# Scaling Up Beauty:
# An Analysis of Economies of Scale in the Cosmetics Industry

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*In this research, the cosmetics industry's economies of scale between 2018 and 2022 were explored by examining the cost efficiencies of 20 cosmetics companies through a translog cost function model. The companies' size was evaluated based on their total revenue and total assets. The study also analyzed the origin of cost efficiencies by considering various cost components such as cost of goods sold, operating costs, selling and general expenses, as well as administrative expenses concerning the total assets of the company. The findings revealed that, on average, larger companies had lower cost of goods sold and operating expenses. However, the cost efficiencies were not distributed equally as some companies showed considerable cost efficiencies, while others exhibited small economies of scale as their size increased.*

*Keywords: cosmetics industry, economies of scale, cost efficiencies, translog cost function model*

## INTRODUCTION

The use of cosmetics has become an integral aspect of modern life, with consumers relying on these products to improve their physical appearance and boost confidence. However, the global cosmetics market has faced significant challenges amidst the pandemic, with negative demand affecting all regions. Despite this setback, the market is set to rebound strongly, exhibiting a projected CAGR of 5.0% from 2021 to 2028, with expected growth from USD 287.94 billion in 2021 to USD 415.29 billion in 2028 (Fortune Business Insights, 2021). The market is dominated by a few multinational players, offering a broad range of products catering to diverse end-user requirements, including face care, hair care, and lip care, among others. Additionally, manufacturers are increasingly focusing on innovation and convenience, launching anti-aging products and developing convenient packaging designs such as compact containers for on-the-go use, attracting consumers.

The cosmetics industry has experienced rapid growth and transformation in recent years, driven by technological advancements, changing consumer preferences, and the emergence of new players in the market. With such fierce competition, companies must find ways to differentiate themselves and achieve cost efficiencies. One way to achieve this is through economies of scale, which refers to the cost advantages that a company can achieve by increasing its production output. The purpose of this study is to analyze the role of economies of scale in the cosmetics industry and its impact on the industry's growth and profitability.

The cosmetics industry is one of the largest and most dynamic industries globally, with a diverse range of products catering to various market segments. However, the industry's growth and competitiveness have also led to increased pressure on companies to reduce costs and improve efficiency. In this context, achieving economies of scale becomes crucial for companies looking to remain competitive and increase their profitability. Despite this, there is limited research on the role of economies of scale in the cosmetics industry and its impact on the industry's growth and development.

This study's significance lies in its potential to provide valuable insights into how companies in the cosmetics industry can leverage economies of scale to achieve cost efficiencies and improve their bottom line. By analyzing the cost structures and production processes of different companies in the industry, this study aims to identify best practices for achieving economies of scale and how these practices can be applied to different product categories and market segments. Furthermore, the findings of this study can be useful for new entrants to the industry, helping them to navigate the complexities of the market and achieve a competitive advantage. Ultimately, this study aims to contribute to the literature on economies of scale in the cosmetics industry and provide practical insights for companies looking to succeed in this dynamic and competitive market.

In summary, this study will provide a comprehensive analysis of the role of economies of scale in the cosmetics industry, identifying best practices and potential areas for improvement. The findings of this study will be useful for existing players in the industry and new entrants looking to succeed in this highly competitive and dynamic market.

## LITERATURE REVIEW

The cosmetics industry is a dynamic and growing sector, as the industry has expanded, the role of economies of scale has become increasingly important in driving cost efficiencies and profitability. Economies of scale is a well-established phenomenon in industry that has been analyzed and documented by numerous scholars, economists, and industry experts. The concept refers to the cost advantages that arise when production output is increased. This literature review provides an overview of the main theories and empirical research on economies of scale within industry.

The traditional view of economies of scale is that as output increases, fixed costs are spread out over a larger number of products, leading to a decrease in the average cost of production (Karsten, 1997). This reduction in costs can be achieved through various means, such as increased specialization, better use of capital, and lower transaction costs. This approach suggests that larger firms with higher production volumes will be able to achieve lower unit costs and thus operate more profitably than smaller firms. Many studies have examined this traditional view of economies of scale in industry. For example, the work by Nielsen (2018) analyzed data from the steel sector and found evidence of significant cost advantages for larger firms with large-scale production. The authors argue that these economies of scale arise mainly from the ability of large firms to take advantage of modern production technologies, which require high levels of capital investment.

However, some scholars have challenged the traditional view, arguing that economies of scale are not always present and can even disappear at higher levels of production output. This perspective suggests that firms may face diminishing returns as they expand their operations, and the costs savings may be offset by higher costs in logistics, transportation, and storage of large quantities of inputs and products. This view has also been explored in health sector (Murphy & Topel, 2003). The study suggests that public investments in basic medical research may yield huge social returns, but distortions in the allocation of medical care and in research incentives may yield future benefits that are smaller than the costs of achieving them.

The literature also suggests that economies of scale may depend on the specific industry and market conditions. For example, studies in airline industry (Zakharenko & Luttmann 2023), container shipping (Cullinane and Khanna, 2000), public transportation (Gschwender, Jara-Diaz, & Bravo, 2016), rail freight (Bitzan and Keeler, 2007), service (Morikawa, 2011) etc. In some cases, such as in the case of natural monopolies, the cost advantages of large firms may be linked to their ability to control key inputs or distribution channels (Mosca, 2008). In other cases, such as in the case of high-technology industries, economies of scale may be linked to the ability of firms to innovate and create new products (Kylaheiko, Jantunen, Puumalainen, Saarenketo & Tuppura, 2011).

Furthermore, Bennur and Malhotra (2021) delved into the concept of economies of scale within the textile, apparel, and accessories industry over a period of five years, ranging from 2015 to 2019. The findings of the study revealed that larger companies had lower costs of goods sold and operating expenses on average. However, the cost efficiencies were not evenly distributed across all companies. While some companies showed significant cost efficiencies as they increased in size, others displayed none or even experienced diseconomies of scale. By exploring the relationship between company size and cost efficiency, this study sheds light on the factors contributing to success within the textile, apparel, and accessories industry.

Another study by Pokharel and Featherstone (2019), examined the relationship between total revenue and total assets, finding that increasing output leads to lower costs of production as a result of the benefits of economies of scale. Similarly, a study by Daglish, Robertson, Tripe, and Weill (2015) used a translog cost function to examine efficiency in banking industry, finding that larger firms experienced lower costs of production as a result of economies of scale.

Other research has explored the impact of specific factors on economies of scale. For example, a study by Bin, Gregory, Frazie and Edmund (2006) examined the impact of outsourcing on cost efficiencies, finding that outsourcing parts of their operations to lower cost countries can be an effective way for firms to take advantage of economies of scale. Another study by Nightingale (2000) examined the impact of R&D investment on cost efficiencies, finding that firms that invested more in R&D experienced greater benefits from economies of scale.

The size of a company can be measured by its total revenue and total assets. In the cosmetics industry, larger firms benefit from economies of scale in terms of reduced unit costs because of their higher production volumes. According to Tsolas (2001) companies with larger revenues can achieve economies of scale from greater bargaining power to negotiate lower production costs, marketing expenses, and distribution costs. Similarly, companies with larger assets have better access to finances, which can help them capitalize on various opportunities.

In the study by Tsolas (2001) the economies of scale of companies in the cosmetics industry were evaluated based on their assets. They found that larger companies had a higher return on assets compared to small companies. The researchers attributed the higher profitability of larger companies to their capacity to spread fixed costs over a larger output level. They also concluded that larger companies can secure better prices and more favorable payment terms from suppliers and distributors as they have greater purchasing power.

Cost efficiencies in the cosmetics industry can be attributed to various cost components that affect the total assets of a company. These cost components include cost of goods sold, operating costs, selling and general expenses, and administrative expenses. According to Yang, Jiang, and Tang (2022), the analyzes the relationship between the development of the Chinese cosmetics industry and operating costs, R&D expenses, and selling expenses through a ten- year data analysis, concludes that the gross margin of sales is negatively related to the cost of production, positively related to the cost of sales, and negatively related to R&D expense. In this study cost efficiencies of 20 cosmetics companies through a translog cost function model were explored.

## MODEL

In order to analyze scale economies, we utilize a translog cost function, which is a commonly used approach in financial economics to assess economies of scale. This model enables us to incorporate a U-shaped average cost function and also permits variations in economies of scale based on a company's size. Equation 1 shows the translog cost function.

$$\mathrm{LN}\, Cost_{it} = \beta_0 + \beta_1 \,\mathrm{LN}\, Output_{it} + \frac{1}{2}\beta_2(\mathrm{LN}\, Output_{it})^2 + \beta_3 Control_{it} + e_{it} \tag{1}$$

The translog model requires two primary data inputs: cost and output. As discussed in Section 2, previous studies have argued over the most suitable measures of each variable, particularly for output. Thus, we adopt multiple measures of cost, including the cost of goods sold, other operating costs, and selling, general, and administrative expenses. For output, we utilize both total company assets and total revenue. When we measure output by total assets, we use total revenue as a control variable in the model. Similarly, when we measure output by total revenue, we use total assets as a control variable in the model.

We utilized the translog cost function to estimate the data for all 15 companies over a period of five years. When data observations vary both over time and across individuals, it is crucial to consider how to model the disparities. Panel data analysis enables identification and measurement of effects that may not be evident in purely cross-sectional or time-series data. By using the full panel, we can mitigate potential multicollinearity problems since explanatory variables are less likely to exhibit high time-series and cross-sectional correlation. However, panel data analysis also presents potential econometric issues. Unobserved heterogeneity across years can result in misleading empirical estimates if left unaddressed (Baltagi 2008). To control for unobserved heterogeneity in our sample of textiles, apparel, and accessories companies, we employed the least squares dummy variable fixed effects model.

**Cost Elasticity**

The cost elasticity of production is a frequently utilized metric to evaluate operating efficiency and scale economies. If costs increase at a slower pace than output, a company or industry demonstrates economies of scale. To determine the cost elasticity, we obtain the first derivative of the translog cost function (Equation 1) with respect to assets. This computation yields Equation 2.

$$\frac{\partial(\mathrm{LN}\, Cost)}{\partial(\mathrm{LN}\, Output)} = \beta_1 + \beta_2(\mathrm{LN}\, Output) \tag{2}$$

If an estimate of cost elasticity is significantly less than one, a company's expenses increase less than proportionately with changes in output. This implies that economies of scale are present. If elasticity is greater than one, we can infer that there are diseconomies of scale. We estimate cost elasticity for the full panel of data as well as for individual years within the sample, averaging elasticities across companies to obtain a group-level measure.

## DATA

This study utilized a sample of fifteen (15) companies over a five-year period from 2018 to 2022. The results of the study are presented in Table 1, which indicates that there were notable changes in the financial metrics of the sample companies over the five-year period. Specifically, the cost of goods sold increased by 20% in 2022 relative to 2018, while other operating expenses and selling, general, and administrative expenses increased by 15% and 14%, respectively, in 2022 relative to 2018. Additionally, the total assets of the companies increased by 22% in 2022 relative to 2018, and the total revenue increased by 19% in 2022 relative to 2018.

Table 1 further demonstrates that the increase in total revenue over the sample period kept pace with the increase in the cost of goods sold but did not outpace the increases in other operating expenses and selling, general, and administrative expenses. This suggests that while the companies were able to increase their revenue, they also faced rising expenses across multiple categories, which may have limited their overall profitability.

**TABLE 1**
**SUMMARY STATISTICS OF VARIABLES USED IN THIS STUDY**

| Year | | 2018 | 2019 | 2020 | 2021 | 2022 | Panel Data |
|---|---|---|---|---|---|---|---|
| **Cost of Goods Sold ($)** | **Mean** | 8857 | 9073 | 9294 | 10075 | 10622 | 9584 |
| | **Standard Deviation** | 10201 | 10548 | 10860 | 12183 | 12730 | 11056 |
| **Other Operating Expenses** | **Mean** | 9453 | 9766 | 9929 | 10640 | 10831 | 10124 |
| | **Standard Deviation** | 9493 | 9959 | 9868 | 11398 | 12170 | 10350 |
| **Selling, General, and Administrative Expenses** | **Mean** | 8517 | 8774 | 8857 | 9429 | 9698 | 9055 |
| | **Standard Deviation** | 7833 | 8367 | 8115 | 9236 | 10205 | 8564 |
| **Total Assets** | **Mean** | 34768 | 38328 | 42093 | 42300 | 42349 | 39968 |
| | **Standard Deviation** | 46204 | 49410 | 54630 | 57051 | 58330 | 51952 |
| **Total Revenue** | **Mean** | 22769 | 23498 | 23736 | 26250 | 27097 | 24670 |
| | **Standard Deviation** | 24980 | 26264 | 26519 | 30623 | 32452 | 27589 |

Note: All figures in Table 1 are in millions of dollars

## EMPIRICAL RESULTS

To evaluate economies of scale, we started by estimating translog cost functions (Equation 1) using a panel data set covering the period from 2018 to 2022. We then used the coefficients obtained from Equation 1 and combined them with the output levels of each company in Equation 2 to estimate the cost elasticity of each company. We used several measures of costs, including total assets and total revenue, in relation to output. In Table 2, we present the estimated translog cost function and the average cost elasticity of the sample companies when total assets are used as the output measure.

The translog regressions have a high level of explanatory power for cost variation, as evidenced by R-squared values ranging from 0.91 to 0.92 for the three models. Additionally, the coefficients on the output terms are consistent with the concept of economies of scale. Irrespective of the cost measures used, costs increase as the logarithm of assets increases, while the negative coefficient on the quadratic logarithm of output term implies that costs increase at a slower rate as output levels increase. The estimated cost elasticities further demonstrate this concept. The cost elasticities range from 0.33 to 0.43 across the three cost measures, including the cost of goods sold, other operating costs, and selling, general, and administrative expenses. As shown in column 1 of Table 2, the average cost elasticity of the cost of goods sold with respect to total assets is 0.43. This implies that in the sample of cosmetics companies, a 1% increase in output (total assets) results in only a 0.43% increase in the cost of goods sold. Similarly, cost elasticity of selling, general, and administrative expenses is 0.33, which means that if the size of a company increase by a dollar, the selling, general, and administrative expenses, on average, increase by only $0.33 in cosmetics industry.

## TABLE 2
## COST ELASTICITY, OUTPUT MEASURED BY TOTAL ASSETS

Translog cost function estimates: output measured by total assets.

| | **Dependent Variable:** | | |
|---|---|---|---|
| | **LN (Cost of Goods Sold)** | **LN (Other Operating Costs)** | **LN (Selling, General, and Administrative Expenses)** |
| **Parameter** | (1) | (2) | (3) |
| LN (Assets) | 2.98 | 2.45 | 2.59 |
| | (2.73***) | (2.60***) | (2.46**) |
| ½ LN $(\text{Assets})^2$ | -0.26 | -0.21 | -0.23 |
| | (-2.04**) | (-1.95**) | (-1.86*) |
| Total Revenue | 0.21-04 | 0.20-04 | 0.76-05 |
| | (2.34**) | (2.51*) | (4.41*) |
| R-Squared | 0.91 | 0.91 | 0.92 |
| No. Observations | 75 | 75 | 175 |
| ***Panel B:*** | | | |
| Cost Elasticity | 0.43 | 0.39 | 0.33 |
| (Total Assets) | -14.76*** | -19.56*** | -19.50*** |

***statistically significant at 1% significance level, **statistically significant at 5% significance level. *statistically significant at 10% significance level

Furthermore, Table 2 indicates that there are economies of scale for other operating costs relative to total assets, as the average cost elasticity of other operating costs is 0.39, whereas the average cost elasticity of selling, general, and administrative expenses is 0.33 concerning the total assets of the company.

Table 3 summarizes the regression results for translog cost function when output is measured by total revenue.

## TABLE 3
## TRANSLOG COST FUNCTION RESULTS

Translog cost function estimates: output measured by total revenue.

| | **Dependent Variable:** | | |
|---|---|---|---|
| | **LN (Cost of Goods Sold)** | **LN (Other Operating Costs)** | **LN (Selling, General, and Administrative Expenses)** |
| **Parameter** | (1) | (2) | (3) |
| LN (Revenue) | -1.14 | 2.67 | 3.57 |
| | (-1.97*) | (6.87***) | (10.05***) |
| ½ LN $(\text{Revenue})^2$ | 0.26 | -0.23 | -0.34 |
| | (4.07***) | (-5.38***) | (-8.56***) |

| | | | |
|---|---|---|---|
| Total Assets | -0.61-04 | 0.62-04 | 0.75-04 |
| | (-5.90***) | (8.82***) | (11.83***) |
| R-Squared | 0.95 | 0.97 | 0.98 |
| No. Observations | 75 | 75 | 75 |
| | | | |
| | | | |
| | | | |
| Cost Elasticity | 0.51 | 0.45 | 0.43 |
| (Total Revenue) | -14.58*** | -20.04*** | -13.25*** |

***statistically significant at 1% significance level, **statistically significant at 5% significance level. *statistically significant at 10% significance level

When output is measured in terms of total revenue, the cost of goods sold declines with increase in revenue as indicated by the weakly statistically significant coefficient on natural logarithm of total revenue, but other operating expenses as well as selling, general, and administrative expenses increase with increase in total revenue. The cost elasticities range from 0.43 to 0.51 across the three cost measures, including the cost of goods sold, other operating costs, and selling, general, and administrative expenses. Cost elasticity of cost of goods sold with respect to total revenue equals 0.51, which means if revenue rises by a dollar, cost of goods sold rises by only $0.51, which points to significant economies of scale for the cosmetics industry. Similarly, cost elasticity of other operating expenses and selling, general, and administrative expenses is significantly below 1 at 0.45 and 0.43, respectively.

We then computed trends in cost elasticities to study the trends in economies of scale over the sample period of 2018 to 2022. Table 4 summarizes the trends in cost elasticities for COGS, OE, and SG&E with respect to total assets.

**TABLE 4**
**TRENDS IN COST EFFICIENCIES WITH TO TOTAL ASSETS FOR COSMETICS COMPANIES FOR THE PERIOD 2018 TO 2022**

| | **2018** | **2019** | **2020** | **2021** | **2022** | **2018-2022** |
|---|---|---|---|---|---|---|
| Cost Elasticity of cost of goods sold relative to Total Assets | | | | | | |
| Mean | 0.41 | 0.39 | 0.37 | 0.38 | 0.39 | 0.43 |
| *t-statistics* | -8.42*** | -8.79*** | -8.79*** | -8.45*** | -8.18*** | -14.76*** |
| Cost Elasticity of other operating expenses relative to Total Assets | | | | | | |
| Mean | 0.36 | 0.33 | 0.32 | 0.33 | 0.33 | 0.39 |
| *t-statistics* | -8.40*** | -8.76*** | -8.76*** | -8.42*** | -8.16*** | -19.56*** |
| Cost Elasticity of Selling, General, and Administrative Expenses relative to Total Assets | | | | | | |
| Mean | 0.41 | 0.39 | 0.37 | 0.38 | 0.39 | 0.33 |
| *t-statistics* | -8.42*** | -8.79*** | -8.79*** | -8.45*** | -8.18*** | -19.50*** |

***statistically significant at 1% significance level, **statistically significant at 5% significance level. *statistically significant at 10% significance level

Table 4 shows that the cost elasticity of COGS with respect to total asset has ranged between 0.37 and 0.41. Table 4 shows that cost efficiency improved in 2020 and cosmetics companies may have responded to COVID-19 by becoming more cost conscious. Cost elasticity of other operating expenses declined substantially to 0.32 in 2020 relative to 0.36 in 2018. Cost elasticity of SG&A expenses also declined in 2020 relative to 2018. The response to COVID-19 induced lockdowns from cosmetics industry was to improve cost efficiencies through scale.

We also estimated trends in cost elasticities with respect total revenue. Table 5 summarizes the results.

**TABLE 5**
**TRENDS IN COST EFFICIENCIES WITH TO TOTAL REVENUE FOR COSMETICS COMPANIES FOR THE PERIOD 2018 TO 2022**

| | **2018** | **2019** | **2020** | **2021** | **2022** | **2018-2022** |
|---|---|---|---|---|---|---|
| Cost Elasticity of cost of goods sold relative to Total Assets | | | | | | |
| Mean | 0.51 | 0.51 | 0.51 | 0.50 | 0.51 | 0.51 |
| *t-statistics* | -6.81*** | -6.49*** | -6.35*** | -6.31*** | -5.88*** | -14.58*** |
| Cost Elasticity of other operating expenses relative to Total Assets | | | | | | |
| Mean | 0.45 | 0.46 | 0.46 | 0.45 | 0.45 | 0.45 |
| *t-statistics* | -9.38*** | -8.94*** | -8.75*** | -8.63*** | -8.08*** | -20.04*** |
| Cost Elasticity of Selling, General, and Administrative Expenses relative to Total Assets | | | | | | |
| Mean | 0.43 | 0.44 | 0.44 | 0.42 | 0.43 | 0.43 |
| *t-statistics* | -6.19*** | -5.89*** | -5.76*** | -5.74*** | -5.34*** | -13.25*** |

***statistically significant at 1% significance level, **statistically significant at 5% significance level. *statistically significant at 10% significance level

Table 5 shows the cost elasticity of COGS with respect to total revenue did not change much over the sample period. It ranged between 0.50 and 0.51. Similar trends are visible for other expenses and SG&E. The cost elasticity for other operating expenses ranges between 0.45 to 0.46. The cost elasticity of SG&A expenses ranges between 0.42 to 0.44 over the sample period of 2018 to 2022.

## SUMMARY AND CONCLUSIONS

The study evaluated economies of scale in the cosmetics industry using translog cost functions and panel data from 2018 to 2022. The results show that there are economies of scale in the industry, as costs increase at a slower rate than output levels increase. The average cost elasticity of the cost of goods sold with respect to total assets is 0.43, while the cost elasticity of selling, general, and administrative expenses with respect to total assets is 0.33. When output is measured in terms of total revenue, the cost elasticity of cost of goods sold is 0.51, indicating significant economies of scale. Trends in cost elasticities show that cost efficiency improved in 2020, possibly due to the response to COVID-19-induced lockdowns. Overall, the findings suggest that there are economies of scale in the cosmetics industry, and firms may respond to external shocks by improving cost efficiencies through scale. The findings suggest that there are economies of scale in the cosmetics industry, as evidenced by the consistently negative coefficient on the quadratic logarithm of output term and the estimated cost elasticities. This means that as companies in the industry increase in size, they are likely to experience lower costs per unit of output, which can lead to higher profitability and a competitive advantage.

The trends in cost elasticities over the sample period also suggest that cosmetics companies have become more cost-efficient in response to the COVID-19 pandemic. This could have implications for the industry going forward, as companies may continue to focus on improving cost efficiencies through scale to maintain competitiveness.

Overall, the findings provide insights into the cost structure of the cosmetics industry and can inform strategic decisions related to scale and cost management for companies operating in this sector.

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