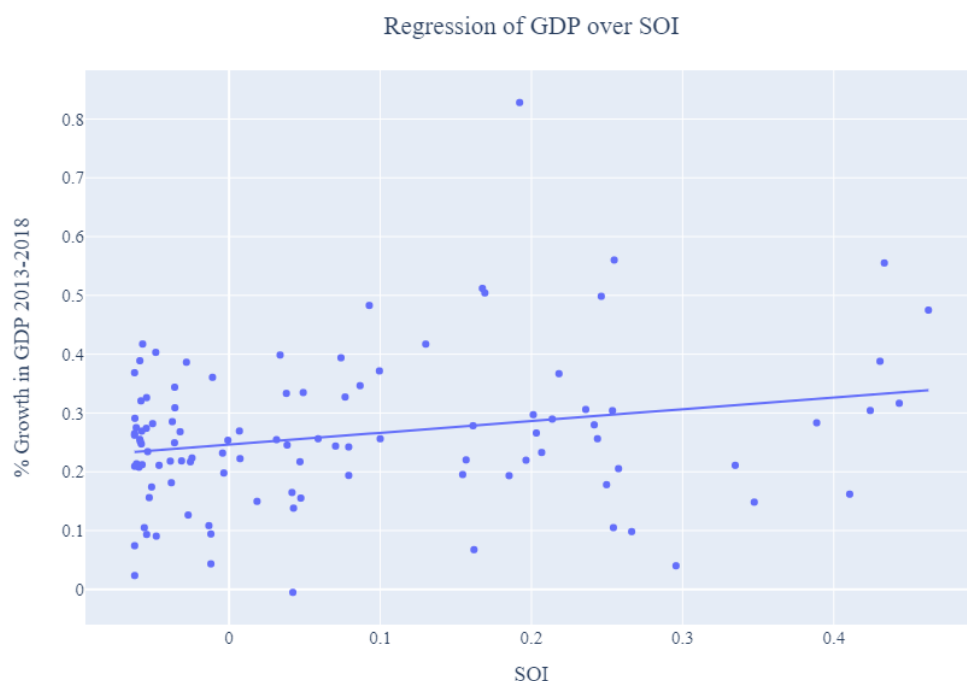


Figure 9. Regression of Five-Year GDP Growth over SOI (2013-2018)

5.2 SOI of Denmark and Its Implications

Denmark, for instance, has an average level of structural optimality as compared with its developed peers. As the regression in Figure 10a suggests (the orange curve represents export increase and the blue curve stands for opportunity gain of the corresponding industry), Denmark demonstrates a lower level of correlation with the suggested developmental path, having an adjusted R-square of around 4.8%. Denmark ranks in the second quartile among all countries in terms of SOI and has made an average rate of economic progress among its emerging peers from 2013 to 2018 with a 5-year GDP growth rate of 23.3%, which is consistent with the regression result in Figure 6. This is in direct contrast to emerging economies such as Turkey, where there is high SOI of around 21.8% and a corresponding GDP growth of 36.7% from 2013 to 2018, making it one of the fastest developing economies during the period. In sum, Denmark's relatively slow economic progress from 2013 to 2018 can be at least partially explained by a development strategy that slightly deviated from our suggested developmental path. In specific, Denmark invested heavily in the Services and Utilities industry, while it should have focused more on industry groups such as Energy Drilling/Mining and Precious Stones.

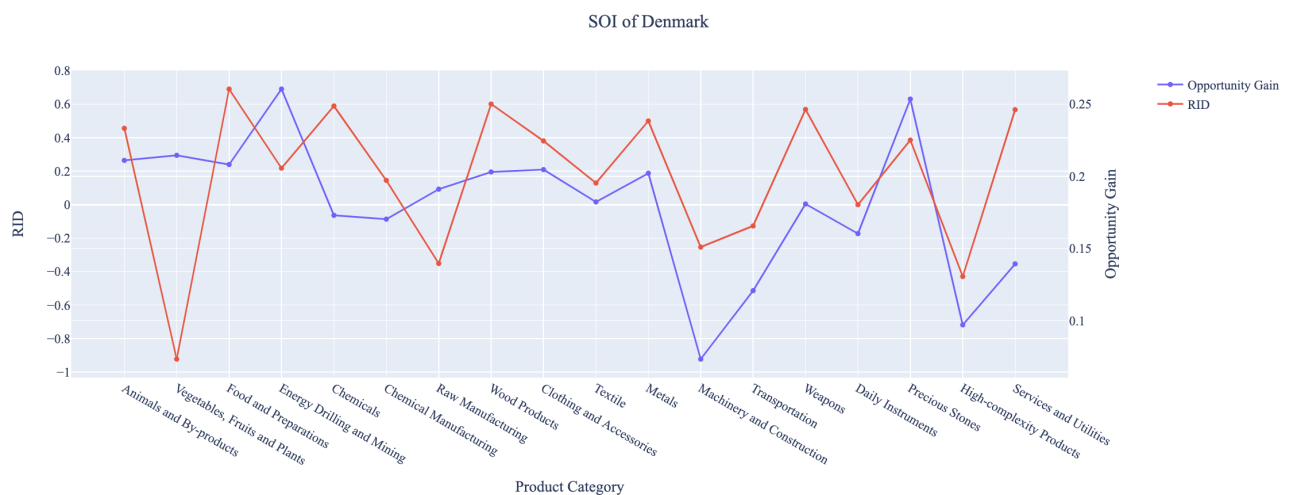


Figure 10a. SOI of Denmark (2013-2018)

For the 2019-2021 years, Denmark has a strong presence in the Chemical Manufacturing and High-Complexity Products industries, which they seem to be overdeveloped when considering their lower opportunity gain relative to RID. It also could consider Energy, Drilling, and Mining to improve its growth. Denmark has seen a slower growth in GDP over those three years at 4.66%, compared to 23.3% for the average yearly growth for the five years prior.

Lower than before, its adjusted R-squared value of 2.4% still indicates a low correlation between the GDP growth and the implemented development path. Progress is slow on a global scale during this period, but Denmark demonstrates a lower ability to adjust to negative economic shocks by improving SOI and increasing GDP growth than it did between 2013 and 2018.

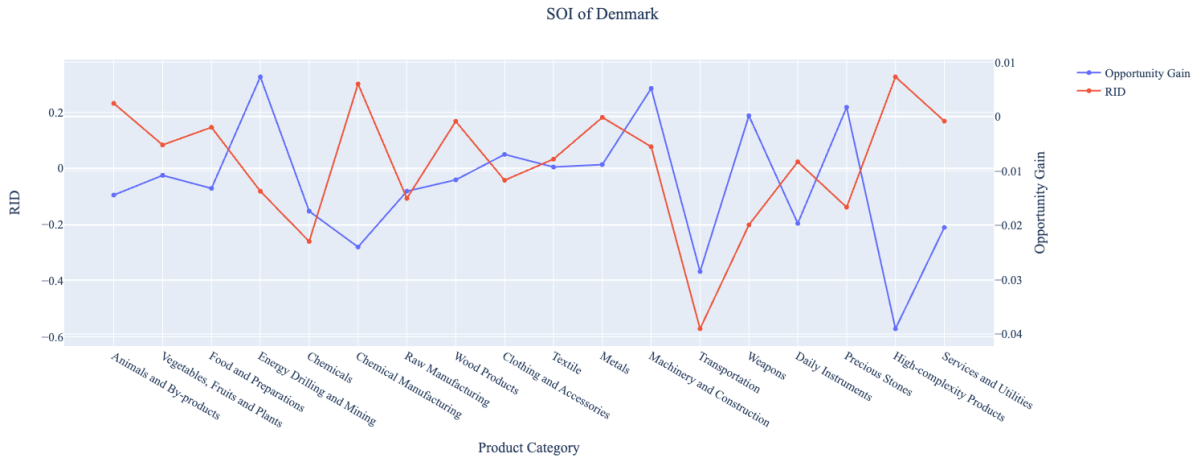


Figure 10b. SOI of Denmark (2019-2021)

6. Concluding Remarks

In conclusion, Denmark has demonstrated a moderate level of economic growth in terms of annual GDP increase during the period from 2013 to 2018, concurrent with a decrease in economic complexity as compared with other developed economies. For 2019-2021, the growth in GDP has slowed alongside a large decrease in ECI, in line with its comparable countries.

The lack of progress during the period, we believe, can be partially explained through analysis of the economic and product complexity structure of Denmark on the industry group level. The product classification system we adopt allows us to measure the realized industry development for various industry groups and to observe that Denmark consistently relied on developing the Food and Preparations, Wood Products, and Chemicals industries in 2013-2018, while its developed counterparts and emerging economies around the globe adopted much more complex and progressive paths.

Based on our analysis of the opportunity gain and a sensitivity analysis of major industry groups, Denmark can further its gains by prioritizing High-Complexity Products and Transportation. We further note that Denmark has a slightly mismatched development strategy that indicates an average (compared to other developed economies) level of structural optimality on the complexity level, having an adjusted R-square of around 4.8%. Since a significant positive correlation exists between five-year GDP growth and the structural optimality index of an economy as we define and calculate, Denmark indeed has a suboptimal growth experience as compared with fast-growing economies both on a regional scale and on a global scale, and has the potential to further its economic gains through industrial structure optimization as suggested in the paper.

During the second examined period from 2019 to 2021, Denmark performed similarly to its comparable countries, particularly Sweden. We infer that during the COVID-19 period, Denmark focused on developing higher complexity industries despite a lower demand for these industries given the global economic downturn. We also note that Denmark has increased its investment in the sectors identified earlier, leading to a strong boost from

High-Complexity Products industries, which remains an integral sector as demonstrated by the sensitivity analysis. The greedy approach suggests that greater growth could have been achieved through investments in Transportation, which is aligned to our recommendations from previous years. The slight decrease to the adjusted R-squared value to 2.4% in 2021 from 4.8% in 2018 demonstrates that Denmark has room for strategic improvement by investing in the industries mentioned above. With the revised focus, Denmark has further potential to advance its economic growth to maintain its position among other countries to continue its ongoing economic expansion.

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