The Predictive Value of the Logistics Managers’ Index

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Abstract

The Logistics Managers Index (LMI) is a monthly metric of logistics activity in the United States, as measured by a survey of supply chain professionals. Over the past 3 years, a group of supply chain researchers, in conjunction with the Council of Supply Chain Management Professionals (CSCMP), Supply Chain Quarterly, and DC Velocity have been periodically collecting, calculating, and publishing the results of LMI. In this article we present how the LMI can be utilized as a leading indicator of the economic activity in U.S.

Introduction

Many measures of economic activity, such as Gross Domestic Product (GDP) or Gross National Product (GNP), are backward-looking in that they report economic growth and contraction after it has already happened, at the
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final point of consumption. While many indicators (such as the PMI, LMI, and FreightWaves) saw the manufacturing and business-to-business economy see slower growth and actual declines in some cases during late 2018 through 2019, “Holiday retail sales for the U.S. peak season during November and December are expected to increase between 3.8 percent and 4.2 percent over their 2018 levels, coming in slightly higher than the average holiday sales increase of 3.7 percent recorded over the previous five years.”

The Logistics Managers’ Index (LMI) is a relatively new indicator that is designed to track economic movement in logistics components such as inventory, warehousing and transportation. These logistics components are believed to be an early warning system as they show changes upstream in the economy as opposed to only at the consumer level, which takes place following the largest portion of aggregated economic activities. The LMI score is a combination of eight unique components that make up the logistics industry, including: inventory levels and costs, warehousing capacity, utilization, and prices, and transportation capacity, utilization, and prices. The LMI is calculated using a diffusion index, in which any reading above 50 percent indicates that logistics is expanding; a reading below 50 percent is indicative of a shrinking logistics industry. The goal of the LMI is to track movements in the logistics industry as we believe many of the metrics we measure function as leading economic indicators. While there is value to lagging indicators, such as GDP, their primary value is not predictive. Leading indicators enhance the ability of supply chain managers to plan their logistics strategies.

When we introduced the LMI in the pages of Rutgers Business Review in 2018, the index was approximately 18 months old, and its predictive abilities were not entirely apparent. Now, 18 months later, we have evidence to suggest that the LMI and its components may act as economic indicators. Much has changed in the macroeconomy since our previous article. In early 2018, the U.S. economy was growing quickly, with consumer confidence riding high and transportation companies rapidly expanding their fleets to keep up with demand. The LMI indices range from 0-100, and reflected this growth. The overall index reached all-time high marks into the low- to mid-70’s throughout the summer of 2018. Transportation Price growth crested at 95.8 in the March/April 2018 reading. A reading of 95.8 indicated that nearly all respondents were observing growth in the cost of shipping. This is no longer the case.

When the economy was expanding, we recorded expansion in the LMI. Now, as the economy shows signs of contraction, we see a similar move in the LMI. In fact, the LMI began predicting signs of a slowdown in November of 2018, well before many other economic indicators. The LMI still suggests
that the economy is expanding, but at a significantly reduced rate relative to 2018.

The remainder of this paper is structured as follows: In section two we will describe our methodology. Section three is dedicated to an exploration of the eight components of the Logistics Manager’s Index, how those components have moved over the past 18 months, and a comparison between them and other key economic indicators. Finally, we conclude with a discussion of the findings of the second 18 months of the LMI, and what they might tell us about the overall economy.

Data and Method of Presentation

Data for the Logistics Manager’s Index is collected in a monthly survey of leading logistics professionals. The respondents are CSCMP members working at the director-level or above. Upper-level managers are preferable as they are more likely to have macro-level information on trends in Inventory, Warehousing and Transportation trends within their firm. Data is also collected from subscribers to both DC Velocity and Supply Chain Quarterly as well. Respondents hail from firms working on all six continents, with the majority of them working at firms with annual revenues over a billion dollars. The industries represented in this respondent pool include, but are not limited to: Apparel, Automotive, Consumer Goods, Electronics, Food & Drug, Home Furnishings, Logistics, Shipping & Transportation, and Warehousing. Through the 37 months of the LMI, we have received responses from 2,952 supply chain professionals.

Respondents are asked to identify the monthly change across each of the eight metrics collected in this survey (Inventory Levels, Inventory Costs, Warehousing Capacity, Warehousing Utilization, Warehousing Prices, Transportation Capacity, Transportation Utilization, and Transportation Prices). In addition, they also forecast future trends for each metric ranging over the next 12 months. The raw data is then analyzed using a diffusion index. Diffusion Indexes measure how widely something is diffused or spread across a group. The Bureau of Labor Statistics has been using a diffusion index for the Current Employment Statics program since 1974, and the Institute for Supply Management (ISM) has been using a diffusion index to compute the Purchasing Managers Index since 1948. The ISM Index of New Orders is considered a Leading Economic Indicator.

We compute the LMI Diffusion Index as follows:

\[ PD = \text{Percentage of respondents saying the category is Declining}, \]
\[ PU = \text{Percentage of respondents saying the category is Unchanged}, \]
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\[
PI = \text{Percentage of respondents saying the category is Increasing},
\]

\[
\text{Diffusion Index} = 0.5 \times PD + 0.5 \times PU + 1.0 \times PI
\]

For example, if 25% say the category is declining, 38% say it is unchanged, and 37% say it is increasing, we would calculate an index value of

\[
0 \times 0.25 + 0.5 \times 0.38 + 1.0 \times 0.37 = 0 + 0.19 + 0.37 = 0.56,
\]

and the index is increasing overall.

For an index value above 0.5 indicates the category is increasing, a value below 0.5 indicates it is decreasing, and a value of 0.5 means the category is unchanged.

**Overall LMI**

The overall LMI was much higher throughout 2018. Since April 2019, it has settled to readings in the mid-high 50’s. This indicates that the overall logistics industry has expanded very slowly for the last 5-6 months. While it has not yet dipped below the index rate of 50.0, which would indicate contraction, it is getting close. Interestingly, four of the lowest overall scores in the history of the index have occurred in the last five months (see Figure 1).

**Figure 1. Logistics Managers’ Index, September 2017 – September 2019**
By juxtaposing the LMI with traditional metrics like GDP, we see a few interesting contrasts. LMI and GDP are both slowing slightly. However, the LMI is slowing more significantly than GDP, and began to do so considerably earlier. This is partially because GDP is a lagging indicator, while we believe that the LMI is a leading indicator of economic activity. GDP tracks the production and consumption of finished goods. The LMI tracks the movement and storage of goods before they reach the consumer. GDP shows us what has already happened, while the LMI shows us what may happen soon. GDP growth from 2016, when the LMI began, to the most recent reading is presented in the graph below (see Figure 2).

**Figure 2.** U.S. Real GDP Growth, 2016 – 2019

![Graph showing U.S. Real GDP Growth, 2016 – 2019](image)

Source: U.S. Bureau of Economic Analysis

When comparing the movement in the LMI to the Purchasing Managers’ Index (PMI) over the last year, we see a similar pattern, albeit with a few differences. As displayed in Figure 3 below, both the LMI and the PMI have decreased significantly over the past 12 months, dropping 14.2 and 10.7 points respectively. While the LMI has decreased more significantly, it is still showing positive (although decreasing) growth. The PMI has recently crossed into a state of detraction. These both stand in stark contrast to the continued growth in consumption metrics such as U.S. GDP. This is partially due to the differences between the manufacturing and consumer economies.

In the September 2019 FedEx earnings call, FedEx chairman Fred Smith noted that the domestic consumer economy can often mask weakness in the global production economy. The PMI primarily tracks upstream manufacturing, while the LMI tracks both upstream and downstream consumer activity. This difference may explain why the LMI still shows some level of growth, and the PMI has begun to demonstrate contraction. These also contrast to GDP, which primarily tracks downstream consumption.
growth has likely remained steady because it does not track the upstream movements in supply chain or production as the PMI and LMI do. Part of the decline in the LMI and PMI can likely be attributed to economic slowdowns happening in other parts of the world. This is not only due to changes in production, but also in capital markets and international interest impacting the U.S. The trade war has clearly had adverse effects on China and the EU. Because the LMI and PMI track upstream activity, they are likely picking some of this up. There is also evidence that the contractions happening internationally are having some impact in the U.S. However, due to its lagging nature, this has not yet been reflected strongly in U.S. GDP. Whether or not this will change at some point remains to be seen.

**Figure 3. Movement in the LMI and PMI, September 2018 - September 2019**

![Graph showing movement in LMI and PMI](image)

**Inventory Levels and Costs**

Of the LMI components, the inventory metrics have been the most consistent. Figure 4 below shows inventory levels and costs over the history of the index. In the whole data series, there is only one period where the inventory level index has dropped below 50. This means that the respondents have consistently indicated that inventory levels are growing.

**Joint Movement**

After some significant volatility in 2017, and September of 2018, both lines have been fairly stable. Interestingly, both show a downward sloping trend
in the past year. Because a company’s total expenditure on inventory costs is directly tied to the amount of inventory it holds, we would expect changes in the two levels to be correlated. There are other factors in inventory costs, including changes in the value of product held, due to changing product mixes, and changes in interest rates. What is surprising is how closely the two lines have tracked each other over the last 18 months.

**Figure 4. Inventory Levels and Costs 2016 - 2019**

![Inventory Levels and Costs 2016 - 2019](image)

In addition to the joint movement, also interesting is the consistency of the direction for both. Doing a linear regression on the inventory level, over the period March 2018-Sept 2019, returns a negative slope with an R-squared value of 0.45. The reduction in the inventory cost line is even more consistent, also returning a negative slope, but with an R-squared value of 0.61.

**Seasonality**

Given the seasonal nature of US retail sales, it would seem likely that there would be evidence of seasonality in the inventory index levels. The graph below shows the index levels for each year from 2017-2019. Figure 5 shows that in the past months, the inventory levels have gone down significantly. Generally, the months of August and September are when inventory levels would be expected to be growing, as companies ramp up for the upcoming holiday shopping season. In 2017, these months were during a period of consistently increasing levels, although in 2018, the index values were falling,
still indicating growing inventory levels, but the rate of growth was falling (see Figure 5).

If these lower levels are just random fluctuations, they are of a much larger magnitude than the other fluctuations that have been seen throughout the life of the index. If they are not merely fluctuations, but evidence of a trend, it would indicate that companies are scaling back on inventory levels heading into the holiday season, which could be consistent with an upcoming recession. If the index continues to fall, it could easily drop below 50, which would mean falling inventory levels, heading into the end of the year.

**Figure 5. Inventory Levels 2017 - 2019**

Inventory costs have been consistently above 50.0, so therefore consistently rising, over the life of the index. There have been fluctuations, but no readily observable trends, nor any consistent signs of annual seasonality.

**Warehousing**

Taken together, there are some interesting insights in the warehousing metrics over the past 18 months. First, the relationship between warehousing price and capacity. There is somewhat of a lagged effect to this relationship, as it appears that the market responds to increases (decreases) in Warehousing Capacity with decreases (increases) in price.
So, there is a certain degree of an inverse relationship between these two measures, but the effect is slightly lagged. As an example, if we look at the September 2018 warehousing capacity index measure it registered in at 56.6, indicating growth in the rate of capacity (Figure 6). Then, if we look at the values for warehousing prices for October to December of 2018, we see that the rate of growth is decreasing. Warehouse Prices tend to be a lagged function of Warehouse Capacity. Therefore, supply chain managers should consider monitoring the LMI Warehouse Capacity metric as they formulate their strategies for warehouse network expansion or configuration.

A similar relationship exists between Warehousing Utilization and Warehousing Prices. Presumably, when excess capacity exists in the warehousing market, the price should decrease. In this area, we also see a similar lagged effect as we noted above with the capacity/price relationship. The utilization/price relation is different however, in that it appears that they trend together rather than interact in an inverse manner. In almost every month of the past year, when the rate of growth for Warehouse Capacity increased, the rate of growth for Warehouse Price went up as well. Similarly, they also move together when the rates of growth decreases. One key difference to note however is that Warehouse Capacity contracted in seven of the last twelve months (see Figure 7). The rate of growth for Warehouse Price has never contracted, but it has slowed significantly in the last 12 months (Figure 8). This is consistent with reports of warehouse shortages in 2018 and early this year, and a subsequent market cooling from mid-to-late 2019.8,9 Warehouse Capacity has been in a state of contraction more often that any of the other metrics in the LMI. This is likely because adding warehouse capacity is time, and resource-intensive, making this measure the
least responsive of the eight LMI metrics. For example, should a warehouse provider want to expand their capacity, there will likely be a time lag until that new capacity is availability.

**Figure 7.** Warehousing Capacity

**Figure 8.** Warehousing Prices
Transportation

Figure 9 below displays the shifts in the three Transportation metrics relative to one another throughout the history of the LMI. Transportation Prices and Transportation Capacity have an inverse relationship. When there is more capacity, prices go down, when there is less capacity, prices go up.

Figure 7. Movement in Transportation Metrics 2016-2019

When we first wrote about the LMI in March of 2018, Transportation Prices were growing at the rapid pace of 95.8 (see Figure 10). Conversely, Transportation Capacity was contracting at a rate of 30.1; leaving a 65.7 point margin between the two metrics. In September of 2018, that story has been flipped on its head. Transportation Prices are essentially holding steady at a rate of 50.6 (although they had been contracting for three of the previous four months).
At the same time, Transportation Capacity is expanding at a rate of 59.5. In 18 months we have gone from Transportation Prices registering a rate of growth 65.7 points higher than Transportation Capacity, to moving at a rate 8.9 points lower, a 73.2 point swing (see Figure 11).

It is interesting that this shift started in November 2018, well before many of the other leading economic indicators began showing any rates of decline. The contraction-to-meager growth of Transportation Prices in our index...
corresponds with the recent shuttering of smaller transportation companies and the low earnings by FedEx.\textsuperscript{10,11} Transportation prices and utilization fell precipitously, approximately a year prior to the recession of 2009. Whether the declines we see today portends any additional economic troubles in the future remains to be seen.

**Conclusion**

After collecting and analyzing 36 months of data, we can draw a number of conclusions. We realize there is value in an additional leading indicator of the global economy beyond the PMI. Both the LMI and PMI reflect different aspects of the global economy in a forward-looking manner. In contrast, GDP, due to its backward-looking nature displays changes in the economy more slowly. Interestingly, as supply chains have become increasingly complex and intertwined, observing metrics that capture the global nature of the world’s economy are necessary.

The trade wars between the United States of American and several other countries are reflected in the data we collected. They seem to have a significant effect on multiple economies by restricting the movement of goods among countries. In addition, the economy of the US has been boosted by the strong consumer sentiment. However, there is evidence that this trend is changing as consumer confidence hit a nine month low, and overall consumer spending contracted in September 2019.\textsuperscript{12,13}

The LMI has been suggesting a slowdown in economic growth since November of 2018. This does not necessarily mean there is an economic contraction or recession, but the magnitude of growth is less than it was over the prior years. This finding is correlated with other indicators such as FreightWaves’ Tender Rejection Index.\textsuperscript{14} For example, we observed that FedEx’s stock price dropped 9% after it missed analysts’ expectations on their earnings call. FedEx, as a major transportation and logistics services company, makes up a large share of the world’s transportation infrastructure. In addition, we saw an increasing number of third-party logistics (3PL) bankruptcies in the recent months.\textsuperscript{15,16} These events occurred approximately 6-9 months after we first began to observe the steep decline in Transportation Prices.

These pieces of evidence suggest that the LMI overall, and in particular Transportation Prices, are strong indicators of macroeconomic health. They seem to predict changes before they are actually observed in the broader economy. Therefore, the use of these metrics can be helpful for supply chain managers as they forecast potential changes in the business climate. This forward perspective of not just their company, but also the economy at large can improve the accuracy of their forecasts. Recently, some commercial
forecasting packages have included forward-looking economic indicators in addition to their time-series based forecasts and this has shown improved accuracy.

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Endnotes
1. National Retail Federation. (2019, October 3). NRF forecasts holiday sales will grow between 3.8 and 4.2 percent. NRF.com.
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