ROBECO
The Investment Engineers

WHITE PAPER

A prudent route to effective factor timing

Sustainable Investing Expertise by ROBECOSAM

Summary

- Diversification is key for effective equity factor investing
- Factor timing benefits depend on accuracy and implementation
- This can be captured through a Dynamic 1/N multi-factor approach

Equity factor investing has gained significant popularity in recent years as investors seek to tap into the factor premiums associated with certain stock characteristics. The various factor portfolio returns exhibit distinct cycles, tempting investors to try their hand at dynamically adjusting their factor allocation. However, the key question remains: how can investors best time these factors to maximize returns while minimizing risk?

In this article, we discuss and explore the promises and pitfalls of factor timing and provide an empirical investigation of the benefits of multi-factor diversification. Our findings show that a Dynamic 1/N multi-factor approach presents a prudent route to effective equity factor timing by combining low strategy turnover with the pervasive factor momentum effect, while at the same time maintaining a proper factor diversification.

Factor investing and factor timing

The case for equity factor investing

Equity factor investing is the process of investing in stocks according to certain characteristic-based strategies, such as value, quality, low risk, or momentum. The premise behind factor investing is that these characteristics have a persistent relation to stock returns and can provide diversification benefits and higher returns compared to a market cap-weighted investment. By investing in a portfolio of stocks based on these factors, investors can potentially tap into the underlying factor premiums. Notably, there is rich literature supporting the relevance of factors in different geographies and over long periods.[1]

Given their low mutual correlations, factor portfolios can serve as natural building blocks to guide the construction of equity portfolios. Specifically, following a diversified factor allocation enables investors to harvest the associated factor premiums in a risk-balanced fashion. Indeed, risk-based portfolio allocation techniques have been advocated by many scholars and practitioners to maximize portfolio diversification.

The simplest weighting scheme invests equal amounts in all targeted factor portfolios, often referred to as 1/N investing, allowing one to evenly spread their dollar risk. Rather than diversifying portfolio weights, one might consider diversifying portfolio risk. To this end, one can exploit the covariance structure governing the factor returns and build a portfolio where volatility (or tracking error) is equally driven by the underlying factors, and the

[1] See Bartram, Lohre, Pope and Ranganathan (2021), Navigating the factor zoo around the world: An institutional investor's perspective, *Journal of Business Economics*, 91, 655-703.

WHITE PAPER JULY 2023

Marketing material for professional investors, not for onward distribution

Guido Baltussen, Prof. dr.
Head of Factor Investing, Co-head of Quant Fixed Income

Daniel Haesen, CFA
Senior Portfolio Manager
Factor Investing

Harald Lohre, PhD
Senior Quantitative Researcher

resulting portfolio is thus referred to as a risk parity portfolio. The premise of risk parity is that dynamically acknowledging the time-variation in the factors' risk structure can improve the diversified harvesting of factor premiums. We will empirically investigate whether the associated increase in portfolio turnover challenges these diversification benefits in practice.

While it seems straightforward to strategically follow a diversified factor allocation, it is natural to ask whether to allow for tactical deviations along the way. In fact, single-factor strategies can experience prolonged periods of disappointing performance – just think of the performance of the value factor over the 2010s – tempting investors to tactically time their factor allocation to better navigate such factor cyclicality.

The promises and pitfalls of factor timing

Factor timing refers to the strategy of dynamically allocating capital to different equity factors based on their expected future performance. While factor timing can potentially provide higher returns compared to a static equity factor allocation, it also comes with some challenges and risks. On the one hand, correctly timing the factors can lead to improved risk-adjusted returns.

On the other hand, factor timing may increase strategy turnover and transaction costs, negatively impacting overall returns. Ultimately, it is all about managing this trade-off between the accuracy of the factor timing signal versus the associated costs. In this regard, it is important to note that there are explicit transaction costs that come from shifting the equity portfolio to reflect the dynamic target factor allocation. But there are also implicit costs that come from a loss of diversification due to partly surrendering optimal factor diversification that is inherent to a strategic risk-balanced factor allocation.

What academic and prior work tell us about the merits of factor timing

Our prior research into factor timing showed mixed results, resonating with the academic literature where some studies found evidence of timing benefits, whilst others reported no significant improvement compared to a static factor allocation strategy. The literature suggests that the success of factor timing is heavily dependent on the signals used to time the factors, and the way in which the timing strategy is implemented. In prior research, we showed that one needs a very high accuracy in forecasting factor returns to improve upon simple 1/N factor allocations after transaction costs.[2]

In general, the literature suggests that a balanced approach to harvesting equity factors, such as 1/N or risk parity investing, can be effective in capturing factor returns while minimizing risk.[3] In particular, 1/N is a strong contender relative to risk parity in terms of risk-adjusted returns, because it helps to avoid higher turnovers associated with risk-driven alternatives.

In regards to factor timing, Dichtl et al. (2019) provide evidence of the predictability of timing signals based on cross-sectional factor characteristics such as factor momentum, crowding or valuation spreads, but the authors also found some support for the use of fundamental time series predictors. Yet, they caution that such predictability is hard to capture after considering realistic transaction costs in real-life portfolio implementations.[4]

Indeed, capturing the short-term trend in factor returns via a factor momentum signal promises additional alpha, although this is meaningfully reduced after considering transaction costs.[5] Neuhierl et al. (2023) also provide a comprehensive analysis of a wide set of timing indicators applied to over 300 equity factors.[6] They found that timing indicators based on factor momentum and volatility offer most added value. Predictability can even be improved upon when multiple timing indicators are aggregated. Lastly, a recent exploration of Blitz (2023) confirms the existence of seasonal and momentum effects in the cross-section of factor returns.[7]

[2] See Blitz, Lansdorp, Roscovan and Vidojevic (2018), The promises and challenges of factor timing, *Robeco Client Note*.
[3] See Dichtl, Drobetz and Wendt (2021), How to build a factor portfolio: Does the allocation strategy matter?, *European Financial Management* 27(1), 20-58.
[4] See Dichtl, Drobetz, Lohre and Rother (2019), Optimal timing and tilting of equity factors, *Financial Analysts Journal* 75(4), 84-102.
[5] See Gupta and Kelly (2019), Factor momentum everywhere, *Journal of Portfolio Management*, 45(3), 13-36.
[6] See Neuhierl, Randl, Reschenhofer and Zechner (2023), Timing the factor zoo.
[7] See Blitz (2023), The cross-section of factor returns, Robeco White Paper.

Factor timing benefits in practice

It takes four to factor

We investigate the practical benefits of factor diversification and timing in a global stock universe that is comprised by the MSCI All Country World Index (ACWI) and liquid stocks outside of the index. Our focus is on four salient equity factors that have a firm footing in academic literature and a proven track record in the practice of factor investing.

Specifically, we study the interplay of the factors value, momentum, quality and low risk, each of which is implemented in a single-factor portfolio that seeks to maximize the relevant factor exposure while controlling for portfolio risks and transaction costs. Note that each factor is constructed to have optimal exposure to the defining factor characteristic, while not going structurally against other factors. Such an approach is crucial for effective multi-factor investing because it enables avoiding stocks that score well on one factor but very poorly on the other factors.[8]

Table 1 shows the annualized outperformances relative to the MSCI ACWI, their volatilities ('active risk') and corresponding information ratios, as well as maximum drawdowns. The sample runs from January 1988 to December 2022.

Table 1 – Performance characteristics of factors

	Low Risk	Value	Quality	Momentum
Outperformance	5.36	3.80	4.14	3.99
Active risk (%)	5.44	6.65	4.24	6.12
Information ratio	0.99	0.57	0.98	0.65
Max drawdowns (%)	-17.2	-31.7	-7.9	-21.7

Source: Robeco, Refinitiv. Note that the presented numbers are based on official simulations (which consist of simulations up to September 2015 and live performances afterwards) for a global stock universe (i.e., all stocks traded in developed and emerging markets that pass our liquidity filters). Returns are measured relative to the MSCI All Country World Index, covering the sample period from January 1988 to December 2022. Simulated returns are net of estimated transaction costs. Outperformance of the low-risk factor is beta-adjusted (using a long-run beta of 0.70) to account for its structurally lower beta. Maximum drawdowns are relative to the benchmark.

All four factor portfolios are characterized by strong stand-alone performance figures, outperforming the MSCI ACWI by 3.80 to 5.36 percentage points. Their active risk range is in a similar ballpark, hence, the outperformance ratios are between 0.57 (value) and 0.99 (low risk). In unreported results, we confirm that these four factor portfolios exhibit benign correlation figures across factors, making them meaningful building blocks of a diversified equity portfolio.

Equipped with these four single-factor portfolios, we can readily explore various targeted factor allocations to exploit factor diversification and factor timing signals. To set the stage, we first look into two allocation procedures that promise a diversified and risk-balanced harvesting of the different equity factor premiums: an equally weighted 1/N allocation that allocates equal dollar amounts across single-factor portfolios versus a risk parity allocation that allocates such that each factor portfolio contributes equally to portfolio risk.

Naturally, both factor allocation strategies come with trading costs, because a factor's performance will see factor weights deviate from target weights over time, even for the 1/N allocation. To pinpoint the actual rewards to factor diversification in an aggregated strategy of four factor portfolios, we assume one-way transaction costs of 25 bps

[8] See Blitz and Vidojevic (2019), The characteristics of factor investing, *Journal of Portfolio Management*, Quantitative Special Issue 2019, 45 (3), 69-86.

for each factor portfolio. Table 2 gives performance statistics of different factor allocation strategies over the sample period from January 1988 to December 2022. Column 1 shows that a simple 1/N factor allocation outperformed the MSCI ACWI by 4.40% p.a. with an active risk of 3.93%. The transaction costs for the 1/N factor allocation are marginal given that the associated factor turnover is only 10%, hence the gross and net performance differ by 2.5 bps only.

Conversely, the risk parity allocation (rebalanced monthly) induces a higher turnover of 17% to achieve risk balance across factors. While its gross performance is slightly lower than that of the 1/N allocation (4.25%), its net performance is 4.21%. Averaging over the whole sample period we note that, relative to the 1/N allocation, the risk parity allocation is overweighting the value factor portfolio as well as underweighting the momentum factor portfolio. While the overall performance statistics are fairly similar, we note that risk parity comes with a slightly more severe maximum drawdown.

Table 2 – Performance of factor diversification and timing strategies with +/- 10% allocation bands

	Factor diversification		Factor timing			
	1/N	Risk parity	Perfect foresight	Factor momentum timing	Factor valuation timing	Factor seasonality timing
Outperformance (gross, %)	4.40	4.25	7.46	4.72	4.54	4.52
Outperformance (net, %)	4.37	4.21	6.62	4.50	4.29	3.64
Costs (%)	0.03	0.04	0.83	0.22	0.24	0.88
Active risk (%)	3.93	3.96	3.94	3.99	4.02	3.96
Information ratio	1.11	1.06	1.68	1.13	1.07	0.92
Max relative drawdown (%)	-13.46	-15.58	-7.83	-11.37	-14.85	-14.91
Turnover (%)	10	17	333	88	97	351

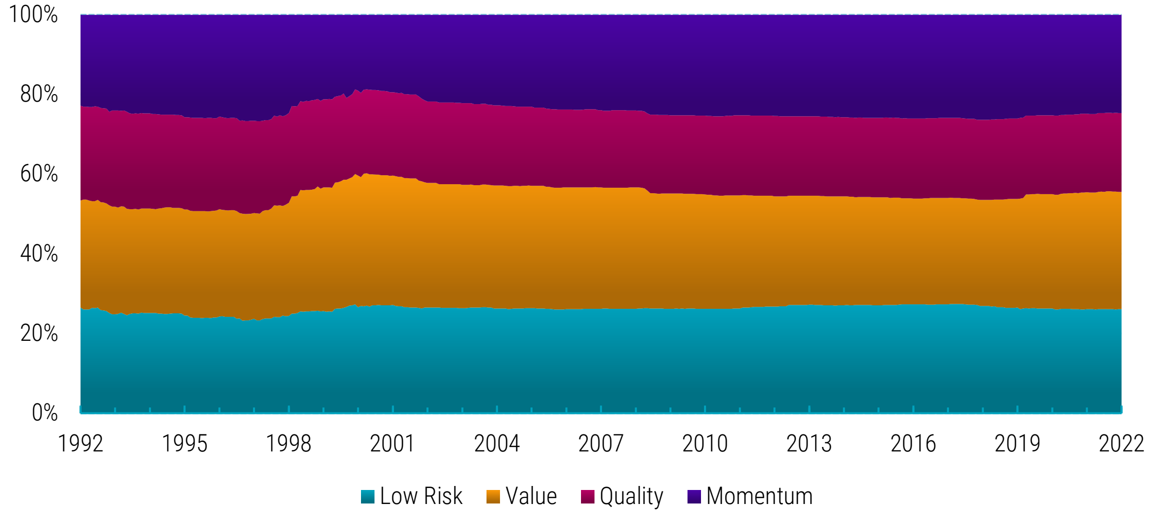
Source: Robeco, Refinitiv. Note that the presented numbers are based on official simulations (which consist of simulations up to September 2015 and live performances afterwards) using a global stock universe (i.e., all stocks traded in developed and emerging markets that pass our liquidity filters). Returns are measured relative to the MSCI All Country World Index, covering the sample period from January 1988 to December 2022). Numbers are net of estimated transaction costs. Outperformance of the low-risk factor is beta-adjusted (using a long-run beta of 0.70) to account for its structurally lower beta. Risk parity is a relative risk parity strategy relative to the MSCI AC World Index based on weekly data expanding window correlations and 36m volatilities. Perfect foresight is the strategy that every month implements the best (with hindsight) factor timing positions.

Given the similar backtest performance of 1/N and risk parity factor allocations we wonder how close the 1/N allocation is in terms of risk balance. Figure 1 thus plots the factor risk contributions to active risk (relative to MSCI ACWI) over time. It turns out that the 1/N allocation consistently exhibits a fairly risk-balanced profile through time, with factors' average risk contributions being close to the equal-weight contribution (25%) and showing relatively little variation over time.

Given the attractive return and risk characteristics of the 1/N allocation, it makes for a sensible starting point for factor investors in the absence of an informed view on the future performance of the individual factors. This conclusion is shared by Khang et al. (2023), who show that no single alternative optimization strategy consistently dominates the 1/N allocation in active returns and information ratios.[9]

[9] See Khang, Picca, Zhang and Zhu (2023), How inefficient is the 1/N strategy for a factor investor, *Journal of Investment Management*, 21(1), 103-119..

Figure 1 - Portfolio active risk decomposition of 1/N factor allocation by factors, 1988-2022



Source: Robeco, Refinitiv. Active risk contributions of each factor to the multi-factor portfolio using at least 60 observations. Note that the presented numbers are based on official simulations (which consist of simulations up to September 2015 and live performances afterwards) using a global stock universe (i.e., all stocks traded in developed and emerging markets that pass our liquidity filters). Returns are measured relative to the MSCI All Country World Index, covering the sample period from December 1992 to December 2022. Numbers are net of estimated transaction costs. Active risk of the low-risk factor is beta-adjusted (using a long-run beta of 0.70) to account for its structurally lower beta.

The opportunity set of factor timing

Before we look into different factor timing signals, we wonder how much room for improvement is actually available. To this end, we first explore the opportunity set of factor timing by assuming a clairvoyant factor investor with perfect foresight over the factors' next month performance. In implementing these perfect monthly timing signals, we impose that any given factor can vary its allocation in a 10% bandwidth around the strategic weight of 25%. In any given month, we would thus put a weight of 35% to the two best performing factors and a weight of 15% to the two worst performing factors.

Table 2 documents the gains that could be enjoyed from perfect factor timing foresight. The strategy has a gross performance of 7.46% relative to the MSCI ACWI, i.e. the opportunity set of factor timing in these narrow bands is 306 bps relative to a static 1/N factor allocation. The required turnover is 333%, reducing the net benefit to 225 bps. Naturally, the perfect foresight strategy comes with improved performance metrics along many dimensions, including a reduction in drawdown statistics. Of course, we are eager to learn about the opportunity set of factor timing in the absence of a crystal ball, which is what we cover in the subsequent section.

Evidence of factor return predictability

Our investigation of factor timing is built around three key factor characteristics that investors often consult to gauge the relative attractiveness of asset classes or securities: momentum, valuation and seasonality. In the realm of factor allocation, we focus on short-term factor momentum as given by the factors' return in the previous month.

To compute a factor's valuation, we simply aggregate the underlying factor portfolio constituents' valuation as a value-weighted average. The factor seasonality signal is computed as the factors' average historical return in a given month, measured over an expanding window. The dynamic factor allocation will be guided by the corresponding factor scores that have been standardized as classic z-scores and thus inform the degree to which the allocation bands of +/- 10% are utilized.

Table 2 highlights that factor momentum indeed is a predictive signal. Gross of transaction cost, the momentum-timed factor allocation displays a 32 bps outperformance relative to the 1/N benchmark. Unsurprisingly, factor momentum comes with considerable turnover (88%) which consumes part of this performance edge. Put differently, the net outperformance of factor momentum over 1/N is 13 bps.

Moving to factor valuation timing, we learn that it is also predictive with respect to future factor returns; its gross outperformance stands at 14 bps over 1/N. Yet, this relative edge cannot be enjoyed in practice given that the factor valuation strategy turnover of 97% erodes all of the gross benefits, rendering its net performance lower than that of 1/N. The case for factor seasonality is even weaker. While its gross outperformance over 1/N is on par with factor valuation, the huge turnover of 351% eats considerably into the net outperformance (3.64%).

Dynamic 1/N: Prudent implementation of factor timing

Taking a step back, one can aptly synthesize our findings as follows: the key discipline in equity factor investing is to install a diversified factor allocation. While the opportunity set for factor timing is appealing, the actual practice of accurately forecasting factors is noisy and comes at a costly turnover that can fully erode the gross predictability of a given factor timing signal, as is the case for factor valuation or factor seasonality.

In this section, we therefore advance a prudent dynamic factor allocation to (1) embrace the factor diversification from equal weighting (1/N), (2) enjoy the benefits from factor momentum, and to (3) avoid the potential drawbacks of a high turnover allocation. We suggest a pragmatic route to square these three considerations and advocate the use of a so-called Dynamic 1/N factor allocation strategy.

The virtue of Dynamic 1/N

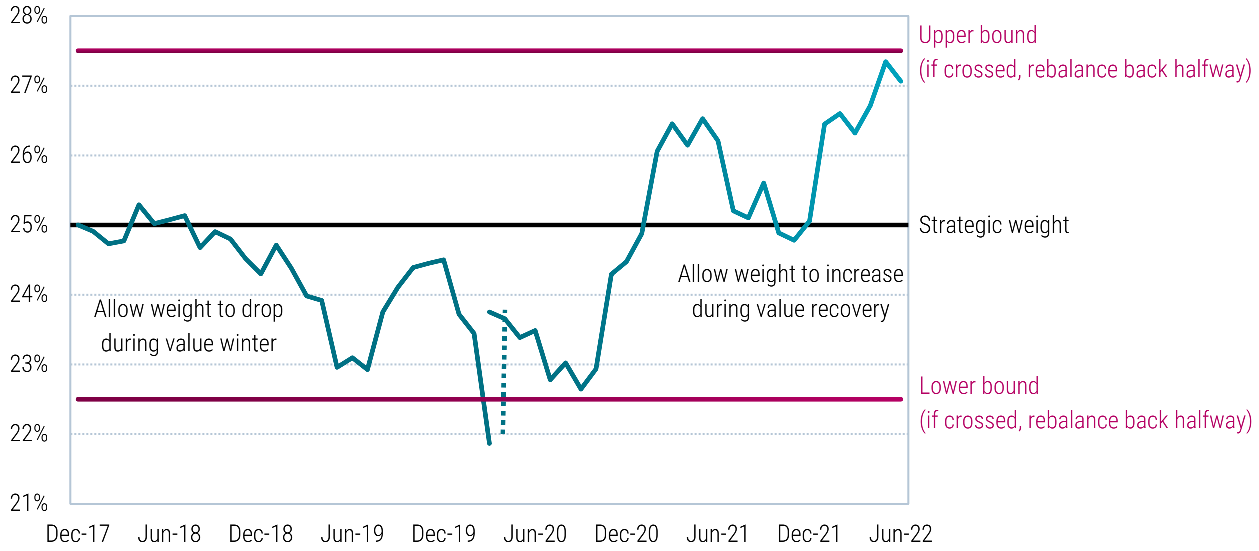
This Dynamic 1/N allocation is anchored around a diversified 1/N factor allocation but only rebalances back to equal weights when it breaches predefined allocation bands. This allocation rule has two important implications. First, it reduces turnover relative to a fixed 1/N allocation that is rebalanced at more frequent intervals and thus saves on factor turnover transaction costs.

Second, because a frequently rebalanced 1/N allocation strategy is regularly selling winning factors and buying losing factors, it is going against the very factor momentum effect. Hence, letting factors run within meaningfully calibrated allocation bands represents a smart way of capturing factor momentum in practice while not overly sacrificing factor diversification and unduly increasing allocation turnover.

In calibrating the allocation bands, we acknowledge the high turnover that is associated with the 10% bands tested in Table 2. To limit factor timing transaction costs, it is prudent to go with a rather narrow allocation band, and we opt for 2.5% in the subsequent analysis. To illustrate the mechanics of the Dynamic 1/N allocation strategy, Figure 2 shows the weight of the value factor portfolio over time, using an actual factor investing mandate. At inception in December 2017, the mandate was initialized with an equal weight allocation in all four factors, hence the starting weight of the value portfolio was 25%.

Given the disappointing performance of value throughout the quant winter (starting in 2018) its allocation weight declined as a result. If we had regularly rebalanced at a given periodic interval, we would have had more exposure to this losing factor. It was only in March 2020 when the value factor weight crossed the lower bound of 22.5%, that prompted us to rebalance. Note that the rebalance would not go all but half the way back to 25%, thus further saving factor turnover and transaction costs. Indeed, this allowed the value factor weight to steadily build up weight throughout the value recovery without the need for an intermediate factor allocation rebalance.

Figure 2 – Dynamic 1/N rebalancing mechanics – weight of Value sleeve



Source: Robeco. Dollar weight development of the value factor weight in a multi-factor portfolio following the Dynamic 1/N rebalancing rule. Starting weight is set at 25%. Rebalancing is triggered when the weight exceeds 27.5% or drops below 22.5%. When rebalance is triggered, the factor weight is rebalanced half the way back to 25%.

Dynamic 1/N in practice

This evolution of the value factor weight suggests that a meaningfully calibrated Dynamic 1/N strategy can participate in factor momentum while saving on factor turnover and transaction costs relative to a naïve 1/N factor allocation. To see how this smart rebalancing works out in the aggregate factor allocation over the whole sample period, we have reassessed the investigated factor allocation strategies through the lens of 2.5% allocation bands in Table 3.

Table 3 – Performance of dynamic 1/N vis-à-vis factor diversification and timing strategies with +/- 2.5% allocation bands

	Factor diversification		Factor timing			Dynamic 1/N
	1/N	Perfect foresight	Factor momentum timing	Factor valuation timing	Factor seasonality timing	
Outperformance (gross %)	4.40	5.16	4.48	4.43	4.43	4.58
Outperformance (net %)	4.37	4.95	4.41	4.36	4.20	4.57
Costs (%)	0.03	0.21	0.07	0.08	0.23	0.01
Active risk (%)	3.93	3.92	3.93	3.94	3.93	3.92
Information ratio	1.11	1.26	1.12	1.11	1.07	1.17
Max relative drawdown (%)	-13.46	-12.04	-12.92	-13.80	-13.74	-12.71
Turnover (%)	10	85	28	30	90	2

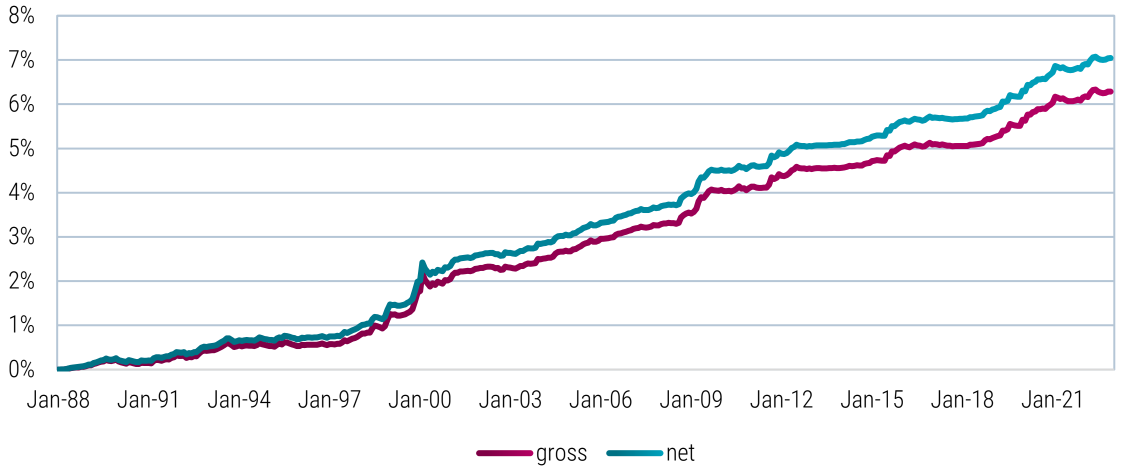
Source: Robeco, Refinitiv. Note that the presented numbers are based on official simulations (which consist of simulations up to September 2015 and live performances afterwards) based on a global stock universe (i.e., all stocks traded in developed and emerging markets that pass our liquidity filters) measured relative to the MSCI All Country World Index, covering the sample period from January 1988 to December 2022, and hence may differ from returns in practice. Numbers are net of estimated transaction costs. Outperformance of the low-risk factor is beta-adjusted (using a long-run beta of 0.70) to account for its structurally lower beta. Perfect foresight is the strategy that always implements the correct factor timing position (with hindsight).

Naturally, the opportunity set of factor timing is smaller in this setup, but still one could enjoy a net outperformance of 58 bps given perfect foresight. While none of the three factor timing signals can reasonably tap into this potential when considering monthly rebalancing, the Dynamic 1/N strategy is able to add 20 bps of net outperformance, thus seizing one third of the available opportunity set. Indeed, the last column of Table 3 sees the Dynamic 1/N strategy outperforming the static version by 18 bps before and 20 bps after transaction costs, resulting from reducing the strategy turnover from 10% to just 2%.

To investigate to what extent this outperformance of Dynamic 1/N is due to factor momentum exposure, we regress the active return of Dynamic 1/N relative to the static 1/N benchmark onto the returns of a pure long-short factor momentum strategy. It turns out that a sizable part of the variation of the active return is attributed to factor momentum, corresponding to a very high correlation (55%) of factor momentum and active Dynamic 1/N returns.

We have considered other controls, but factor momentum effects prove highly robust. There is also a significant regression intercept in the performance attribution regression, which partly resonates with the transaction cost savings because of reduced turnover. Figure 3 shows the benefits of the Dynamic 1/N approach over a static factor allocation to accrue consistently over time, highlighting the effectiveness of this prudent route to factor timing.

Figure 3 – Benefits of the dynamic 1/N factor timing strategy



Source: Robeco, Refinitiv. Note that the presented numbers are based on official simulations using a global stock universe (i.e., all stocks traded in developed and emerging markets that pass our liquidity filters). Returns are measured relative to the MSCI All Country World Index, covering the sample period from January 1988 to December 2022. Numbers are net of estimated transaction costs. Outperformance of the low-risk factor is beta-adjusted (using a long-run beta of 0.70) to account for its structurally lower beta.

Conclusion

Factor timing is the holy grail in equity factor investing. With factors exhibiting underperformance at times, the temptation to dynamically adjust one's factor allocation is high. Indeed, a clairvoyant factor investor could enjoy sizable outperformance relative to a static factor allocation. We have explored to what extent this factor timing opportunity set can be tapped in practice. Specifically, we have investigated the practical implications of factor timing by considering the role of factor momentum, valuation spreads and seasonality.

Indeed, valuation spreads and seasonality signals have predictive power with regards to factor returns; yet these factor timing gains turn out to be more apparent than real as the timed strategy is lagging the benchmark after considering transaction costs. Conversely, factor momentum can add active return before costs, of which almost half can be salvaged after transaction costs.

Notwithstanding, factor momentum brings about high strategy turnover. As a consequence, one has to thoughtfully trade-off the associated transaction costs (which are for certain) versus the expected factor momentum alpha (which is noisy). Instead, we advocate a prudent factor timing strategy that benefits from short-term factor momentum effects while reducing turnover and transaction costs and maintaining proper factor diversification. This Dynamic 1/N strategy adds attractive alpha to a multi-factor strategy, proving to be a prudent route to effective factor timing.

Important information

Robeco Institutional Asset Management B.V. has a license as manager of Undertakings for Collective Investment in Transferable Securities (UCITS) and Alternative Investment Funds (AIFs) ("Fund(s)") from the Netherlands Authority for the Financial Markets in Amsterdam. This marketing document is intended solely for professional investors, defined as investors qualifying as professional clients, who have requested to be treated as professional clients or are authorized to receive such information under any applicable laws. Robeco Institutional Asset Management B.V. and/or its related, affiliated and subsidiary companies, ("Robeco"), will not be liable for any damages arising out of the use of this document. Users of this information who provide investment services in the European Union have their own responsibility to assess whether they are allowed to receive the information in accordance with MiFID II regulations. To the extent this information qualifies as a reasonable and appropriate minor non-monetary benefit under MiFID II, users that provide investment services in the European Union are responsible for complying with applicable recordkeeping and disclosure requirements. The content of this document is based upon sources of information believed to be reliable and comes without warranties of any kind. Without further explanation this document cannot be considered complete. Any opinions, estimates or forecasts may be changed at any time without prior warning. If in doubt, please seek independent advice. This document is intended to provide the professional investor with general information about Robeco's specific capabilities but has not been prepared by Robeco as investment research and does not constitute an investment recommendation or advice to buy or sell certain securities or investment products or to adopt any investment strategy or legal, accounting or tax advice. All rights relating to the information in this document are and will remain the property of Robeco. This material may not be copied or shared with the public. No part of this document may be reproduced or published in any form or by any means without Robeco's prior written permission. Investment involves risks. Before investing, please note the initial capital is not guaranteed. Investors should ensure they fully understand the risk associated with any Robeco product or service offered in their country of domicile. Investors should also consider their own investment objective and risk tolerance level. Historical returns are provided for illustrative purposes only. The price of units may go down as well as up and past performance is no guarantee of future results. If the currency in which the past performance is displayed differs from the currency of the country in which you reside, then you should be aware that due to exchange rate fluctuations the performance shown may increase or decrease if converted into your local currency. The performance data do not take account of the commissions and costs incurred when trading securities in client portfolios or for the issue and redemption of units. Unless otherwise stated, performances are i) net of fees based on transaction prices and ii) with dividends reinvested. Please refer to the prospectus of the Funds for further details. Performance is quoted net of investment management fees. The ongoing charges mentioned in this document are the ones stated in the Fund's latest annual report at closing date of the last calendar year. This document is not directed to or intended for distribution to or for use by any person or entity who is a citizen or resident of or located in any locality, state, country or other jurisdiction where such distribution, document, availability or use would be contrary to law or regulation or which would subject any Fund or Robeco Institutional Asset Management B.V. to any registration or licensing requirement within such jurisdiction. Any decision to subscribe for interests in a Fund offered in a particular jurisdiction must be made solely on the basis of information contained in the prospectus, which information may be different from the information contained in this document. Prospective applicants for shares should inform themselves as to legal requirements which may also apply and any applicable exchange control regulations and taxes in the countries of their respective citizenship, residence or domicile. The Fund information, if any, contained in this document is qualified in its entirety by reference to the prospectus, and this document should, at all times, be read in conjunction with the prospectus. Detailed information on the Fund and associated risks is contained in the prospectus. The prospectus and the Key Information Document (PRIIP) for the Robeco Funds can all be obtained free of charge from Robeco's websites.

Additional information for US investors

Robeco is considered "participating affiliate" and some of their employees are "associated persons" of Robeco Institutional Asset Management US Inc. ("RIAM US") as per relevant SEC no-action guidance. Employees identified as associated persons of RIAM US perform activities directly or indirectly related to the investment advisory services provided by RIAM US. In those situations these individuals are deemed to be acting on behalf of RIAM US, a US SEC registered investment adviser. SEC regulations are applicable only to clients, prospects and investors of RIAM US. RIAM US is a wholly owned subsidiary of ORIX Corporation Europe N.V. and offers investment advisory services to institutional clients in the US.

Additional information for US Offshore investors – Reg S

The Robeco Capital Growth Funds have not been registered under the United States Investment Company Act of 1940, as amended, nor the United States Securities Act of 1933, as amended. None of the shares may be offered or sold, directly or indirectly in the United States or to any US Person. A US Person is defined as (a) any individual who is a citizen or resident of the United States for federal income tax purposes; (b) a corporation, partnership or other entity created or organized under the laws of or existing in the United States; (c) an estate or trust the income of which is subject to United States federal income tax regardless of whether such income is effectively connected with a United States trade or business. In the United States, this material may be distributed only to a person who is a "distributor", or who is not a "US person", as defined by Regulation S under the U.S. Securities Act of 1933 (as amended).

Additional information for investors with residence or seat in Australia and New Zealand

This document is distributed in Australia by Robeco Hong Kong Limited (ARBN 156 512 659) ("RIAM BV"), which is exempt from the requirement to hold an Australian financial services license under the Corporations Act 2001 (Cth) pursuant to ASIC Class Order 03/1103. Robeco is regulated by the Securities and Futures Commission under the laws of Hong Kong and those laws may differ from Australian laws. This document is distributed only to "wholesale clients" as that term is defined under the Corporations Act 2001 (Cth). This document is not intended for distribution or dissemination, directly or indirectly, to any other class of persons. In New Zealand, this document is only available to wholesale investors within the meaning of clause 3(2) of Schedule 1 of the Financial Markets Conduct Act 2013 (FMCA). This document is not intended for public distribution in Australia and New Zealand.

Additional information for investors with residence or seat in Austria

This information is solely intended for professional investors or eligible counterparties in the meaning of the Austrian Securities Oversight Act.

Additional information for investors with residence or seat in Brazil

The Fund may not be offered or sold to the public in Brazil. Accordingly, the Fund has not been nor will be registered with the Brazilian Securities Commission (CVM), nor has it been submitted to the foregoing agency for approval. Documents relating to the Fund, as well as the information contained therein, may not be supplied to the public in Brazil, as the offering of the Fund is not a public offering of securities in Brazil, nor may they be used in connection with any offer for subscription or sale of securities to the public in Brazil.

Additional information for investors with residence or seat in Brunei

The Prospectus relates to a private collective investment scheme which is not subject to any form of domestic regulations by the Autoriti Monetari Brunei Darussalam ("Authority"). The Prospectus is intended for distribution only to specific classes of investors as specified in section 20 of the Securities Market Order, 2013, and must not, therefore, be delivered to, or relied on by, a retail client. The Authority is not responsible for reviewing or verifying any prospectus or other documents in connection with this collective investment scheme. The Authority has not approved the Prospectus or any other associated documents nor taken any steps to verify the information set out in the Prospectus and has no responsibility for it. The units to which the Prospectus relates may be illiquid or subject to restrictions on their resale. Prospective purchasers of the units offered should conduct their own due diligence on the units.

Additional information for investors with residence or seat in Canada

No securities commission or similar authority in Canada has reviewed or in any way passed upon this document or the merits of the securities described herein, and any representation to the contrary is an offence. Robeco Institutional Asset Management B.V. relies on the international dealer and international adviser exemption in Quebec and has appointed McCarthy Tétrault LLP as its agent for service in Quebec.

Additional information for investors with residence or seat in the Republic of Chile

Neither Robeco nor the Funds have been registered with the *Comisión para el Mercado Financiero* pursuant to Law no. 18.045, the *Ley de Mercado de Valores* and regulations thereunder. This document does not constitute an offer of or an invitation to subscribe for or purchase shares of the Funds in the Republic of Chile, other than to the specific person who individually requested this information on their own initiative. This may therefore be treated as a "private offering" within the meaning of Article 4 of the *Ley de Mercado de Valores* (an offer that is not addressed to the public at large or to a certain sector or specific group of the public).

Additional information for investors with residence or seat in Colombia

This document does not constitute a public offer in the Republic of Colombia. The offer of the fund is addressed to less than one hundred specifically identified investors. The fund may not be promoted or marketed in Colombia or to Colombian residents, unless such promotion and marketing is made in compliance with Decree 2555 of 2010 and other applicable rules and regulations related to the promotion of foreign funds in Colombia. The distribution of this Prospectus and the offering of Shares may be restricted in certain jurisdictions. The information contained in this Prospectus is for general guidance only, and it is the responsibility of any person or persons in possession of this Prospectus and wishing to make application for Shares to inform themselves of, and to observe, all applicable laws and regulations of any relevant jurisdiction. Prospective applicants for Shares should inform themselves of any applicable legal requirements, exchange control regulations and applicable taxes in the countries of their respective citizenship, residence or domicile

Additional information for investors with residence or seat in the Dubai International Financial Centre (DIFC), United Arab Emirates

This material is distributed by Robeco Institutional Asset Management B.V. (DIFC Branch) located at Office 209, Level 2, Gate Village Building 7, Dubai International Financial Centre, Dubai, PO Box 482060, UAE. Robeco Institutional Asset Management B.V. (DIFC Branch) is regulated by the Dubai Financial Services Authority ("DFSA") and only deals with Professional Clients or Market Counterparties and does not deal with Retail Clients as defined by the DFSA.

Additional information for investors with residence or seat in France

Robeco Institutional Asset Management B.V. is at liberty to provide services in France. Robeco France is a subsidiary of Robeco whose business is based on the promotion and distribution of the group's funds to professional investors in France.

Additional information for investors with residence or seat in Germany

This information is solely intended for professional investors or eligible counterparties in the meaning of the German Securities Trading Act.

Additional information for investors with residence or seat in Hong Kong

The contents of this document have not been reviewed by the Securities and Futures Commission ("SFC") in Hong Kong. If there is any doubt about any of the contents of this document, independent professional advice should be obtained. This document has been distributed by Robeco Hong Kong Limited ("Robeco"). Robeco is regulated by the SFC in Hong Kong.

Additional information for investors with residence or seat in Indonesia

The Prospectus does not constitute an offer to sell nor a solicitation to buy securities in Indonesia.

Additional information for investors with residence or seat in Italy

This document is considered for use solely by qualified investors and private professional clients (as defined in Article 26 (1) (b) and (d) of Consob Regulation No. 16190 dated 29 October 2007). If made available to Distributors and individuals authorized by Distributors to conduct promotion and marketing activity, it may only be used for the purpose for which it was conceived. The data and information contained in this document may not be used for communications with Supervisory Authorities. This document does not include any information to determine, in concrete terms, the investment inclination and, therefore, this document cannot and should not be the basis for making any investment decisions.

Additional information for investors with residence or seat in Japan

This document is considered for use solely by qualified investors and is distributed by Robeco Japan Company Limited, registered in Japan as a Financial Instruments Business Operator, [registered No. the Director of Kanto Local Financial Bureau (Financial Instruments Business Operator), No.2780, Member of Japan Investment Advisors Association].

Additional information for investors with residence or seat in South Korea

The Management Company is not making any representation with respect to the eligibility of any recipients of the Prospectus to acquire the Shares therein under the laws of South Korea, including but not limited to the Foreign Exchange Transaction Act and Regulations thereunder. The Shares have not been registered under the Financial Investment Services and Capital Markets Act of Korea, and none of the Shares may be offered, sold or delivered, or offered or sold to any person for re-offering or resale, directly or indirectly, in South Korea or to any resident of South Korea except pursuant to applicable laws and regulations of South Korea.

Additional information for investors with residence or seat in Liechtenstein

This document is exclusively distributed to Liechtenstein-based, duly licensed financial intermediaries (such as banks, discretionary portfolio managers, insurance companies, fund of funds) which do not intend to invest on their own account into Fund(s) displayed in the document. This material is distributed by Robeco Switzerland Ltd, postal address: Josefstrasse 218, 8005 Zurich, Switzerland. LGT Bank Ltd., Herrengasse 12, FL-9490 Vaduz, Liechtenstein acts as the representative and paying agent in Liechtenstein. The prospectus, the Key Information Documents (PRIIP)the articles of association, the annual and semi-annual reports of the Fund(s) may be obtained from the representative or via the website.

Additional information for investors with residence or seat in Malaysia

Generally, no offer or sale of the Shares is permitted in Malaysia unless where a Recognition Exemption or the Prospectus Exemption applies: NO ACTION HAS BEEN, OR WILL BE, TAKEN TO COMPLY WITH MALAYSIAN LAWS FOR MAKING AVAILABLE, OFFERING FOR SUBSCRIPTION OR PURCHASE, OR ISSUING ANY INVITATION TO SUBSCRIBE FOR OR PURCHASE OR SALE OF THE SHARES IN MALAYSIA OR TO PERSONS IN MALAYSIA AS THE SHARES ARE NOT INTENDED BY THE ISSUER TO BE MADE AVAILABLE, OR MADE THE SUBJECT OF ANY OFFER OR INVITATION TO SUBSCRIBE OR PURCHASE, IN MALAYSIA. NEITHER THIS DOCUMENT NOR ANY DOCUMENT OR OTHER MATERIAL IN CONNECTION WITH THE SHARES SHOULD BE DISTRIBUTED, CAUSED TO BE DISTRIBUTED OR CIRCULATED IN MALAYSIA. NO PERSON SHOULD MAKE AVAILABLE OR MAKE ANY INVITATION OR OFFER OR INVITATION TO SELL OR PURCHASE THE SHARES IN MALAYSIA UNLESS SUCH PERSON TAKES THE NECESSARY ACTION TO COMPLY WITH MALAYSIAN LAWS.

Additional information for investors with residence or seat in Mexico

The funds have not been and will not be registered with the National Registry of Securities or maintained by the Mexican National Banking and Securities Commission and, as a result, may not be offered or sold publicly in Mexico. Robeco and any underwriter or purchaser may offer and sell the funds in Mexico on a private placement basis to Institutional and Accredited Investors, pursuant to Article 8 of the Mexican Securities Market Law.

Additional information for investors with residence or seat in Peru

The Superintendencia del Mercado de Valores (SMV) does not exercise any supervision over this Fund and therefore the management of it. The information the Fund provides to its investors and the other services it provides to them are the sole responsibility of the Administrator. This Prospectus is not for public distribution.

Additional information for investors with residence or seat in Singapore

This document has not been registered with the Monetary Authority of Singapore ("MAS"). Accordingly, this document may not be circulated or distributed directly or indirectly to persons in Singapore other than (i) to an institutional investor under Section 304 of the SFA, (ii) to a relevant person pursuant to Section 305(1), or any person pursuant to Section 305(2), and in accordance with the conditions specified in Section 305, of the SFA, or (iii) otherwise pursuant to, and in accordance with the conditions of, any other applicable provision of the SFA. The contents of this document have not been reviewed by the MAS. Any decision to participate in the Fund should be made only after reviewing the sections regarding investment considerations, conflicts of interest, risk factors and the relevant Singapore selling restrictions (as described in the section entitled "Important information for Singapore Investors") contained in the prospectus. Investors should consult their professional adviser if you are in doubt about the stringent restrictions applicable to the use of this document, regulatory status of the Fund, applicable regulatory protection, associated risks and suitability of the Fund to your objectives. Investors should note that only the Sub-Funds listed in the appendix to the section entitled "Important information for Singapore Investors" of the prospectus ("Sub-Funds") are available to Singapore investors. The Sub-Funds are notified as restricted foreign schemes under the Securities and Futures Act, Chapter 289 of Singapore ("SFA") and invoke the exemptions from compliance with prospectus registration requirements pursuant to the exemptions under Section 304 and Section 305 of the SFA. The Sub-Funds are not authorized or recognized by the MAS and shares in the Sub-Funds are not allowed to be offered to the retail public in Singapore. The prospectus of the Fund is not a prospectus as defined in the SFA. Accordingly, statutory liability under the SFA in relation to the content of prospectuses does not apply. The Sub-Funds may only be promoted exclusively to persons who are sufficiently experienced and sophisticated to understand the risks involved in investing in such schemes, and who satisfy certain other criteria provided under Section 304, Section 305 or any other applicable provision of the SFA and the subsidiary legislation enacted thereunder. You should consider carefully whether the investment is suitable for you. Robeco Singapore Private Limited holds a capital markets services license for fund management issued by the MAS and is subject to certain clientele restrictions under such license.

Additional information for investors with residence or seat in Spain

Robeco Institutional Asset Management B.V., Sucursal en España with identification number W0032687F and having its registered office in Madrid at Calle Serrano 47-14º, is registered with the Spanish Commercial Registry in Madrid, in volume 19.957, page 190, section 8, sheet M-351927 and with the National Securities Market Commission (CNMV) in the Official Register of branches of European investment services companies, under number 24. The investment funds or SICAV mentioned in this document are regulated by the corresponding authorities of their country of origin and are registered in the Special Registry of the CNMV of Foreign Collective Investment Institutions marketed in Spain.

Additional information for investors with residence or seat in South Africa

Robeco Institutional Asset Management B.V. is registered and regulated by the Financial Sector Conduct Authority in South Africa.

Additional information for investors with residence or seat in Switzerland

The Fund(s) are domiciled in Luxembourg. This document is exclusively distributed in Switzerland to qualified investors as defined in the Swiss Collective Investment Schemes Act (CISA). This material is distributed by Robeco Switzerland Ltd, postal address: Josefstrasse 218, 8005 Zurich. ACOLIN Fund Services AG, postal address: Leutschenbachstrasse 50, 8050 Zürich, acts as the Swiss representative of the Fund(s). UBS Switzerland AG, Bahnhofstrasse 45, 8001 Zurich, postal address: Europastrasse 2, P.O. Box, CH-8152 Opfikon, acts as the Swiss paying agent. The prospectus, the Key Information Documents (PRIIP), the articles of association, the annual and semi-annual reports of the Fund(s), as well as the list of the purchases and sales which the Fund(s) has undertaken during the financial year, may be obtained, on simple request and free of charge, at the office of the Swiss representative ACOLIN Fund Services AG. The prospectuses are also available via the website.

Additional information relating to RobecoSAM-branded funds/services

Robeco Switzerland Ltd, postal address Josefstrasse 218, 8005 Zurich, Switzerland has a license as asset manager of collective assets from the Swiss Financial Market Supervisory Authority FINMA. The RobecoSAM brand is a registered trademark of Robeco Holding B.V. The brand RobecoSAM is used to market services and products which entail Robeco's expertise on Sustainable Investing (SI). The brand RobecoSAM is not to be considered as a separate legal entity.

Additional information for investors with residence or seat in Taiwan

The contents of this document have not been reviewed by any regulatory authority in Hong Kong. If you are in any doubt about any of the contents of this document, you should obtain independent professional advice. This document has been distributed by Robeco Hong Kong Limited ("Robeco"). Robeco is regulated by the Securities and Futures Commission in Hong Kong.

Additional information for investors with residence or seat in Thailand

The Prospectus has not been approved by the Securities and Exchange Commission which takes no responsibility for its contents. No offer to the public to purchase the Shares will be made in Thailand and the Prospectus is intended to be read by the addressee only and must not be passed to, issued to, or shown to the public generally.

Additional information for investors with residence or seat in the United Arab Emirates

Some Funds referred to in this marketing material have been registered with the UAE Securities and Commodities Authority ("the Authority"). Details of all Registered Funds can be found on the Authority's website. The Authority assumes no liability for the accuracy of the information set out in this material/document, nor for the failure of any persons engaged in the investment Fund in performing their duties and responsibilities.

Additional information for investors with residence or seat in the United Kingdom

Robeco is deemed authorized and regulated by the Financial Conduct Authority. Details of the Temporary Permissions Regime, which allows EEA-based firms to operate in the UK for a limited period while seeking full authorization, are available on the Financial Conduct Authority's website.

Additional information for investors with residence or seat in Uruguay

The sale of the Fund qualifies as a private placement pursuant to section 2 of Uruguayan law 18,627. The Fund must not be offered or sold to the public in Uruguay, except under circumstances which do not constitute a public offering or distribution under Uruguayan laws and regulations. The Fund is not and will not be registered with the Financial Services Superintendency of the Central Bank of Uruguay. The Fund corresponds to investment funds that are not investment funds regulated by Uruguayan law 16,774 dated 27 September 1996, as amended.