ROBECO
The Investment Engineers

Central bank watcher

SPECIAL EDITION: The invisible hand that guides the bond market

Sustainable Investing Expertise by ROBECOSAM

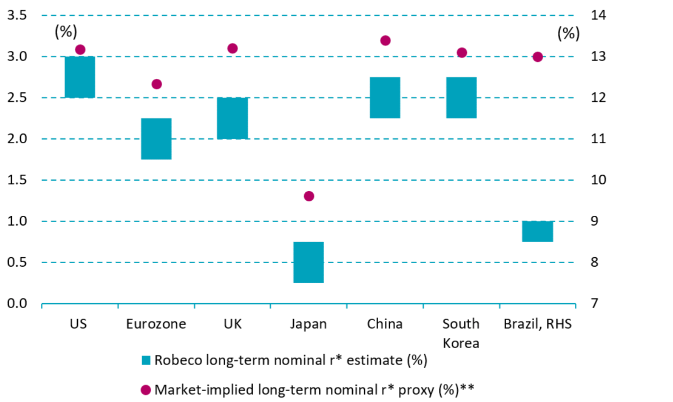
- A view on r* is crucial for assessing bond yield valuations
- Our estimates of this 'invisible hand' are below those of the market
- We are turning more constructive on government bonds

ECB and Fed policymakers have recently made frequent references to the neutral rate, or r*, confirming that central banks consider it to be a guide for interest rate policy. To understand cross-market differences in longer-term bond yields and yield curves – and to identify investment opportunities – it is therefore crucial to have a view on r*. The complication is that it is a theoretical concept. For each market, estimates of r* depend on assumptions about a whole host of variables, including inflation, growth, fiscal prudence and demographics.

Our r* estimates are below those of the market. While we agree with the view that an easier post-pandemic fiscal stance may be a factor in halting the secular downtrend in the neutral rate, our view is that demographic shifts could keep it low by historical standards over the next five to ten years. This is particularly true for advanced economies.

We have a bias for developed market policy rates to reverse somewhat quicker towards our below-market estimates of r* over the coming years. Hence, we are in the process of turning constructive on 5 to 10-year government bonds.

Long-run nominal r* estimates vs. market proxy



Source: Bloomberg, Federal Reserve, ECB, BoE, BoJ, BIS
** 5y OIS 5y forward, except for China & South Korea (5y5y IRS) & Brazil (5y5y sovereign yield)

Article
For professional investors
February 2023

Global Macro Team
Martin van Vliet
Rikkert Scholten
Bob Stoutjesdijk

CONTENTS

1. What's driving R* and where is it headed?

Introducing r*

Many central banks in developed and emerging markets are approaching the final stage of their tightening cycles – embarked upon to tame inflation. How high policy rates will go is very much data dependent (and we update our readers every six weeks on what we think). But if central banks succeed in steering inflation back towards their targets, likely helped by an impending economic slowdown, policy rates are likely to be lowered again over time. Indeed, this is what financial markets are discounting. What's more, over the long run, after the economy has adjusted to any cyclical fluctuations, policy rates are assumed to converge back to their *equilibrium* level. This is the level at which monetary (interest rate) policy is considered neither accommodative nor contractionary, i.e. it neither stokes nor slows economic growth.[1]

The difficulty for investors is that this long-run equilibrium policy rate, also called the neutral rate, or r*, is a theoretical construct that is unobservable and must be estimated. Even so, it can – in the words of BoE governor Andrew Bailey – "provide an indication of the general outlook for interest rates over the coming years", especially because central banks use it as a point of reference. Indeed, ECB policymakers have frequently referenced the neutral rate in speeches over the past months, as have US Fed officials, including Chair Powell. Moreover, a long-run r* estimate is included in the quarterly Summary of Economic Projections of Fed Board members and Bank Presidents.

R* is often referred to in 'real', or inflation-adjusted, terms, as consumer and business investment decisions are typically affected by the level of borrowing costs that take into account the inflation expected to prevail during the life of the investment. Converting it into a nominal variable thus implies adding a measure of inflation expectations. A good example would be a central bank's prevailing inflation target. An r* perspective can greatly help in understanding cross-market differences in longer-term bond yields and yield curves – and in assessing their future evolution.

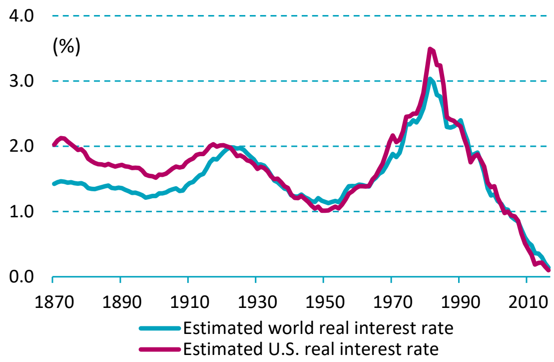
Before we turn to this and compare official r* estimates and market proxies, we first discuss the drivers of r* and whether we think the secular downtrend in r* has been broken (or not).

Drivers of r* and its direction of travel

Put simply, r* largely depends on the interplay between the supply of savings and the demand for savings (to fund investment). How this works exactly – and what factors typically influence saving and investment behavior in an economy – is discussed in the box at the end of this section.

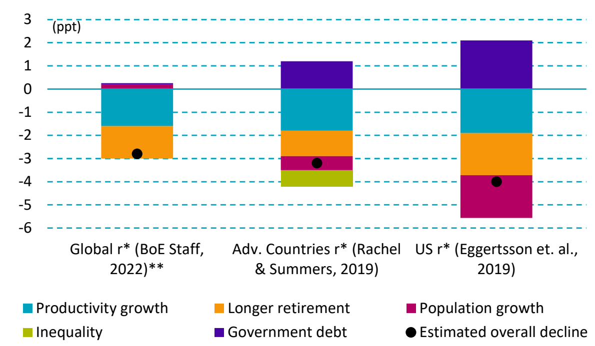
Many studies have documented that, due to an excess of desired savings over investments,[2] r* has been on a secular downtrend since the end of the 1970s – as Chart 1 confirms. A recent study by BoE researchers[3] postulates that, from a global point of view, this decline has been predominantly driven by (i) an increase in longevity (which has pushed up desired savings of (would-be) retirees) and (ii) a slowdown in productivity growth (which has reduced demand for capital at a given interest rate given lower potential returns on new investments) (see Chart 2). Good examples of countries where these two effects are clearly evident are Japan and China.

Chart 1 | Trend in world and US real interest rate



Source: Del Negro et al. (2019)

Chart 2 | Drivers behind the change in r* between 1970-2017

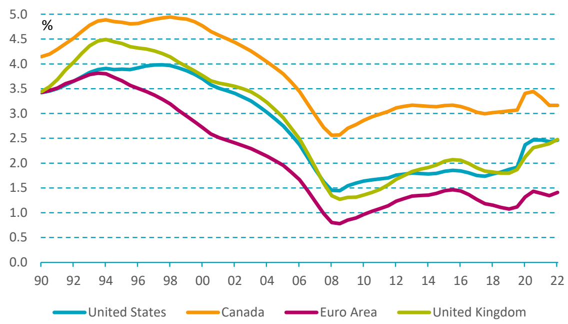


Source: BoE, Rachel & Summers, Eggertsson et al.

[1] In the remainder of this note we take this 'longer-run' perspective on the equilibrium interest rate.
[2] As desired saving outstripped desired investment, the real rate of interest fell to equilibrate actual demand and supply of capital.
[3] BoE Staff Working Paper, *Decomposing the drivers of Global R**, July 2022

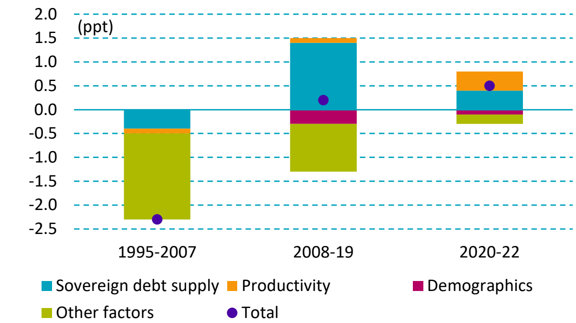
Meanwhile, Rachel and Summers (2019) show that in advanced economies, slowing population growth and increased inequality have added to this. The latter is believed to have lowered r* because of the higher marginal propensity to save of higher income/wealth cohorts. They also estimate that the increase in government debt since the 1970s has helped to dampen the secular decline in r*. Such findings are corroborated by estimates from Eggertsson et al. (2019) and Ferreira and Davin (2022). Notably, the latter study also shows that the increased sovereign debt supply between 2008 and 2019 has actually worked to *push up* the long-run r* in the US, Canada, the UK and the Eurozone from earlier lows. The further rise in government indebtedness since the pandemic may have reinforced this (see Chart 3 and 4). This finding is in contrast to the view of some private sector pundits, who have argued that high and rising government debt actually tends to push down r* by increasing economic agents' desire to save (out of fear of future tax rises).

Chart 3 | Nominal long-run r* across selected economies



Source: Ferreira & Davin, *Longer-Run Neutral Rates in Major Advanced Economies*, FEDS Notes, Dec-2022

Chart 4 | Drivers of changes in US longer-run r* since 1995



Source: Ferreira & Davin, *Longer-Run Neutral Rates in Major Advanced Economies*, FEDS Notes, Dec-2022

Studies for EM countries confirm the positive relationship between government debt and the level of r*, although here the causation seems to run via the credibility channel of monetary policy as highlighted by Ruch (2021) and Clarida (2019). Typically, countries with relatively high levels of government debt and twin deficits (i.e. a fiscal and current account deficit) run the risk of high imported inflation and it is up to the central bank to credibly prevent this. Fiscal policy loosening will thus require a firm response by the central bank to counterbalance this potential inflationary impulse by preventing the current account from weakening further (by trying to keep the currency stable). Hence, r* is higher in such economies relative to those with lower government debt levels and more sound fiscal metrics (Brazil versus Korea, for example).

Looking ahead, we concur with the view that a generally looser fiscal regime since the pandemic may have helped break the secular downtrend in r*. One additional consideration here, as also flagged by the IMF at Jackson Hole in 2022, is the upward effect on r* from accelerating global investment to address climate change.[4] Nonetheless, in view of the lingering demographic trends[5] we suspect that r* – certainly in advanced economies – is likely to remain low by historical standards over the next five to ten years.

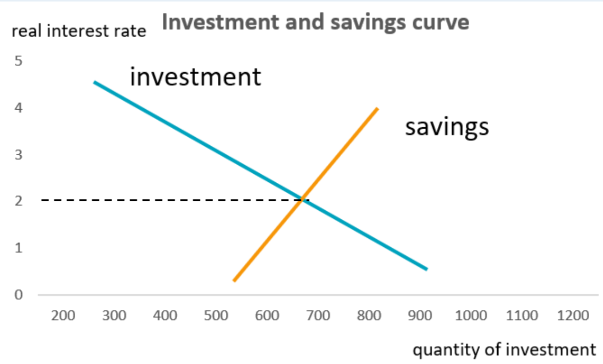
The next section provides our latest r* estimates for four selected G-10 markets (US, UK, Eurozone and Japan) and three EM markets (China, South Korea and Brazil), and compares these with the latest official r* estimates as well as market proxies.

[4] This upward effect might be tempered, as Andrew Bailey has argued, by increased precautionary saving of households given the "uncertainty about the transition path towards carbon neutrality".
[5] Indeed, simulations by the BoE Staff as well as Rachel and Summers (2019) are consistent with the notion that demographics will continue to dampen r* in advanced economies for quite some time to come.

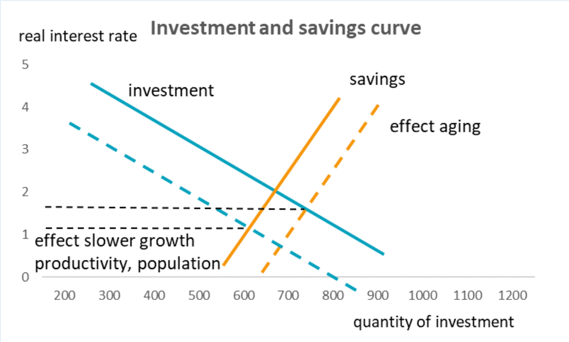
Box: r* and the interplay between savings and investment

The so-called Loanable Funds Model helps clarify how the interaction between the demand for funds for investment purposes and the supply of funds via savings affects the equilibrium level of real interest rates. This is the "IS" part of the IS-LM model that was made famous by John Hicks in his response to Keynes' General Theory of Employment, Interest and Money (1936).

The investment function in this model relates the desired amount of investment funds to the level of interest rates. As it is assumed that a lower cost of borrowing will increase the desired amount of investment, the investment function can be described as a downward-sloping line, as in the chart below. The supply of loanable funds, or savings, is assumed to have a positive relationship with the level of interest rates, which is illustrated via an upward-sloping line. The crossing of both lines gives the equilibrium level of real interest rates, r*.



With this in mind, we can investigate examples of the drivers of r*. In an economy experiencing slowing productivity, for example because it moves into a next stage of economic development (e.g. DMs vs. EMs), the potential return on new investments should come down Hence, the propensity to invest will be lower. This is depicted by a downward shift of the desired investment function. Lower population growth can lead to a similar decline in potential returns and thus also results in a shift downwards.



Aging is an example of a factor that influences the propensity to save. An older population is more prone to saving. This should push the savings curve towards the right and result in a combination of a lower equilibrium rate and higher investment. The lower equilibrium rate will likely dominate as aging will also imply lower population growth and thus shift the investment function downwards.

Increased fiscal borrowing leads to an upward shift of the savings curve, and hence a higher r*. Private sector agents, however, may realize they have to pay for that borrowing later (following Ricardian equivalence theory). Any such effect will push the savings curve downward and thus temper the rise in r*.

2. R* estimates for selected DM and EM markets

The table below presents our latest estimates for the long-run r* rate in seven selected markets. To ease the comparison with what the market is discounting in terms of r* (the final column on the right), the estimated range is expressed in nominal terms (and hence includes long-term inflation expectations). R* estimates by official institutions or academics – which are typically expressed in real or inflation-adjusted terms – are converted into nominal terms by adding the long-term inflation expectations figures (second column).

Before we discuss the estimates per market, we want to make two caveats. First, some of the *official* r* estimates, notably those for China and Brazil, are based on studies from a few years ago and in view of the latest developments seem somewhat high (in the case of China) or somewhat low (Brazil). Secondly, where available, the market-implied proxies of r* are either derived from 5-year overnight indexed swap (OIS) rates 5 year forward or from sovereign forward yields. Such forwards typically contain risk premia, in particular for inflation uncertainty. Especially for markets with weaker debt fundamentals and large current account deficits, some caution is therefore needed when interpreting the differences between our long-term r* estimates and those of the market.

Table 1 | Long-run r* estimates vs market proxies

	Official long term real r* estimate (%)	Long-term inflation expectations (%)	Official long-term nominal r* estimate (%)	Robeco long-term nominal r* estimate (%)	Market-implied long-term nominal r* proxy (%)**
US	0.25 to 1.00	2.00	2.25 to 3.00	2.50 to 3.00	3.1
Eurozone	-1.00 to 0.00	2.00	1.00 to 2.00	1.75 to 2.25	2.7
UK	0.00 to 1.00	2.00	2.00 to 3.00	2.00 to 2.50	3.1
Japan	-1.00 to -0.50	1.00	0.00 to 0.50	0.25 to 0.75	1.3
China	2.00	2.00	4.00	2.25 to 2.75	3.2
South Korea	-1.00 to -0.50	2.00	1.00 to 1.50	2.25 to 2.75	3.1
Brazil	3.00 to 3.50	4.50	7.50 to 8.00	8.50 to 9.00	13.0

Source: Bloomberg, Fed, ECB, BoE, BoJ, BIS

** 5y OIS rate 5y forward, except for China & South Korea (5y5y IRS) and Brazil (5y5y sovereign yield)

- *US*. The Fed's nominal r* estimate has declined from 4% in 2014 to 2.5% in 2019. It has been stable since 2019. The decline in r* can be explained by slowing productivity growth and aging. The 10-year moving average of productivity growth peaked at 3.0% in 2005 and declined to 1¼% in 2016. More recently, there has been a small uptick in trend productivity growth. Aging can be monitored via the old-age dependency ratio. This started rising in 2010, a trend which the OECD expects to continue until 2027. An upward effect on r* should be incorporated owing to what seems a structural increase in fiscal deficits. Between 2009 and 2019 the 10-year average of the deficit has risen from 2.5% to 4.5% GDP, only to rise further during the pandemic. We do notice that r* declined during this episode so the upward impact from this factor should be limited and might be temporary. The change in the Fed monetary policy framework to a flexible inflation target in 2019 may have added to expected inflation. Market prices of forward inflation rates suggest this effect should be at maximum 0.25%. Adding these factors together leaves a modestly higher r* estimate of 2.5-3.0%.
- *Eurozone.* The latest estimates by the Eurosystem point to a long-run real r* rate for the Eurozone of somewhere between -1% and 0%. Adding the new ECB inflation target of 2%, yields a nominal r* of between 1 and 2%. ECB governor Villeroy mentioned this range on several occasions last year – and more recently he argued that r* is closer to the top end of this range. This is also reflected in our estimated range (of between 1.75% and 2.25%). The market seems to believe that the nominal r* is another 50 bps above this range. Importantly, the r* within the eurozone differs across countries, and both the ECB (2018) and IMF (2020) have shown that it is below average in Southern Europe. This implies that at a given policy rate, monetary policy is more restrictive there than elsewhere.
- *UK.* The BoE does not provide explicit estimates of the long-run real r* so we have to rely on estimates from the academic and central banking world. These generally point to a level between 0% and 1%. With the inflation target set at 2% this would equate to a neutral rate estimate in nominal terms between 2% and 3%. Even though the BoE does not provide actual r* forecasts, it is possible to derive an implied r* from the monetary policy forecasts regarding growth and inflation subject to an assumed Bank rate policy path. Such a rough estimate would yield a long-run r* in nominal terms in the order of 1.5% to 2%, which has been

mentioned at times by former MPC member Saunders and current governor Bailey. Our estimate is a bit higher to reflect the fact that the UK tends to be more inflation prone via their dependence on imports and due to a generally much tighter labor market post Brexit and Covid-19, with reduced labor migration flows.

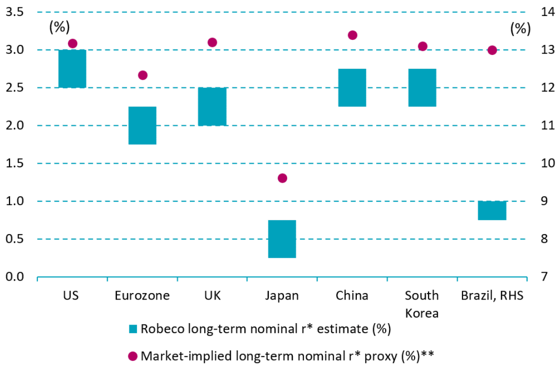
- *Japan.* There are a lot of estimates for Japan's r* rate depending on the model and assumptions being used. The majority put the long-run real r* somewhere between -1.0% and -0.5%. For Japan we would not add the official inflation target given its structural issues with inflation (and the BoJ's track-record in meeting this target) and would rather use a combination of surveys from the BoJ and the 5y5yr Inflation Swap forward. That combination currently yields 1%, which implies that long-run r* in nominal terms is somewhere between 0% and 0.5%, which is not far off our estimate but quite a bit below the market proxy.
- *China.* A BIS study from 2021 pitched the long-run real r* at close to 2% in 2018. In nominal terms, after adding the 5-year moving average inflation rate of 2% (the PBoC does not have a formal inflation target), this equates to a rate of 4%. With ageing in China progressing, demographics is a key reason why we believe that nominal r* is currently much lower in China. Our estimated range of 2.25-2.75% is roughly in line with the actual policy rate corridor, but also well below the market-implied proxy of 3.2%.
- *South Korea.* An IMF study from 2021 expressed the long-run real r* between -1.0% and -0.5%. Adjusting for the inflation target leaves the nominal long-run r* between 1.0% and 1.5%. Further, because aging is progressing at a rapid pace in South Korea, just like in Japan and China, demographics is one of the key reasons why many r* estimates are quite low. Our estimate is a bit higher as South Korea has become more import dependent and therefore more inflation prone. Still, the large current account surplus, an aging society and a structural savings-investment imbalance will yield a relatively low r* for South Korea compared with r* estimates for other emerging markets countries.
- *Brazil.* Banco Central do Brasil (BCB) frequently publishes estimates of the long-run real r* with the most recent estimate set at 3.0-3.5%. Taking into account long-run inflation expectations in Brazil of 4.5%, the nominal long-run r* is estimated at between 7.5% and 8.0%, which is below our estimate. The relatively high neutral rate estimate is due to Brazil being (very) inflation prone, its strong wage growth, relatively poor fiscal and debt metrics and the BCB's poor track record in controlling inflation. We note the big difference compared to current market estimates of around 13%. We would highlight that the market is discounting a large inflationary risk premium, which overstates the market implied r* proxy.

3. Implications for bond yields going forward

Policy rates in many markets have increased sharply over the past year. But over the long run they are assumed to converge back to their equilibrium level, the r*. There are good reasons to believe (as we argue in the first chapter) that the generally looser fiscal regime since the pandemic has helped break the secular downtrend in r*. Still, in view of lingering demographic trends, we believe that r* is likely to remain low by historical standards over the next five to ten years – and certainly in advanced economies.

We showed in the previous chapter that most markets are discounting a nominal r* that is higher than our current estimates (Chart 5). This in itself could be an argument for being constructive on longer-term bonds. However, as long-term bond prices are also affected by the trajectory of policy rates over the next few years (albeit less than shorter-dated bonds), we have to factor in the cyclical outlook for inflation and economic growth as well.

Chart 5 | Long-run nominal r* estimates vs. market proxy



Source: Bloomberg, Fed, ECB, BoE, BoJ, BIS
** 5y OIS rate 5y forward, except for China & South Korea (5y5y IRS) and Brazil (5y5y sovereign yield)

Chart 6 | Key policy rates and mkt-implied path for next 3 years

Source: Bloomberg, Robeco

Markets are pricing in a peak in policy rates – which is well above the respective long-run r* – in the US, UK and Eurozone, followed by a 100-200 bps descent in the next few years (Chart 6). This trajectory seems premised on the view that underlying inflation pressures will gradually retreat against an economic backdrop of weak growth (but no deep recession). If a deep recession *were* to transpire, a quicker fall in core inflation would seem possible – and hence a quicker reversal in policy rates, potentially to levels below r* (if central banks believe inflation could again settle below their targets).

While we acknowledge that the sharp drop in wholesale gas prices in Europe, China's reopening from Covid curbs and resilient labor market data have brightened the global economic outlook, we suspect that much of the economic impact of recent monetary tightening is yet to be felt. The recent weakening in bank lending surveys to recessionary levels in the US and Europe – which have leading indicator properties for future growth in loans according to a recent ECB study – are a case in point. In short, while weighing the cyclical outlook for inflation and growth, we have a bias for DM policy rates to reverse somewhat quicker towards our below-market estimates of r* over the coming years. Hence, we are in the process of turning constructive on five to 10-year government bonds.

Finally, we would like to make one last comment on r*. If we as well as markets are underestimating the secular rise in r*, this could mean that the current monetary policy stance in many (DM) countries is less restrictive than they may seem. If markets were to revise upward their r* estimates embedded in longer-dated bond yields, this also means there is a risk of yield curve steepening. Such r* uncertainty is an additional reason why the strategies managed by the Global Macro team are braced for meaningful re-steepening of yield curves over the next few years (see our Global Macro Outlook, 'Recession investing').

References

- Rachel, L. and L Summers (2019), "On secular stagnation in the industrialized world", NBER Working Paper 26198
- Brand, C. et. al. (2018), "The natural rate of interest: estimates, drivers, and challenges to monetary policy", ECB occasional paper No 217
- Guofeng Sun and D. Rees (2021), "The natural interest rate in China, BIS working paper No. 949
- Ferreira, T. and C. Davin (2022), "Longer-run neutral rates in major advanced economies, FEDS Notes
- Del Negro et al. (2019), "Global trends in interest rates", Journal of International Economics, vol. 118, issue C
- Bailey, A., "The economic landscape: structural change, global R* and the missing-investment puzzle", speech OMFIF
- Cesa-Bianchi, A. et al. (2022), "Decomposing the drivers of Global R*", BoE Staff Working Paper No. 990
- Eggertsson, G. et al. (2019), "A model of secular stagnation: Theory and Quantitative evaluation", American Economic Journal: Macroeconomics 2019
- Arena, M. et al. (2020), "It is only natural: Europe's low interest rates", IMF Working Paper 20/116
- Gopinath, G. (2022), "How will the pandemic and the war shape future monetary policy?", Presentation by IMF
- Rafiq, S. (2021), "What's in the (R)-Stars for Korea", IMF Working Paper 21/93
- Ruch, F. (2021). "Neutral real interest rates in inflation targeting emerging and developing economies", World Bank Policy Research Working Paper 9711
- Clarida, R. (2019). "The global factor in neutral policy rates: some implications for exchange rates, monetary policy, policy coordination", Board of Governors of the Federal Reserve System number 1244

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, the prices used for the performance figures of the Luxembourg-based Funds are the end-of-month transaction prices net of fees up to 4 August 2010. From 4 August 2010, the transaction prices net of fees will be those of the first business day of the month. Return figures versus the benchmark show the investment management result before management and/or performance fees; the Fund returns are with dividends reinvested and based on net asset values with prices and exchange rates as at the valuation moment of the benchmark. 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 Investor Information Document for the Robeco Funds can all be obtained free of charge from Robeco's websites.

Additional Information for US investors

Robeco is considered "participating affiliated" 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 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 fewer 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.

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 in 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 Investor Information Documents (KIIDs), 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, 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 Fund has not been registered with the Superintendencia del Mercado de Valores (SMV) and is being placed by means of a private offer. SMV has not reviewed the information provided to the investor. This document is only for the exclusive use of institutional investors in Peru and 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 your 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: Affolternstrasse 56, 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 Investor Information Documents (KIIDs), 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. RobecoSAM-branded financial instruments and investment strategies referring to such financial instruments are generally managed by Robeco Switzerland Ltd. 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 temporarily 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 September 27, 1996, as amended.