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Is it easier for quants in small-caps?

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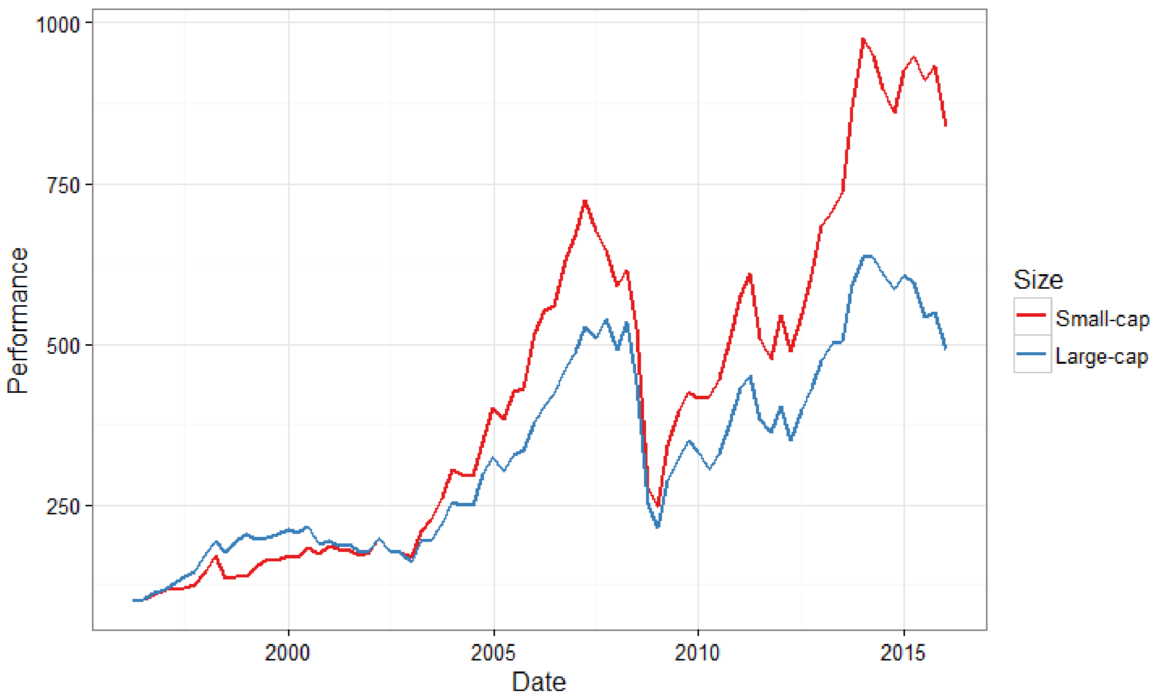
Introduction

- It is widely believed that it is easier to be a quant manager in less efficient markets like small-caps. Is that true?
  - longer half-life of quant signals e.g. earnings announcements
  - smaller reduction in returns to an anomaly post publication (McLean and Pontiff, 2014)

- A very naïve look would suggest quant styles *are* easier in the small-cap universe, but we need to dig deeper.

Performance before trading costs of VQM strategy in European small-caps and large-caps



Source UBS Quantitative Research

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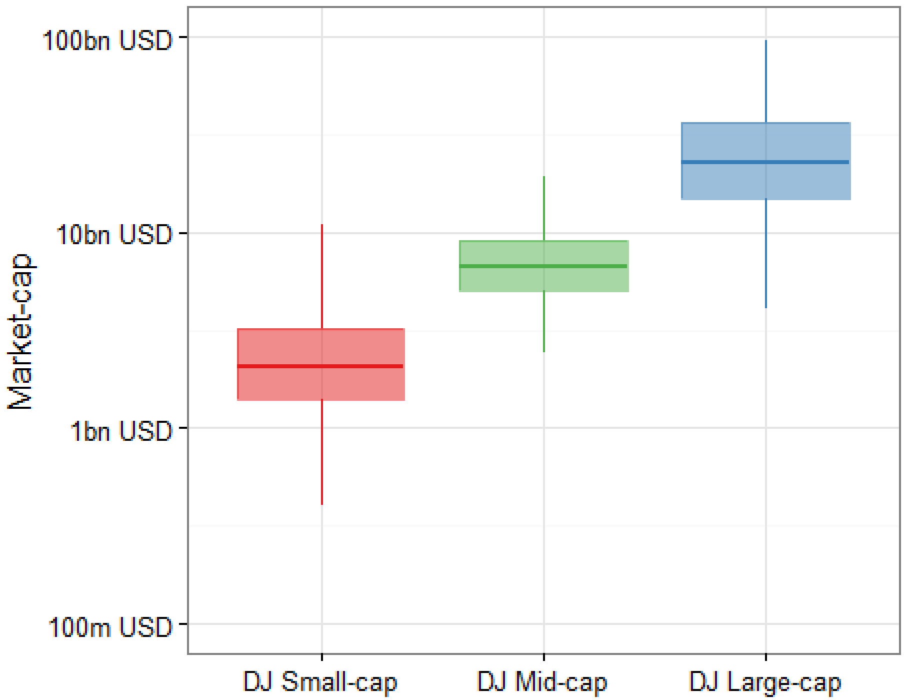
What do you mean by "small" in Europe?

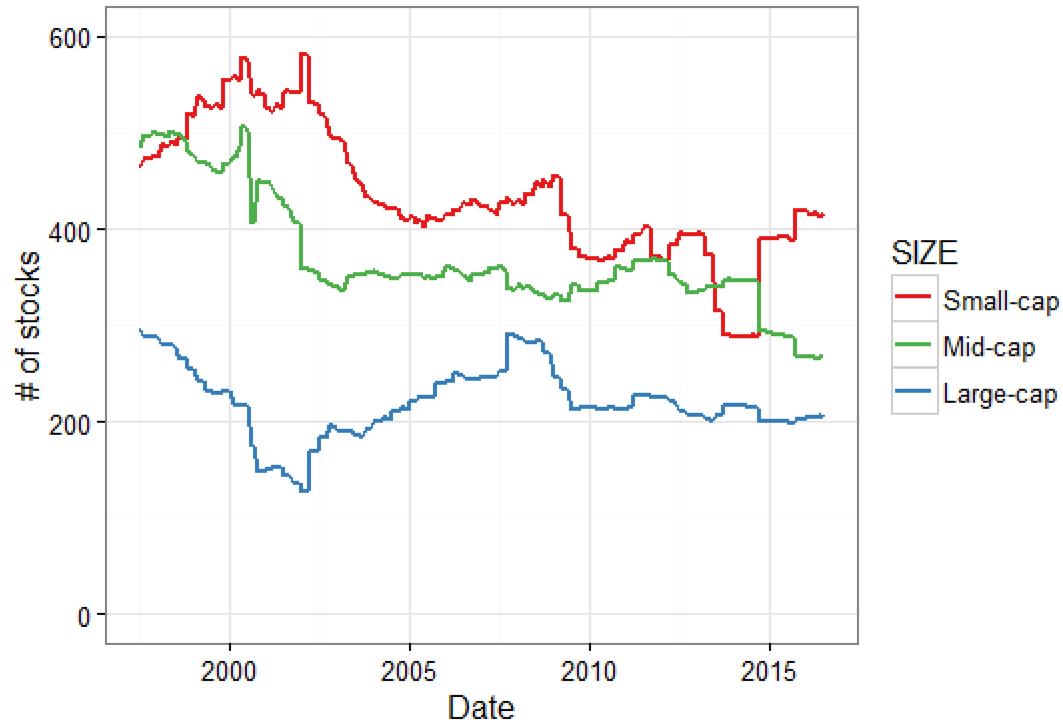
- Our European universes are the European stocks in the Dow Jones Small-cap, Dow Jones Mid-cap and Dow Jones Large-cap indexes.

Distribution of market caps in Jun-2016



Source UBS Quantitative Research

How many stocks in each size band?

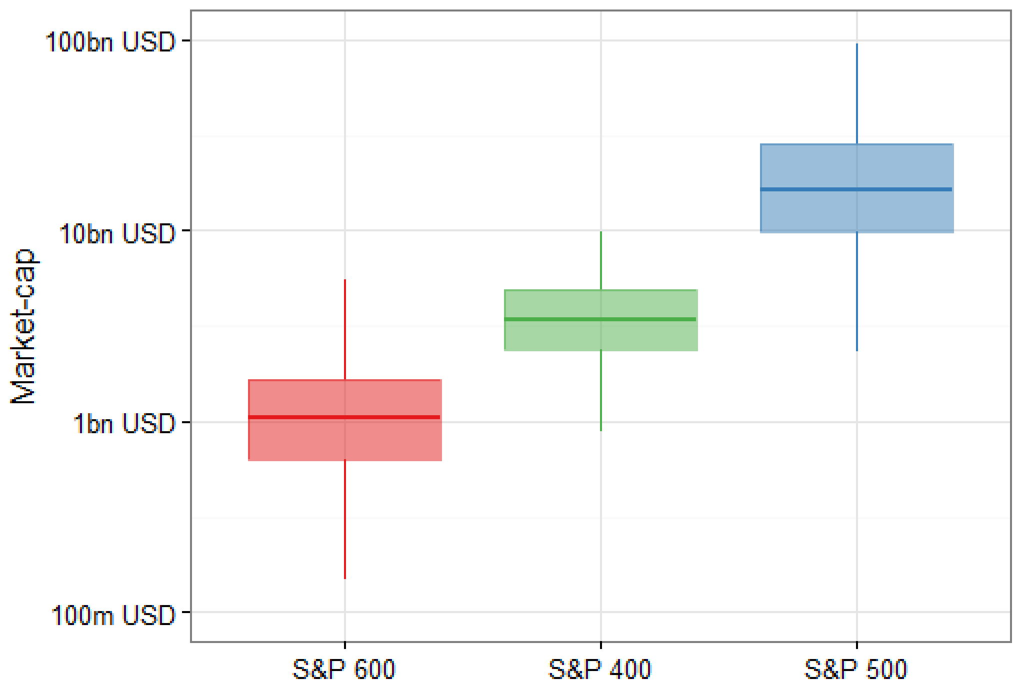


Source UBS Quantitative Research

What do you mean by "small" in the US?

- Our US universes are the S&P 500, the S&P 400 and the S&P 600, which together cover the largest 1500 names in the US.

Distribution of market caps in Jun-2016



Source UBS Quantitative Research

- Our data history goes from Mar-1996 to Jun-2015, but for much of our analysis we focus on the period Jul-2006 to Jun-2016

What affects the performance of quant strategies?

- The fundamental law of active management:

  Information Ratio = Information Coefficient x √ (# of bets)

  would suggest:

  i. IC of quant signals

  ii. Breadth of the universe (how many possible bets are there)

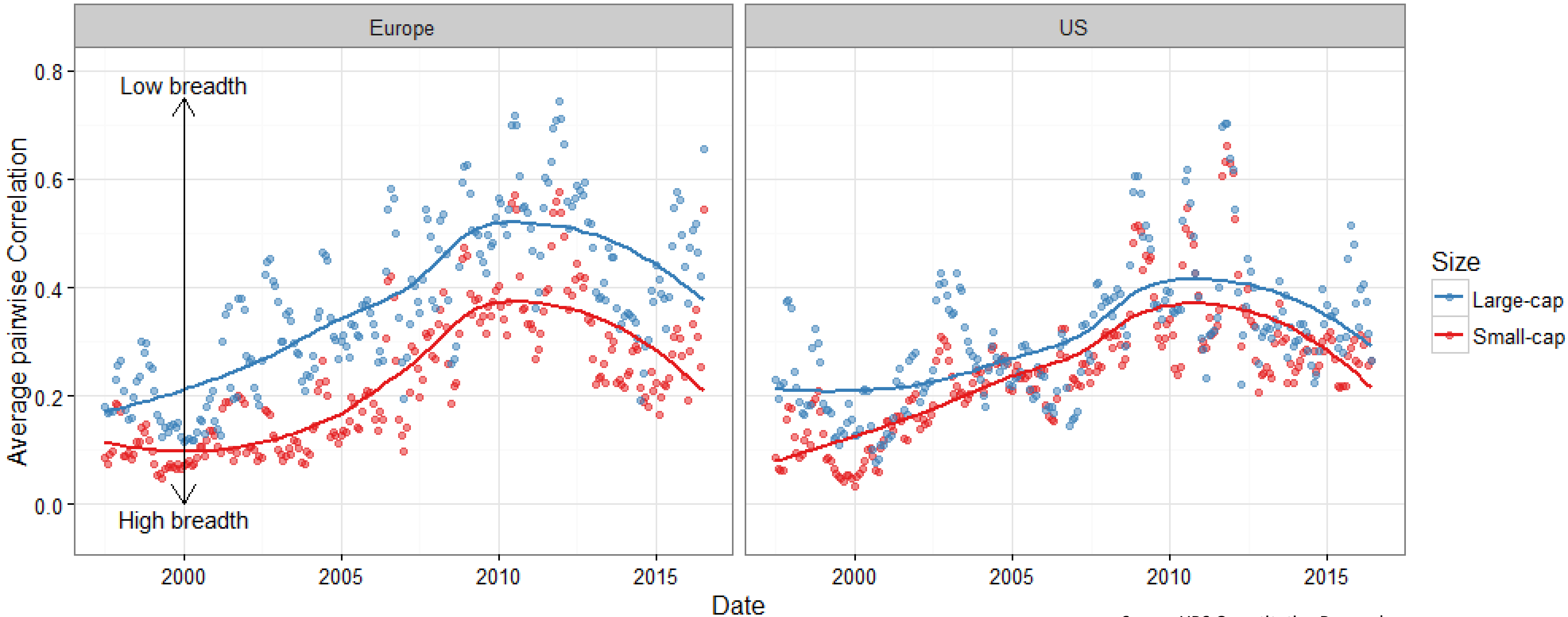
- And we would further add:

  iii. Trading costs

Breadth (1)

- There is a long-term trend of increasing pairwise correlation in the markets (although this has slipped back somewhat since 2010) but small-cap stocks consistently move together less than large-cap stocks.
- Note that the breadth gap is much larger in Europe than in the US.

Average pairwise correlation: Are the stocks moving together?



Source UBS Quantitative Research

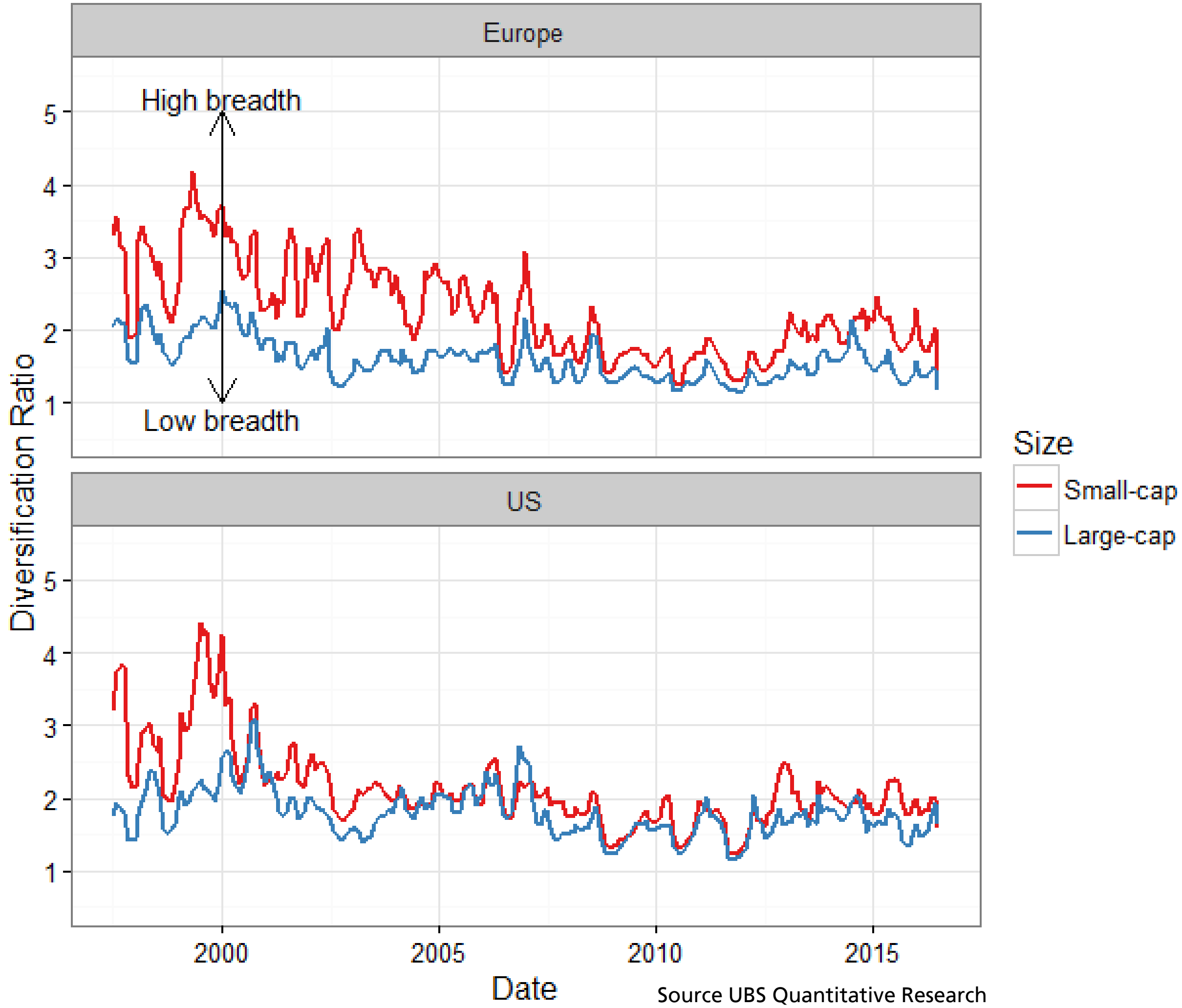
Breadth (2)

- The diversification ratio agrees: there is greater breadth in the small-cap names than in the large-cap names but this difference is much more pronounced in Europe than in the US.

Diversification ratio:

How much higher would the portfolio risk be without the effect of diversification?

$$\frac{\sum_i w_i \sigma_i}{\sigma_{Portfolio}}$$



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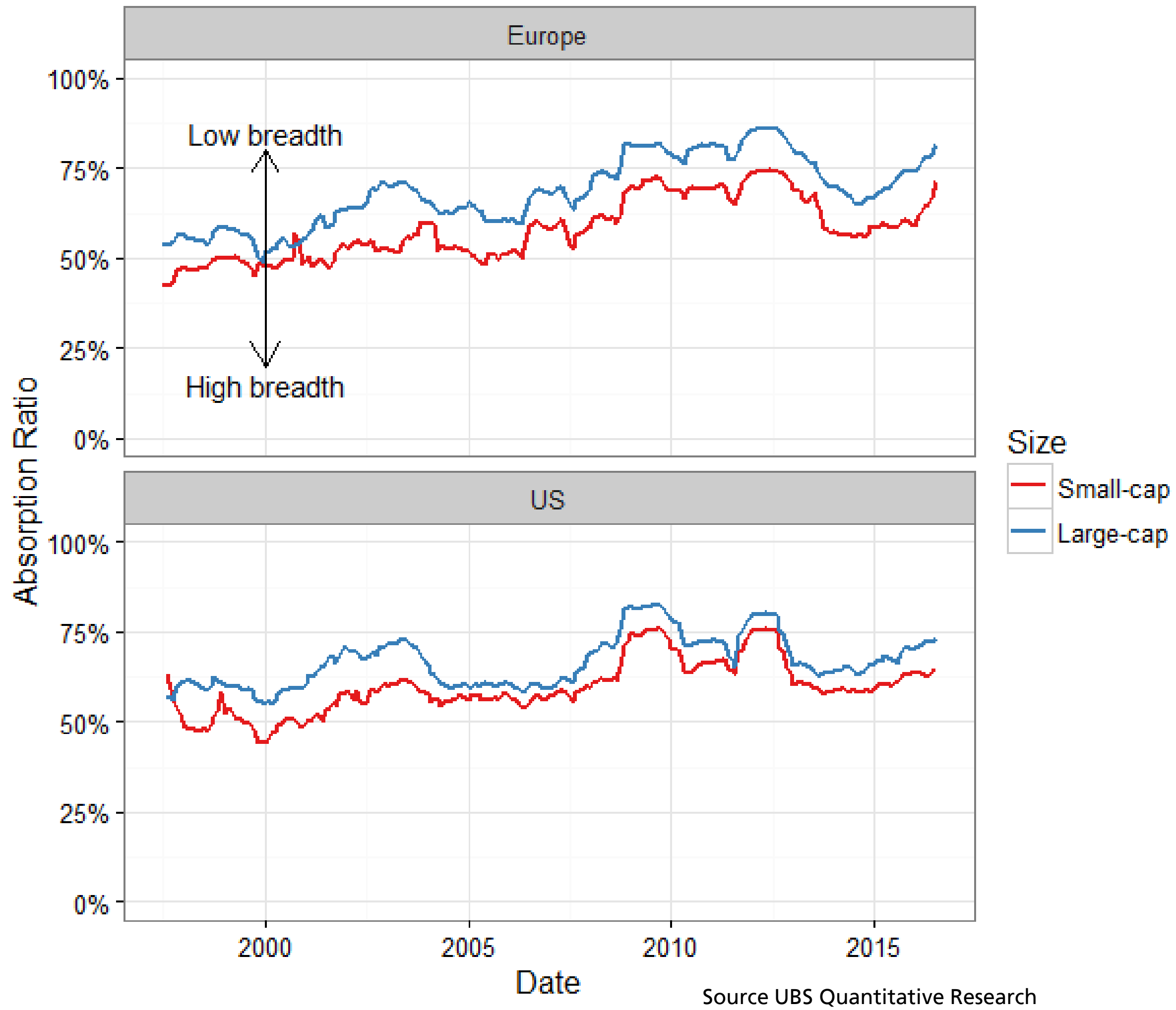
Breadth (3)

- Our final breadth measure, the absorption ratio, again shows greater breadth in small-caps, but a smaller gap in the US than we see in Europe.
- This suggests there should be greater investment opportunities amongst small-caps, but this effect is stronger in Europe than in the US.

Absorption ratio:

How much of the risk is explained by first 10% of statistical risk factors?



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Costs model

- Costs vary according to:
  - the bid-ask spread, BA
  - volatility, σ,
  - order size as a proportion of average daily trading volume, $\frac{X}{V}$,
  - length of time allowed to complete the order, T, ← assumed to be 1-day throughout this presentation
  - the inverse of the average daily trading volume as a proportion of shares outstanding, $\frac{\Phi}{V}$

- We use a simple costs model from Almgren et al's paper, *Direct Estimation of Equity Market Impact*, May 2005, to estimate our costs to trade each stock:

  I. $Permanent\ price\ impact = 0.314 \cdot \sigma \cdot \frac{X}{V} \cdot \left(\frac{\Phi}{V}\right)^{0.25}$

  II. $Temporary\ price\ impact = \frac{1}{2} \cdot permanent\ price\ impact + sign(X) \cdot 0.142 \cdot \sigma \cdot \left|\frac{X}{V \cdot T}\right|^{0.6}$

  III. $Other\ costs = 0.5 \cdot BA$

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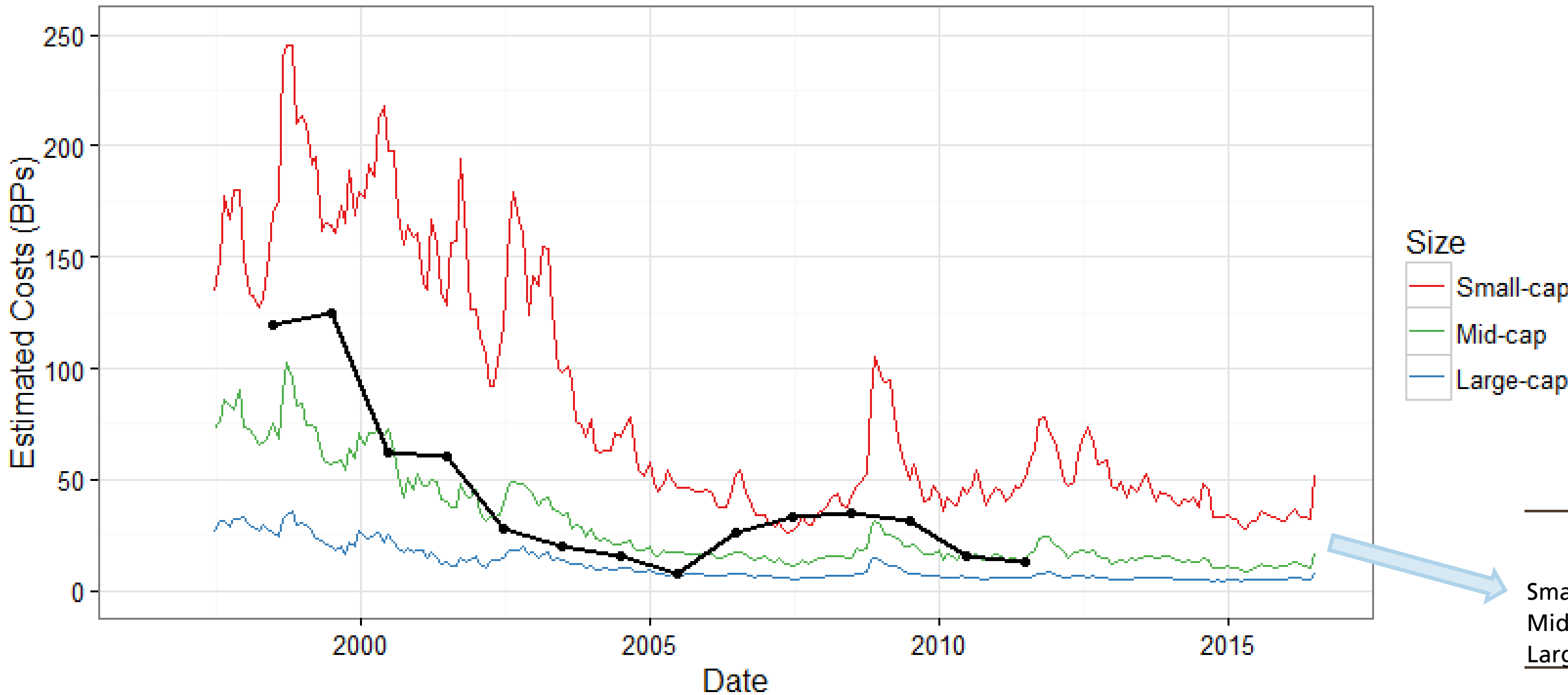
Costs (Europe)

- Small-caps are considerably more expensive to trade than large-caps, although costs to trade have fallen enormously over recent years.
- Costs have stabilised since 2005.

Costs estimates: How much does it cost to buy $250,000 of a stock in a day?



	Current Estimate
Small	36
Mid	12
Large	6

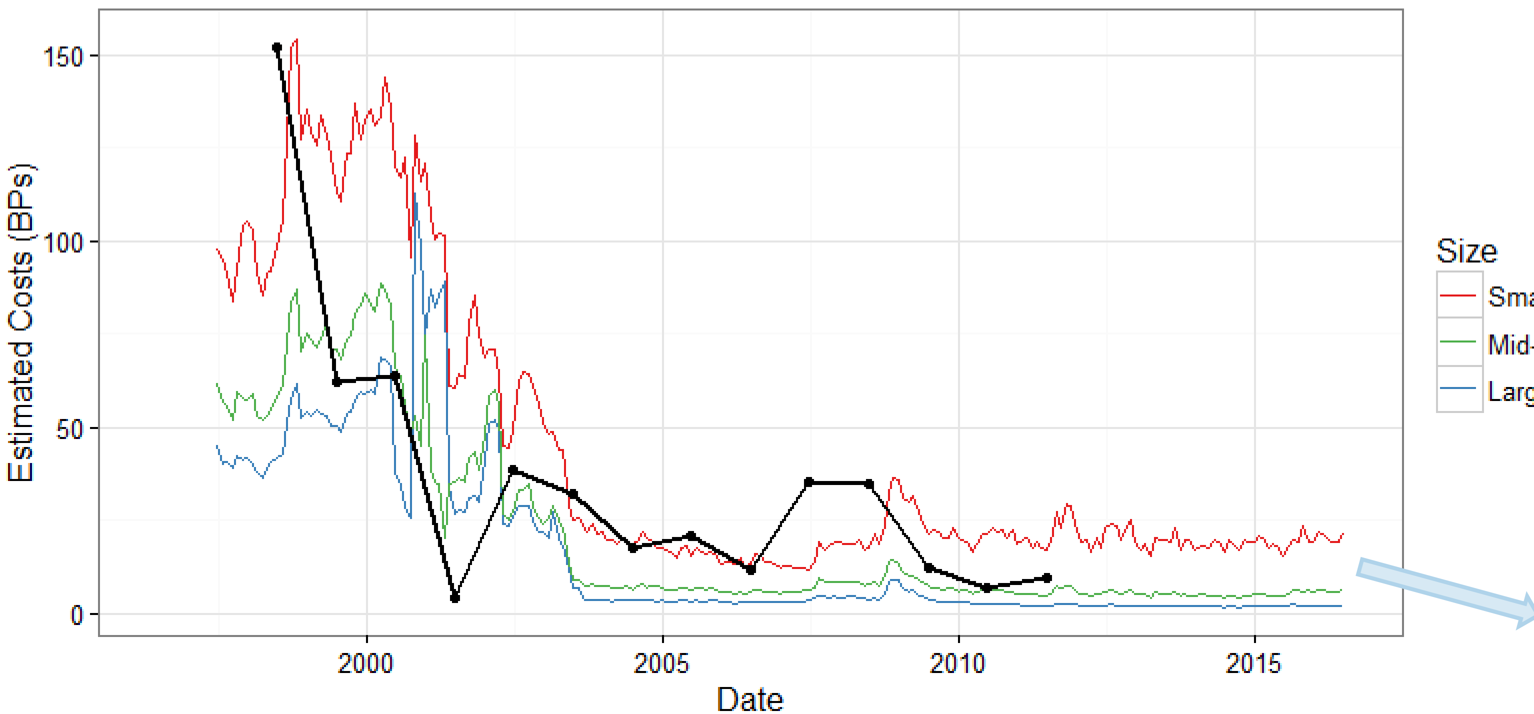
Source UBS Quantitative Research & "Trading Costs of Asset Pricing Anomalies" by Frazzini A., Israel R. and Moskowitz, T, 2012

The coloured lines shows the median estimated cost to buy $0.25m in each stock in the index in one day, based on our costs model. The black line shows the value weighted average cost of trades in the International markets over the course of the year, taken from Moskowitz et al.

Costs (US)

- US small-caps are radically more expensive to trade than US large-caps.
- Most of the rest of this analysis will focus on the most recent 10 years, as trading costs pre-2005 were dramatically higher than costs today.

Costs estimates: How much does it cost to buy $250,000 of a stock in a day?



	Current Estimate
Small	20
Mid	6
Large	2

Source UBS Quantitative Research & "Trading Costs of Asset Pricing Anomalies" by Frazzini A., Israel R. and Moskowitz, T, 2012

The coloured lines shows the median estimated cost to buy $0.25m in each stock in the index in one day, based on our costs model. The black line shows the value weighted average cost of trades in the USI markets over the course of the year, taken from Moskowitz et al.

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Random portfolios (1)

- To isolate the effects of the different trading costs on our two universes, we have created random signals in each universe with the same expected IC and seen how portfolios generated with these signals perform.

Repeat x 500:

1. Create an artificial signal with a given expected information coefficient.
   – Signal = future return + noise
2. Create a portfolio using that signal with some simple portfolio construction rules.
   – Equal weighted top 50 names, rebalanced quarterly, with a buffer at top 100
3. Simulate the returns to the portfolio taking costs into account

- The different performances should be due to different costs and breadth of the two universes.

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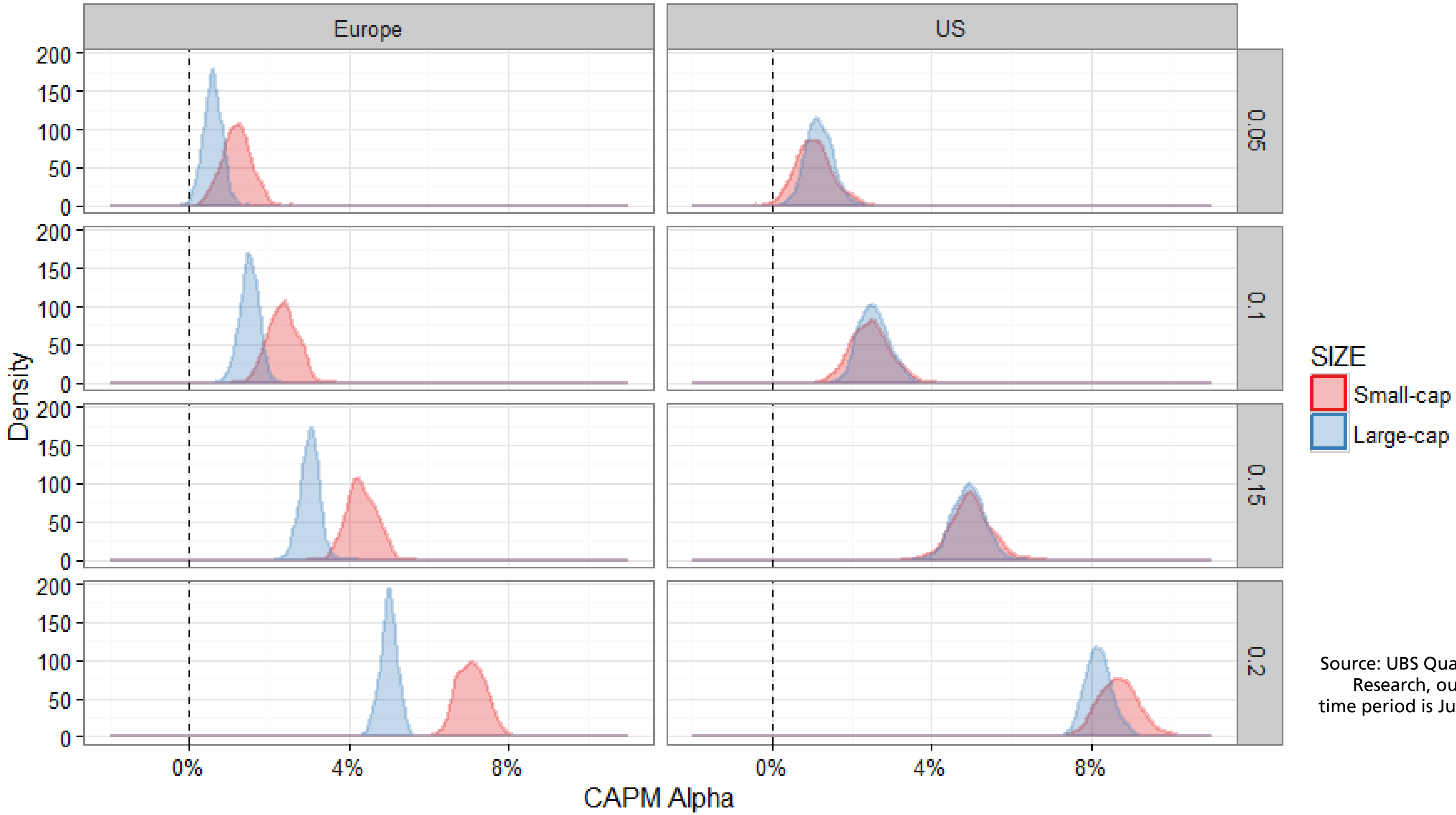
Random portfolios (2)



Source: UBS Quantitative Research, our sample time period is Jul 2006 to Jun 2016

Results **before** costs

- Before costs, the difference between the portfolios distributions are due to the difference in the breadth of the two universes
- You can see i) the effect of the greater breadth in the small-cap universes and ii) that the breadth gap is narrower in the US.

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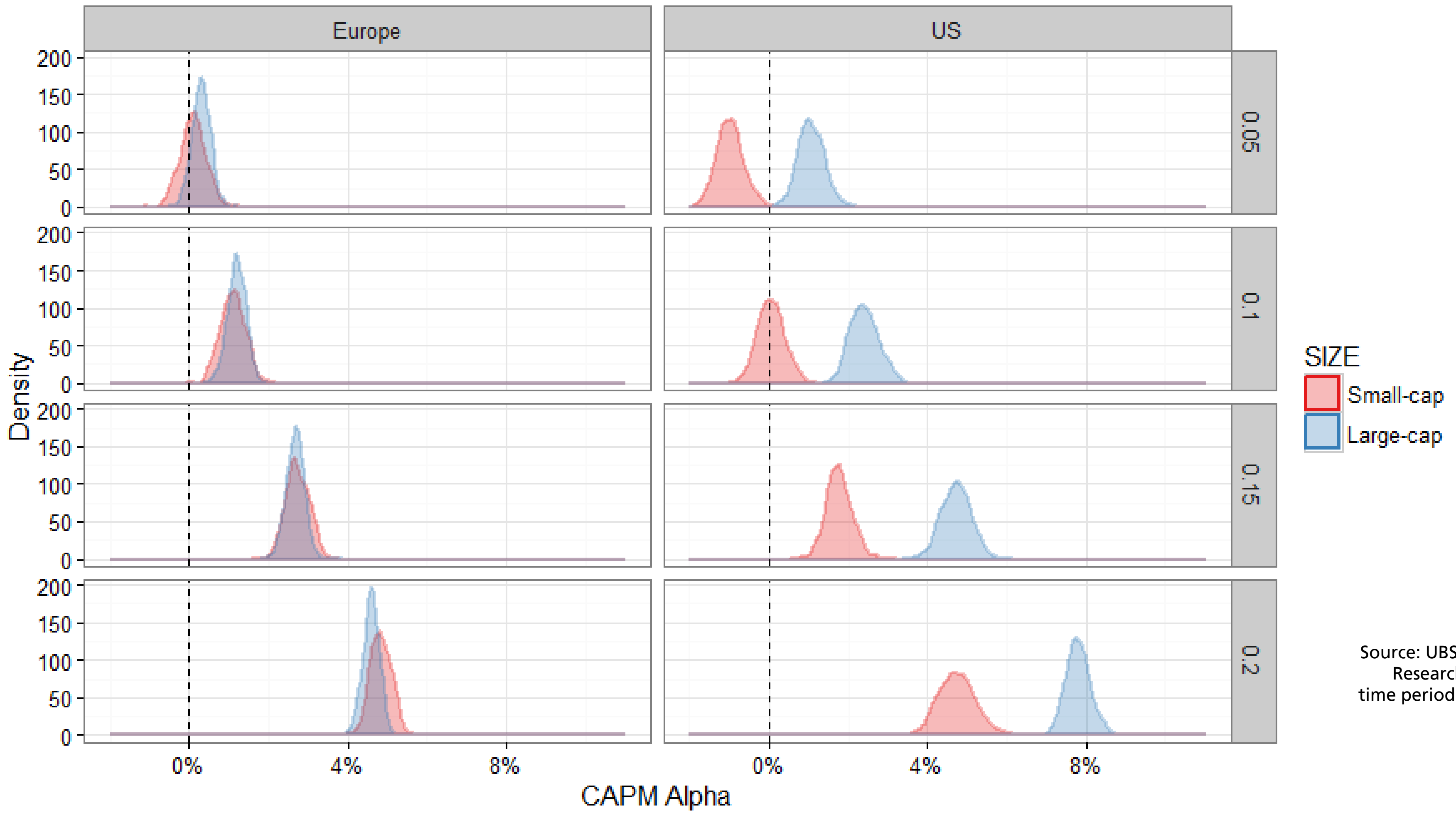
Random portfolios (3)



Source: UBS Quantitative Research, our sample time period is Jul 2006 to Jun 2016

Results **after** costs:

- Costs are so much bigger in small-caps that you need a significantly higher IC signal for the small-cap strategy to outperform.
- In the US, where small-caps had only a small lead on a gross basis, the large-caps dominate after costs.

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Our styles

- There are 20 different styles.
- The style portfolios we use are based on our Global Style Watch factor data. These portfolios are:
  - Long only
  - Thirds by names e.g. low / mid / high earnings yield
  - Cap weighted
  - Rebalanced quarterly
- Please note that these portfolios do not have turnover constraints. This will tend to bias up our estimates of the cost to trade the portfolios.
- We assume that we start our portfolios with an initial investment of $50m in June 2006. This is important for our trading costs estimations.

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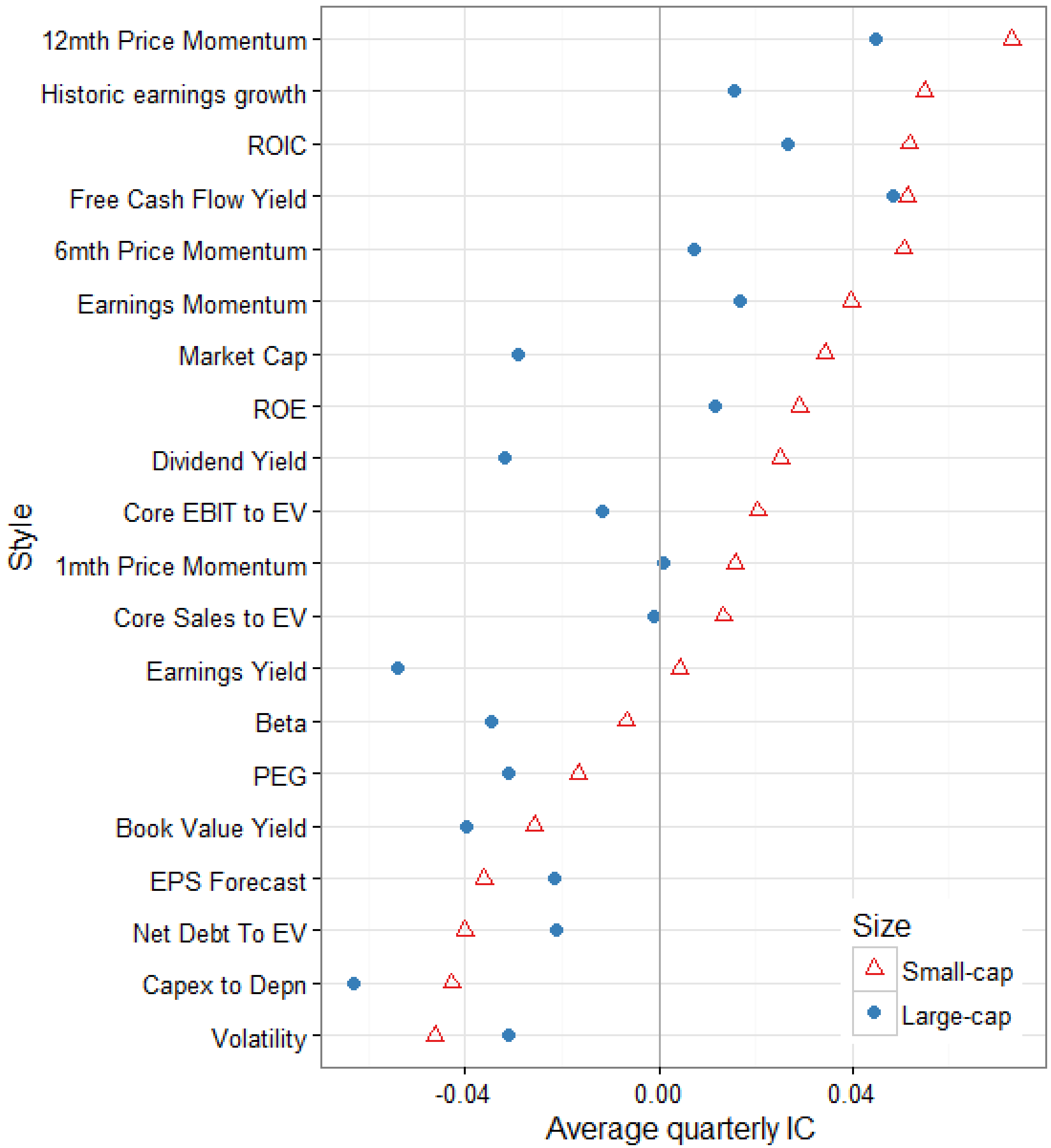
Information Coefficient (Europe)



Source UBS Quantitative Research

- Almost all traditional quant signals have bigger ICs in the small-cap universe.
- The 12 month momentum signal has the strongest IC in small-caps.
- Note that we *want* a negative IC for volatility, capex/depn and beta, (and expect a negative IC for EPS growth).

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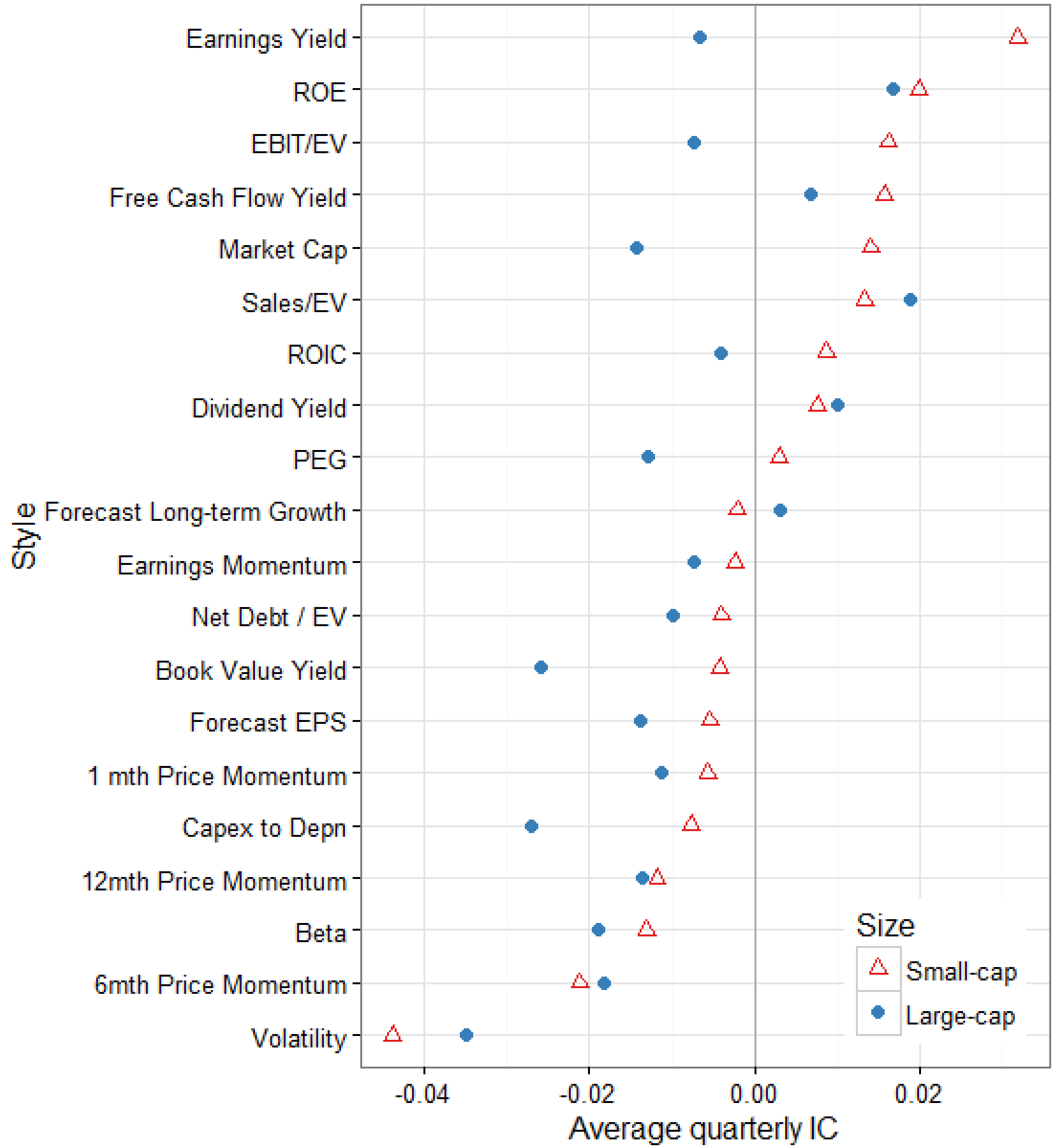
Information Coefficient (US)

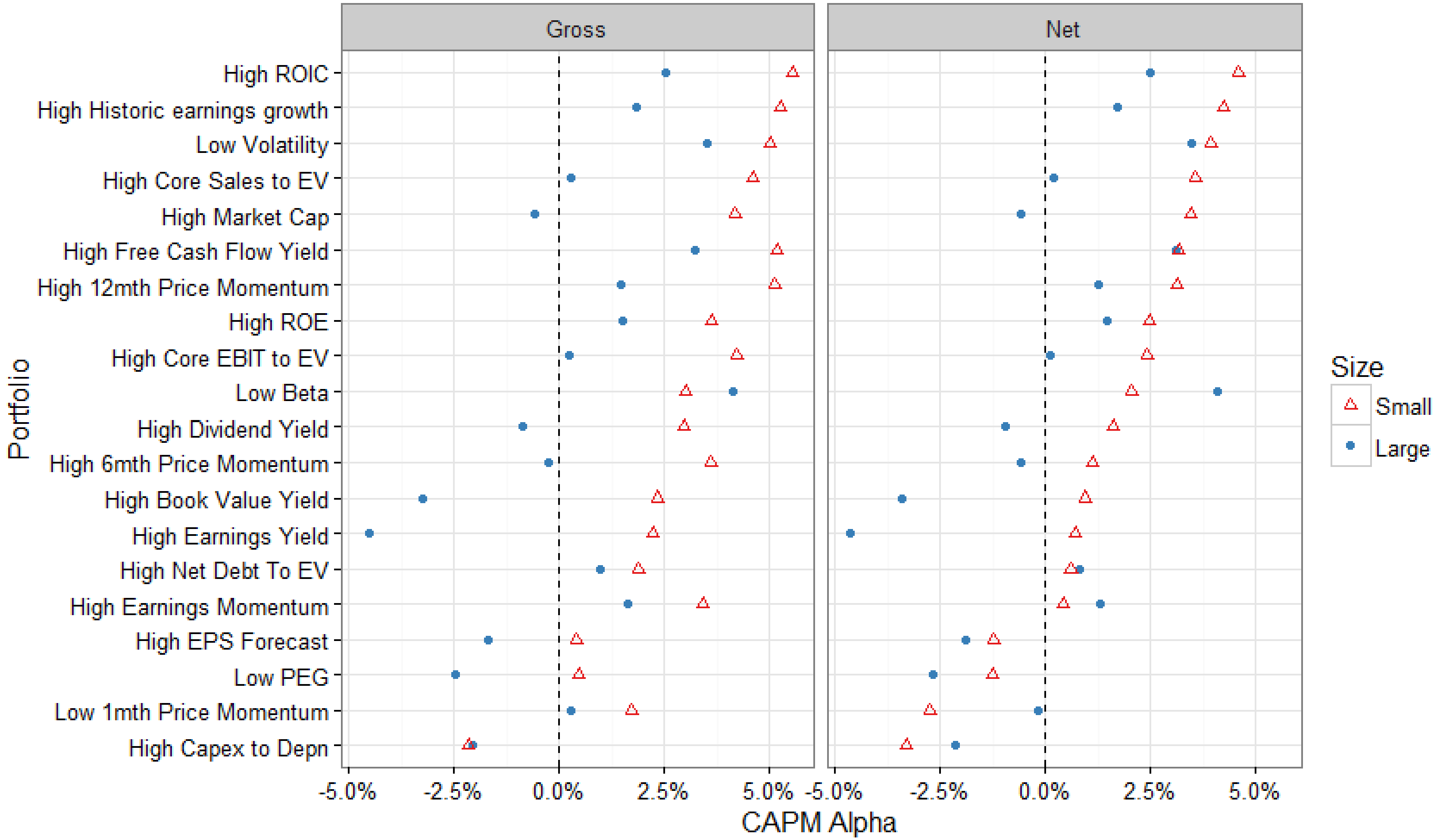


- In the US, we again see that the classic quant signals typically have a higher IC amongst small-caps than large-caps.
- However, the gap in ICs is smaller than in Europe – it seems that small-caps have only a narrow advantage here.

Source UBS Quantitative Research

Historic performances: Information Ratios in Europe

- In Europe, all but two of the strategies would have outperformed in the small-cap universe over the large-cap on a gross basis, but, after costs have been taken into account that drops to 15 out of the 20 strategies.



Source: UBS Quantitative Research, our sample time period is Jul 2006 to Jun 2016, CAPM alpha is versus the overall benchmark i.e. DJ Europe. For illustrative purposes only

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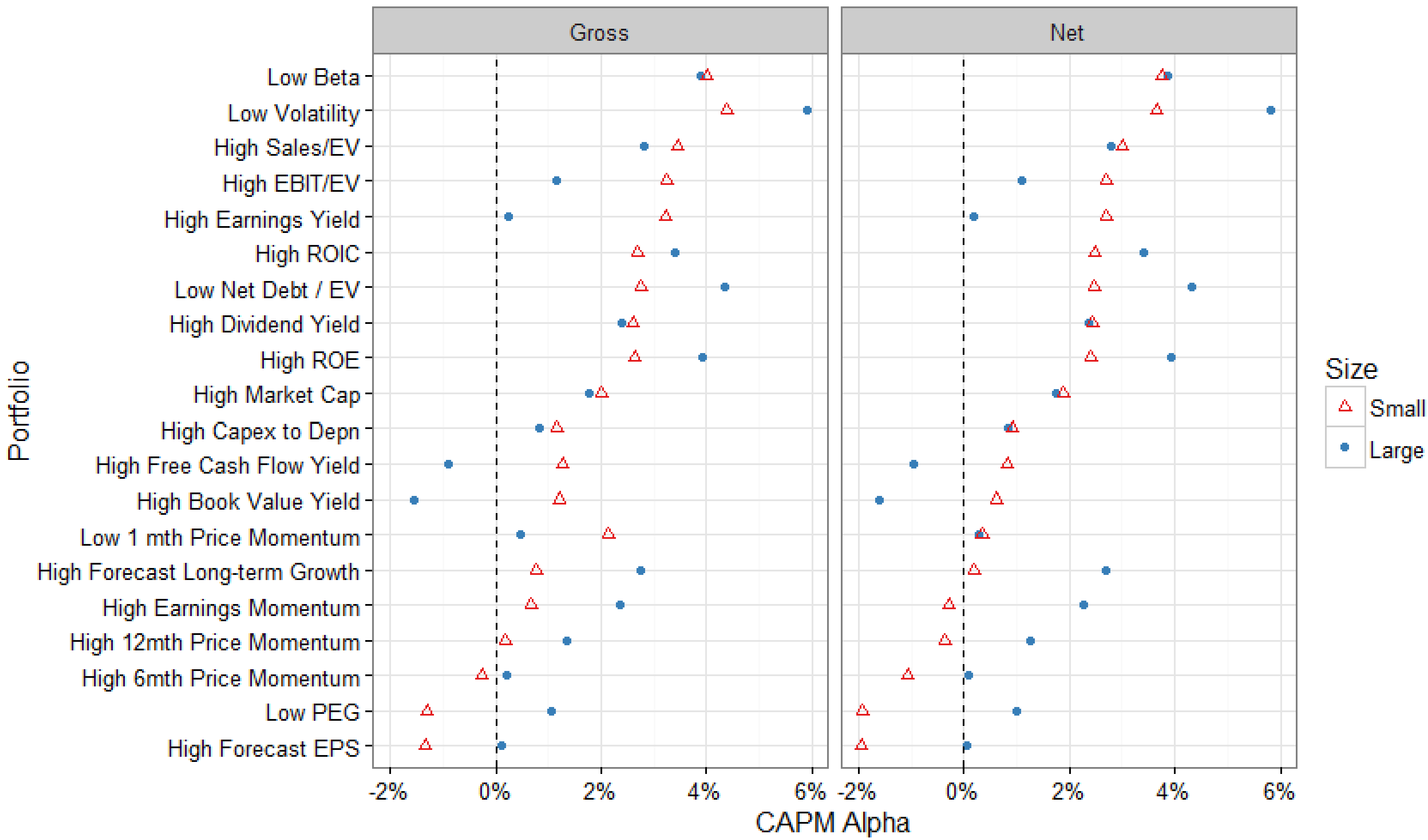
Historic performances: Information Ratios in the US

- In the US, the small-cap strategies would not have been as successful. Only half of the small-cap portfolios would have outperformed their large-cap peers on a net basis, and that falls to just 8 out of 20 once we look at the net returns.



Source: UBS Quantitative Research, our sample time period is Jul 2006 to Jun 2016, CAPM alpha is versus the overall benchmark i.e. S&P 1500. For illustrative purposes only

Conclusions

- Is it easier for quants in small-caps? Mostly yes in Europe and mostly no in the US.
- There is a higher breadth in small-cap universe (suggesting greater investment opportunities) in both regions, but the effect is more pronounced in Europe.
- Traditional quant signals have better information coefficients amongst small-cap stocks than large-cap stocks, but again, the difference is more dramatic in Europe.
- In our analysis, these effects offset the higher costs that small-caps face in Europe but not in the US, however, this will very much depend on the size of your investment portfolio.

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Neutral	FSR is between -6% and 6% of the MRA.	38%	25%
Sell	FSR is > 6% below the MRA.	15%	21%
Short-Term Rating	**Definition**	**Coverage[3]**	**IB Services[4]**
Buy	Stock price expected to rise within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%
Sell	Stock price expected to fall within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%

Source: UBS. Rating allocations are as of 30 June 2016.
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