International Journal of Business and Management; Vol. 19, No. 5; 2024
ISSN 1833-3850 E-ISSN 1833-8119
Published by Canadian Center of Science and Education

Appraising Supplier Economic Resilience in the Post-COVID Era

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Received: October 18, 2022 Accepted: Noveber25, 2022 Online Published: September 2, 2024

doi:10.5539/ijbm.v19n5p214 URL: https://doi.org/10.5539/ijbm.v19n5p214

Abstract

Resiliency is the ability to sustain growth and prosper during adverse disruptions. This translates into continuing to provide profitable service with operational efficiency amidst exceptional situations. At the very minimum, company buyers can view a supplier's financials that could convey the vital signs of operational stability, which is the underlying platform of resiliency. In this paper, we view a supplier as an operational process and employ process behavior analysis tools combined with analytics to decipher the operational resiliency of two competing companies. We demonstrate how one can glean operational resiliency by viewing several common financial indicators and their behavior over time. High variability in these indicators reflects a firm's inability to deal with disturbances that may arise from systemic or external causes. In contrast, stable behavior reflects the ability to self-heal and absorb the effects of disturbances. While many more factors and indicators need to be considered to obtain an overall resiliency picture, this analysis focused on several to demonstrate the approach's potential.

Keywords: supply chain, resiliency

1. Introduction

1.1 Problem Overview

The COVID-19 pandemic presented a unique opportunity for affected companies to recognize the need for change. More than ever, companies will prioritize risk management as a strategic necessity. As systemic and significant crises are likely to become more common in the future, companies must reassess their supply chains to evaluate the resilience of their suppliers. One key indicator of resilience is financial and operational health. Organizations in strong financial health are better equipped to withstand disruptions and maintain operations during challenging times, whereas financially weak businesses are highly susceptible to these disruptions (Jacobs & Lummus, 2019). The enduring resilience of a company, like any economic system, depends on its ability to recover successfully from shocks that disrupt its growth trajectory or threaten to derail it entirely (Simme & Martin, 2009). A resilient supplier can resist, absorb, recover, and adapt to business disruptions in an ever-changing and increasingly complex environment, ultimately rebounding and continuing to thrive (Hallegatte, 2014). This paper will demonstrate how common financial indicators can be used to determine whether a supplier can consistently manage operations amid adverse disruptions. This assessment shows whether the company has learned, improved, and continued to prosper through a crisis, thus demonstrating resilience.

1.2 Importance of the Problem

Given that many threats can lead to similar effects, companies should adopt strategies aimed at minimizing these impacts. This approach, often referred to as an 'all hazards approach,' involves developing systemic capabilities to enhance resilience against plausible disturbances. Companies achieve this by integrating preparedness and response planning throughout their operations. In addition to employing traditional controls such as inventory management, lead time optimization, and production capacity provisioning, other tools like contractual mechanisms and strategic supplier relationships can be valuable (Pound, et al., 2014). These measures are designed to prepare, respond, and recover from adverse events by establishing diversity and redundancy in critical business operations. Furthermore, companies should maintain the ability to access supplemental resources when necessary (McKinsey Global Institute, 2020). Regularly engaging suppliers about their resilience strategies is also essential.

1.3 Relevant Prior Research

There have been numerous studies that have attempted to formulate supply chain resilience methodologies, each having a different focus. An expert survey of practitioners and academics (Paul, Moktadir, & Ahsan, 2023) explored supply chain strategies in the manufacturing sector in the post-COVID era. A quantitative analysis revealed that supply chain resilience practices play a dominant role in this period. A comprehensive performance measurement and evaluation methodology (Equbal & Ohdar, 2017) devised for an integrated supply chain focusing on measures of effectiveness, efficiency, quality, productivity, and profitability linked these down to the plant level using an assumed association. In another study (Ajalli, Saberifard, & Zinati, 2021), two combined subjective approaches were introduced that used six key factors and identified the overall resilience of suppliers in eighteen variables via a petrochemical case study. Flexibility, management culture, cooperation risk, redundancy and agility were extracted as the most important variables in supply chain resilience. A new metric of supply chain resilience was introduced (Behzadi, O'Sullivan, & Olsen, 2020) titled the net present value of the loss of profit that integrates time to recovery, recovery level and lost profit during recovery. This study illustrated how the choice of supply chain metric can alter a resiliency strategy. For example, one study (Ozdemir, Sharma, Dhir, & Daim, 2020) proposed supply chain velocity, pace of recovery or adaptation after an event, as a preferred metric for perishable foods. A similar study (Barroso, Machado, Carvalho, & Machado, 2015) proposed a supply chain resilience index which is a hierarchical composite of resilience indices associated with individual risks. While such indices as these incorporate analytical frameworks, other more subjective approaches might be viewed as more practical to implement. For example, using a vulnerability score (Descartes, 2022) derived from observations of the performance of different industries during COVID can characterize their potential resilience.

While most research studies view resilience as the ability to withstand disturbances as measured by chosen metrics, one study (Novak, Wu, & Dooley, 2021) argued that such a definition presumes that a firm maintains a state of operational equilibrium prior to a disturbance, but this state might be completely altered after resumption. This upholds the notion that most firms must adapt and continuously transform their supply chains to alternative states considering disturbances, (GEP, 2021) and that the multiplicity of those states is affiliated with the scale of the firm. For example, many firms will turn to innovate their operations (Shih, 2020) based on lessons learned from an adverse event like COVID. Study has shown (GEP, 2021) that many firms lost profit and experienced increased operating costs because of COVID and had to scramble to find new suppliers and invest in new technologies to improve supplier visibility. Firms with fully depreciated production assets will likely experience lower marginal costs to inspire production innovation. In a more global context (Maguire, et al., 2020), supply chains continue to undergo transformation driven by political and technological innovations, and emerging markets. This paper will build on these notions by utilizing some statistical approaches that can observe shifts towards alternative states considering disturbances, whether internal or external.

1.4 Hypotheses

It is evident from the previous discussion there have been a wide range of approaches to assessing supply chain resilience. Our approach hypothesizes that supply chain resilience is defined by the *stability* of the operational health of a firm’s suppliers. By stability, we mean the degree of variability in the observed behavior of some common supply chain economic metrics, and the extent to which the variability is influenced by assignable cause disturbances versus systemic causes. From the perspective of viewing such behavior as a process, stability would be disrupted by exogenous events and would also include unanticipated adverse events. Observed stable behavior under the duress posed by such events would thus characterize the predictability of a supplier to withstand the impacts and continue to provide service. Furthermore, a key characteristic to be considered is the degree to which performance transformed to an alternative state (better or worse) following a major disruption. This research is designed to explore this hypothesis through a case study of selecting two major semiconductor suppliers and comparing the economic performance over time using some common supply chain metrics. We then use several statistical techniques to determine evidence of shifts in variability.

2. Methodology

Like other prior research studies, this study will examine the hypothesis using a case study. In this situation, financial and operating performance data from two competing semiconductor suppliers will be used to explore the notion of viewing resilience in terms of stable behavior and/or transitioning to different states. The data represents quarterly results from the two companies from 2010 through the first quarter of 2024. We will use an example to infer resiliency using a few common metrics found in financial reports, combined with some analytics. It should be noted that numerous other metrics can be analyzed, but this paper will focus on only a few that are widely used to assess operational performance, for brevity. (It should be noted that generally, no single metric should be used in isolation, but rather should be evaluated along with other metrics that convey cash flow, liquidity, and profitability) (Rapid Ratings, 2021).

3. Results

We draw data from databases housing public company financials of two well-known competing suppliers of semiconductors and chips, whom we'll call Company A and B (Mergent Inc., n.d.). The time range extends from the first quarter of 2024 back to the first quarter of 2010. In addition to COVID, many major global material events occurred during this timeframe, including the global recession (2010), Haiti earthquake (2010), Fukushima disaster (2011), Hurricane Sandy (2012), West Africa Ebola outbreak (2016), Hurricanes Harvey and Maria (2017), global wildfires (2019), among others.

While financial analysis often involves reviewing annual end-of-year figures, this approach can sometimes obscure underlying behavior and lead to misguided decisions by potential buyers. For instance, if a firm's end-of-year performance indicates a decline compared to the previous year, analyzing quarterly behavior might reveal that the firm was still operating within the expected range of performance variability. Additionally, managers have been known to manipulate assets to present a favorable picture of the company at the end of reporting periods, particularly year-end. For example, purchasing departments may intentionally delay goods receipts from suppliers to artificially reduce reported inventory levels or equipment leases might be bought out to convert their associated costs into assets.

3.1 Gross Margin

Figure 1 compares the quarterly gross margins of the two companies over this timeframe. We specifically choose to analyze the gross margin because, in general, ratios can facilitate more equitable comparisons between companies. This is particularly relevant since Company B's market capitalization is over twice that of Company A. Gross margin represents the percentage of sales that a company retains after covering its operating costs, such as labor and supplies. It provides insight into how efficiently a company can convert each dollar of sales into a dollar of gross profit. Essentially, it reflects the degree of service provided to customers, as it indicates the premium customers are willing to pay for the service delivered. Typically, gross margins tend to remain stable throughout a company's lifetime, unless internal or external irregularities occur, leading to significant fluctuations (Huq, Pawar, & Rogers).

Another metric related to gross margin is Earnings Before Interest and Taxes (EBIT), also known as operating profit, which is commonly used to measure profitability. This metric accounts for depreciation and amortization costs but excludes the effects of debt obligations and the company's fiduciary structure, offering an unbiased view of profitability (DeSmet, 2017). For this discussion, we will focus solely on the operational aspect of resilience using the gross margin metric, which includes only the direct operational costs, as opposed to other overhead costs like Selling, General, and Administrative (SGA) expenses which could be driven by a firm's financial nature. However, a comprehensive and balanced resilience analysis should also incorporate metrics that relate these factors to the company's overall financial health.

The chart in Figure 1 represents the gross margins for two companies using an Individuals Moving Range (IMR) approach. IMR charts are commonly employed in quality control to monitor process outcomes for signs of assignable variation. However, their utility extends beyond quality control, as they can be applied in various contexts (Wheeler, Which Chart to Use?, 2018). The IMR chart examines a set of values to determine whether they originate from a consistent, unchanging process or if there is evidence of process change. The top graph serves as a running record of each firm's gross margin performance. It is bounded by upper and lower control limits (UCL and LCL, respectively), represented by dashed lines. These control limits are defined as ±3 standard deviations (3σ) from the mean gross margin level ($\bar{X}$). Data points falling within the region bound by these control limits are considered typical and not rare events. In summary, the IMR chart provides insights into the stability and consistency of gross margins, helping identify any significant process changes.

Given that we are seeking evidence of non-homogeneity in the data, assuming there are underlying changes in operating conditions from quarter to quarter, it is standard practice to use the average moving range ($\bar{R}$) to compute the standard deviation when calculating the UCL and LCL values. This approach better captures routine short-term, point-to-point (or local) variability, as opposed to using the traditional definition of standard deviation, which assumes data to be completely homogeneous and serves as a global measure of dispersion. Variability within this range, as well as points that fall outside it, indicate process uncertainty due to some degree of operating or managerial irregularity, raising questions about overall process stability. Statistically, this range approximately captures at least 99.7% of all outcomes, minimizing the likelihood of Type I errors. Since we are examining gross margins, values above the UCL might be seen as desirable, but this also raises the question of whether these values are exceptions rather than the norm.

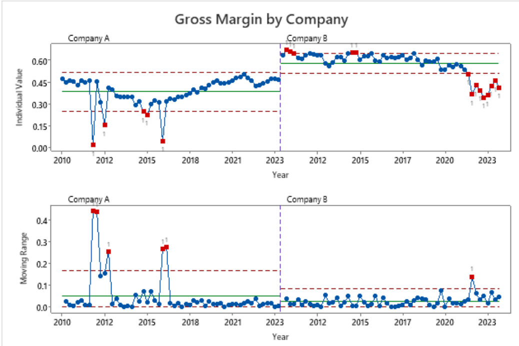

Figure 1. Company A and Company B Gross Margin

Note. The points labelled with the number 1 indicate excursions outside the control limits.

In the top graph of Figure 1, we assess the company's performance to a known or calculated norm, seeking a central tendency. The bottom graph is a moving range chart, where each point represents the difference between two successive points in the top graph. Here, we look for instances where differences exceed the naturally observed limits of baseline variability (Behzadi, O'Sullivan, & Olsen, 2020). Changes in the point-to-point differences indicate the degree of systemic variability within a process. Like the top graph, the bottom graph includes upper and lower control limits (UCL and LCL) for the range values, but these are calculated and interpreted differently. In this context, the limits represent the spread of local variability, with the lower limit being zero (indicating no variability). We use these limits to identify instances where differences exceed the naturally observed limits of variability (Wheeler, The Six Sigma Practioner's Guide to Data Analysis, 2010). Although such situations often coincide with points falling outside the control limits in the top graph, this is not always the case. The bottom chart can more effectively detect shifts and trends in variability, even when the values in the top graph remain within the control limits.

When analyzing the two companies using this approach, the most striking observation is the difference in the spread of their operating regions. Company A's spread, as determined by the difference between the UCL and LCL, is much wider than that of Company B. This wider spread indicates greater uncertainty, which ultimately translates into higher risk for Company A. Additionally, both in 2012 and 2016, Company A's gross margin dipped below expected levels due to special charges paid to suppliers. While there may be plausible managerial reasons for these dips, buyers are likely unaware of them.

What redeems Company A is the steady upward shift in gross margin beyond 2016, suggesting corrective actions are being taken. In contrast, Company B exhibits more stable behavior, with a narrower gross margin spread of about 11% compared to Company A's spread of about 30%. While Company B appears to be performing well overall, there is a significant concern: a gradual downward shift in gross margin starting in 2020, reaching undesirable levels in 2022—coinciding with the arrival of COVID. During the same period, Company A maintains steady growth. A closer examination reveals that Company B experienced sales decreases coupled with proportional changes in the cost of goods sold (COGS) for quarters falling below the LCL in the top graph of Figure 1. Buyers might interpret this behavior as issues related to product availability, supply, and network costs.

3.2 Inventory

Inventory is a key driver of profitability for producers and suppliers, representing the non-fixed assets of the firm, which include products, components, and materials needed to produce finished goods. Inventory turnover measures how many times a firm's inventory is replaced, typically through sales, over a reporting period, indicating the rate at which a firm cycles through its materials and goods. This metric often reflects a firm's throughput, while days of inventory can serve as a proxy for cycle times (Hopp, 2011). Applying Little's Law can also offer insights into a firm's daily cost throughput.

While higher inventory turnovers are generally viewed favorably, their implications can vary depending on the firm's context. High inventory turnover might suggest insufficient supply to meet demand or could be costly if ordering, setup, or changeover costs are high. Conversely, low inventory turnover could indicate excess inventory or weak sales and may pose quality issues as goods or materials are more likely to suffer damage or loss the longer they are stored. Excess inventory may serve as safety, anticipation, or strategic stock to hedge against disruptions, but it can be costly if product costs are high. Effective inventory management involves optimizing the balance between supply and demand. Therefore, it is crucial to benchmark a company's inventory metrics against those of other firms within the same industry or value chain to properly assess performance.

In Figure 2, we observe the quarterly reported inventory turnovers for both Company A and Company B. The top graphs reveal a wider spread of variability in Company A's inventory turnover compared to Company B. Despite this variability, there's a positive trend: gradual decreases in variability over time. This is evident from the declining values of the moving range in the bottom graph. Interestingly, these improvements align with the gradual enhancements in gross margin observed earlier in Figure 1 for Company A. Company B demonstrates better inventory control, with a narrower spread of variability. However, there's cause for concern: a shift toward lower turnover. This suggests challenges in maintaining efficient inventory cycles. In 2022, both inventory turnover and gross margin decline for Company B. This signals an inability to profitably turn over excessive inventory. Balancing inventory turnover and profitability remains critical for both companies.

Linking inventory performance with gross margin illustrates how effectively a company converts its inventory into profit. Achieving high margins with high inventory turnover is challenging (Serrano & Lekkakos, 2020). A higher or sustained gross margin alongside increased inventory turnover indicates a firm's improved capability to provide profitable services at a faster pace. Figure 3 compares the relationship between gross margin and inventory turnover for Company A and Company B, using data from the last observed quarters from 2018 through the first quarter of 2024 (Cecere, 2015). This approach excludes the anomalies observed before 2018, allowing us to focus on more recent performance.

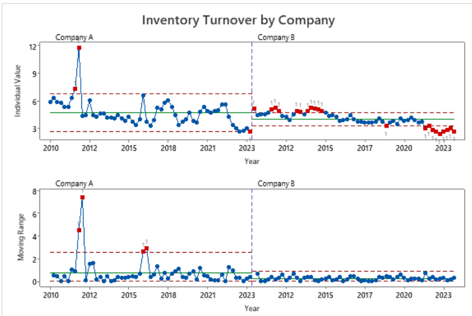

Figure 2. Company A and Company B Inventory Turnover

Note. The points labelled with the number 1 indicate excursions outside the control limits.

Each cluster in Figure 3 includes an implied regression line, whose slopes were not statistically significant but are shown to indicate the direction of the relationships. The figures clearly show that Company B operates with much higher gross margins than Company A and exhibits lower variability in inventory turns. Additionally, there is an observable improvement in Company B's gross margin as inventory turnover increases. Conversely, Company A shows relatively stable gross margins despite variations in inventory turnover, suggesting a consistent level of service to customers.

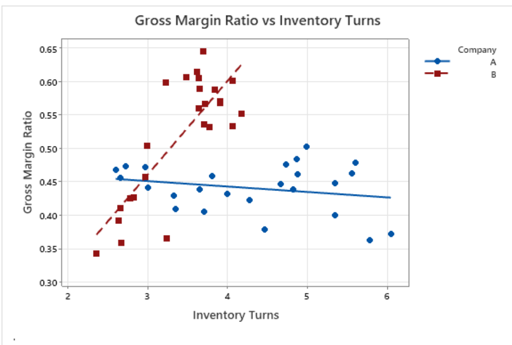

Figure 3. Linking Inventory Turnover with Gross Margin

3.3 Statistics and Data Analysis

When evaluating a supplier's operational performance from a buyer's perspective, the resiliency assessment will largely depend on the information used in the analysis. The buyer must determine whether the supplier's operations can absorb disturbances and demonstrate learning, improvement, and growth. Specifically, they might ask the following questions:

- Does the firm exhibit control over its operations?
- What are the effects of disruptions?
- Can the firm maintain service despite disruptions?
- Does the firm have the potential to maintain stable operations in the face of disturbances?
- Is the performance trending in the right direction?
- What is the level of risk?

To address these questions, several process measures can be utilized. Numerous solution providers and academic studies have attempted to develop resilience indices that encapsulate all aspects of operational risk into a single metric (Rapid Ratings, 2021) (Lucas, 2018) (Pettit, Croxton, & Fiksel, 2013). Many of these indices focus on specific areas of resilience, such as financial risk or revenue at risk. However, relying on a single metric can often obscure underlying behaviors that could inform remedial actions, as no single metric can capture all factors contributing to resiliency (Paulsson, 2007). While we encourage using various available metrics to aid in deciphering operational resilience, some additional statistical indices can be used to interpret process behavior based on the fluctuation of value indicators over time. These include:

- The average *moving range* ($\overline{R}$) value observed in the bottom portion of the previously shown IMR charts characterizes the magnitude of systematic variation in the gross margins of both companies. It represents the average change in gross margin as a percentage of sales. High $\overline{R}$ values indicate the percentage of sales that, on average, are impacted by shifts due to disturbances, whether systemic or from external sources (Ringwood, Watson, & Lewin, 2018).
- The *coefficient of variation* (CV) is a statistical measure that quantifies the relative dispersion of data points in a data series around the mean. It is defined as the ratio of the standard deviation to the mean and is often expressed as a percentage. The CV is most meaningful when dealing with data on a ratio scale, where the zero point has a clear meaning. In analytical chemistry, the CV is used to express the precision and repeatability of an assay. Additionally, it finds applications in fields such as engineering, physics, and finance (where it provides a relative measure of risk to return), among others. Lower CV values (less than 1.0) are favored because they indicate less interruption with disruption across the observed outcomes.
- The *capability index* is widely used across various industries to measure how well a process aligns with specified limits or targets. It compares the accepted tolerance range (usually defined by operating specifications) to the observed process spread based on short-term systemic variability (Minitab). Essentially, it estimates whether an inherently stable process has enough flexibility to comfortably operate within the specified tolerance range, even when disturbances (such as shifts) occur. Desirable values for the capability index are greater than one and closer to two or more, indicating that the process can consistently meet specifications without significant disruptions. Industries strive for processes with values well above 1 to ensure reliable and high-quality production.
- Like the capability index, the *performance index* is used to verify whether a process has performed acceptably within a specified range of tolerance over the long-term considering disturbances that might have shifts in performance. As in the capability index, values greater than one and closer or greater than two are desirable.
- The *stability index* represents the relationship between the long-term and short-term standard deviations. In simpler terms, it measures how consistently a process behaves compared to its inherent variability. It is calculated as the ratio of the long-term standard deviation (associated with overall process behavior) to the short-term standard deviation (associated with individual measurements or short time intervals). When a process is stable, this ratio should ideally be close to one. In other words, the long-term variability should be similar to the short-term variability. However, due to natural variations and process shifts over time, it's acceptable for the stability index to exceed one by small amounts slightly. (Savage, 2020).

We estimated the values for each measure for both companies using the data from the last observed quarters of 2018 through the first quarter of 2024, as done previously. We assumed lower specification limits for gross margin and inventory turnover to be 0.30 and 2.0, respectively. These limits were derived by observing the reasonable lower bounds reported by companies in the same industry category. (Other values can be chosen if desired, and the analysis can be repeated accordingly.) The results are summarized in Table 1 for gross margin and Table 2 for inventory turnover.

From Table 1, the effects of disturbances on providing profitable service are similar for both companies, as indicated by the moving range value showing that about 1.5-3.5% of gross margin is affected on average. Although Company A's past performance in this area has been highly variable and unstable, the capability index suggests that it has the potential for steady performance and is improving, particularly in the last quarters during the COVID pandemic. In contrast, Company B's variation is twice that of Company A, with less potential for stable performance as indicated by the three indices, and it is trending downward.

Table 1. Gross Margin Resilience Indices

Index	Average Moving Range	Coefficient of Variation (%)	Capability Index	Performance Index	Stability Index	Process Shift
Company A	0.015	8.26	3.47	1.29	2.70	Positive
Company B	0.035	17.81	2.34	0.79	2.97	Negative

Regarding inventory turnover (Table 2), Company A shows high variability and slightly lower improvement capability, indicating a need to stabilize operating processes to efficiently convert inventory into output amidst disturbances. Although Company B's indices are slightly more favorable, both firms are trending downward, reflecting a struggle to manage and turn over excessive inventory.

Table 2. Inventory Turnover Resilience Indices

Index	Average Moving Range	Coefficient of Variation (%)	Capability Index	Performance Index	Stability Index	Process Shift
Company A	0.505	24.74	1.71	0.72	2.37	Negative
Company B	0.288	15.55	1.84	0.89	2.08	Negative

4. Discussion

The previous analysis primarily focused on supplier operational resilience in terms of maintaining profitable service and operational efficiency amidst disturbances. However, to fully assess a supplier's ability to withstand disruption, other areas of resilience must also be considered. These include indicators of cash flow, liquidity, and profitability, as well as service delivery metrics. Relevant indicators include operating margin, inventory percentage, gross margin return on inventory (widely used in retail), debt coverage ratio, cash conversion cycle, current ratio, return on assets, and operating and financial leverage ratios, among others (Kannegiesser, 2008). The indices used in this analysis can be applied to these additional metrics to gauge a supplier's financial resilience by examining the effects, stability, and capability to sustain control of profit, liquidity, and cash flow amidst disturbances. Ultimately, it will be up to the buyer to prioritize the key value indicators that should form a balanced scorecard for appraising a supplier's resilience (Camerinelli, 2009).

The demonstrated methods provide a framework for evaluating a supplier's resilience, which is fundamentally supported by their financial health. The economic resilience of a firm, determined by how its operational pace reacts to disruptions from unforeseen events, is likely to influence a buyer's capacity to assess the impact of a disruption on their investment in a supplier. This information is utilized by buyers to measure the risk associated with forming strategic alliances with suppliers. In the aftermath of COVID, this kind of vetting becomes crucial as companies are anticipated to collaborate more closely with suppliers, aiming for resilient and high-quality relationships. Supply chain and procurement departments will seek low-risk suppliers who can maintain sales and production in the face of disruption. By examining a supplier's historical economic performance and operational speed, a buyer can detect early signs of potential insolvency, throughput bottlenecks, inefficiency, and other issues that may arise from disruptions.

5. Conclusions

When viewed as a process, a supplier's operational health forms the backbone of its resiliency. This provides a steady platform for performance during disruptions. The ability to self-heal and absorb the effects of disturbances is reflected in stable behavior. In its strictest sense, operational resilience is the ability to maintain or improve profitable service while keeping production efficiency in mind during disruption. Beyond recovering from major events using triage, resilience includes the ability to continuously withstand disruptions of various magnitudes, endure the effects of shocks and self-healing, much like the shock absorbers on a car, and transform into an alternative state of improved performance.

In this discussion, we considered a supplier as an operational process. We used process behavior analysis tools and some analytics to infer the operational resiliency of the organization. We showed how operational resiliency can be inferred by observing several common financial and operational indicators and their behavior over time. High variability in these indicators indicates a firm’s inability to handle disturbances that may arise from systemic or external causes. Gross margin and inventory turnover were used as preliminary markers to infer resilient behavior. These markers help us understand how a firm responds to disruptions and maintains its operational health in the following ways:

- Viewing the average change of these values to determine the effects of shifts over periods of disturbance.
- The degree of spread of their variability, characterizing the level of operational risk.
- The potential of these values to perform within desired targets over the short and long term.
- How well does the observed variability from disturbances compare to systemic variability.
- Trends in shifts of behavior to improved states.

To get a comprehensive picture of resiliency, it is necessary to consider many factors and indicators. This analysis chose to concentrate on a select few to illustrate the potential of the approach. Buyers, at the very least, can examine reported financials, which can provide insights into a company's operational health. The analysis primarily uses data from the financial statements of public companies. Acquiring similar information from private businesses might pose a challenge. Yet, in the aftermath of the COVID era, it is likely that buyers will require financial disclosures from privately owned suppliers. This would especially be the case for those supplying high volumes of key materials over an extended period. Such transparency could also prove beneficial for the suppliers. They could utilize the insights gained from the analysis to enhance their operations.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Canadian Center of Science and Education.

The journal and publisher adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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