

# **Claude Skills, Fundamental Indicators**

BUSI 722: Data-Driven Finance II

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# Database Access

# The Rice Data Portal

- We will use the **Rice Data Portal** for stock market data.
- The portal provides daily prices, valuation metrics, and fundamental data from SEC filings.
- Four main tables:
  - **SEP** – daily stock prices (open, high, low, close, volume)
  - **DAILY** – daily valuation metrics (marketcap, pb, pe, ps)
  - **SF1** – fundamentals from 10-K/10-Q filings
  - **TICKERS** – company metadata (sector, industry)

## Storing Your Access Token

Visit [data-portal.rice-business.org](http://data-portal.rice-business.org) to get an access token.

**Prompt:** “Create a .env file with my Rice access token: abc123...”

Claude creates a .env file: RICE\_ACCESS\_TOKEN=abc123...

- The .env file keeps your token out of your code.
- Python's dotenv library loads it automatically.
- Add .env to .gitignore to avoid sharing your token.

# Step 1: Fetch Monthly Returns

## Fetching Returns

**Prompt:** “Get monthly returns for all stocks from 2010 onward and save as monthly.parquet.”

Claude uses the `fetch-returns` skill, which:

1. Queries **SEP** for end-of-month prices, **DAILY** for market cap, and **TICKERS** for sector/industry
2. Calculates return, momentum, and lagged return
3. Assigns size categories (Nano- through Mega-Cap)

Includes **delisted stocks** by default to avoid survivorship bias.

## Returns Data: What You Get

```
>>> df = pd.read_parquet("monthly.parquet")
>>> df.shape
(544262, 8)
>>> df.columns
['ticker', 'month', 'return', 'momentum', 'lagged_return',
 'close', 'marketcap', 'pb']
```

```
>>> df[df.ticker=="AAPL"].head(5)
ticker    month   return  momentum  lagged_return  close  marketcap  pb
AAPL 2010-02  0.0655       NaN          NaN  6.859  174151.7  4.9
AAPL 2010-03  0.1484       NaN  0.0655  7.308  185551.9  5.2
AAPL 2010-04  0.1110       NaN  0.1484  8.393  213100.4  6.0
AAPL 2010-05 -0.0161       NaN -0.0161  9.325  237584.9  6.0
AAPL 2010-06 -0.0208       NaN -0.0161  9.174  233737.7  5.9
```

## How Momentum Is Calculated

Momentum is the cumulative return from month  $t-13$  to month  $t-2$ :

$$\text{momentum}_t = \frac{\text{closeadj}_{t-2}}{\text{closeadj}_{t-13}} - 1$$

- Skips the most recent month ( $t-1$ ): short-term reversal contaminates the signal.
- Uses split- and dividend-adjusted prices (`closeadj`); requires 13 months of history.
- All calculations are **grouped by ticker** — never mixing prices across stocks.

## Variables from the Returns Step

- ticker, month (identifiers); return (monthly, decimal); momentum (12-month skipping recent); lagged\_return (prior month)
- close (split-adjusted price); marketcap (in thousands, **shifted by 1 month**); size (Nano- through Mega-Cap)
- sector, industry – classifications from TICKERS table

# Step 2: Fetch Fundamentals

## Precomputed vs. Calculated Variables

**Rule:** Before calculating any ratio, check if it already exists in the database.

**Precomputed in DAILY:** marketcap, pb, pe, ps, ev, evebit, evebitda

**Precomputed in SF1:** roe, roa, grossmargin, netmargin, de (leverage), assetturnover, currentratio

**Must calculate:**

- Growth rates: asset growth, revenue growth
- Custom ratios: gross profit / assets, book-to-market

## Fetching Fundamental Data

**Prompt:** “Get annual fundamentals from SF1: equity, assets, gross profit, and the precomputed ratios roe, grossmargin, assetturnover, and de. Calculate asset growth and gross-profit-to-assets. Save as `fundamentals.parquet`.”

Claude uses the `fetch-fundamentals` skill, which:

1. Checks which variables are precomputed, then queries SF1 for annual data (`dimension='ARY'`)
2. Calculates growth rates **before** merging (critical!)
3. Queries DAILY for valuation ratios if requested and shifts them by 1 month

## Why Calculate Growth Rates Before Merging?

After merging, fundamentals are **forward-filled**: each filing's values repeat every month until the next filing.

**The Problem:** If you calculate `pct_change()` after forward-fill, consecutive months with the same value produce **zero growth** — which is wrong.

**Solution:** Calculate growth from the raw SF1 data (one row per filing), where consecutive rows are consecutive filings.

```
df_fund['asset_growth'] = df_fund.groupby('ticker')  
                           ['assets'].pct_change()
```

## Step 3: Merge Returns & Fundamentals

## Merging the Datasets

**Prompt:** “Merge monthly.parquet with fundamentals.parquet and save as merged.parquet.”

Claude uses the `merge-data` skill, which:

1. Aligns fundamentals to the first month **after** the SEC filing date, then merges on (ticker, month)
2. Forward-fills fundamentals within each ticker, then shifts SF1 variables and close by 1 month
3. Applies data quality filters

## Merged Data: What You Get

```
>>> df = pd.read_parquet("merged.parquet")
>>> df.shape
(886460, 20)
>>> df[df.ticker=="AAPL"].dropna().head(5)
```

ticker	month	return	momentum	close	marketcap	pb	roe	grossmargin
AAPL	2012-02	0.1883	0.1936	16.303	425612.0	4.7	0.396	0.405
AAPL	2012-03	0.1053	0.2924	19.373	505758.5	5.6	0.396	0.405
AAPL	2012-04	-0.0260	0.5564	21.413	559015.5	6.2	0.396	0.405
AAPL	2012-05	-0.0107	0.7123	20.857	546072.5	5.3	0.396	0.405
AAPL	2012-06	0.0109	0.6789	20.633	540207.8	5.3	0.396	0.405

Note: roe and grossmargin are constant across months — they reflect the most recent annual filing, forward-filled and shifted.

# Avoiding Look-Ahead Bias

## The Core Problem

We want each row to represent: **what we knew at the start of the month** paired with **what happened during the month**.

**Look-Ahead Bias:** Using information that was **not yet available** at the time of the investment decision. Backtests that suffer from this overstate performance — sometimes dramatically.

## How the Skills Handle It

- **Market cap, DAILY ratios, and close price:** all shifted by 1 month so January's values come from end of December.
- **SF1 fundamentals** (roe, de, etc.): aligned to the first month *after* the SEC filing date, then forward-filled, then shifted by 1 month.
- **Momentum and lagged return:** built with a lag by construction (momentum uses  $t-13$  to  $t-2$ ; lagged return uses  $t-1$ ).

## Summary of Shifts

Variable	Source	Shifted By
marketcap, pb, pe, ps	DAILY	1 month after fetching
close	SEP	1 month after merging
roe, de, grossmargin, ...	SF1	filings date + 1 month after merge
momentum	SEP	built-in (uses $t-13$ to $t-2$ )
lagged_return	SEP	built-in (uses $t-1$ )
return	SEP	not shifted (target variable)

return is the **only variable that is not known at the start of the month**. It is what we are trying to predict.

# Data Filters

## Data Quality Filters

The `merge-data` skill applies two filters automatically:

- **Price filter:** drop rows with `close < $5.00`
- **Missing data:** drop rows with any `Nan` values

Before filters:	886,460 rows	9,375 tickers
After filters:	589,006 rows	6,825 tickers

## Penny Stocks

- Must filter out low-price stocks. Infeasible for equally weighted portfolios and distort portfolio returns.
- Use CQA Competition filter: \$5.60?
- Example: Tell Claude to read the data and drop all rows with  $\text{close} \leq \text{price}$  threshold. Sort into quintiles each month on momentum and lagret and compute average returns.

## Market Cap Filters

- If we were managing a fund, we would specify the universe of stocks in our prospectus.
- We would likely include some market cap filter: large cap = S&P 500, large and midcap = Russell 1000, smallcap = Russell 2000, etc.
- It is hard for large funds to trade microcaps, so they will exclude them.

# The Complete Workflow

## End-to-End Prompts

1. “Get monthly returns for all stocks from 2010 onward. Save as `monthly.parquet`.”
2. “Get annual fundamentals from SF1: equity, assets, gp, and the precomputed ratios roe, grossmargin, assetturnover, de. Calculate asset growth and gp/assets. Save as `fundamentals.parquet`.”
3. “Merge monthly returns with fundamentals. Save as `merged.parquet`.”

Three prompts produce a complete, bias-free panel dataset ready for portfolio analysis or machine learning.

## The Final Dataset

```
>>> df = pd.read_parquet("merged.parquet")
>>> df.shape
(589006, 17)
>>> df.columns
['ticker', 'month', 'return', 'momentum', 'lagged_return',
 'close', 'marketcap', 'pb', 'asset_growth', 'roe',
 'gp_to_assets', 'grossmargin', 'assetturnover', 'leverage',
 'sector', 'industry', 'size']
>>> df.ticker.nunique()
6825
```

589,006 stock-months × 17 variables, spanning 2011–2025, covering 6,825 stocks (including delisted).