# Are Benchmark Returns Transaction- or Holdings-Based?

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# Holdings-Based Returns

$$P_{b/h} = \sum_{i=1}^{I} w_i * r_{b/h,i}$$

$$w_i = \frac{holdings_{b,i} * (price_{b,i} + accrued_{b,i})}{\sum_{j=1}^{I} holdings_{b,j}(price_{b,j} + accrued_{b,j})}$$

$$r_{b/h} = 100 * \left[ \frac{price_e + accrued_e + dividend + coupon}{price_b + accrued_b} - 1 \right]$$

Source: Bonafede, J. K. and M. C. McCarthy, 2003. "Transaction-based vs. Holdings-based Attribution: the Devil is in the Definitions." The Journal of Performance Measurement 8(1): 42 - 51.

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# Transaction-Based Returns

$$P_t = \sum_{i=1}^{I} W_i * r_{t,i}$$

$$W_i = \frac{market\_value_{b,i}}{\sum_{j=1}^{I} market\_value_{b,j}}$$

$$r_t = 100 * \left[ \frac{market\_value_e - cash\_flow}{market\_value_b} - 1 \right]$$

Source: Bonafede, J. K. and M. C. McCarthy, 2003. "Transaction-based vs. Holdings-based Attribution: the Devil is in the Definitions." The Journal of Performance Measurement 8(1): 42 - 51.

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# Benchmark Returns

$$PriceIndexLevelUSD_t = PriceIndexLevelUSD_{t-1} * \frac{IndexAdjustedMarketCapUSD_t}{IndexInitialMarketCapUSD_t}$$

$$IndexAdjustedMarketCapUSD_t =$$
$$\sum_{s \in I,t} \frac{EndOfDayNumberOfShares_{t-1} * PricePerShare_t * InclusionFactor_t * PAF_t}{FXrate_t}$$

$$IndexInitialMarketCapUSD_t =$$
$$\sum_{s \in I,t} \frac{EndOfDayNumberOfShares_{t-1} * PricePerShare_{t-1} * InclusionFactor_t}{FXrate_{t-1}}$$

Source: MSCI_Index_Calculation_Methodology_20240301.pdf, pgs. 6-7

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# In Which Cases Are Transaction- and Holdings-Based Returns the Same?

$$r_{b/h} = 100 * \left[ \frac{price_e + accrued_e + dividend + coupon}{price_b + accrued_b} - 1 \right]$$

$$r_t = 100 * \left[ \frac{market\_value_e - cash\_flow}{market\_value_b} - 1 \right]$$

- With no transactions/cash flows

- With dividends/coupons, when dividend + coupon = - cash flow

- With (buy/sell) transactions, when transactions occur at end price (plus accrued)
  => adjustment to end price (plus accrued) equals the cash flow

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