



Analysing Singapore's Semiconductor Industry Using Supply, Use and Input-Output Tables

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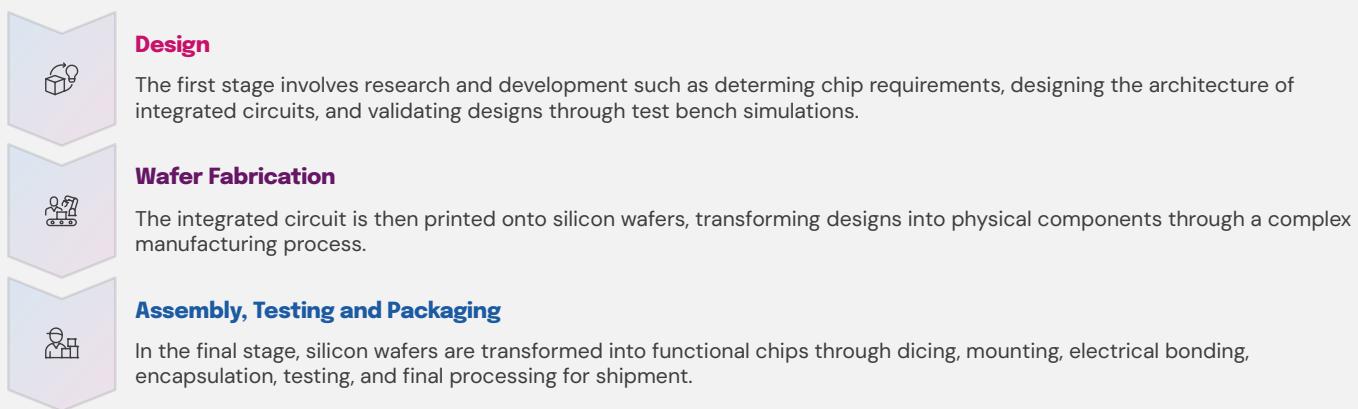
Introduction

In today's digital age, semiconductor chips serve as the foundation of modern electronic systems. Despite their minuscule size, they power our digital technologies from smartphones to automobiles. The production of these chips is an important contributor to Singapore's economy. Given the global strategic importance of the industry, this article examines its economic contributions using data from the Singapore Supply, Use and Input-Output Tables (SU-IOTs) 2022 to better understand its impact across Singapore's domestic economy [1].

The Value Chain of the Semiconductor Industry

Semiconductor chips are manufactured through an intricate production process, supported by a complex value chain where specialised companies handle different stages, from design and wafer fabrication to assembly, testing and packaging (Figure 1). Each semiconductor chip undergoes rigorous development and manufacturing phases. Once these chips complete the manufacturing process, they are integrated as core components into various electronic products.

Figure 1: Complex Value Chain of the Semiconductor Industry



Over the years, Singapore has developed a diverse semiconductor ecosystem encompassing activities across the value chain. Since the establishment of the Semiconductor industry [2] more than 55 years ago, Singapore has moved upstream in the semiconductor value chain – from assembly, testing, and packaging towards higher value-added activities such as wafer fabrication and chip design – with an increased emphasis on research, development, and innovation.

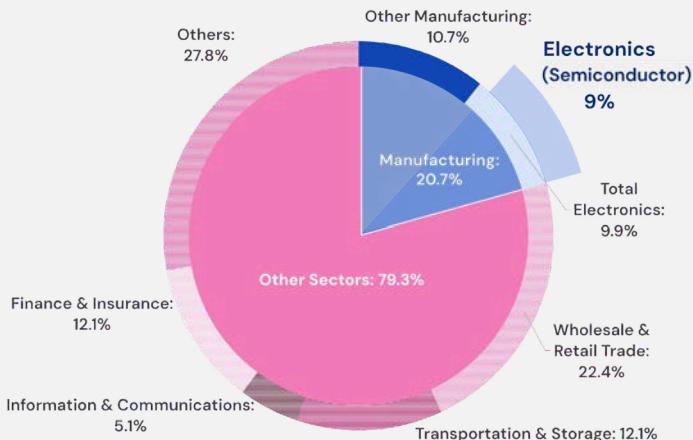
[1] Data on the SU-IOTs are published annually on the [SingStat Website](#).

[2] The Semiconductor industry comprises firms whose principal activity is the manufacturing of semiconductor chips or other electronic components and boards. The firms are classified under group code 261 of the [Singapore Standard Industrial Classification \(SSIC\) 2020](#).

Contribution to Singapore's Economy

The manufacturing sector stands as a key driver for Singapore's economy, generating about one-fifth of Singapore's Gross Domestic Product (GDP) in 2022 (Chart 1). Within this sector, the electronics cluster played a vital role, accounting for 9.9% of the economic value-added. The Semiconductor industry dominated the electronics cluster, contributing 9.0 percentage points. In 2022, Singapore's Semiconductor industry generated a total output of \$158.6 billion with a substantial value-added contribution of \$60.3 billion.

Chart 1: Value-Added of Singapore's Economy in 2022



Importance of Global Trade

Semiconductor manufacturing has grown increasingly complex with globalisation. Each stage of the production process is highly specialised and the entire value chain is distributed across multiple countries. Singapore's open economy and position as a key node in the semiconductor global value chain attracts high-quality investments from major semiconductor producers. As a key node, Singapore imports intermediate inputs (e.g. diodes and transistors) and transforms them into higher value-added products such as integrated circuits. To quantify Singapore's contribution, this analysis examines export patterns using data from the SU-IOTs 2022, which capture both direct exports and value-added flows of the Semiconductor industry.

Share of Value-Added of Exports in Total Value-Added

Chart 2: Top 10 Industries with Highest Export Share of Total Value-Added in 2022

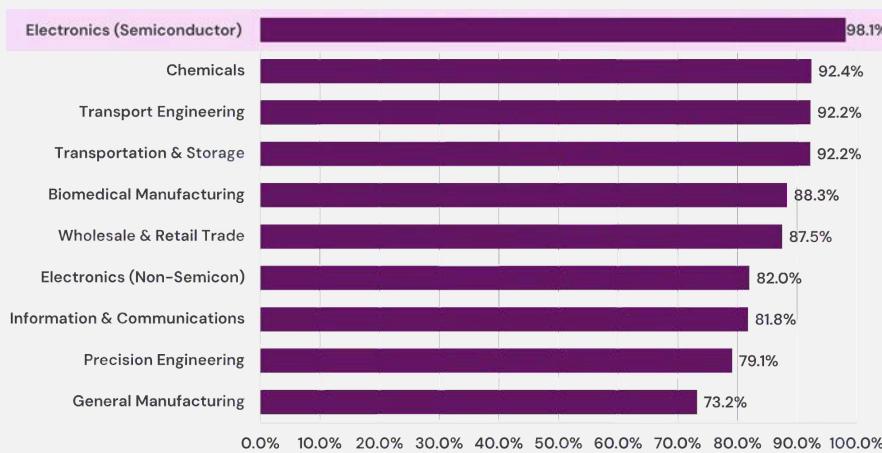


Chart 2 examines the export dependency across Singapore's industries [3] by deriving the percentage of value-added from exports to total value-added. The Semiconductor industry has the highest export dependency, with 98% of its value-added derived from exports.

Singapore's semiconductor exports comprise two distinct categories – finished chips ready for integration into electronic products and intermediate components that undergo further processing by overseas facilities or firms. The high export dependency indicates Singapore's semiconductor production is primarily directed towards international markets rather than domestic consumption.

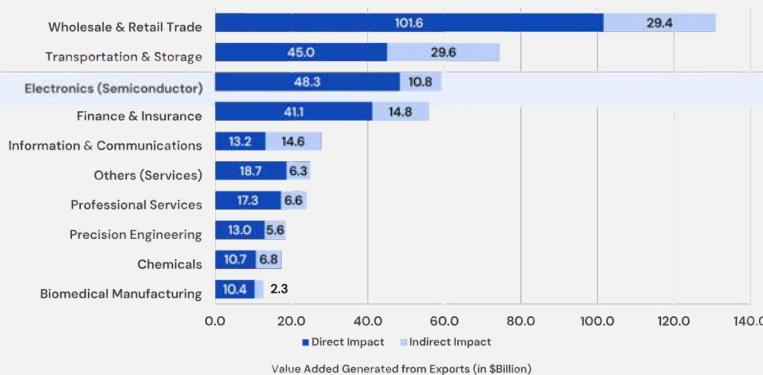
[3] For analysis purposes, Singapore economy is divided into 18 broad industries using the SU-IOTs.

Note:

Figures for all charts are computed at basic price. Basic price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable, and plus any subsidy receivable, on that unit as a consequence of its production or sale; it excludes any transport charges invoiced separately by the producer.

Direct and Indirect Effect of Value-Added Generated from Exports

Chart 3: Top 10 Industries with Highest Value-Added Generated from Exports in 2022



The Semiconductor industry has significant contributions in export-generated value-added in absolute terms (Chart 3).

Of the \$59.1 billion in total value-added generated, \$48.3 billion came from direct value-added, and the remaining \$10.8 billion were from indirect value-added.

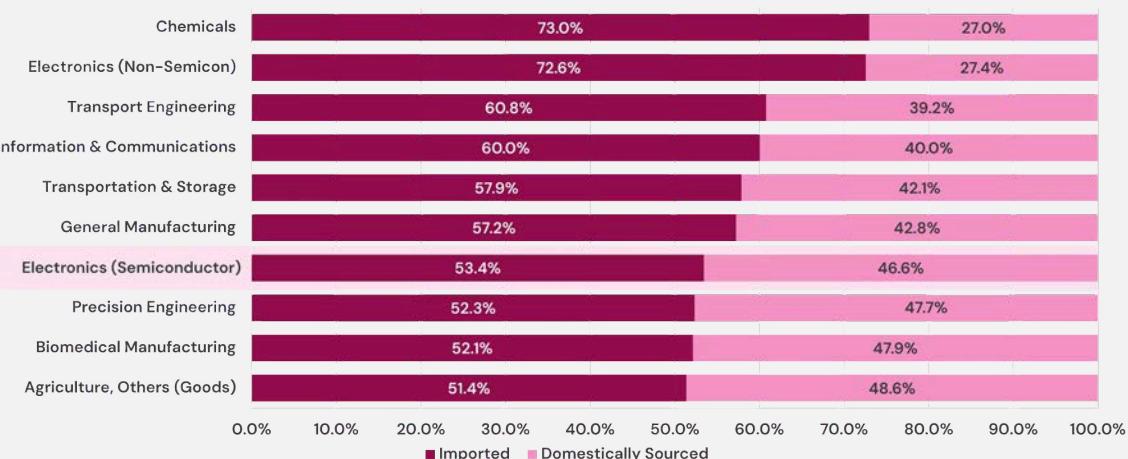
Direct value-added reflects the value generated by semiconductor production and sales through export. Indirect value-added captures the broader economic impact of the industry.

For the Semiconductor industry, its output could serve as intermediate inputs for exports of other domestic industries. Hence, while semiconductor chips produced domestically are mainly for direct exports, they can also be used in the production of other products to be exported to international markets. Compared to other major industries, the relatively smaller indirect value-added contribution indicates the Semiconductor industry's limited role in supporting other domestic industries' exports than its direct export contribution.

Vertical Specialisation

Beyond measuring export-related value-added, the analysis of the composition of inputs used in exports is useful to determine the degree of vertical specialisation. Vertical specialisation refers to the division of production processes into different stages where each stage is completed in different locations. It can be measured by the country's usage of imported intermediate inputs to make goods or goods-in-process for exports to track the interconnectedness of global production networks across countries. The vertical specialisation ratio of the Semiconductor industry ranked seventh among Singapore's industries in 2022, with 53.4% of its export-related intermediate inputs imported and 46.6% domestically sourced (Chart 4).

Chart 4: Top 10 Industries with Highest Vertical Specialisation in 2022



The Semiconductor industry's high import dependency reflects its integration into complex global supply chains. This dependency stems from two key factors: the need for raw materials and semi-processed components in semiconductor manufacturing, and Singapore's resource constraints. The industry relies on over 100 specialised chemicals and materials that are often only available from specific countries. With Singapore contributing 10% of the global semiconductor output [4], maintaining reliable access to these imported inputs is crucial. This high import dependency underscores Singapore's vulnerability to global supply chain disruptions, thus emphasising the need to maintain strong international trade relationships while developing resilient sourcing strategies and diversifying suppliers where possible.

[4] Economic Development Board (2024). [What makes Singapore a prime location for semiconductor companies driving innovation?](#)

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Integration with Other Domestic Industries

The analysis of the Semiconductor industry's backward and forward linkages further explains its interconnections with other domestic industries. These linkages are key indicators of an industry's relationships within the domestic economy [5].

Backward Linkages

They are demand-oriented and measure an industry's dependence on upstream production inputs from other domestic industries.

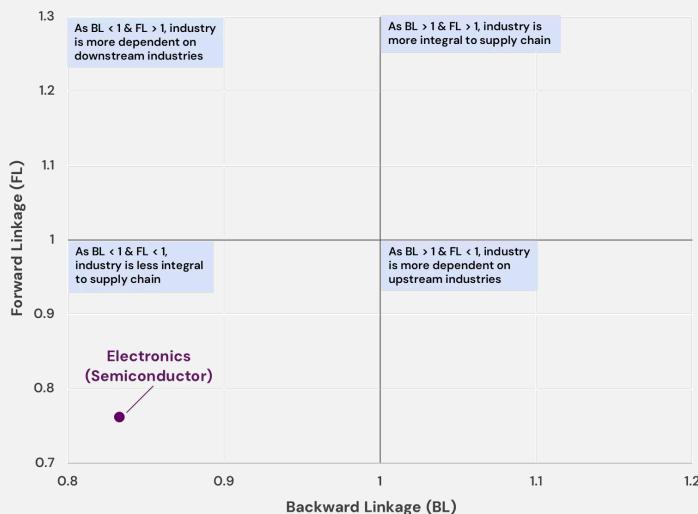
Forward Linkages

They are supply-oriented and measure the dependency of downstream domestic industries on an industry's outputs.

The Semiconductor industry showed a backward linkage coefficient of 0.83 and forward linkage coefficient of 0.76 in 2022 (Chart 5). These metrics suggest that the industry has low reliance on domestic inputs and its outputs are less utilised by other domestic industries, as most outputs are exported either for integration into electronic products or for further processing overseas. With both linkage coefficients falling below one, the data indicate that the Semiconductor industry operates relatively independently from other industries within Singapore's economy.

The Semiconductor industry's relative independence reflects its distinct input-output patterns. For inputs, the production of semiconductor chips relies considerably on imported materials and components rather than domestic inputs, evidenced by its vertical specialisation percentage points of 53.4. On the output side, the industry's production is largely export-oriented, with a high proportion of semiconductor chips channelled to global markets rather than domestic consumption. The industry has the highest proportion of direct export value-added and small indirect export value-added. These cross-border trade flows reflect Singapore's role in the global semiconductor value chain, where its production capabilities support international demand while drawing on global supply networks.

Chart 5: Backward and Forward Linkages of Semiconductor Industry in 2022



Conclusion

The SU-IOTs are vital in analysing the economic structure of Singapore's semiconductor industry, facilitating better understanding of its distinct characteristics – export orientation, import dependency for inputs, and low linkages with other domestic industries. While being part of the global value chain provides Singapore the access to markets beyond its shores, it increases the Semiconductor industry's vulnerability to global trade disruptions.

[5] Linkages are expressed in normalised form relative to other industries, where a value of one represents the economy-wide average. Industries with linkage values above 1 have stronger connections with other industries, while those below 1 have weaker connections.

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