

Empirical Asset Pricing

You have 2 hours to complete the exam. The exam is open-book. Good luck!

1. In the working paper "Carry", Kojen, Moskowitz, Pedersen, and Vrugt show that carry strategies are profitable not just for currencies but for a range of different asset classes.

(a) They define 'carry' as the return the investor would make if the price did not change. Apply this concept to equity and define formally the carry return for a stock.

Answer: $\text{Return} = \frac{D_{t+1}}{P_t}$ which is the dividend yield expressed in terms of future dividends

(b) Given your definition of carry from part (a), does this anomaly remind you of other anomalies that we discussed in class as far as Equities are concerned? Which one? Why?

Answer: The value anomaly largely overlaps with a dividend yield anomaly. That is, stocks with high dividend yield tend to be high BM stocks

(c) How would you test the profitability of a carry strategy based on US stocks? In your explanation, be detailed about your testing approach and the adjustment for risk that you would employ.

Answer: I would form portfolios based on the deciles of the dividend yield distribution. Then, regress portfolio returns on the three-factors of Fama and French. In some specifications, I would also include a momentum and a liquidity factor.

(d) The authors find that a carry strategy based on global equity (long in high-carry and short in low-carry stocks) earns an unconditional alpha relative to the global market portfolio of 0.86% monthly, the unconditional beta on the market factor is -0.07. The strategy however does poorly in recessions. How would you explain the fact that the strategy has an almost zero beta and, at the same time, its returns decline in recessions, when the market also does poorly?

Answer: It's possible that the conditional beta, in recessions, is high. So, on average the unconditional beta is close to zero because recessions are a low frequency event.

(e) Could the finding of part (c) provide a risk-based explanation of the abnormal performance of the strategy within the framework of one-factor models? Provide a formal answer.

Answer: Follow the explanation in Lewellen and Nagel (JFE 2006) on how the conditional CAPM could explain the anomalies (that's the formalilty that was requested by the question), but it does not work in practice because it does not get the magnitudes right.

(f) The authors find that the annual Sharpe Ratio of this strategy is 0.93. Is this large? Why yes, why not?

Answer: The Sharpe Ratio is high. Compare to about 0.5 for the market factor.

(g) Kent Daniel, who was the discussant of the paper at a recent conference, made the point that this Sharpe Ratio is not compatible with risk based explanations because it requires implausibly large volatility of consumption growth. Try to make the same

argument starting from the pricing equation for any consumption based asset pricing model:

$$E(mR^e) = 0$$

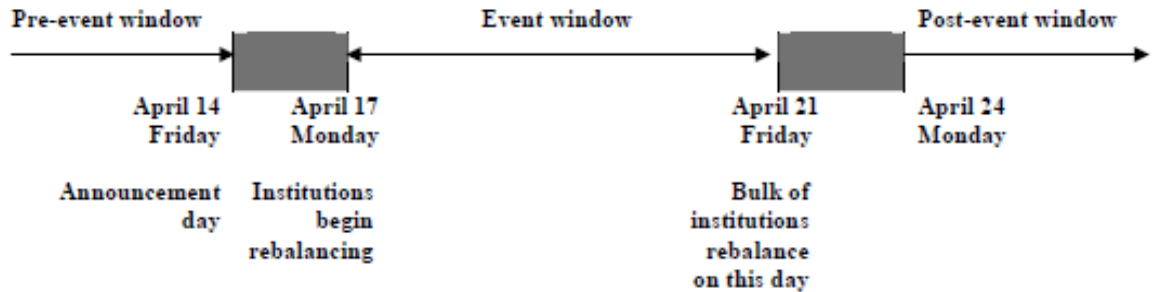
where m is the stochastic discount factor and R^e is the excess return on the strategy. Hint: derive an expression for the Sharpe Ratio of the strategy as a function of the $Cov(m, R^e)$, then use the fact that the covariance can be written in terms of the correlation between m and R^e . Then, obtain an upper bound for the Sharpe Ratio as a function of the risk free rate and the volatility of the stochastic discount factor. Finally, notice that Kent Daniel's point was based on making a judgement call on how high the volatility of the stochastic discount factor could be.

Answer: These are the Hansen-Jagannathan Bounds. See Cochrane's Asset Pricing book for a derivation.

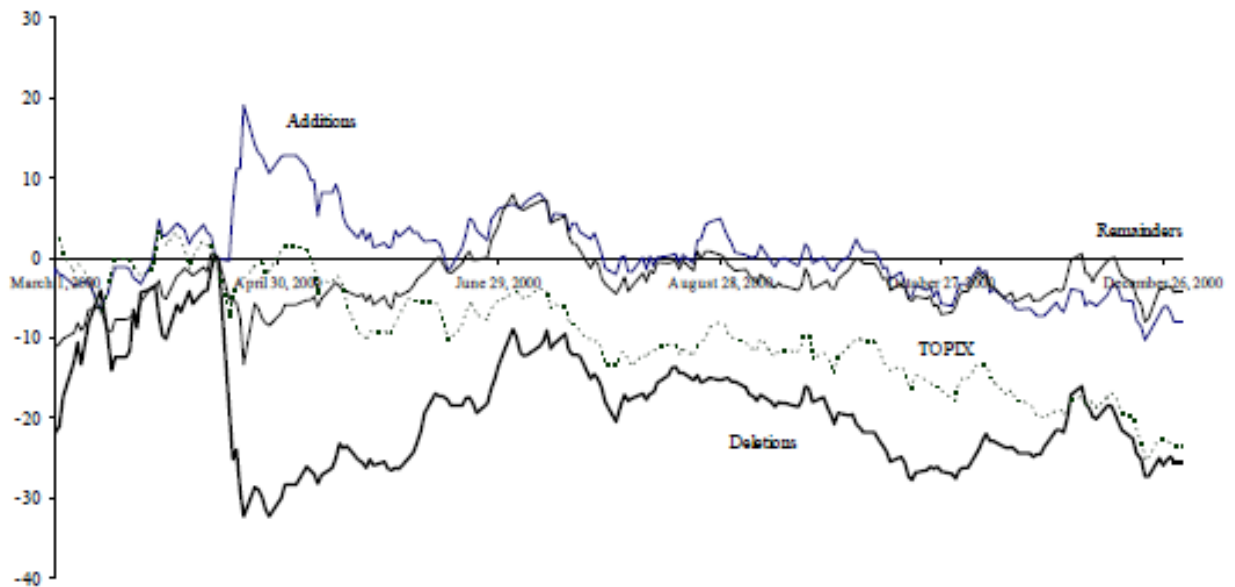
2. In the paper "Short- and long-term demand curves for stocks: theory and evidence on the dynamcis of arbitrage", JFE 2005, Robin Greenwood studies the effect of the Nikkei 225 index redefinition for stocks that are in the index and stocks that are outside the index. The working assumption of the paper is that demand curves for stocks slope down. That is, asset demand causes price pressure, as arbitrage is limited. In this context, the institutional portfolio rebalancing that followed the index redefinition caused price pressue on stocks in and out of the index. The author develops a model to make predictions about the direction and magnitude of these price effects in the short and long run and he tests the model empirically. Here's the abstract of the paper:

I develop a framework to analyze demand curves for multiple risky securities at extended horizons in a setting with limits-to-arbitrage. Following an unexpected change in uninformed investor demand for several assets, I predict returns of each security to be proportional to the contribution of that security's demand shock to the risk of a diversified arbitrage portfolio. I show that securities that are not affected by demand shocks but are correlated with securities undergoing changes in demand should experience returns related to their hedging role in arbitrageurs' portfolios. Finally, I predict a negative cross-sectional relation between post-event returns and the initial return associated with the change in demand. I confirm these predictions using data from a unique redefinition of the Nikkei 225 index in Japan, in which 255 stocks simultaneously undergo significant changes in index investor demand, causing more than ¥2,000 billion of trading in one week and large price changes followed by subsequent reversals for all of the reweighted stocks.

- (a) Here is the sequence of events:



Given this sequence of events, how would you explain the cumulative return patterns of the stocks that are added to the Index (Additions), excluded from the Index (Deletions), and which stayed in the Index (Remainders), as shown in the below figure? Make sure you comment on both the short and the long run behavior of the cumulative returns for Additions and Deletions.



Answer: There is positive price pressure for Additions and Negative pressure for Deletions in the short run. This is likely due to institutions buy/selling to track the benchmark portfolio. In the medium run the effect of price pressure partly reverts.

- (b) In the model, arbitrageurs provide liquidity to institutions that rebalance their portfolios after the index redefinition. So, arbitrageurs go short (long) the securities that are added to (excluded from) the index. At the same time, arbitrageurs hedge these positions using other stocks that are not affected by the index redefinition. In each of the following three cases, state which group of stocks you would expect the short-run event return from the index redefinition to be larger, keeping everything else equal. Motivate your answer using the theoretical framework given above and keep in mind that the index is value-weighted.
- Newly included stocks with high market market capitalization Vs. newly in-

cluded stocks with small market capitalization

Answer: High Mkt Cap stocks, because they rank higher in the index and there's more demand for them by institutions.

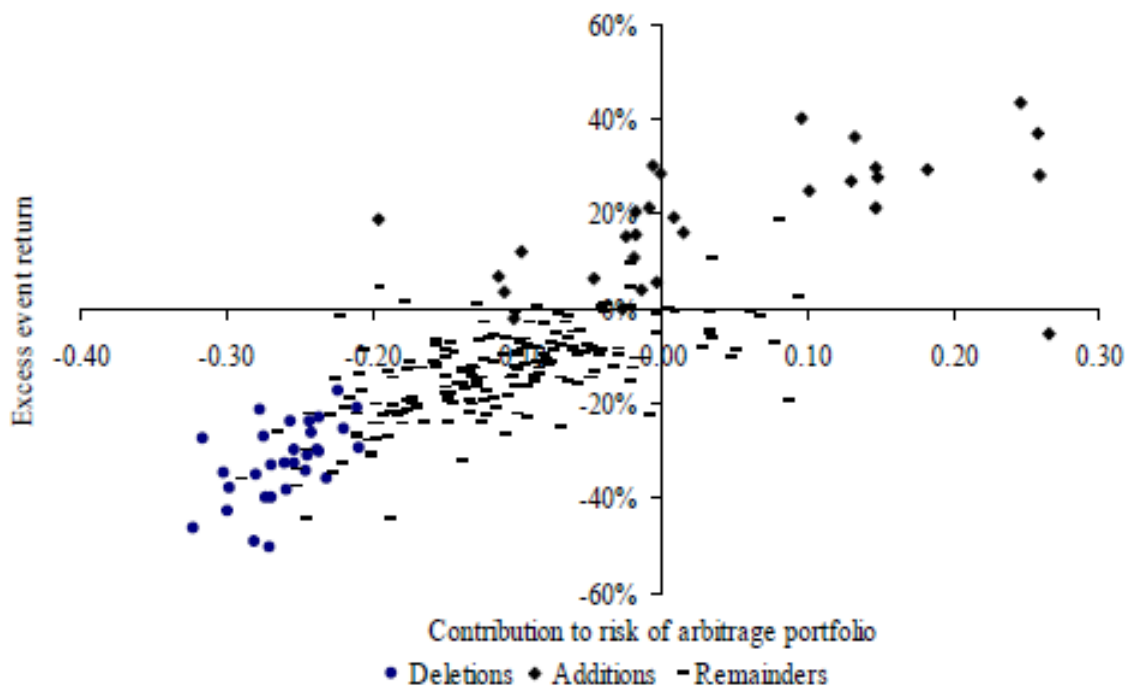
- ii. Stocks that stayed out of the index which have positive correlation with newly included stocks Vs. stocks that stayed out of the index which have negative correlation with newly included stocks

Answer: Stocks with positive correlation are going to be used as hedges by arbitrageurs. So, they buy these stocks, which then have a positive price impact. The opposite holds for stocks with negative correlation.

- iii. Newly included stocks with high idiosyncratic volatility Vs. newly included stocks with low idiosyncratic volatility

Answer: Stocks with high volatility are more risky for arbitrageurs to be short of. So, arbitrageurs are going to ask a bigger return from them. So, the price impact is a positive function of volatility, all else equal.

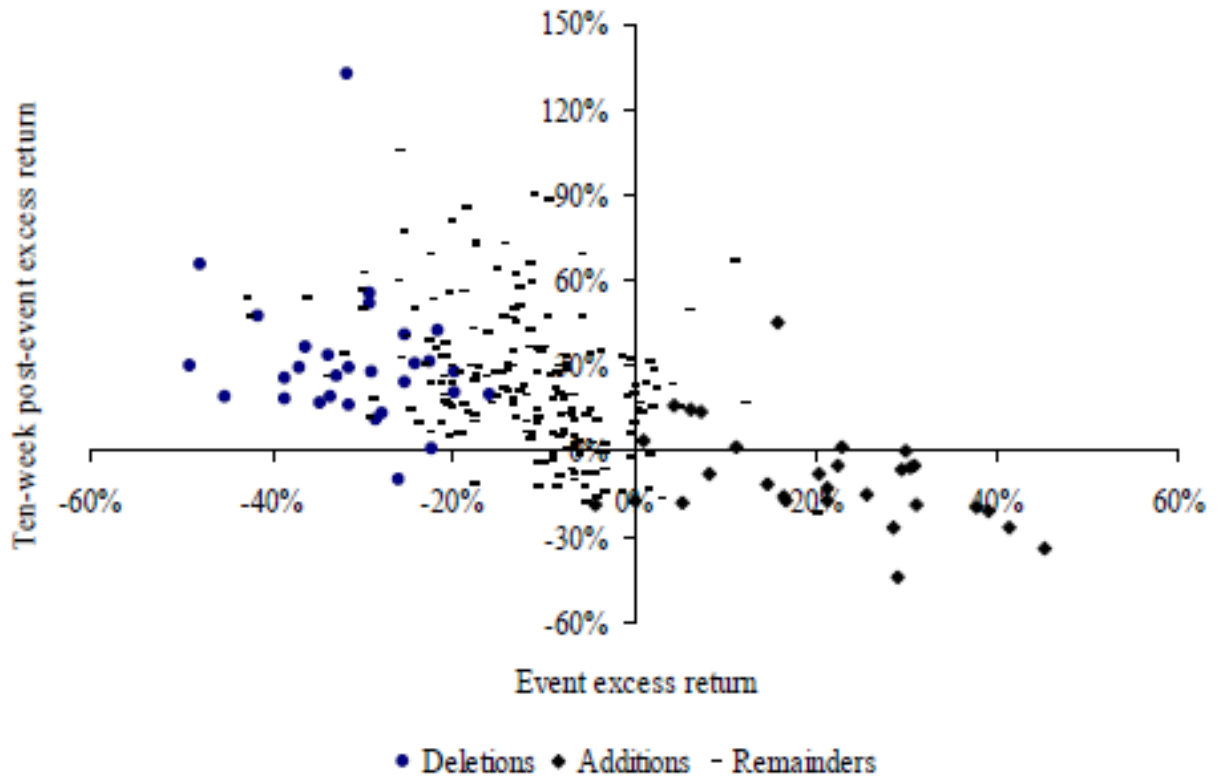
- (c) The author computes the contribution of each stock to the risk of arbitrageurs' portfolio using his model. This contribution is a positive function of how much of the stock arbitrageurs have to sell, the volatility of the stock, and the correlation with other stocks in the market. Comment the following graph which relates the short-run event return for each stock to its contribution to arbitrageurs' portfolio risk. Make sure to separate your explanation for Additions and Deletions



Answer: Stocks that are more risky for arbitrageurs (both to buy and to sell) need to give arbitrageurs a bigger remuneration. In the case of additions, arbitrageurs are short the stocks, so the short-run price impact needs to be positive and large, so that the price reversion in the future will be large. The opposite holds for deletions.

- (d) Given your answer to part (c), comment the following graph which relates the long-

run (ten weeks) event return to the short-run (one week) event return.



Answer: As said in the previous answer, for additions, you need to have a positive price increase in the short run as arbitrageurs are short these stocks. Arbitrageurs will be compensated by a price drop in the future (the negative return in the long-run). The opposite holds for deletions.