

"Stock returns are positively correlated to beta overnight, whereas returns are negatively related to beta during the trading day"¹

Why Invest in Stocks?

Investors buy stocks to earn higher rates of return compared to other types of investments, i.e. fixed income securities. Of course the reason stocks are predicted to earn more is that investing in stocks is seen as riskier than investing in fixed income securities.

The question then becomes how much more should an investor earn by investing in a risky asset relative to investing in one that is judged to be "risk free". Or put another way,

"A fundamental question in finance is how the risk of an investment should affect its expected return. The Capital Asset Pricing Model (CAPM) provided the first coherent framework for answering this question"²

In calculating expected returns, CAPM considers three components:

- Return on a "risk free investment"* - typically measured using a short term US Treasury instrument
- Equity Risk Premium (ERP)- the additional return an investor should require for broadly investing in the equity markets versus investing "risk free"
- Beta - the volatility of a single asset relative to the overall equity market

Equity investors therefore make two key decisions when constructing portfolios. This first is how much exposure do they want to the "equity risk premium". The second is if/how to adjust the beta of their overall equity portfolio to end up with more or less exposure to equity risk.

Buying Beta

Equity investors who do anything more than simply invest in the broad market, i.e. the S&P 500, are likely taking on higher or lower levels of beta exposure whether they mean to or not.

As Charles Schwab tells investors,

"Beta is the risk in an investment that cannot be diversified away. It is a measurement of the volatility of an investment compared to the market as a whole. By definition, the beta of the benchmark index is 1.0. A fund with a beta of 1.10 tends to be 10% more volatile than the market, while a fund with a beta of 0.90 tends to be 10% less volatile than the market. Usually, higher betas represent riskier investments"³

Equity investors can adjust the beta of their portfolios in multiple ways - through the purchase of individual stocks or by buying investment products with betas greater or less than 1.0. One example of an investment product with a beta different from one is a Sector Exchange Traded Fund (ETF).

* All investments carry some degree of risk.

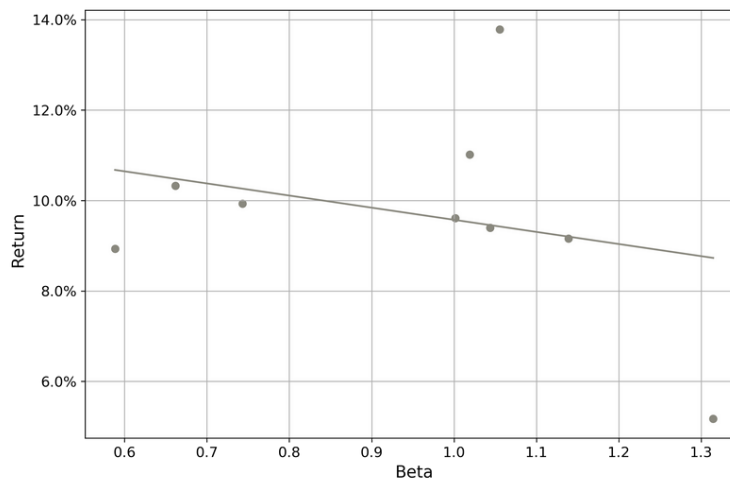
¹ "Asset Pricing: A tale of night and day", Hendershott, Livdan and Rosch, Journal of Financial Economics, 2020

² "The Capital Asset Pricing Model", Andre Perold, Journal of Economic Perspectives, Summer 2004

³ Schwab.com, November 2022

Sector ETFs give investors diversified exposure to an individual industrial sector, eg. Utilities, Consumer Staples or Energy. These diversified investment products, each with their own beta relative to the S&P 500, provide insights as to how risk and return are related (see Appendix A for additional information on Sector ETFs).

Based on CAPM, one would expect higher beta sector ETFs to deliver higher returns (more risk, more return). However, Chart 1 shows that not to be case:



Source: AlphaTrAI (9/30/2002 - 9/30/2022), nine of eleven S&P 500 sectors representing ~ 90% of the S&P 500 market capitalization used in the analysis given two sectors have limited history given their inception dates: XLRE (2015) and XLC (2018)

Sector ETFs with a beta around 1.0 range in return from 9.4 to 13.8 percent. The sector with the highest beta (financials) has the lowest return at 5.2 percent. While these results are not expected, they should not be surprising as “most empirical studies find little relationship between beta and returns in the cross-section of stocks”¹

Buying the Equity Risk Premium

Does this mean that the CAPM is wrong? Or is there another way to effectively buy the Equity Risk Premium with beta in mind?

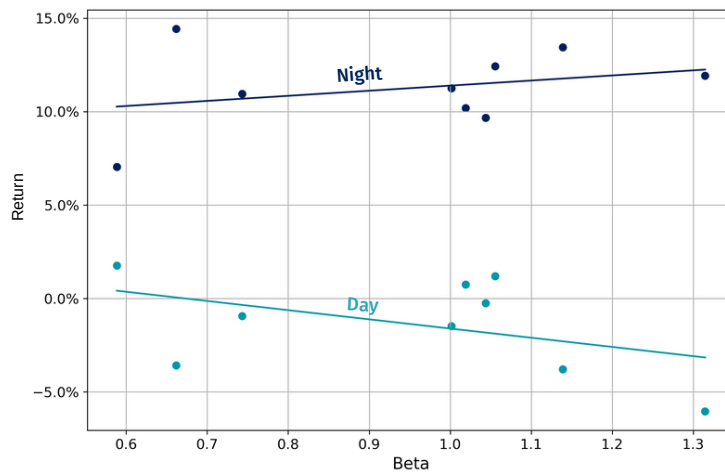
The answers to these types of questions are often hiding in plain sight. As three academics wrote in a paper published in the Journal of Financial Economics in 2020:

“The capital asset pricing model (CAPM) performs poorly overall, as market risk (beta) is weakly related to 24 hour returns. This is because stock prices behave very differently with respect to their sensitivity to beta when markets are open for trading versus when they are closed. Stock returns are positively correlated to beta overnight, whereas returns are negatively related to beta during the trading day”¹

The empirical work used to draw these conclusions was based on a series of beta-decile portfolios dating from 1992 to 2016. This work is powerful although it doesn't represent more recent trading periods and beta-decile portfolios aren't readily available to most investors.

To further explore this disconnect in using beta to understand equity returns (and risk) over varying trading periods, we substituted Sector ETFs for beta-decile portfolios. Sector ETF are strong proxies as they a) represent diversified portfolios with varying betas and b) given they trade on exchanges, they provide daily price quotes at both market open and market close to distinguish between overnight and daytime returns.

A sector based beta vs. return analysis incorporating different market sessions shows a compelling difference between the night and day (Figure 2):



Source: AlphaTrAI (9/30/2002 - 9/30/2022), nine of eleven S&P 500 sectors representing ~ 90% of the S&P 500 market capitalization used in the analysis given two sectors have limited history given their inception dates: XLRE (2015) and XLC (2018)

The overnight session shows that returns are correlated with risk, as measured by beta. Conversely, the day session returns decline as risk is added. The sector with the lowest beta (consumer staples) had a daytime return of 1.77% while the sector with the highest beta (financials) had a daytime return of -6.03%.

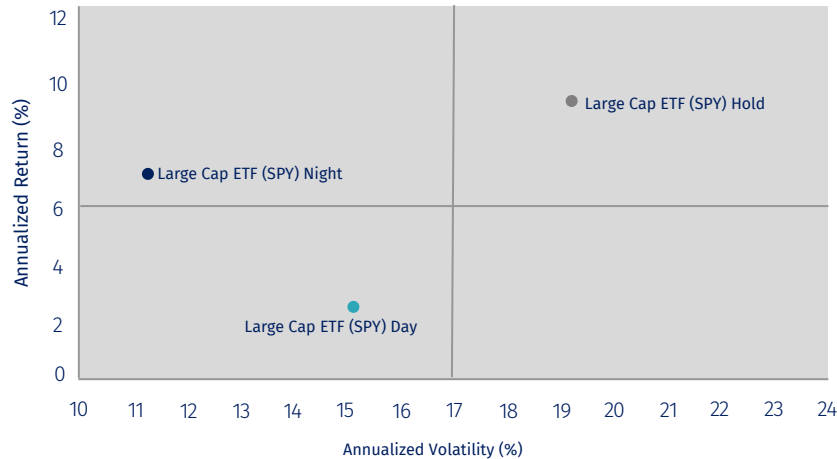
Capturing the Night Effect

Many equity investors however may not want to buy a limited number of sectors (and hold them during only a portion of the 24 hour trading cycle) but rather simply invest in the broader equity markets to capture the Equity Risk Premium . As a case in point, there is close to \$1 trillion invested in the three largest ETFs, each one focused on delivering exposure to the S&P 500⁴.

⁴ SPY/IVV/VOO, VettaFi, Nov 2, 2022

As the sector analysis shows, risk and return are different in the day than they are at night. A trio of academics wrote in 2008,

“The US equity premium over the last decade is solely due to overnight returns; the returns during the night are strongly positive, and returns during the day are close to zero and sometimes negative”⁵



Source: AlphaTrAI (9/30/2002 - 9/30/2022), returns based on large cap ETF (SPY) open/closing prices as index data not available for open and closing market sessions

Market returns vary over time and over the last 20 years, the 9.75% annualized return in the S&P 500 was driven by the 7.14% return in the overnight session versus the 2.43% return during the day (and with night having much lower volatility)⁶. In other words, the night delivered the majority of CAPM’s equity risk premium.

Markets are complicated and no single model can consistently explain the relationship between risk and return. Investment knowledge builds upon itself as professionals leverage new data sources and analysis to create new insights. And from new insights come better investment strategies.

⁵ “Return Differences between Trading and Non-Trading Hours: Like Night and Day, Cliff, Cooper and Gulen, September 2008

⁶ AlphaTrAI, 9/30/2002 - 9/30/2022, ETF (SPY) used to calculate returns as index data not available on market open and market close

Appendix A

Sector	Ticker	Beta	Return (%)	Volatility (%)	Weight (%)
Financials	XLFX	1.31	5.17	29.63	11.55
Energy	XLE	1.14	9.16	29.87	5.44
Technology	XLK	1.06	13.78	22.32	26.17
Materials	XLB	1.04	9.40	23.55	2.55
Consumer Discretionary	XLY	1.02	11.02	21.75	10.77
Industrials	XLI	1.00	9.61	21.17	8.30
Health Care	XLV	0.74	9.93	17.29	15.40
Utilities	XLU	0.66	10.32	18.95	2.99
Consumer Staples	XLP	0.59	8.93	14.45	6.94

Note; Total of 11 Select SPRRs with varying inception dates. Two sectors, Communications (XLC) and Real Estate (XLRE), excluded from the analysis given their inception dates fell outside of the 20 year time horizon used for this analysis, the nine sectors shown reflect ~90% of total S&P 500 market capitalization.

Source: sectorspdr.com (weight) and AlphaTrAI analysis (beta, return, volatility)

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