Thasos MallStreams

Redefining Key Performance Indicators for Retail REITs
September 27, 2018
Background: Thasos, Data, Products
By the numbers:

- 7 Years sourcing, cleaning, and selling location data
- 1,000 App sources individually evaluated
- 500,000 Data feeds delivered to subscribers weekly
- 30,000,000 Phones in the core panel
Sources of Location Data
Apps on Phones Log Raw Latitude and Longitude Coordinates

Notes:

- Applications running on mobile phones, whether they assist with navigation, forecasting the weather, or connecting with friends and family, log phone positions in terms of latitude and longitude coordinates.
- Often, this logging happens passively, meaning no engagement with the phone is required for the position to be logged.
- Thasos ingests over 5 terabytes of this type of data on a daily basis.
Intelligent Models Coupled with Precise Geofences Transform Raw Coordinates into Useful Information

Notes:

› To make sense of those massive quantities of raw data, Thasos has built an AI platform to distinguish signal from noise and a rich database of high-precision geofences.
› The red and blue boxes depicted in the graphic on the left represent geofences for Walmart and Target. A geofence is a set of latitude and longitude coordinates that describes geographic area of interest—in this case, a store. The geofence is constructed by drawing a bounding box or polygon around the store and parking lot and translating the vertices into latitude and longitude coordinates. Geofences also contain critical meta data, such as when the store first opened for business and when it shuttered operations in order to preserve point-in-time information.
› Oversimplifying a bit, Thasos looks for the intersection of coordinates from phones and geofences to determine potential visits to places of interest.
› Such visits, and the other metrics described on the following pages, form the foundation for measuring a broad range of economic activity: from shoppers at big box retailers to hours worked on assembly lines in manufacturing facilities.
# Core Products

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MallStreams and Attribution
Indexed Mall Visitation

**Notes:**
- Index values represent normalized customer visitation aggregated over 7-day rolling windows. Visitation is measured at the property-level and then aggregated to the company or index level.
- Enclosed Malls is an index created to measure the performance of all properties classified as enclosed regardless of which REIT owns or operates them. Similarly, CMBX 6+7 tracks all properties underlyng the CMBS deals associated with CMBX Series 6 and 7.
- The rank is meaningful here and denotes the average weekly visitation in absolute terms. URW, or Unabail-Westfield, attracts considerably more visitors than the average enclosed mall, which in turn attracts considerably more visitors than the average CBL mall.
- The plot also highlights business seasonality: Black Friday and Christmas are clearly visible along with at least 5 national holidays.
YoY Change in Mall Visitation

Notes:

- Values represent the year-over-year change in customer visitation aggregated over 91-day rolling windows.
- For the time period highlighted here, CBL did not trend consistently with the broad retail comeback that began in October 2017, though recent growth remains elevated relative to the CMBX indices.
Average Household Income of Mall Visitors

Notes:
- Income values represent the average household income, in thousands, of mall visitors each month. Income, which is a component of the Attribution product, is inferred from statistics for census blocks that we associate with phones in the core panel.
- Unabail-Westfield attracts wealthier customers than the average enclosed mall, which attracts significantly wealthier customers than the average CBL mall.
Average Visits per Person

Notes:
- Values represent the average number of visits per customer each month.
- An index representing all grocery-anchored open air malls replaces CBL to illustrate the Loyalty component of Attribution, which is the frequency of visitation per person per month.
- As expected, people visit grocery-anchored malls more frequently than traditional enclosed malls.
Average Distance Traveled

Notes:

- Values represent the average distance, in kilometers, between the census blocks associated with customers and the malls visited by those customers.
- The distance people travel to reach an enclosed mall, which tends to have destination restaurants, department stores, and other destination tenants, is about twice the distance people travel to visit grocery-anchored open air malls.
A Closer Look at Two Competing Malls
Diverging YoY Change in Mall Visitation

Notes:
- Values represent the year-over-year change in customer visitation aggregated over 91-day rolling windows.
- Century City, owned by URW, and Westside Pavilion, owned by MAC, are located within about 1.5 miles of each other and compete for customers in the same trade area. As recent events suggest, Century City has basically won the battle for customers in this particular trade area, but that was after committing to a $1 billion dollar redevelopment plan to bring on high-end destination tenants.
- An investor in this property would find it useful to know that, after opening Eataly and reaching a peak in YoY visitation in February, the visitation rate fell by 50% within 2 months.
- What caused the decline? Will the trend continue? What level of visitation is necessary to sustain the expensive new tenants?
Diverging YoY Change in Mall Visitation

Notes:
- Values represent the year-over-year change in customer visitation aggregated over 91-day rolling windows.
- The rapid decline in YoY growth was just a function of comparing visitation to a year ago when Macy's first opened for business.
- While visitation growth has rebounded and Century City appears to be in good health, the Attribution product enables a deeper analysis.
Declining Average Household Income

Notes:

- Income values represent the average household income, in thousands, of mall visitors each month. Income, which is a component of the Attribution product, is inferred from statistics for census blocks that we associate with phones in the core panel.
- Despite several top tier tenants opening for business, the average household income of visitors to Century City is declining. How does this impact the mall’s long-term prospects?
**Diverging Average Distance Traveled**

Notes:

- Values represent the average distance, in kilometers, between the census blocks associated with customers and the malls visited by those customers. Distance traveled is another component of Attribution.
- Eataly, Macy’s, and Nordstrom are all major destination tenants, which caused the average distance people travel to visit Century City to double in about a year.
- As people are attracted from greater distances, the average income level falls because the trade area in which these malls are located is significantly above the national average.
- In this case, decreasing income and increasing distance together are a positive sign for Century City. As shown in the next section, Applications for Investment Managers, income is a key variable for predicting property-level loan delinquencies.
Affinity: Where else do Century City Visitors Shop?

Notes:

▸ Values represent the percentage of all visitors to a specified mall, in this case Century City, who also visited a property owned or operated by the indicated companies during a specified month. Affinity is the final component of Attribution covered in these materials.

▸ The distribution tells us that Century City visitors prefer to shop at Kroger over Costco or Whole Foods by about 3-to-1.
Affinity: We Can Measure M’s Closure, But Can We Predict It?

Notes:
- Values represent the percentage of all visitors to a specified mall, in this case Westside Pavilion, who also visited that mall’s Macy’s anchor store each month.
- Affinity increases in the months prior to closure as liquidation sales commence and then drops to zero after March when Macy’s shuttered this particular location.
Applications for Investment Managers
Predicting Anchor Tenant Closures with Thasos Data Only

Notes:
- The above figures summarize the results from a model that predicts which stores owned by J.C. Penny, Macy’s, and Sears will close due to poor performance.
- Figure 1 shows the variables that are most important for the prediction. Figure 2 shows that, across 1,600 stores, 90 of which closed, the model has a precision of about 20%. While that leaves room for improvement, 20% should be thought of as a “lift” on a baseline model using financial data. From this perspective, a model 20% better than what everyone else uses provides a significant information edge.
Predicting Delinquent Loan Status

Notes:
- The above figures summarize the results from a model that predicts which mall properties will be unable to service their loans on agreed terms.
- Figure 1 shows the variables that are most important for the prediction. The baseline model in Figure 2 uses only the non-Thanos variables listed in Figure 1. As indicated by the blue line in Figure 2, Thanos variables provide significant “lift” over the baseline model, increasing precision from 63% to 76%.
- The model’s logic is explained in detail on the following page.
Notes:
- The model on the left is the same one that achieved the 76% precision on the previous page.
- One of the nice properties of a decision tree, unlike many other machine learning models, is that the internal logic can be easily visualized and validated against a fundamental understanding of the variables and the problem.

1. Starting at the top of the tree diagram, if the interest rate on the loan is less than or equal to 5.3%, then the model classifies the loan status as current.
2. If greater than 5.3%, then the model checks the prior loan status. If that value is delinquent, then the model classifies the loan as delinquent.
3. If prior loan status is current, the model checks whether the interest coverage ratio is less than or equal to 1.39x. If true, the baseline model would’ve classified the loan as delinquent. However, Thasos provides “lift” at this point by allowing the model to next check total mall visitation. If the visitation index is less than or equal to 0.73, then the model classifies the loan as delinquent; otherwise, the class is current.
4. On the other hand, if the interest coverage ratio exceeds 1.39x, Thasos adds “lift” again by next checking the average household income of mall visitors. If income is greater than $62,000, then the model classifies as current.
5. If income is less than or equal to $62,000, then the model checks whether the tenant occupancy is less than or equal to 94%. If true, then the model classifies as delinquent; otherwise current.
Pairs Trade on REITs using MallStreams

Signal: Derivative of YoY Change in Visitation

Strategy: Long Top 5, Short Bottom 5

Notes:
- This page and the next illustrate one of the most direct ways to monetize MallStreams visitation data: a pairs trade on the REIT stocks themselves. Oversimplifying a bit, the model ranks REITs by visitation each week and then takes long positions in the top 5 and short positions in the bottom 5.
- The figures on the left illustrate how the signal is constructed and positions are derived.
- Figure 1 shows the signal for just 4 of 30 total REITs during a few months in 2017. The signal is technically the first derivative of the year-over-year change in customer visitation across all mall properties on a quarterly rolling basis. The model uses this measurement to rank the REITs by which have the strongest increases or decreases in quarterly rolling YoY visitation. In October, GGP and SKT had the highest ranks, while WRE and AKR had the lowest, so they’re included in the long and short baskets during that timeframe, as indicated in Figure 2.
- Figure 2 shows the positions taken in the 10 specified REITs during the months indicated, with blue denoting long and gray denoting short. White indicates that the REIT was not in the top 5 or bottom 5. Positions taken on those days were in other REITs not shown here for simplicity.
- Despite re-evaluating ranks each week, the long position for TCO in Figure 2 demonstrates that holding periods can persist for months.
- The model’s performance and stability are summarized on the following page.
Pairs Trade on REITs using MallStreams

1.8 Sharpe Using Visitation Only

- Figure 3 shows the return profile for the strategy, which yields a 1.8 Sharpe and a 9% return over approx. 2 years.
- The strategy is dollar neutral and unlevered, ignoring the inherent leverage in any short position. If $100 were allocated to the strategy, $50 would be allocated to long and $50 to short.
- The model makes no attempt to account for transaction costs, liquidity, or other factors relevant to assessing performance.
- Figure 4 shows that the model remains stable when varying the main parameter, which is the lag or expected time needed for the market to assimilate this and similar fundamental information. That the performance stability extends to a lag of 20-25 days suggests that the market has not yet broadly incorporated the fundamental information in MallStreams, at least for this type of application.

Insensitive to Sole Parameter: Signal Lag
Pairs Trade on CMBX Series 6 and 7

1. Signal: Difference in YoY Change in Visitation

- CMBX6 Minus CMBX7
- 28-Day Trend

2. 2.2 Sharpe Using Visitation Only

3. 3.0 Sharpe Using Visitation and Attribution

Notes:
- To interpret the signal plot in Figure 1, the blue line represents the difference between the YoY change in visitation to CMBX Series 6 malls and Series 7 malls. The green line is a 28-day rolling window (trend line) of that difference. When the blue line exceeds the green line, Series 6 is outperforming Series 7 and we take long and short positions accordingly.
- In Figures 2 and 3, the dotted gray line corresponds to the right y-axis and represents the positions taken in Series 6 and 7.
- In Figure 3, the model adds only the income component of Attribution. By trading only when the visitation and income signals agree, the strategy eliminates the largest drawdowns and improves the Sharpe considerably.