Banking Project Report on:

Computing three stock market informativeness measures for banking industry

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Dec2021-Jan 2022

Introduction

Stock price informativeness (later mentioned as SPI) indicates how much (private) information is present in stock prices. There have been numerous efforts to find or relate indices and financial variables to SPI, four of which we have tried to calculate for Iranian banks in this project. These measurements are including, but not limited to:

- *Stock return non-synchronicity*: Defined as the part of stock returns that are not explained by the market/industry movements, this measure is basically calculated from estimating R^2 in the regression below:

$$r_{i,j,t} = a_i + b_i r_{j,t} + c_i r_{m,t} + \varepsilon_{i,j,t} \quad (1)$$

  $r_{i,j,t}$ in eq. 1 is the return of stock ***i*** in industry ***j*** at time ***t***, where $r_{j,t}$ and $r_{m,t}$ are the return of industry and market respectively. Eq. 1 is one of the most basic forms of the estimation procedure, as one can use n-factor models for the estimation of R^2. Roll [1988] explains that $1 - R^2$, whatever that is left unexplained by the model (market/industry/etc. movements), is showing either private information or occasional frenzy-trading not related to concrete information. We have used $\ln(\frac{1-R^2}{R^2})$ as the first measure of SMI.

- *Amihud's illiquidity ratio*: It represents the response of price to daily currency-volume of trade. One can compute the ratio for different time frequencies and for different scales of a currency. The order of magnitude for this measure was around 10^6 for American stocks in the 90's. we have used this measure scaled by 1000 Tomans as the second measure of SMI.

$$ILLIQ_{iy} = \frac{1}{D_{iy}} \sum_{d=1}^{D_{iy}} \frac{|R_{iyd}|}{VOLD_{iyd}} \quad (2)$$

  In eq. 2, $ILLIQ_{iy}$ is the illiquidity ratio of stock ***i*** in year ***y***, D_{iy} represents the number of available data days in year ***y*** for stock ***i***, R_{iyd} is the daily return of stock ***i*** in year ***y*** at day ***d***, and $VOLD_{iyd}$ is the dollar-volume traded of the stock in the same day in year ***y***.

- *Future earnings response coefficient (FERC)*: The pillars of FERC and FINC are based upon the same regression as explained in Durnev [2003]:

$$r_t = a + b_0 \Delta E_t + \sum_\tau b_\tau \Delta E_{t+\tau} \, (+ \sum_\tau c_\tau \mathrm{r}_{\mathrm{t}+\tau}) + \varepsilon_t \quad (3)$$

  In eq. 3, r_t is the annual return at time ***t***, ΔE_t represents the changes in EBITDA of the stock divided by its market value at the beginning of the fiscal year of the stock, $\Delta E_{t+\tau}$ is the earnings per share (EPS) change τ periods ahead scaled by the price at the beginning of current year, and $r_{t+\tau}$ is the annual return τ periods ahead. Collins et al. [1994] recommend including $r_{t+\tau}$ as control variables in the regression. Eq. (3) proxies for current unexpected earnings using current change in earnings, and for changes in expected future earnings using changes in reported future earnings.

FERC is then calculated after estimating eq. (3) with $\sum_\tau b_\tau$. It shows the magnitude of response of unexpected future earnings on current returns. Together with the next measure, we have tried to estimate these measures of SPI as the third measure.

- *Future earnings incremental explanatory power (FINC)*: Based on eq. (3) too, FINC is computed from estimating eq. (3) with and without future EPS changes and controls:

$$FINC = R^2_{r_t = a + b_0 \Delta E_t + \sum_\tau b_\tau \Delta E_{t+\tau} (+ \sum_\tau c_\tau r_{t+\tau}) + \varepsilon_t} - R^2_{r_t = a + b_0 \Delta E_t + \varepsilon_t}$$

It illustrates the incremental explanatory power of future earnings.

Ideally, the higher each of these measurements, the more informative the stock price.

Methodology and Data Initiation

Trading data and historical market values of each stock has been collected from TSETMC. Historical data on EPS and EBITDA are gathered from Codal. Initially, all the stocks were checked if they were open for trade for at least 70% of their time in SE market so that, on average, at least more than 30 weekly observations would be available annually.

For stock price non-synchronicity, weekly price data is used. As in eq. 1, $r_{i,j,t}$ is the weekly return of stock ***i*** in industry ***j*** in week ***t***, $r_{j,t}$ is the weekly return of industry ***j***, and $r_{m,t}$ is the weekly return of market. Stock price non-synchronicity is then calculated as explained in introduction. This SPI measure is considered as the base throughout the project for SPI comparison. The measure is computed both annually and totally for each bank.

Amihud's illiquidity ratio is calculated using daily data, both annually and totally, as $VOLD_{iyd}$ is essentially the dollar volume traded of stock ***i*** in year ***y*** in day ***d***. the ratio is traditionally scaled by 10^6, however, we scaled it by 1000 Tomans due to differences in currency and market. Zero-volume trading days are omitted from the dataset. For annual ratio calculation, only the years in which at least 30 open days are available for the stock are used. Due to Iran SE market's limited return floor and ceiling, a better approach could be calculating the ratio for weekly data, but then the annual ratio would be limited to half of the dataset because there are not more than 30 open weeks for some banks in each year.

As for FERC and FINC, data on EPS and EBITDA are extremely limited for Iranian banks and it is impossible to duplicate the same methodology as Durnev [2003]. Also, this project's aim is to calculate these measures for Iranian banks, not to calculate the measure for several industries with different groups of stock return non-synchronicity. Initially, 8 banks are selected from the dataset by stock return non-synchronicity level, 4 highest and 4 lowest overall. Another approach would be to select banks each year over the annual return non-synchronicity. After the selection, FERC and FINC are determined for each group. Finally, the difference in the measures between the two groups could tell if the first measure is consistent with the last two. Again, because of extremely

limited data for FERC and FINC, eq. 3 could not be regressed annually. The regressions below could potentially illustrate the correlation between these measures and return non-synchronicity if: 1. More years of data was available and 2. The SE market had more banks.

$$\Delta FINC = \alpha + \beta\Delta\psi + \sum_{k} \gamma_k C_k + \varepsilon$$

$$\Delta FERC = \alpha + \beta\Delta\psi + \gamma C + \varepsilon$$

Where Δ shows the difference between high synchronous and low synchronous groups, ψ is the return non-synchronicity measure, and C_k are control variables. For more robust results, eq. 3 is estimated with and without control variables in the parenthesis.

Results and Conclusion

The stock price return non-synchronicity is decreasing around 2018 for almost all the banks. Changes in the annual non- synchronicity measure are mostly because there are only 48 weeks in each year, hence the lack of observations. This decrease could partly be due to the extreme increases and decreases of the market index at the time. As the whole market was affected by the massive population submitting and entering the market, the role of public information and market/industry movements became more abundant. The same could be said about the annual illiquidity ratio, however, the decrease is mostly because of the increase in trading volume and the huge increase in the stocks' value. Data for annual measures of each bank are all separately plotted in the results folder.

After trimming out the quintile below 10% and above 90% for the illiquidity ratio, regression of illiquidity on non-synchronicity shows the positive and significant relation between the two. This is an ideal result, as mentioned before, positive correlations between measures are the ideal result we are looking for. As Figure 1 illustrates, the higher the non-synchronicity, the bigger the variance (error terms are widening), hence selecting the GLS regression for it. The result of the GLS regression is printed in detail inside the Jupyter notebook.

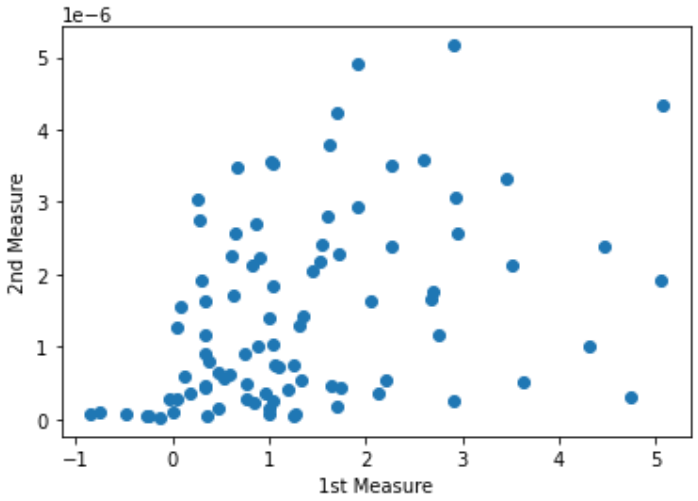

Figure 1: annual illiquidity ratio of Iranian banks on their respective annual return non-synchronicity.1st Measure is the annual return non-synchronicity and 2nd Measure is the annual illiquidity ratio, as explained in Introduction.

There are only two points estimated for each of the last two measures. FERC is higher for banks with higher non-synchronicity, but FINC is lower. The conclusion for the last two measures is ambiguous at best, because we only have 2 data points for each of them. Nothing much can be concluded about the positive or negative relation of these measures with the return non-synchronicity. Also, with only 16 and 15 observations for high and low non-synchronicity groups available for FERC and FINC estimations, even the regressions without control variables lack at least 25 observations for an acceptable estimation as a rule of thumb.

P.S.: *This is only a brief report on the idea and the process of the project, for more detailed information on the regression results, plots and calculations, please refer to the results folder and Jupyter notebook file/PDF. PDF files of references to the whole project is provided in the project folder too. References mentioned below are only references to the papers that are directly written about in the report.*

References

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