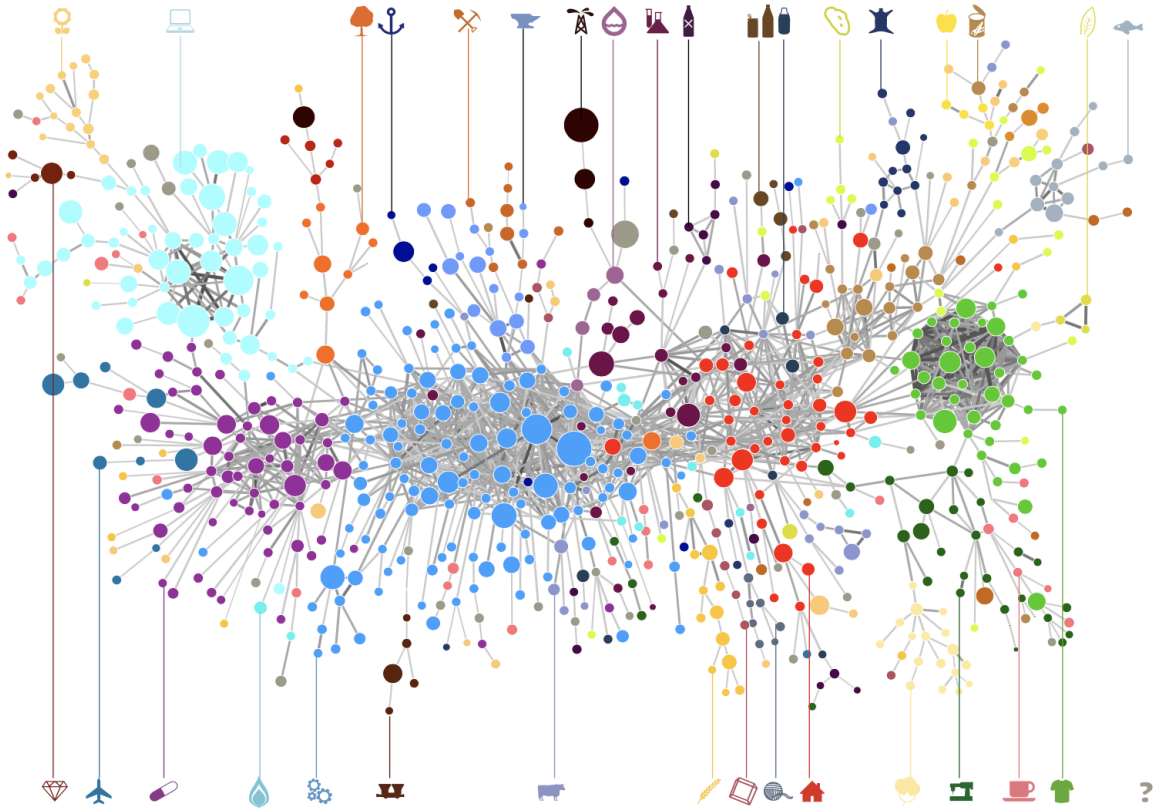

https://atlas.cid.harvard.edu/

# Optimal Industry Development Strategy Using Economic and Product Complexity

# Myanmar

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The Economic Complexity Lab - Columbia University

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# Optimal Industry Development Strategy for Myanmar

## 0. Executive Summary

In this report, we aim to uncover the economic path Myanmar went through during the period from 2013 to 2018. Specifically, we dive into the topic through a macroeconomic overview of Myanmar 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, Myanmar demonstrated a moderate level of economic growth with an average annual GDP growth rate of 7.09%, concurrent with a decrease in economic complexity as compared with other major developed economies. Average annual GDP growth decreased to to negative 0.89% and ECI index increased significantly during the period between 2019 to 2021. The increase in economic complexity was in opposite trend with the decline of economic complexity of other major developed countries.

The lack of progress during the period, we believe, can be partially explained through analysis of the economic and product complexity structure of Myanmar 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 Myanmar consistently relied on developing the Metals industry during the period, while its developed counterparts and emerging economies around the globe have adopted much more complex and progressive paths.

Based on our analysis of the opportunity gain and a sensitivity analysis of major industry groups, Myanmar can further its gains by prioritizing Textiles, Wood Products, or Daily Instruments. We further note that Myanmar has a slightly mismatched development strategy that indicates a moderate (compared to other developed countries) level of structural optimality on the complexity level, having an adjusted R-square of around 7.51%. Since a significant positive correlation exists between five-year GDP growth and the structural optimality index of an economy as we define and calculate, Myanmar, however, still 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.

# 1. Report Overview

In this report, we aim to uncover the economic path Myanmar went through during the period from 2013 to 2018, and the impact of COVID-19 on its economic development as observed in 2021. Specifically, we dive into the topic through a macroeconomic overview of Myanmar 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 Myanmar 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 Myanmar, 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 1 illustrates the time-series GDP results for Myanmar and three of its peer countries (Kuwait, Kazakhstan, Oman) from 2013-2018. Similar to most of the other countries, Myanmar generally displayed relatively steady positive growth over all years. Additionally, Myanmar's average annual growth rate of 7.09% over the five-year period is at the top of its peers, which are 1.54%, 3.91%, and 3.88% for Kuwait, Kazakhstan, and Oman respectively.

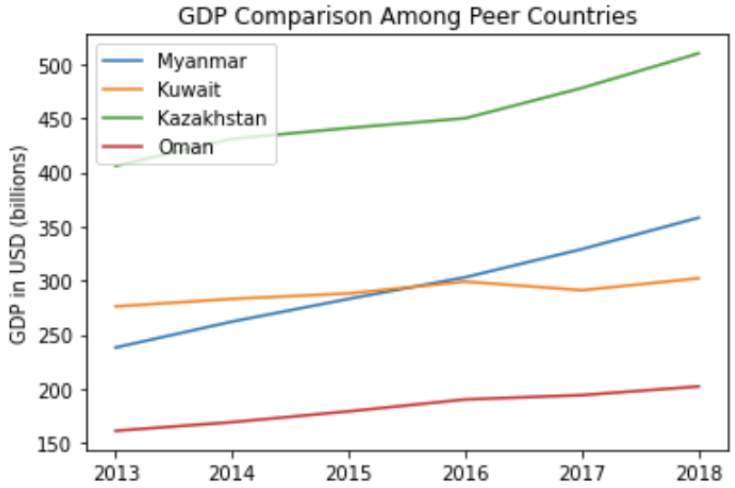



Figure 1: GDP Comparison Among Peer Countries (2013-2018)

Figure 2 illustrates the time series GDP results in 2019-2021. Unlike the rest of its peer countries, Myanmar was the only country which displayed negative growth over the period, since its GDP decreased to a negative annual growth rate of 0.89%. All of its peer countries experiences a positive annual growth rate for the period (16.23% for Kuwait, 1.9% for Kazakhstan, and 0.03% for Oman). The peer countries also experienced an initial decrease in GDP due to the economic implications of COVID-19 and then a upward growth signaling a recovering of the countries economies from the pandemic. For Myanmar, however, it was the opposite case. The GDP initially increased during the pandemic and later decreased below

pre pandemic levels in 2021. This suggests that how Myanmar dealt with the pandemic caused COVID 19 to have a different impact on its economy than the rest of its peer countries.

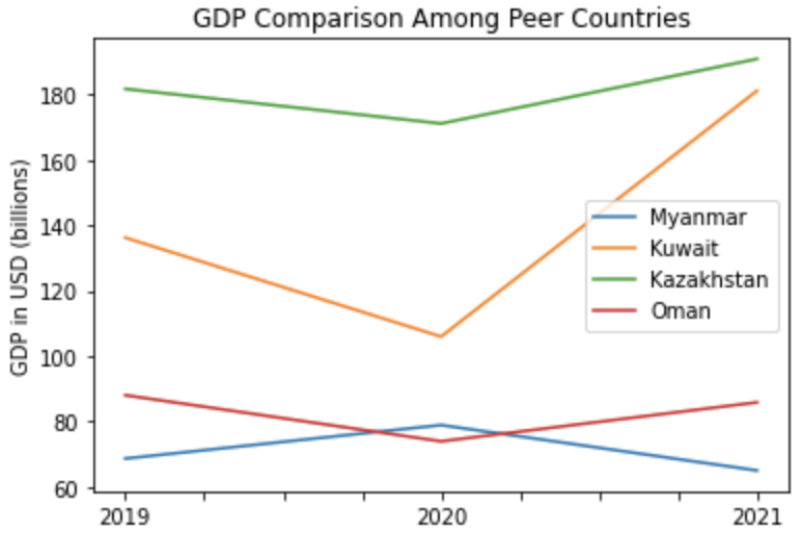



Figure 2: GDP Comparison Among Leading Economies (2019-2021)

**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, exhibits a similar growth pattern for Myanmar. As illustrated in Figure 3 below, Myanmar (-64.32% ECI change) exhibited a decrease in terms of its production capability from 2013 to 2018, which is similar to Kazakhstan (-118.18%) and Oman (-440.13%), but different from Kuwait (70.41%). Ultimately, Myanmar is in the middle of the peer country set, as it displays the highest GDP growth rate and average ECI change across the period of 2013-2018.

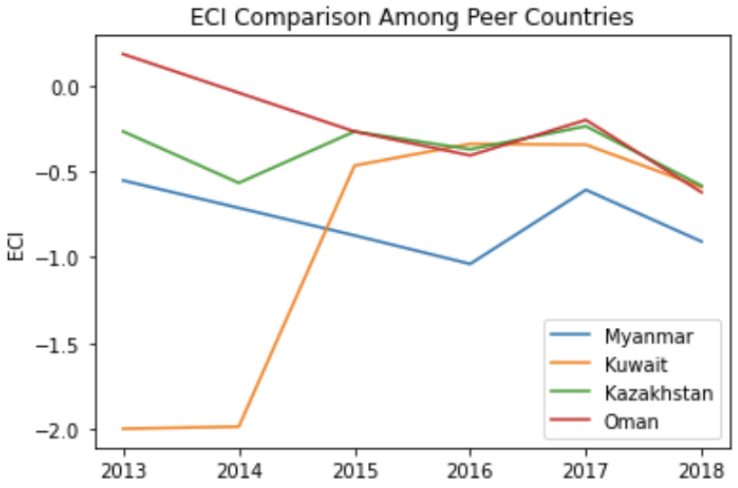



Figure 3: ECI Comparison (2013-2018)

However, as shown in Figure 4, Myanmar was also the exception among its peer countries in terms of its ECI index. During the period between 2019 and 2020, all of its peer countries experienced a decrease in ECI index while Myanmar was the only country to exhibit an increase in its ECI index. During the years 2020 to 2021 it can be seen that Myanmar had a significant increase in ECI when compared to its peer country Oman. Note that no data was available for ECI index for Kuwait and Kazakhstan for the 2021 year.

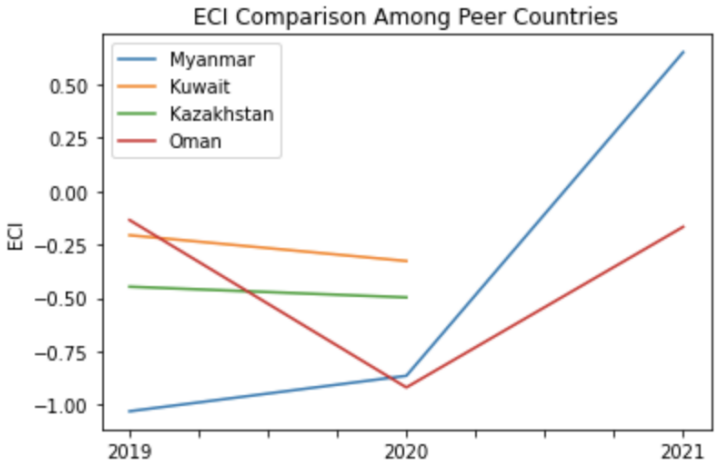



Figure 4: ECI Comparison (2019-2021)

Figure 5 offers a further comparison of GDP Growth and ECI over the time span from 2013 to 2018 for Myanmar. The increase in GDP during the period from 2013 to 2018 is accompanied by a sharp decline in ECI. The results show that the economic growth experienced by Myanmar during the period from 2013 to 2018 is not very consistent with the predictions by ECI and Myanmar did not effectively make strides to develop 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 Myanmar's production structure and its product space designs in the next few chapters.

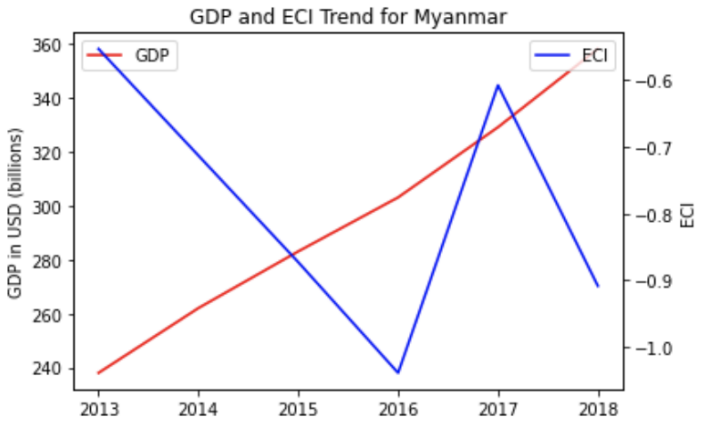



Figure 5: GDP Growth and ECI (2013-2018)

Figure 6 compares GDP Growth and ECI between 2019 and 2021 for Myanmar. As seen in the graph, ECI sustained a positive growth over the period while GDP experienced a growth until 2020 followed by a sharp decrease. This suggests that even though during the pandemic, most countries prioritized low complexity industries for basic needs and essential products, Myanmar did not and rather increased its economic complexity. Consequently, Myanmar's GDP suffered a great decrease due to the increase in economic complexity during this 2020 to 2021 period.

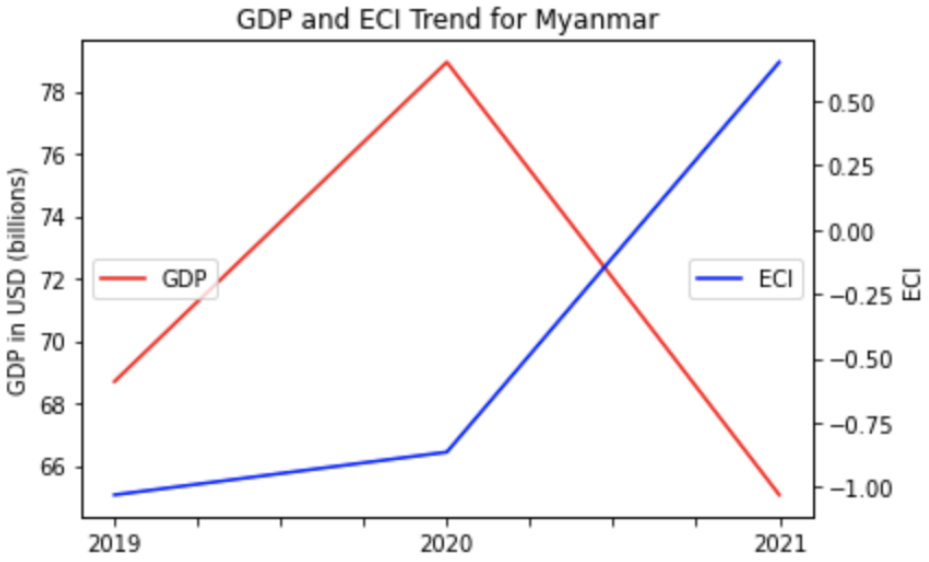



Figure 6: GDP and ECI (2019-2021)

## 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 labeled 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 Myanmar's realized industry production strategy between 2013 and 2018 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 2018 and 2021 through subtraction, where a positive RID indicates a shortening of the distance (i.e., advancement of the industry), and a negative RID indicates the reverse.

| | Category | RID |
|---|---|---|
| 6 | Raw Manufacturing | -0.080469 |
| 17 | Services and Utilities | -0.041698 |
| 8 | Clothing and Accessories | -0.006270 |
| 0 | Animals and By-products | -0.003310 |
| 15 | Precious Stones | -0.002560 |
| 2 | Food and Preparations | 0.007146 |
| 1 | Vegetables, Fruits and Plants | 0.011757 |
| 9 | Textile | 0.014484 |
| 5 | Chemical Manufacturing | 0.019683 |
| 3 | Energy Drilling and Mining | 0.020779 |
| 7 | Wood Products | 0.033479 |
| 16 | High-complexity Products | 0.037042 |
| 4 | Chemicals | 0.039356 |
| 11 | Machinery and Construction | 0.056253 |
| 13 | Weapons | 0.057687 |
| 14 | Daily Instruments | 0.066245 |
| 12 | Transportation | 0.070602 |
| 10 | Metals | 0.112165 |

Table 2: Realized Industry Development (RID) of Myanmar (2013-2018)

| | Category | RID |
|---|---|---|
| 13 | Weapons | -0.033994 |
| 9 | Textile | -0.030246 |
| 14 | Daily Instruments | -0.025343 |
| 5 | Chemical Manufacturing | -0.024668 |
| 7 | Wood Products | -0.024502 |
| 6 | Raw Manufacturing | -0.019174 |
| 12 | Transportation | -0.018173 |
| 0 | Animals and By-products | -0.016158 |
| 15 | Precious Stones | -0.013291 |
| 11 | Machinery and Construction | -0.008741 |
| 2 | Food and Preparations | -0.006325 |
| 1 | Vegetables, Fruits and Plants | -0.004635 |
| 4 | Chemicals | -0.003682 |
| 16 | High-complexity Products | -0.003137 |
| 3 | Energy Drilling and Mining | -0.001784 |
| 8 | Clothing and Accessories | -0.001180 |
| 10 | Metals | 0.000497 |
| 17 | Services and Utilities | 0.007909 |

Table 3: Realized Industry Development (RID) of Myanmar (2019-2021)

Between 2013 and 2018, Myanmar shows advancement in more than two thirds of the product groups with negative RIDs pertaining mostly to low complexity industries. However, Myanmar demonstrates a regressive trend between 2019 and 2021 with all but two industries showing negative RIDs.

### 3.3 Regional and Global Comparison

Table 3 and 4 below summarize how the production strategy adopted by Myanmar compares with leading economies and a selected group of emerging economies in the world, as measured in RID.

| Ranking | France | US | 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)

| 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

| 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)

Tables 4c and 4d further examines Myanmar's development strategy against those of emerging economies on a global scale. Reasonably, emerging economies such as China, South Korea, Singapore and India have devoted the majority of their efforts into intermediate industry groups, while developing economies such as one in Myanmar should have relied more on essential industry groups. This trend holds true in general, regardless of the continent or time period and serves as an indicator for which phase of development a country is currently in as evaluated from its production strategy. Based on this standard, Myanmar is adopting an aggressive and slightly out-of-phase strategy that seeks development in industry groups with a higher level of complexity than it should.

# 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 | Kazakhstan | Myanmar | Oman | Kuwait |
|---|---|---|---|---|
| 1 | Machinery and Construction | High-complexity Products | High-complexity Products | High-complexity Products |
| 2 | High-complexity Products | Wood Products | Transportation | Machinery and Construction |
| 3 | Transportation | Transportation | Machinery and Construction | Transportation |
| 4 | Daily Instruments | Machinery and Construction | Daily Instruments | Daily Instruments |
| 5 | Services and Utilities | Daily Instruments | Weapons | Services and Utilities |
| 6 | Weapons | Weapons | Textile | Chemicals |
| 7 | Textile | Metals | Chemical Manufacturing | Weapons |
| 8 | Chemical Manufacturing | Chemicals | Energy Drilling and Mining | Textile |
| 9 | Raw Manufacturing | Textile | Chemicals | Chemical Manufacturing |
| 10 | Energy Drilling and Mining | Chemical Manufacturing | Services and Utilities | Raw Manufacturing |
| 11 | Chemicals | Animals and By-products | Raw Manufacturing | Energy Drilling and Mining |
| 12 | Metals | Vegetables, Fruits and Plants | Metals | Metals |
| 13 | Animals and By-products | Food and Preparations | Animals and By-products | Wood Products |
| 14 | Wood Products | Energy Drilling and Mining | Wood Products | Clothing and Accessories |
| 15 | Clothing and Accessories | Raw Manufacturing | Clothing and Accessories | Animals and By-products |
| 16 | Precious Stones | Clothing and Accessories | Precious Stones | Food and Preparations |
| 17 | Food and Preparations | Precious Stones | Food and Preparations | Precious Stones |
| 18 | Vegetables, Fruits and Plants | Services and Utilities | Vegetables, Fruits and Plants | Vegetables, Fruits and Plants |
| ECI | -0.267 | -0.552 | 0.182 | -1.999 |

| Ranking | Kazakhstan | Myanmar | Oman | Kuwait |
|---|---|---|---|---|
| 1 | High-complexity Products | High-complexity Products | High-complexity Products | High-complexity Products |
| 2 | Transportation | Transportation | Transportation | Transportation |
| 3 | Machinery and Construction | Machinery and Construction | Machinery and Construction | Machinery and Construction |
| 4 | Daily Instruments | Wood Products | Daily Instruments | Daily Instruments |
| 5 | Weapons | Daily Instruments | Weapons | Weapons |
| 6 | Chemical Manufacturing | Weapons | Chemical Manufacturing | Chemical Manufacturing |
| 7 | Textile | Textile | Textile | Textile |
| 8 | Raw Manufacturing | Raw Manufacturing | Raw Manufacturing | Raw Manufacturing |
| 9 | Animals and By-products | Chemicals | Clothing and Accessories | Energy Drilling and Mining |
| 10 | Clothing and Accessories | Chemical Manufacturing | Food and Preparations | Chemicals |
| 11 | Precious Stones | Services and Utilities | Wood Products | Services and Utilities |
| 12 | Food and Preparations | Animals and By-products | Animals and By-products | Clothing and Accessories |
| 13 | Energy Drilling and Mining | Vegetables, Fruits and Plants | Energy Drilling and Mining | Metals |
| 14 | Chemicals | Food and Preparations | Chemicals | Precious Stones |
| 15 | Metals | Energy Drilling and Mining | Metals | Wood Products |
| 16 | Vegetables, Fruits and Plants | Clothing and Accessories | Precious Stones | Animals and By-products |
| 17 | Wood Products | Metals | Vegetables, Fruits and Plants | Food and Preparations |
| 18 | Services and Utilities | Precious Stones | Services and Utilities | Vegetables, Fruits and Plants |
| ECI | -0.583 | -0.908 | -0.622 | -0.591 |

Table 5: SDV of High $E_f$CI Countries 2013(up), 2018(down)

We define the ranking of opportunity gain for a country c, as the Suggested Development Vector (SDV) of c. Table 5 and 6 summarize how the SDV of Brazil compares with a selected group of comparable and leading economies in the world, with the industry groups ranked in decreasing order of significance. 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, developing 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 Myanmar shares the characters of developing countries, with a balanced economics structure that leans towards intermediate-level industries. 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.

| Ranking | Algeria | Italy | USA | United Arab Emirates |
|---|---|---|---|---|
| 1 | High-complexity Products | Energy Drilling and Mining | Energy Drilling and Mining | High-complexity Products |
| 2 | Machinery and Construction | Precious Stones | Precious Stones | Transportation |
| 3 | Transportation | Vegetables, Fruits and Plants | Animals and By-products | Machinery and Construction |
| 4 | Services and Utilities | Animals and By-products | Vegetables, Fruits and Plants | Daily Instruments |
| 5 | Daily Instruments | Food and Preparations | Food and Preparations | Chemicals |
| 6 | Chemicals | Chemical Manufacturing | Chemicals | Weapons |
| 7 | Chemical Manufacturing | Raw Manufacturing | Chemical Manufacturing | Textile |
| 8 | Weapons | Wood Products | Raw Manufacturing | Chemical Manufacturing |
| 9 | Textile | Clothing and Accessories | Wood Products | Raw Manufacturing |
| 10 | Raw Manufacturing | Textile | Machinery and Construction | Energy Drilling and Mining |
| 11 | Energy Drilling and Mining | Metals | Weapons | Precious Stones |
| 12 | Metals | Machinery and Construction | Daily Instruments | Services and Utilities |
| 13 | Wood Products | Daily Instruments | High-complexity Products | Metals |
| 14 | Clothing and Accessories | High-complexity Products | Services and Utilities | Clothing and Accessories |
| 15 | Animals and By-products | Weapons | Clothing and Accessories | Wood Products |
| 16 | Food and Preparations | Chemicals | Metals | Animals and By-products |
| 17 | Precious Stones | Services and Utilities | Textile | Vegetables, Fruits and Plants |
| 18 | Vegetables, Fruits and Plants | Transportation | Transportation | Food and Preparations |
| ECI | -2.190 | 1.180 | 1.220 | -0.734 |

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:

$$\max_{x \in \mathbf{R}^{|P|}} \quad \left(\frac{k(x) - < k(x) >}{stdev(k(x))}\right)_C$$

Subject to

$$\sum_{p \in P} x_p \leq B$$

$$x \succcurlyeq 0$$

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

Below is the economic panel for Myanmar in 2013. We can see that for different percentages of heuristic total export growth, the ECIs of Myanmar have different amounts of increments. Overall, 5 and 10 percent export growth result in a similar ECI improvement pattern, which starts from around -0.553 and ends at around -0.23 However, 15 and 20 percent export growth are able to result in more positive ECI improvement trajectories. For a 15 percent growth budget, ECI of Myanmar is able to end at around -0.09 while for a 20 percent budget, the increment is even more obvious, eventually achieving around 0.14, which enters the positive ECI range.

For the case of 5 percent export growth, Chemicals and Wood Products account for most of the portfolio. For 10 percent export growth, in addition to the industries that we mentioned before, more weight is put on the Metal industry. For the case of 15 and 20 percent increment budgets, we realize that the development trajectories are in a relatively similar pattern except that there are a few additional steps when there are more budgets, and correspondingly new industries have more importance as well. Different from the previous two cases, in the 15 percent growth scenario the solutions suggest that Myanmar should invest more in Daily Instruments and Metals, while in the 20 percent growth scenario the solutions suggest that Myanmar should invest more in Machinery and Construction. This makes sense because with more budgets, a country should definitely focus more on the development of different product spaces. A more detailed numerical representation of the portfolio is shown in Table 8.

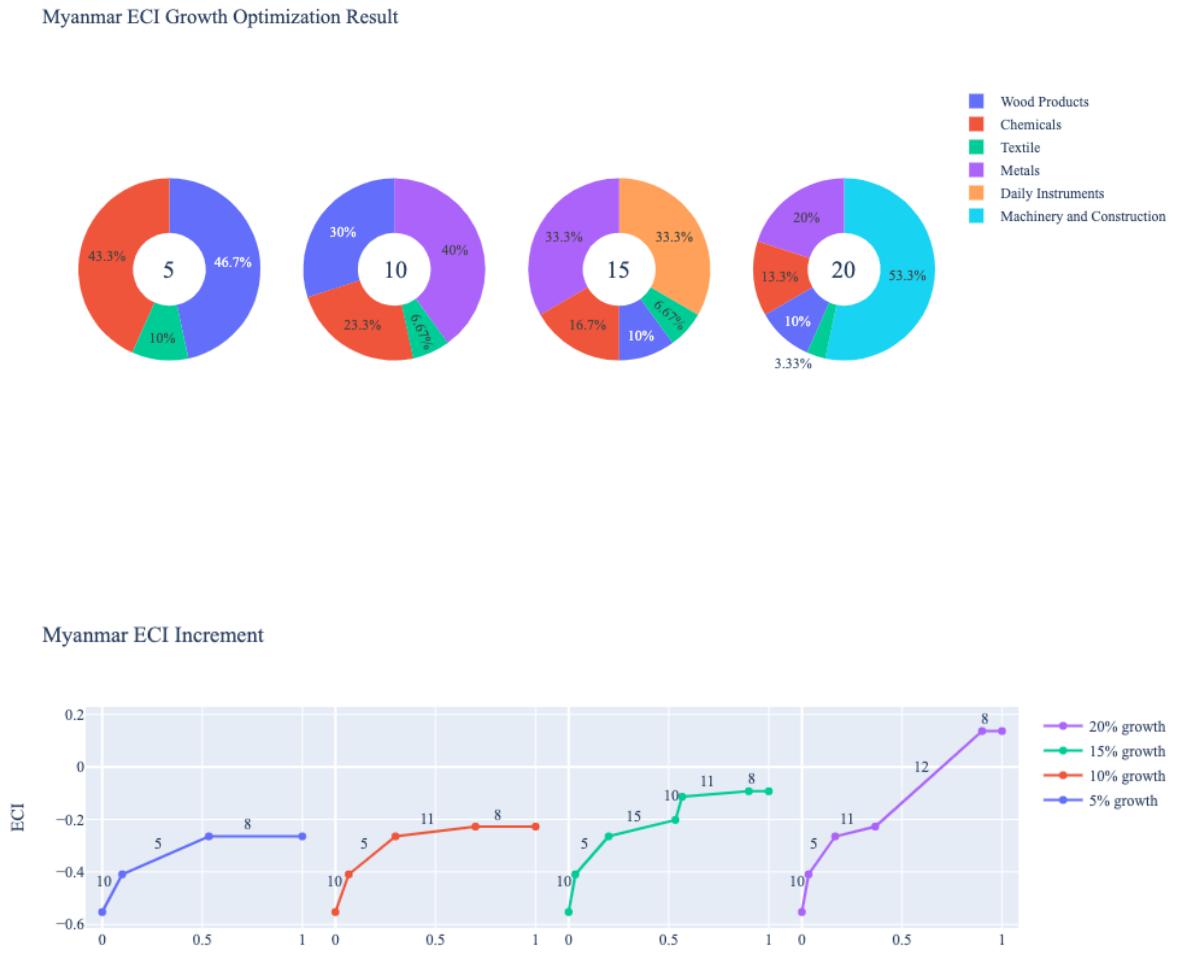



Figure 5: Greedy Based ECI Improvement Results of Myanmar in 2013 with Different Budgets

| Original ECI | Myanmar (2013) -0.553 | | | |
|---|---|---|---|---|
| Heuristic Export Growth | 5% | 10% | 15% | 20% |
| Chemicals | 2.49E+08 | 2.68E+08 | 2.87E+08 | 3.07E+08 |
| Wood Products | 2.68E+08 | 3.45E+08 | 1.72E+08 | 2.30E+08 |
| Textile | 5.75E+07 | 7.67E+07 | 1.15E+08 | 7.67E+07 |
| Metals | 0.00E+00 | 4.60E+08 | 5.75E+08 | 4.60E+08 |
| Machinery and Construction | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.23E+09 |
| Daily Instruments | 0.00E+00 | 0.00E+00 | 5.75E+08 | 0.00E+00 |
| Increased ECI | -0.26 | -0.23 | -0.09 | 0.14 |

Table 8: Portfolio of Myanmar in 2013

For further suggestions on Myanmar's development in the future, we also offer the optimization result of Myanmar based on export data in 2018. Below is the economic panel for Myanmar in 2018. We can see that there is a similar pattern for the ECI improvement trajectories, which is that the improvements in 5 and 10 percent export growth are more similar, and the ones in 15 and 20 are similar. But one difference is that the main components that result in ECI improvements are not quite similar. For a 5 percent export growth, the main components include primarily Daily Instruments as well as Wood Products, while for a 10 percent growth, the main components also consist of Chemicals, with more importance

placed on the Wood Products industry. For situations with higher budgets of investment, like 15 or 20 percent of growth, the portfolios are more diverse than the previous two cases. In detail, the Chemical Manufacturing industry is the one that contributes primarily in ECI increments. A more detailed numerical representation of the portfolio is shown in Table 9.

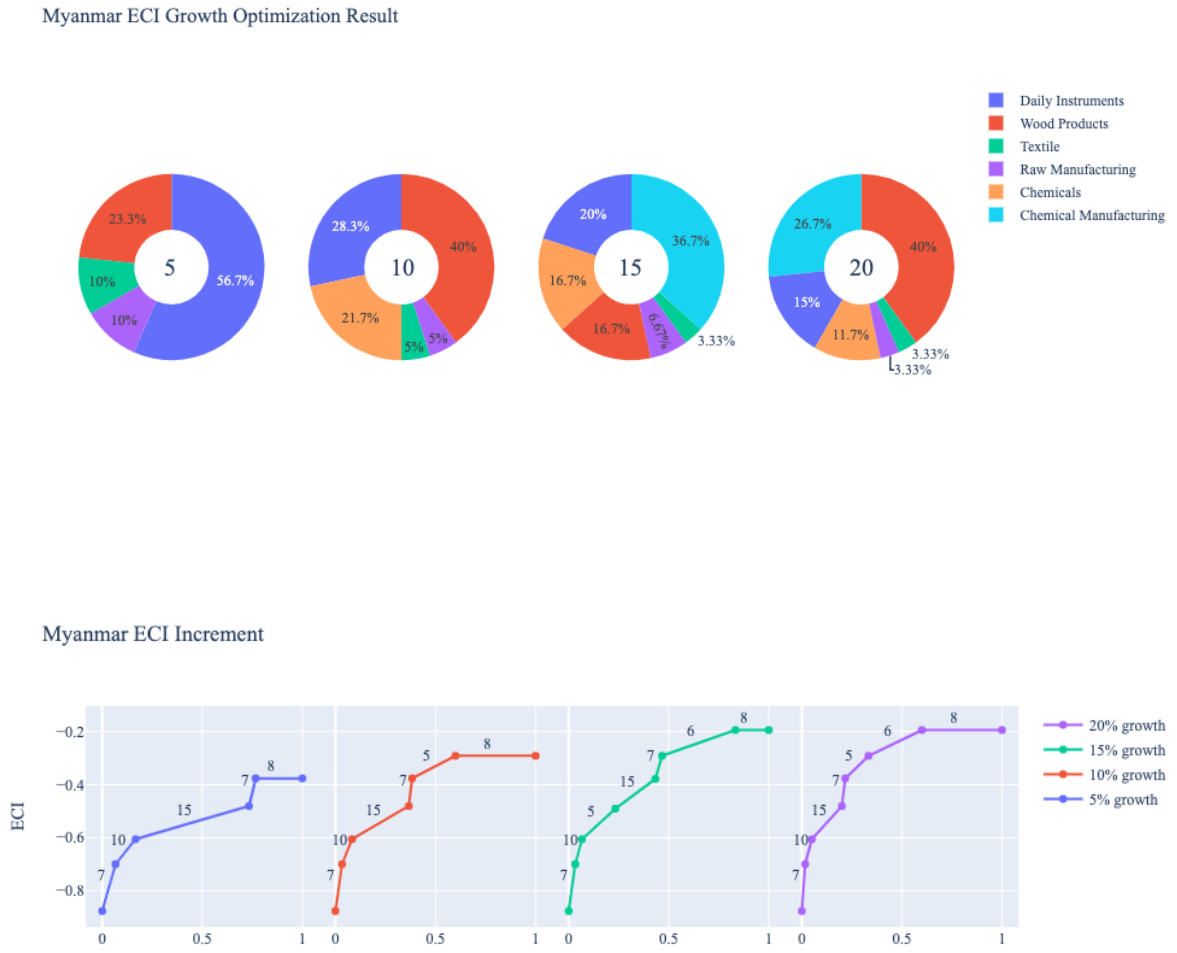



Figure 6: Greedy Based ECI Improvement Results of Myanmar in 2018 with Different Budgets

| | Myanmar (2018) | | | |
|---|---|---|---|---|
| Original ECI | -0.909 | | | |
| Heuristic Export Growth | 5% | 10% | 15% | 20% |
| Chemicals | 0.00E+00 | 3.76E+08 | 4.34E+08 | 4.05E+08 |
| Chemical Manufacturing | 0.00E+00 | 0.00E+00 | 9.55E+08 | 9.26E+08 |
| Raw Manufacturing | 8.68E+07 | 8.68E+07 | 1.74E+08 | 1.16E+08 |
| Wood Products | 2.03E+08 | 6.95E+08 | 4.34E+08 | 1.39E+09 |
| Textile | 8.68E+07 | 8.68E+07 | 8.68E+07 | 1.16E+08 |
| Daily Instruments | 4.92E+08 | 4.92E+08 | 5.21E+08 | 5.21E+08 |
| Increased ECI | -0.38 | -0.29 | -0.19 | -0.19 |

Table 9: Portfolio of Myanmar in 2018

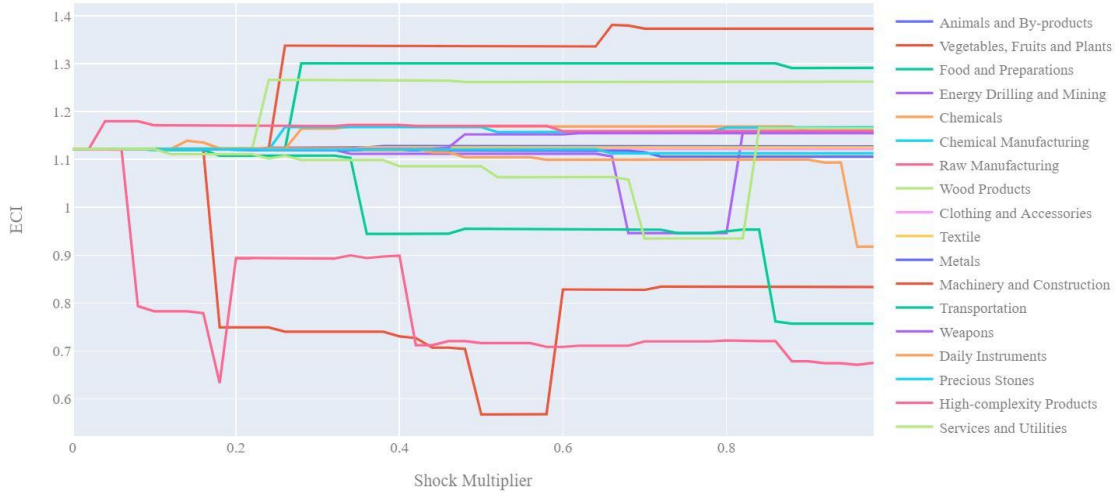
## 4.3 Sensitivity Analysis and Contingency Strategy

In the following section our broad aim is to understand how sensitive Myanmar 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 the 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 shocks 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 the 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)

## Contingency Plan

The Contingency Plan aims to present a set of solutions with respect to upheavals in different industries. Instead of compensating for the declining production directly, the best strategy is to develop those incipiently profitable industries. In this manner, we can derive the contingency strategy for countries to deal with possible abrupt declines of crucial industries. In some cases, the SDV remains unchanged even when a zero-opportunity-gain industry declines to its 20% in terms of export. We can then conclude the industry is not indispensable to the country. As a clarification, the three consecutive N/As means that the country doesn't even need to respond to a collapse in the industry. Countries tend to have distinct solutions to the up and down of the same industry. To create the contingency strategy table we decrease the export level for each industry in the country's current production space by 60% respectively. The three highest ranking industries in the new SDV are then returned.

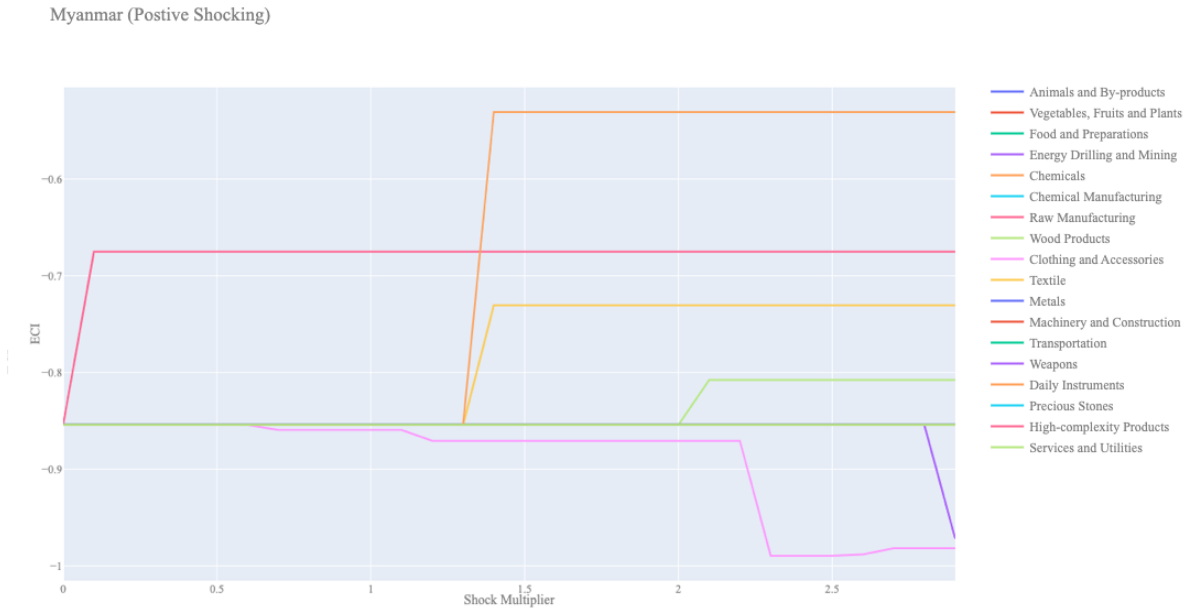
| | 0 | 1 | 2 |
|---|---|---|---|
| **Animals and By-products** | Services and Utilities | Daily Instruments | Weapons |
| **Vegetables, Fruits and Plants** | Services and Utilities | Daily Instruments | Weapons |
| **Food and Preparations** | Services and Utilities | Daily Instruments | Weapons |
|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

Example Contingency Strategy 2018

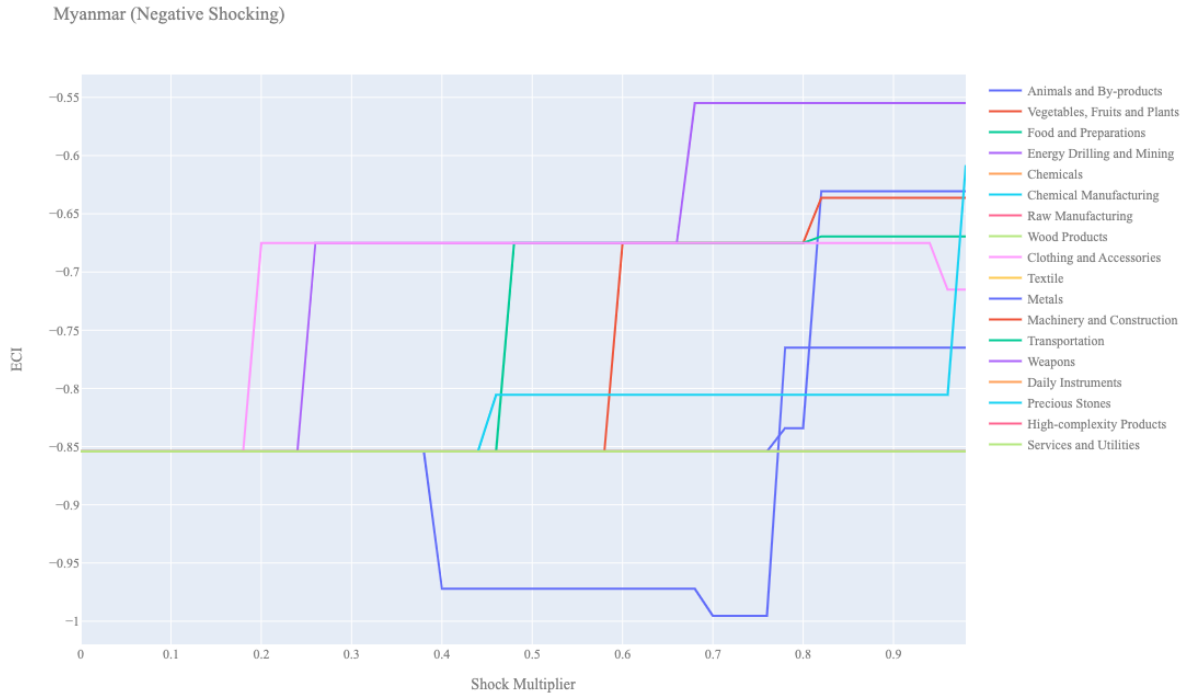
## 4.3 Sensitivity Analysis Results and Interpretation

Below is Myanmar's 2018 ECI Sensitivity Charts. Firstly in the positive chart, we notice immediately that increases in Daily Instruments, Raw Manufacturing, and Textiles lead to an uptrend in ECI. Daily Instruments offer the best ECI growth per unit of export increase. All other industries tend to not greatly affect the ECI level making it fairly clear which industries to pursue.

Next we consider Myanmar's 2018 Negative Shock chart. We see that Myanmar's ECI is slightly sensitive to drawdowns in Metals. More interestingly, we see that large decreases in several industries, such as Energy, Drilling, and Mining, Animals and By-products, Clothing and Accessories, and Vegetables, Fruits, and Plants, seem to greatly increase the ECI score. These industries are important industries for Myanmar's economy and thus the results that are reflected in the chart may be suggesting that there is another industry that could be very beneficial for Myanmar that is far in proximity from those.



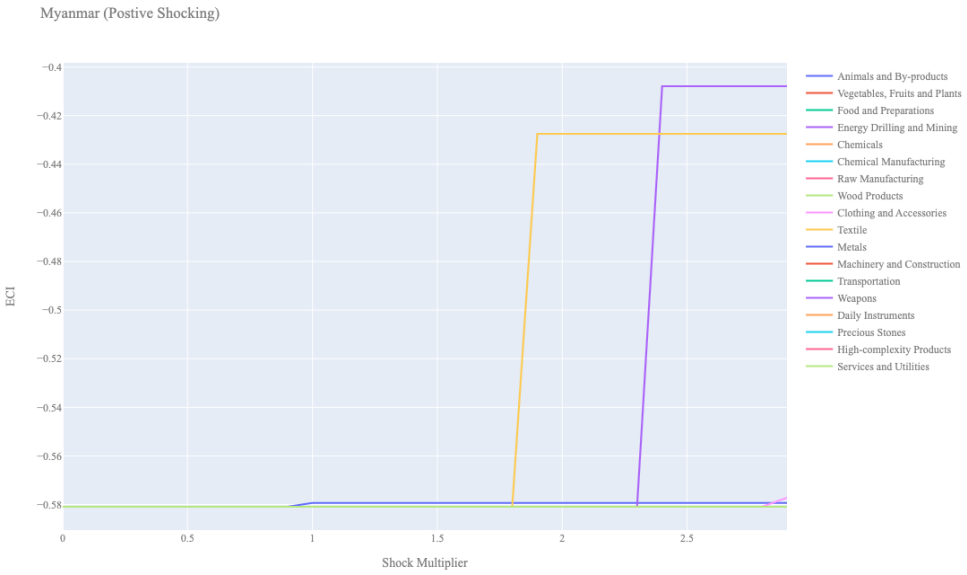

Myanmar 2018 (Incremental ECI Sensitivity)



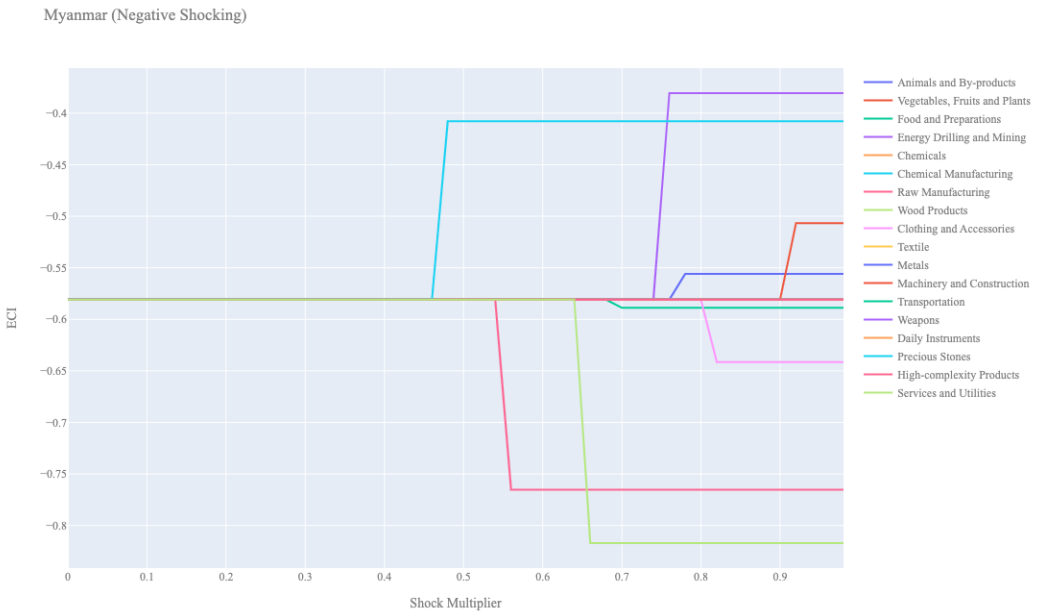

Myanmar 2018 (Decremental  ECI Sensitivity)

Next we consider the 2013 ECI Sensitivity graphs. We see that in the positive shocking case, the landscape of ECI sensitivity has changed substantially. Increases in Energy, Drilling, and Mining and Textile also lead to increases in ECI, whereas all other industries do not affect the ECI. Textiles presented potential to increase ECI for both 2013 and 2018 whereas the other industries changed over the 5 years.

In the 2013 negative shocking case, we see that again Myanmar is very sensitive to drawdowns in Services and Utilities and Raw Manufacturing.



Myanmar 2013 (Incremental ECI Sensitivity)




Myanmar 2013 (Decremental  ECI Sensitivity)

Below we see the SDV sensitivity charts for Daily Instruments in 2018. We see that increasing the export of Daily Instruments opens up few positive opportunity gain industries for Myanmar to move into. In fact after a 150% increase, the number of positive opportunity gain countries actually decreases.

In the negative Daily Instruments SDV chart, we see that decreasing the export of Daily Instruments has little impact, suggesting that this is not an important industry in terms of the stability of its SDV.

Concerning Raw Manufacturing, Myanmar reacts similarly to Daily Instruments. Increasing the export of Raw Manufacturing generates fewer positive opportunity gain industries, and decreasing export has little impact.

| | 0% | 150% |
|---|---|---|
| 0 | Machinery and Construction | High-complexity Products |
| 1 | High-complexity Products | Machinery and Construction |
| 2 | Transportation | Transportation |
| 3 | Daily Instruments | Chemicals |
| 4 | Chemicals | Weapons |
| 5 | Weapons | Services and Utilities |
| 6 | Chemical Manufacturing | Textile |
| 7 | Services and Utilities | Chemical Manufacturing |
| 8 | Raw Manufacturing | Raw Manufacturing |
| 9 | Textile | Wood Products |
| 10 | Wood Products | Clothing and Accessories |
| 11 | Metals | Vegetables, Fruits and Plants |
| 12 | Vegetables, Fruits and Plants | Metals |
| 13 | Clothing and Accessories | Energy Drilling and Mining |
| 14 | Energy Drilling and Mining | Daily Instruments |
| 15 | Precious Stones | Precious Stones |
| 16 | Food and Preparations | Food and Preparations |
| 17 | Animals and By-products | Animals and By-products |
| ECI | -0.867987316 | -0.529308799 |

Myanmar Daily Instruments 2018 (Incremental SDV Sensitivity)

| | 0% |
|---|---|
| 0 | Machinery and Construction |
| 1 | High-complexity Products |
| 2 | Transportation |
| 3 | Daily Instruments |
| 4 | Chemicals |
| 5 | Weapons |
| 6 | Chemical Manufacturing |
| 7 | Services and Utilities |
| 8 | Raw Manufacturing |
| 9 | Textile |
| 10 | Wood Products |
| 11 | Metals |
| 12 | Vegetables, Fruits and Plants |
| 13 | Clothing and Accessories |
| 14 | Energy Drilling and Mining |
| 15 | Precious Stones |
| 16 | Food and Preparations |
| 17 | Animals and By-products |
| ECI | -0.867987316 |

Myanmar Daily Instruments Products 2018 (Decremental SDV Sensitivity)

| | 0% | 50% |
|---|---|---|
| 0 | Machinery and Construction | Machinery and Construction |
| 1 | High-complexity Products | High-complexity Products |
| 2 | Transportation | Transportation |
| 3 | Daily Instruments | Daily Instruments |
| 4 | Chemicals | Chemicals |
| 5 | Weapons | Services and Utilities |
| 6 | Chemical Manufacturing | Weapons |
| 7 | Services and Utilities | Chemical Manufacturing |
| 8 | Raw Manufacturing | Textile |
| 9 | Textile | Vegetables, Fruits and Plants |
| 10 | Wood Products | Metals |
| 11 | Metals | Clothing and Accessories |
| 12 | Vegetables, Fruits and Plants | Raw Manufacturing |
| 13 | Clothing and Accessories | Energy Drilling and Mining |
| 14 | Energy Drilling and Mining | Precious Stones |
| 15 | Precious Stones | Food and Preparations |
| 16 | Food and Preparations | Animals and By-products |
| 17 | Animals and By-products | Wood Products |
| ECI | -0.867987316 | -0.683334122 |

Myanmar Raw Manufacturing 2018 (Incremental SDV Sensitivity)

| | 0% |
|---|---|
| 0 | Machinery and Construction |
| 1 | High-complexity Products |
| 2 | Transportation |
| 3 | Daily Instruments |
| 4 | Chemicals |
| 5 | Weapons |
| 6 | Chemical Manufacturing |
| 7 | Services and Utilities |
| 8 | Raw Manufacturing |
| 9 | Textile |
| 10 | Wood Products |
| 11 | Metals |
| 12 | Vegetables, Fruits and Plants |
| 13 | Clothing and Accessories |
| 14 | Energy Drilling and Mining |
| 15 | Precious Stones |
| 16 | Food and Preparations |
| 17 | Animals and By-products |
| ECI | -0.867987316 |

Myanmar Raw Manufacturing 2018 (Decremental SDV Sensitivity)

## 4.4 Contingency Strategy

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

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

Myanmar 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 |
| **$R^2$:** 0.054 | **Prob (F-Stat):** 0.0163 |

| | |
|---|---|
| **Adj $R^2$:** 0.045 | **No. Observations:** 106 |


Figure 2: Regression of Five-year GDP Growth over SOI

**5.2 SOI of Myanmar and Its Implications**

Myanmar for instance, has a moderate level of structural optimality as compared with its developed peers. As the regression in Figure 7 suggests (the orange curve represents export increase and the blue curve stands for opportunity gain of the corresponding industry), Myanmar demonstrates an average level of correlation with the suggested developmental path, having an adjusted R-square of around 7.51%. Myanmar ranks in the bottom half among all countries in terms of SOI and has made a high rate of economic progress below its developed peers from 2013 to 2018 with a 5-year GDP growth rate of 7.09%, which is consistent with the regression result in Figure 6. This is in direct contrast to other developed economies such as Japan, where there is low SOI of around -5.7% and a corresponding GDP growth of 9.05% from 2013 to 2018, making it a slower developing economy during the period. In sum, Myanmar's mixed economic progress from 2013 to 2018 can be at least partially explained by a development strategy that demonstrates a decent, but not perfect, level of matches with our suggested developmental path. In specific, Myanmar invested heavily in the Transportation and Metals industry, while it should have focused more on other groups such as Textiles.

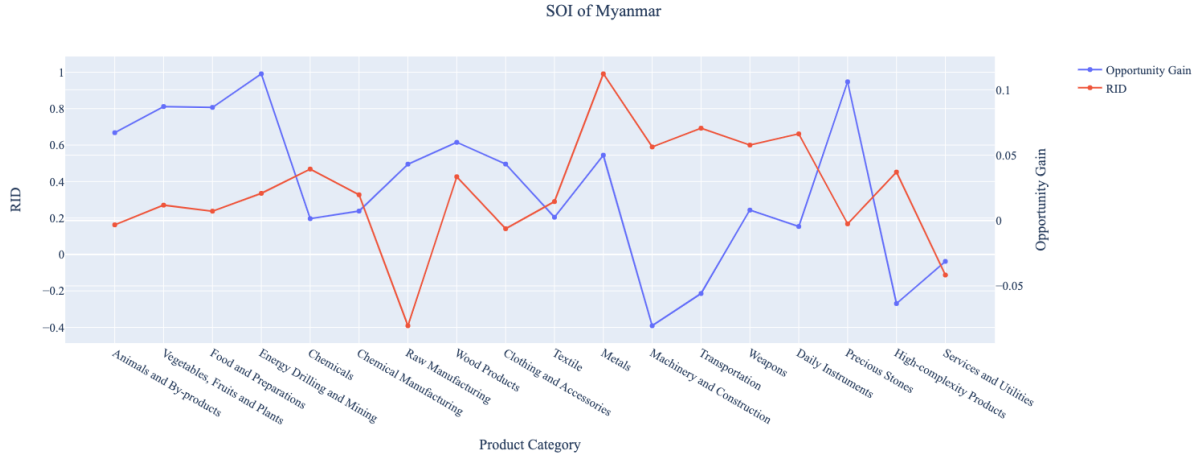



Figure 7: SOI of Myanmar (2009-2014)

## 6. Concluding Remarks

In conclusion, Myanmar 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 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 Myanmar 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 Myanmar consistently relied on developing the Transportation industry during the period, while its developed counterparts and emerging economies around the globe have adopted much more complex and progressive paths.

Based on our analysis of the opportunity gain and a sensitivity analysis of major industry groups, Myanmar can further its gains by prioritizing Textiles, Daily Instruments, or Wood Products with higher percentage export growth. We further note that Myanmar has a slightly mismatched development strategy that indicates a moderately high (compared to other developed countries) level of structural optimality on the complexity level, having an adjusted R-square of around 7.51%. Since a significant positive correlation exists between five-year GDP growth and the structural optimality index of an economy as we define and calculate, Myanmar, however, still 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.

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