ROBECO
The Investment Engineers

LONG-TERM EXPECTED RETURNS

Robeco regularly revises its outlook on long-term expected returns.
This document was last updated in September 2020.

Contents

1

Long-term expected returns

The purpose of this report is to show our long-term return expectations for a wide set of asset classes. We take an unconditional long-term view, which means that neither valuation or current economic environment is relevant. These long-term expected returns can be used as the equilibrium returns for asset and liability management (ALM) studies for long-term investors such as pension or endowment funds.

Naturally, these estimates are uncertain. Nevertheless, by using thorough empirical and theoretical research methods, and rounding returns to the nearest quarter, i.e. 0.25% precision, and volatilities to the nearest 1%, they should reflect net returns for investors that want to gain exposure to each asset class. For liquid assets, transaction costs and management fees are low and only play a marginal role when rounding expected returns to the nearest 0.25% precision. Situations where costs actually play a larger role are also discussed; for example, alternative assets such as private equity, and hedge funds that cannot be tracked at low cost.

The returns we estimate here are geometric, which are better suited to long investment horizons. Since we also estimate the volatility risk of each asset class, readers who are interested can convert the geometric return to an arithmetic expected return.[1] Our estimates are based on the worldwide market capitalization-weighted asset classes. For historical returns on the invested market portfolio, i.e. the market capitalization-weighted investment portfolio of all asset classes, see Doeswijk, Lam, and Swinkels (2020). They find a realized geometric real return in USD of 4.45% per year, with a standard deviation of 11.2% and a Sharpe ratio of 0.36 over the period 1960-2017.

1. Assuming log-normally distributed returns, the arithmetic average is the geometric average plus half of the variance of the returns. See Campbell, Lo and MacKinlay (1997, p. 15).

Table 1.1: Historical returns for several markets over the period 1900-2017

	Inflation	Real returns			Excess returns over cash	
		Cash	Bonds	Equities	Bonds	Equities
Australia	3.8%	0.7%	1.7%	6.8%	1.0%	6.0%
Austria	12.6%	-7.9%	-3.7%	0.8%	4.6%	9.5%
Belgium	5.0%	-0.3%	0.5%	2.7%	0.8%	3.0%
Canada	3.0%	1.5%	2.2%	5.7%	0.7%	4.2%
Denmark	3.7%	2.1%	3.3%	5.4%	1.2%	3.3%
Finland	7.0%	-0.5%	0.3%	5.4%	0.7%	5.9%
France	6.9%	-2.7%	0.3%	3.3%	3.1%	6.2%
Germany	29.5%	-2.3%	-1.3%	3.3%	1.0%	5.8%
Ireland	4.1%	0.7%	1.6%	4.4%	0.9%	3.6%
Italy	8.1%	-3.5%	-1.1%	2.0%	2.5%	5.7%
Japan	6.7%	-1.9%	-0.8%	4.2%	1.1%	6.1%
Netherlands	2.9%	0.6%	1.8%	5.0%	1.2%	4.5%
New Zealand	3.6%	1.7%	2.1%	6.2%	0.4%	4.4%
Norway	3.6%	1.1%	1.8%	4.3%	0.7%	3.2%
Portugal	7.3%	-1.1%	0.7%	3.5%	1.8%	4.6%
South Africa	5.0%	1.0%	1.8%	7.2%	0.9%	6.2%
Spain	5.6%	0.3%	1.8%	3.6%	1.6%	3.3%
Sweden	3.4%	1.8%	2.7%	5.9%	0.9%	4.0%
Switzerland	2.2%	0.8%	2.3%	4.4%	1.6%	3.6%
United Kingdom	3.7%	1.0%	1.8%	5.5%	0.8%	4.4%
United States	2.9%	0.8%	2.0%	6.4%	1.1%	5.5%
World	2.9%	0.8%	1.8%	5.1%	1.0%	4.2%
Average	6.2%	-0.3%	1.0%	4.5%	1.4%	4.8%
Median	4.1%	0.7%	1.8%	4.5%	1.0%	4.6%

Source: Dimson-Marsh-Staunton database (2017), Robeco. Note that for Austria and Germany have experienced hyperinflation periods in 1922 (Austria) and 1923/24 (Germany).

We start this study by examining the 2017 database compiled by Dimson, Marsh and Staunton (the DMS database). For each of the 21 countries in this database, we calculate the compounded rate of inflation, the compounded real rates of return for cash, bonds and equities, and the excess returns over the 117-year period 1900-2016. Table 1.1 shows the results. We also calculate the average of and a median over the 21 countries.

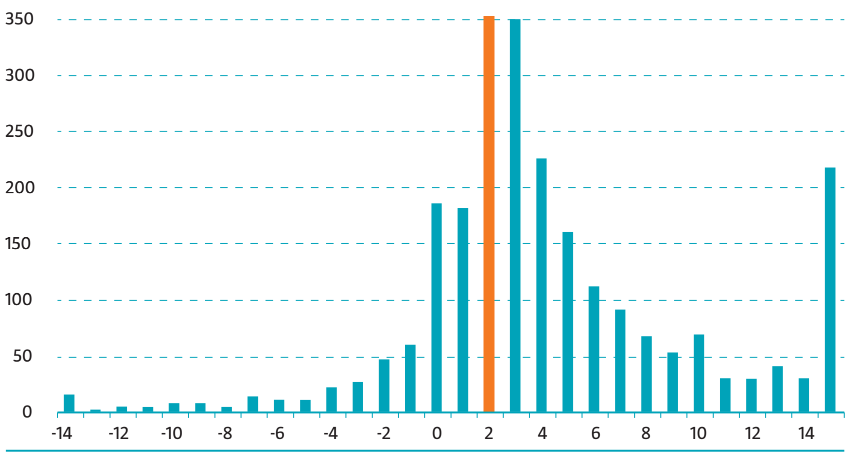
Note that recently, several other independently developed historical databases have been created. The Jordà-Schularick-Taylor MacroHistory database is described by Jordà, Schularick, and Taylor (2017) and Jordà, Knoll, Kuvshinov, Schularick, and Taylor (2019) and contains country-level annual bond and stock returns starting as early as 1870. The Global Financial Data database contains data going back as far as 1602, when stock market trading started in Amsterdam. Swinkels (2020) uses this database to create global bond and equity returns over the period 1800-1914. These relatively new and less explored datasets are used as additional novel evidence complementing the evidence from the DMS database that is central in the sections below.

1.1 Inflation

Inflation around the globe was significantly higher from 1900 to 2000 than that we have seen over the past two decades. Germany is an outlier with its hyperinflation period in the early part of the sample period, resulting in an average inflation rate of 29.5% per year. The median compounded inflation rate equals 4.1%. Although central banks in developed markets target inflation at close to 2%, we doubt whether, looking at historical records, they will succeed in achieving in the long run what would be lower than historically observed in any country since 1900.[2]

2. Note that Swinkels (2020) finds that the four major markets had an average inflation of only 0.4% from 1800 to 1914. An important difference between the 19th and 20th century is that in the 19th century most currencies were directly linked to gold.

Figure 1.1: Distribution frequency of 2,457 annual inflation data (1900-2016, 21 countries, in %)



Source: Dimson-Marsh-Staunton database (2017), Robeco

Another way of describing the history of inflation is to map all 2,457 inflation figures that we have for 21 countries over 117 years – see Figure 1.1. Using this method, as illustrated in the distribution frequency, it appears that inflation most often falls in the range of 2 to 3%, with 353 observations, and the median of these individual observations together comes in at 2.8%. In addition, Figure 1.1 clearly shows an asymmetric distribution: there are far more years in which inflation is above 2% than below 2%. A future distribution is likely to show the same asymmetry, as we have yet to meet a central bank that argues in favor of targeting a period of deflation after a period of overshooting its target inflation rate, as this would detract from its ability to achieve its target rate. This applies in particular to an environment where the zero lower bound problem for central banks remains an issue. Blanchard, Dell'Ariccia and Mauro (2010) along with De Grauwe and Ji (2019) find that a low inflation target creates the risk of persistent recessions and low growth.

Our view is that when investors make long-term predictions about inflation, they should consider both past and present inflation targets; see Svensson (2010). We believe long-term inflation to be around 3% as a compounded average: right between the central banks' inflation target of 2% and the empirical reality of the 4.1% median compounded inflation over the period 1900 to 2017. It therefore seems to be a conservative estimate, being below the 4.1% median and the 6.2% average of the 21 individual compounded inflation rates. Note that the median is less sensitive to outliers (such as Germany) than the average of the data series. Finally, we would like to point out that our long-term estimate is one for an average compounded inflation rate. This results from lengthy periods with inflation of around 2%, some periods with inflation spikes above 2%, and the occasional deflationary episode.

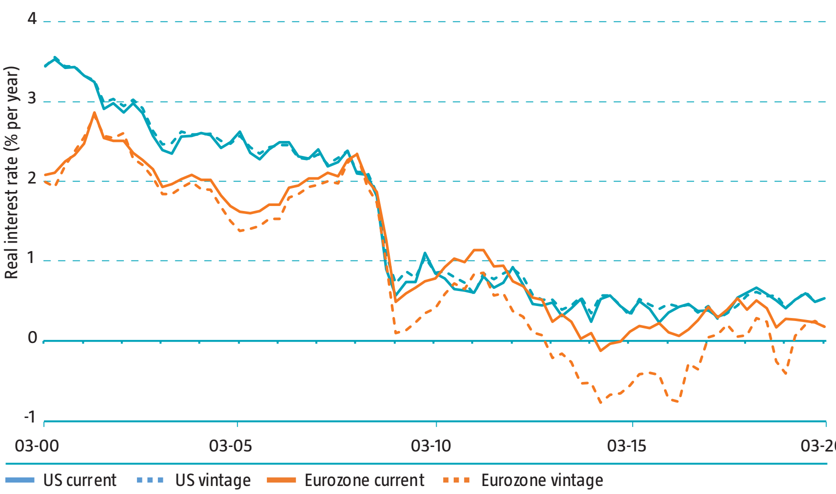
1.2 Cash

For cash we assume the real rate of return to be 0.5%, roughly in line with the historical median of 0.7%. Note that the average of -0.3% is heavily impacted by several cases of hyperinflation. There is a wide dispersion in real cash returns. No fewer than eight out of twenty-one countries in our sample experienced compounded negative real returns on cash over the 1900-2016 period.

New York Fed President John C. Williams has devoted an important part of his career to researching an unobservable phenomenon: the neutral rate of interest, or 'r-star' in economic jargon. It was first defined by Wicksell (1898) as "…a certain rate of interest on loans which is neutral in respect to commodity prices, and tends neither to raise nor to lower them." Nowadays, the r-star is defined as the short-run real interest rate that is expected to prevail when an economy is at full strength and inflation is stable. It is the rate at which the economy neither accelerates nor slows down. Central banks consider it their responsibility to move their policy rates towards the r-star.

One popular model for estimating the r-star is the Holston, Laubach, and Williams (2017) (HLW) model.

Figure 1.2: Natural rate of interest



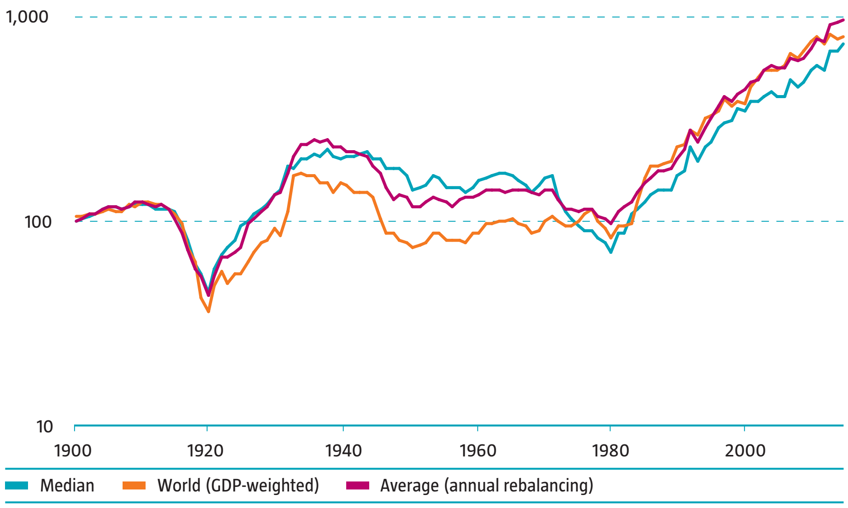
Source: Holston, Laubach, Williams (2017), Robeco. The series 'US current' and 'Eurozone current' refer to the historical estimates based on the Q1-2020 update. The 'US vintage' and 'Eurozone vintage series contain the last updated quarterly observations. These are updated from Q4 2015, and vintage data before refer to the Q4-2015 historical time series.

Figure 1.2 contains the recent time series of the r-star estimate for the US and Eurozone. The latest estimate provided by the HLW model for the US neutral real rate of interest is 0.53%, with its Eurozone counterpart close to zero. The average HLW r-star since 1961 is 2.77%, which is substantially above our estimate of the real short rate in equilibrium of 0.5%. The HLW r-star is also substantially above the realized short real interest rate over the period 1961 to 2016 for the US, which equals 0.87% per annum.[3] Therefore, we feel comfortable with our long-run estimate of 0.5%, which corresponds with the long-run average real interest rate since 1900 for a few dozen countries.[4]

1.3 Government bonds

We estimate the real return on high-quality government bonds to be 1.25%, which is the sum of a 0.5% real return on cash and a 0.75% term premium on bonds. This real-return estimate is substantially lower than the historical median of 1.75% and the 1.82% for the GDP-weighted global bond index. Due to the strong recent performance of bonds, this figure has gradually moved higher in recent years, making a 1.25% real return estimate look conservative in historical terms. For example, Doeswijk, Lam, and Swinkels (2020) report a real return on government bonds of 2.81% per annum from 1960 to 2017. Our total expected nominal return on bonds is 4.25%, as our expected long-term inflation rate is 3%.[5] The estimate for the long-term return on bonds is 0.25% lower than our estimate for long-term economic growth. Looking deeper, it is also 0.25% lower than the global bond term premium of 1% observed from 1900 to 2016.[6] This discount is validated by our observation that the median capture of real GDP growth by real bond returns over the past 114 years for the countries in the DMS database is only 91%, and the average compensation a mere 58%. This suggests bond investors are not being fully compensated for economic growth risks in the long run.

Figure 1.3: Real return index for global bonds with different weighting methods



Source: Dimson-Marsh-Staunton database (2017), Robeco

We would like to point out that the real returns generated on bonds have failed to rise gradually over time. As Figure 1.3 shows, real bond returns were roughly unchanged from 1900 to 1980. Since then, the real annual compounded return exceeded 6% as a historically unprecedented bull market set in. This dynamic historical pattern suggests that our real return estimate for bonds is more uncertain than for equities.

3. Source: Dimson, Marsh, and Staunton (2017) database.

4. Note that Swinkels (2020) documents a real rate on cash of no less than 3.7% for the four main markets from 1800 to 1914, possibly due to the scarcity of cash during the 19th century. Jordà, Knoll, Kuvshinov, Schularick, and Taylor (2019) find that the real return on cash has been very volatile, sometimes even more volatile than the real return on risky assets. They report especially low real rates on cash in periods of wars and stagflations.

5. For Solvency II regulation, the European Commission had initially suggested a Ultimate Forward Rate (UFR) of 4.2%, which is close to our long-term return estimate on high-quality government bonds of 4.25%. The arguments used by the European Commission are very different to ours. They expect a 2% inflation rate and a 2.2% real interest rate in the long run. Note that the UFR has since decreased due to a lower historical average real rate on government bonds. The UFR is 3.75% as of 1 January 2020.

6. Swinkels (2020) reports a term premium of 1.1% from 1800 to 1914 for the four main markets, which is very similar to the average term premium in the 20th century.

1.4 Investment grade corporate credits

Historical excess returns for investment grade corporate credits are displayed in Table 1.2. According to Elton, Gruber, Agrawal and Mann (2001), the credit spread comprises the following three components: specific default risk compensation, the tax premium, and systematic default risk premium. Additionally, Bongaerts, De Jong, and Driessen (2011) also find a liquidity premium in credit spreads. Houweling, Mentink, and Vorst (2005) estimate the liquidity premium to be between 13 and 23 basis points.

Table 1.2: Estimated excess returns for investment grade credits, high yield bonds and inflation-linked bonds

	Excess returns		
	over bonds	Volatility	Period
Investment grade credits			
Bloomberg Barclays US	0.4%	4.3%	1988-2020
Bloomberg Barclays Pan-European	0.6%	3.6%	1999-2020
ICE Bank of America US	0.4%	5.0%	1997-2020
ICE Bank of America UK	0.6%	5.0%	1997-2020
ICE Bank of America Eurozone	0.6%	3.1%	1997-2020
JP Morgan U.S. Liquid	1.1%	5.3%	2000-2020
Altman (1998)	0.8%	5.4%	1985-1997
Giesecke, Longstaff, Schaefer, Strebulaev (2011)	0.8%		1866-2008
Ng and Phelps (2011)	0.3%	7.9%	1990-2009
Asvanunt and Richardson (2017)	0.5%	3.9%	1988-2014
High yield bonds			
Bloomberg Barclays US	2.3%	9.4%	1988-2020
Bloomberg Barclays Pan-European	3.6%	11.8%	1999-2020
ICE Bank of America US	2.1%	10.2%	1997-2020
ICE Bank of America UK	4.9%	11.6%	1998-2020
ICE Bank of America Eurozone	2.6%	12.7%	1998-2020
Altman (1998)	2.5%	5.2%	1978-1997
Ng and Phelps (2011)	3.1%	19.2%	1990-2009
Asvanunt and Richardson (2017)	2.5%	9.6%	1988-2014
Inflation-linked bonds			
Barclays US	-0.3	4.7%	1997-2017
Barclays UK	-1.8%	7.1%	1981-2017
Barclays UK	0.5%	5.8%	1997-2017
Hammond, Fairbanks, and Durham (1999)	-0.5%		
Grishchenko and Huang (2013)	-0.3%		2000-2008

Source: Bloomberg Barclays, Barclays, ICE Bank of America, JP Morgan, Robeco.

We estimate the total risk premium of credits over government bonds at 0.75%, which is close to the 0.8% premium in Altman (1998) from 1985 to 1997 and the 0.8% premium in Giesecke, Longstaff, Schaefer and Strebulaev (2011) from 1866 to 2008. These are slightly higher than the historical excess return in the corporate bond indices published by Bloomberg Barclays and reported by Ng and Phelps (2011) from 1990 to 2009 and Asvanunt and Richardson (2017) from 1988 to 2014.[7] Our own empirical analysis shows that from 1988 to April 2020, the excess return for the Barclays U.S. Corporate Bond Index is 0.4%. For pan-European corporate bonds, the average excess return was 0.6% from 1999 to 2020. ICE Bank of America shows similar excess returns from January 1997 to April 2020.

7. One might be tempted to use Ibbotson's longer data series instead of Barclays'. However, Hallerbach and Houweling (2013) argue that the Ibbotson's long-term credit series is an unreliable source from which to calculate excess returns, as most credits are of extremely high credit quality and the series is not appropriately duration-matched with the long-term government bond series.

We note that the Bloomberg Barclays corporate bond indexes do not contain bonds with less than one year to maturity, and investors are forced to sell bonds when they are rated below investment grade. Ng and Phelps (2011) find that relaxing these constraints leads to approximately 0.4% additional return compared to constrained indices. This is a substantial increase and investors should be aware of this benchmark issue when investing in credit bonds.

Table 1.3: Risk and return for credit factors

	Investment grade			High yield		
	Return	Volatility	Sharpe ratio	Return	Volatility	Sharpe ratio
Size	1.81%	3.54%	0.51	7.71%	11.68%	0.66
Low risk	0.87%	2.04%	0.43	3.77%	6.21%	0.61
Value	2.00%	6.38%	0.31	6.24%	13.23%	0.47
Momentum	1.16%	4.24%	0.27	4.13%	9.89%	0.42

Source: Data obtained from www.robeco.com/data and is updated from Houweling and Van Zundert (2017). The four factor series (Size, Low Risk, Value, Momentum) are constructed by sorting each month-end all index constituents in 10 groups based on the respective measure. An overlapping portfolio method is used to hold on to bonds for the subsequent 12 months while rebalancing monthly. The series listed are the excess returns over duration-matched Treasuries of the top (D1) portfolio. Results are provided for both the Bloomberg Barclays U.S. Corporate Investment Grade index (left) and the Bloomberg Barclays U.S. Corporate High Yield index (right). Period January 1994 to December 2019.

Recent research suggests that excess corporate bond returns have a factor structure; see Houweling and Van Zundert (2017), Israel, Palhares, and Richardson (2018), Bai, Bali, and Wen (2019), and Bektic, Wenzler, Wegener, Schiereck, and Spielmann (2019). For example, there is a low-risk phenomenon in credit bonds. This implies that credits with low distress risk and a short time to maturity achieve the same returns as the credit bond market as a whole; see, for example, Ilmanen, Byrne, Gunasekera, and Minikin (2004). Several recent studies, such as Frazzini and Pedersen (2014) and Houweling and Swinkels (2019), confirm higher risk-adjusted returns for investors in low-risk credits than for the credit market as a whole. But size, value, and momentum factor premiums are also present in corporate bonds markets. In Table 1.3, we show the updated factor premiums from Houweling and Van Zundert (2017) from 1994 to 2019. We see that over this extended period, each of the four factors has delivered Sharpe ratios in the range of 0.27 to 0.51 for US investment grade credits.

1.5 High yield corporate credits

High yield bonds require a higher default premium than corporate bonds due to the lower creditworthiness of the issuers and hence their higher risk profile. Altman (1998) also examines the return on US high yield bonds compared to US Treasuries from 1978 to 1997. The excess return of high yield over Treasuries during this 20-year period is 2.5%, as can be seen in Table 1.2. We believe that this figure may overstate the risk premium of high yield. At the start of the sample period, the high yield market was still immature with the associated liquidity problems and biases. Nevertheless, the sample period from August 1988 to April 2020 has a risk premium for high yield bonds of 2.3% over duration-matched government bonds. For European high yield indices the excess returns are very similar.

Houweling and Van Zundert (2017) document factor premiums in the high yield bond market. In Table 1.3, we show their updated factor premiums from 1994 to 2019. We see that over this extended period, each of the four factors has delivered Sharpe ratios in the range of 0.42 to 0.66 for US high yield bonds. These Sharpe ratios are slightly higher than for investment grade.

It is important to discuss the possible negative impact of transaction costs on investors' ability to achieve our estimated returns for corporate bonds. We note the argument of Houweling (2012) that the returns for corporate bond indices are difficult to replicate, as transaction costs for corporate bonds are higher than for government bonds, which are more liquid and cheaper to trade. Houweling reports an underperformance of 16 basis points for government bonds for the average exchange-traded fund in his study, with investment grade bonds underperforming by 56 basis points, and high yield funds by as much as 384 basis points on average. Obviously, the liquidity or lack of it for these asset classes requires extra attention in terms of portfolio implementation. Passive index investing is likely to underperform the paper indexes substantially in fixed income markets. We proceed with a 1.75% net premium over government bonds.

1.6 Inflation-linked bonds

The return to maturity on default-free inflation-linked bonds comprises the real interest rate and the realized inflation rate. Intermediate returns depend on changes in expected real rates and realized inflation. This differs from the return on default-free nominal bonds, which consists of a real interest rate, expected inflation, and an inflation-risk premium. The cost of insurance for inflation shocks should be reflected in a discount in the risk premium for inflation-linked bonds relative to nominal bonds.

Theoretically, the inflation risk premium should be positive, as this is related to the positive skewness in the historical inflation numbers. From March 1997 to October 2017, the inflation risk premium in the US was small (see Table 1.2) as inflation-linked bonds earned a 0.3% lower return than nominal bonds.[8] When the inflation-risk premium is positive and other premia non-existent, we expect inflation-linked bonds to underperform nominal bonds of the same maturity.

For the UK sample, we find that inflation-linked bonds underperform comparable nominal bonds by a staggering 1.8% per annum since 1981. However, over the last 20 years of the sample (1997 to 2017), they outperformed comparable nominal bonds. This suggests that estimating these premiums in newly developed asset classes can be particularly difficult. Grishchenko and Huang (2013) point to liquidity problems in the Treasury Inflation-Protected Securities (TIPS) market as the reason for the low inflation risk premium they document. After adjusting for liquidity in TIPS, they find an inflation risk premium of between -0.09% and 0.04% from 2000 to 2008, depending on the proxy used for expected inflation. They estimate the liquidity premium to be around 0.13%.

Driessen, Nijman, and Simon (2017) find a liquidity premium of 0.33% for inflation-linked bonds. A study by García and Werner (2010) finds an inflation risk premium varying from 0.07% to 0.25% at longer horizons. Hammond, Fairbanks, and Durham (1999) estimate the risk premium at 0.5%.[9] Based on these findings, we estimate the premium of nominal bonds over inflation-linked bonds to be 0.25%. This results in an ex-ante estimated total nominal return of 4% for inflation-linked government bonds relative to 4.25% for nominal government bonds. A disadvantage of inflation-linked bonds is their short historical data availability. To circumvent the problem of statistical analysis, researchers can resort to historical simulation of inflation-linked bond returns. Swinkels (2018) compares several proposed methods for historical simulation. His results show that inflation-linked bond returns are most accurately simulated by subtracting inflation predictions from professional forecaster from the nominal interest rates. Using historically simulated series this way gives researchers the opportunity to artificially extend the data history of this asset class.

8. Even though we compare the inflation-linked bond index with a comparable nominal government bond, it could be due to differences in duration between nominal and inflation-linked bonds, their tax treatment, and the slightly higher credit risk in inflation-linked bonds due to the cash flow pattern that is further into the future

9. For a sample of developed and emerging market inflation-linked bonds, Swinkels (2012) estimates returns on maturity matched nominal and government bonds to be virtually the same, indicating that the inflation risk premium in practice is small. This could be partially due to the lower liquidity of inflation-linked bonds compared to nominal government bonds

1.7 Emerging market debt

Emerging market debt (EMD) is a fast-growing asset class with dynamic characteristics. The size of the EMD market has grown significantly in recent years. As data availability is limited, it is impossible to take a firm view on risk and return for this asset class. Moreover, it is not a completely homogenous asset class.

Table 1.4: Return and risk for emerging debt and other fixed income asset classes (2003-2013; hedged USD unless noted otherwise)

	Return	Annualized st.dev.
Global developed government bonds	4.4%	2.9%
Global corporate investment grade credits	5.1%	4.5%
Global corporate high yield	7.8%	9.5%
Emerging markets USD debt	8.0%	8.8%
Emerging markets Corporate USD debt	7.4%	8.8%
Emerging markets local currency government debt	4.2%	4.0%
Emerging markets local currency government debt (unhedged)	6.7%	12.5%
Frontier market USD debt	9.4%	13.1%

Source: Bloomberg Barclays, JP Morgan, Robeco. Bloomberg Barclays Treasury (index id: 23), Bloomberg Barclays Global Corporate (index id: 9805), Bloomberg Barclays Global Corporate High Yield (index id: 23059), JP Morgan EMBI Global, JP Morgan Corporate EMBI, JP Morgan GBI-EM, JP Morgan NEXGEM.

In Table 1.4 we compare global government bonds, credits, high yield, and EMD. We display external USD-denominated debt for the latter as well as local currency government debt. This is our main focus asset class when it comes to EMD, as USD-denominated high yielding asset prices tend to be highly correlated. This means that less diversification might be obtained than with local currency assets, even though they are all risky assets that tend to perform poorly in 'risk off' environments; see Agur, Chan, Goswami, and Sharma (2019). On a currency-hedged basis, local currency debt has underperformed global developed bond markets over this 18-year period. The volatility risk on a currency-hedged basis is modest at 4.0%. However, when currency risks are not hedged (as is usual for this category), the volatility shoots up to 12.5%. The average return is also higher with 6.7%.

We position EMD between credits and high yield, but closer to high yield. While the volatility is somewhat higher from 2002 to 2020, the credit rating for emerging markets that can issue local currency debt is on average investment grade. So we estimate the EMD premium over government bonds to be 1.50%, which brings the nominal return to 5.75%. This is one notch below our return estimate for high yield bonds, as we believe the risk profile is closer to high yield bonds than to credits. Once again, we stress that this asset class is young and dynamic, and so we feel less certain about this estimate than for asset classes that have a longer history and more data to back up our estimates.

1.8 Developed equities

Ever since Mehra and Prescott (1985) documented the equity premium puzzle, i.e. the relatively high observed equity premium in the US compared to reasonable values of investor risk aversion used in economic models, researchers and practitioners have been trying to solve it. These answers have been found partly by introducing frictions in economic models and partly from improved (i.e. lower) estimates of the equity premium.

Table 1.1 contains the estimates by the DMS database. From 1900 to 2016, the average and the median real equity returns were 4.5% for 21 countries per annum, with the market capitalization-weighted equity market index 5.1% per annum. The risk premium relative to cash was 4.2% per year for the world index. We assume that this is a reasonable guidance for the

Table 1.5: US factor premiums since 1963

Factor	Acronym	Return	Volatility	Alpha	t-statistic	Beta	t-statistic
Market	RMRF	6.44	15.40	-	-	-	-
Size	SMB	2.60	10.46	1.34	1.00	0.20	7.87
Value	HML	3.04	9.96	3.95	3.05	-0.14	-5.83
Profitability	RMW	3.07	7.45	3.73	3.83	-0.10	-5.67
Investment	CMA	3.13	6.91	4.22	4.95	-0.17	-10.74
Beta	BETA	-1.28	22.61	5.09	2.28	-0.99	-23.78
Variance	VAR	5.21	27.05	12.17	4.28	-1.08	-20.41
Momentum	MOM	7.83	14.50	8.76	4.58	-0.14	-4.03

Source: Data library of Kenneth French, Robeco. Period July 1963 to June 2020.

future, but perhaps slightly high because for part of the sample period, these countries were emerging markets. Moreover, Swinkels (2020) reports a global equity risk premium of only 2.6% for 1800 to 1914. Therefore, we adjust our expected excess return over cash to 3.5% per annum, leading to a developed equity markets return estimate of 7%. We do not separately discuss regional equity premiums for long-term expected returns.

Table 1.5 contains the excess returns relative to the risk-free rate for the US stock market from 1963 to 2020. The arithmetic annualized average was 6.44% for a volatility of 15.40%. The table also contains several of the documented factor premiums in the US. We see that the size premium was statistically insignificant with an annualized alpha of 1.34% and t-statistic of 1.00. The other factor premiums were strong over this sample period, and most had a modest negative covariance with the market between -0.1 and -0.2. However, the BETA and VAR premiums were clear exceptions, with market exposures close to -1. This is why the risk adjustments through, for example, alphas, are more important than the raw return difference in the first column. Note that these estimates do not yet include transactions costs. This might be a larger problem for the momentum strategy as this requires trading each stock approximately once a year (assuming one-year momentum) while the holding period for value strategies is typically three to five years.

Table 1.6: Global factor premiums since 1990

		Developed markets ex US				Emerging markets			
Factor	Acronym	Return	Volatility	Alpha	t-stat	Return	Volatility	Alpha	t-stat
Market	RMRF	3.83	16.49	-	-	8.07	21.23	-	-
Size	SMB	1.07	7.06	1.44	1.14	2.04	8.20	2.71	1.88
Value	HML	3.12	7.59	3.23	2.33	7.07	9.38	6.61	3.94
Profitability	RMW	4.34	4.74	4.68	5.67	1.91	5.99	2.51	2.33
Investment	CMA	1.45	6.10	1.82	1.69	2.75	6.56	3.46	2.91
Momentum	WML	8.49	12.09	9.34	4.36	9.63	10.22	10.28	5.62

Source: Data library of Kenneth French, Robeco. Developed ex US markets, period July 1990 to July 2020, except WML starts in November 1990. Emerging markets, period July 1989 to July 2020, except RMW starts in July 1991, CMA in July 1992, and WML in January 1990.

These factor strategies do not by definition earn excess returns each year, as they also have sustained periods of negative excess returns; see Blitz (2020). For example, in the period leading up to the internet bubble, valuation strategies severely underperformed the market capitalization-weighted index. Moreover, executing these strategies is not as simple as following such an index – several types of choices have to be made regarding rebalancing frequency and the exact definition of the strategy parameters. Hence, it is difficult to define a uniform value premium. The historical evidence on the US is overwhelming, and many authors have empirically detected the same return factors in other countries; see for example Rouwenhorst (1998). Table 1.6 contains this international evidence. Except for the size premium, the other factor premiums are positive and statistically significant.

1.9 Emerging equities

We make a distinction between the equity risk premiums for developed and emerging markets, mainly because most of the investment management industry is organized in this way. Several researchers have argued that equity risk premiums can be higher for countries that are less integrated into global financial markets; see Errunza and Losq (1985) and Bekaert and Harvey (1995) for examples. Developed markets also tend to have better governance, which should result in a higher risk premium for emerging markets. Furthermore, Erb, Harvey, and Viskanta (1996) and Damodaran (2009) argue that country credit spreads are related to the magnitude of the equity risk premium in that particular country. Since most emerging markets have become more integrated into the global financial markets and country credit spreads have decreased substantially, the estimated excess returns of emerging markets relative to developed markets have also decreased in recent years. See Salomons and Grootveld (2003) for a discussion of the emerging markets equity premium relative to that of developed markets.

The profitability of factor strategies in emerging and frontier markets has been widely documented in the literature; see for example Rouwenhorst (1999), Van der Hart, Slagter and Van Dijk (2003), Van der Hart, De Zwart and Van Dijk (2005), De Groot, Pang and Swinkels (2012), and Hanauer and Lauterbach (2019). Table 1.6 confirms these earlier studies with updated data. Again, the size premium is not statistically significant, while the other factors are strong.

1.10 Private equity

A large number of studies have tried recently to compare the returns of private equity with those of listed equities. Kaplan and Schoar (2005) do not find an outperformance for private equity, with a public market equivalent (PME) of 0.96 for all funds. Phalippou and Gottschalg (2009) draw a comparable conclusion using a larger sample. However, Stucke (2011), using a different methodology, finds a net outperformance for the same data set as Phalippou and Gottschalg (2009). Harris, Jenkinson and Kaplan (2014) perform a meta-study using databases from Burgiss, Venture Economics (VE), Preqin and Cambridge Associates (CA). They show that for all datasets, except VE, the median buy-out fund has returned a PME of between 1.2 and 1.27. For venture capital, their findings show outperformance in the 1990s and underperformance in the 1980s and 2000s. Robinson and Sensoy (2016) findings also demonstrate outperformance over the S&P 500 for buy-out funds from 1984 to 2010. They document a similar performance for venture capital to the S&P 500, using data from one large limited partner. These recent studies suggest that private equity may well perform better than listed equities but that fund management effects can be important. Korteweg (2019) summarizes the literature on the performance of different private equity styles and concludes that after 2000, the net-of-fees returns are not above those of public equity markets.

Driessen, Lin and Phalippou (2012) estimate the beta of buy-outs at 1.5. Ang, Chen, Goetzmann, and Philippou (2018) find a beta of 1.4 and a strong factor exposure to the size factor, indicating that private equity fund returns are similar to listed small-cap stocks. Kaplan and Schoar (2005), Higson and Stucke (2012), Sensoy, Wang and Weisbach (2013), Korteweg and Sorensen (2017) also note a heterogeneous pattern in the performance of private equity funds. This implies that results depend strongly on manager selection. Finally, Robinson and Sensoy (2016) show more capital calls than distributions during crises. Higson and Stucke (2012) also find this cyclical pattern.

Although Table 1.7 shows an underperformance of 0.9% for private equity over stocks from 1998 to 2020, there is no consensus in the academic literature saying that that private equity returns (net of fees) exceed public equity returns. Most studies point to private equity outperformance, but the issue of what is left after proper risk adjustment remains up for debate. Moreover, most of the studies mentioned above are subject to selection and reporting biases. Hence, we assume the risk premium of private equity as a group to match that of listed equities.

Table 1.7: Estimated excess returns for private equity, real estate and hedge funds

	Excess returns			
	over cash	over equities	Volatility	Period
Private equity				
LPX America	4.6%	-0.9%	32.2%	1998-2020
Driessen, Lin, Phalippou (2012)		-4.9%		1980-2003
Higson and Stucke (2012)		4.5%		1980-2000
Ang, Chen, Goetzmann, and Phlippou (2018)		2%		1994-2015
Real estate				
NAREIT US	4.5%	-1.1%	19.6%	1972-2020
Fugazza, Guidolin and Nicodano (2006)	4.7%	-1.0%		1986-2005
Francis and Ibbotson (2020)		-0.5%	7.8%	1991-2018
Commodities				
S&P GSCI	1.0%		23.4%	1970-2020
S&P GSCI	-3.7%		21.5%	1991-2020
Bloomberg Commodity Index	-1.4%		17.5%	1991-2020
Bhardwaj, Janardanan, and Rouwenhorst (2019)	5.2%		14.4%	1870-2018
Levine, Ooi, Richardson, and Sasseville (2018)	4.6%		17.7%	1877-2015
Hedge funds				
HFRI Fund-of-Fund Composite	3.6%	-3.4%	8.5%	1990-2019
HFRI Fund-of-Fund Composite	7.3%	-4.6%	8.3%	1990-1999
HFRI Fund-of-Fund Composite	1.2%	4.5%	8.4%	2000-2009
HFRI Fund-of-Fund Composite	2.3%	-9.4%	4.3%	2010-2019

Source: Refinitiv Datastream, www.reit.com, www.hedgefundresearch.com, Kenneth French Data Library, Robeco.

1.11 Real estate

In principle, we view direct and indirect real estate as one particular source of risk and return. This corresponds to Idzorek, Barad and Meier (2006), who state: "Although all investors may not yet agree that direct commercial real estate investments and indirect commercial real estate investments (REITs) provide the same risk-reward exposure to commercial real estate, a growing body of research indicates that investment returns from the two markets are either the same or nearly so." Hoesli, Oikarinen, and Serrano (2015) report that returns on REITs lead those of private real estate returns. Of all alternative asset classes, real estate has probably received the most attention from academics in the past. A literature review by Norman, Sirmans and Benjamin (1995) tries to summarize all the findings. Overall, they find no consensus for risk and return characteristics for real estate. However, more than half of the consulted literature in their paper reported a lower return for real estate compared to equities. Fugazza, Guidolin and Nicodano (2006) also show lower excess returns for real estate than for stocks. Their estimate of -1.0% per year can be seen in Table 1.7. More recently, Francis and Ibbotson (2020) report that commercial real estate had a -0.5% performance relative to the

S&P 500 index from 1991 to 2018. Note that their volatility estimate of 7.8% per annum is based on smoothed returns and economic risks are likely substantially higher.

We proceed with an estimated excess return for indirect real estate that is 1% lower than our estimate for stocks. Due to the lower leverage in direct real estate compared to indirect real estate, we estimate expected returns to be another 1% lower for that asset class.

1.12 Commodities

An unleveraged investment in commodities is a fully collateralized position which has three drivers of returns: the risk-free rate, the spot return, and the roll yield. Erb and Harvey (2006) point out that the roll return has historically been a very important driver of commodity returns, but it is unclear what the size of roll returns will be in the future.[10] In their extensive study they find that the average individual compound excess return of commodity futures is zero. They argue that individual commodities are not homogeneous and that their high volatility and low mutual correlations result in high diversification benefits. The diversification benefit comes from periodically rebalancing the portfolio and is reflected in the high historical performance of the S&P GSCI Index compared to the return from individual commodities.

10. The upward (contango) or downward (backwardation) sloping term structure of futures prices creates a negative or positive roll return. It arises when an almost expiring future is rolled over to a future with a longer maturity.

Gorton and Rouwenhorst (2006) create an equally-weighted monthly rebalanced portfolio of commodity futures with returns similar to those for stocks from 1959 to 2004. Erb and Harvey (2006) raise questions over the representativeness of both the equally-weighted portfolio and the GSCI index. On the one hand, they show that an equally-weighted stock index would outperform a market cap-weighted index by far. On the other hand, the GSCI index composition has changed dramatically over time and now allocates heavy weights to energy commodities. They suggest that a simple extrapolation of historical commodity index returns might not be a good estimate for future returns.

Recently, two studies have hand-collected commodity futures data going back to before 1900. Levine, Ooi, Richardson, and Sasseville (2018) collect data for the period 1877 to 2015. Before 1960, their sample consists of five to ten commodities. They find an average arithmetic excess return on commodity futures of 4.6% per annum, and 3.1% geometric. Bhardwaj, Janardanan, and Rouwenhorst (2019) go even further, collecting data starting in 1870 with over 20 different commodities contracts before 1960. They find an average arithmetic excess return of 5.2% for their commodity index, which is slightly less volatile because there is more diversification among its increased cross-section of commodities, as can be seen in Table 1.7.

We observe that the return from systematically rolling over energy-related futures has historically added substantially to the total return of commodity investing in energy and livestock until the early 1990s (see Figure 1.5). However, over roughly the past ten years roll returns on all commodity categories have tended to be negative. Due to the increased interest of institutions in commodity investors, the future roll return is unlikely to turn positive again. Lummer and Siegel (1993) and Kaplan and Lummer (1998) argue that the long-term expected return of commodities equals the return on Treasury bills. From 1970 to 2020, the S&P GSCI index had an excess return of 1.0% relative to cash. Most of that excess performance was made in the beginning of the sample period, as the excess return from 1991 to 2020 was -3.7%. For the Bloomberg Commodity Index, the return was somewhat higher, but still poor at -1.4%. Many theories for commodity risk premiums exist but most of those are not easily measurable.

There seems to be substantial evidence for a large risk premium on commodities in historical data. However, Tang and Xiong (2012) indicate that there was a structural break in commodity markets in 2000, also known as the ‘financialization’ or financial integration of commodity markets. This implies that risk premiums are likely to be lower going forward, because of more investors willing and able to provide insurance for commodity producers. This might be partially offset by a higher correlation of commodity future returns with equity markets, which should increase the required return for those providing the hedge. We use a modest long-term commodity risk premium of 0.5% relative to cash. Note that this is a geometric risk premium, and because of the high volatility of commodity futures, its arithmetic return is still substantial (around 2.5%).

Recent research suggests there are factor premiums in commodity markets similar to those that exist in credit and equity markets. The momentum and carry factor have been documented by Erb and Harvey (2006), Gorton and Rouwenhorst (2006), Miffre and Rallis (2007) and Shen, Szakmary and Sharma (2007). The low volatility factor is in the spirit of findings by Miffre, Fuertes and Fernandez-Pérez (2015) and Frazzini and Pedersen (2014). Blitz and De Groot (2014) also find that the case for factor premium investing carries over to the commodity market. More specifically, they find that a commodity portfolio which simply invests equal amounts in the various factor premiums achieves a significantly higher risk-adjusted performance than a traditional commodity market portfolio, with much smaller drawdowns.

1.13 Hedge funds

Table 1.7 shows historical excess returns for hedge funds of funds. We use the HFRI Fund of Funds Composite Index which is net of all fees, equally weighted and includes over 600 funds. Furthermore, it is broadly diversified across different hedge fund styles.

At first sight, hedge funds appear to show a reasonable performance with a net-of-fees excess return over cash of 3.6% from 1990 to 2019. Since 2000, this has dropped to around 2%, though biases and the favorable equal weighting affect this figure. The academic literature contains extensive information on biases in hedge fund indices, as shown in Table 1.8. However, estimates for the market portfolio of hedge funds are scarce. Funds of hedge funds are often considered to be a good proxy for the market portfolio, since they have fewer biases than typical hedge funds, but their returns are affected by the double counting of management fees. Fung and Hsieh (2000) estimate the portfolio management costs for a typical hedge fund of fund portfolio to be between 1.3% and 2.9%. There is no cheaper way to obtain exposure to this asset class.[11]

11. There are cheaper and more liquid so-called hedge fund replication strategies available for investors. We do not include these in our analysis, as they are usually dynamic strategies using derivatives on traditional asset classes.

Taking all this into account, we believe Bekkers, Doeswijk, and Lam's estimate (2009) to be reasonable with an excess return over cash of 1.25%. Note that this is a combination of possible manager skill and also the systematic exposures that hedge funds seem to have.

Table 1.8: Biases in hedge fund databases

	Robeco	Magnitude	Period
Fung and Hsieh (2000)	Backfill	0.7%	1994-1998
Fung and Hsieh (2000)	Survivorship	1.4%	1994-1998
Posthuma and Van der Sluis (2003)	Backfill	2.3%	1996-2002
Amin and Kat (2005)	Survivorship	0.6%	1994-2001

Source: Robeco

2

Economic growth and financial markets in a steady state

Long-term economic growth stems from increasing labor productivity and changes in the potential labor force, emanating from cyclical swings in the unemployment rate. Labor productivity and labor force growth also play an important role in the earnings growth rate and thus in financial returns for investors. So we will start by discussing labor productivity and labor force growth rates and then move on to economic and earnings growth. We will conclude with the theoretical implications this will have for equity and bond returns in the long-term steady state.

2.1 Labor productivity

Labor productivity in a mature economy grows between 1.5% and 2% per year. Productivity gains can be determined by looking at the real growth in per capita gross domestic product (GDP). In the long run, this matches the increase in labor productivity, if we assume that the per capita hours worked remain constant. Apart from periods of significant unrest, the speed of productivity growth has been remarkably gradual. According to data from macroeconomist Angus Maddison covering a wider set of 20 Western countries, growth in per capita GDP averaged 1.9% in the period 1870 to 2008. Developing economies can temporarily show higher labor productivity growth rates. For example, Japan experienced an average increase of 3.8% between the end of World War II and 1980. However, as an economy matures, it is harder to realize productivity gains. For example, in the period 1980 to 2015, Japan's labor productivity increased by 1.5%, which is close to the gains of 1.6% seen in the US over this same period. Some developing countries have shown even stronger growth rates. China has enjoyed an annual productivity gain of 6.6% since 1980 and India 4.5%. In contrast, Brazil has lagged with a modest gain of just 0.8%. Barro and Ursúa (2008) estimate an average historical growth rate for developing economies of 2.8% over the period 1960-2006, 0.4% above the growth rate for mature economies over that same period. Please note that these numbers are average per capita real GDP growth rates, and that there can be significant differences between different countries.

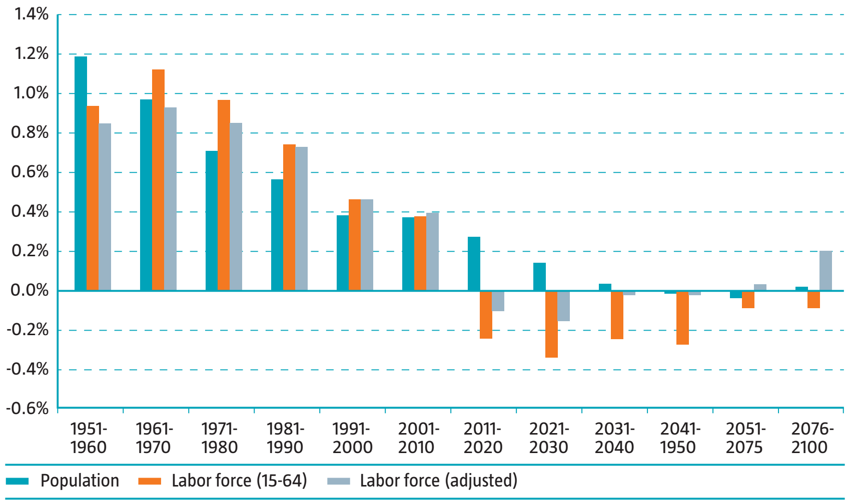
If history is a good proxy for what happens in the future, a 1.75% gain for mature economies seems to be a good starting point. Some commentators such as Robert Gordon argue that the past two centuries of economic growth could actually just be 'one big wave' of dramatic change rather than a new era of uninterrupted progress, and that the world is returning to a regime in which growth is mostly of the extensive sort. The idea that technology-led growth must either continue unabated or steadily decline, rather than ebbing and flowing, is at odds with history. Nevertheless, the last two centuries have been a 'special' period in terms of population growth. And although it is difficult to make a link between population growth and productivity, academic literature indicates a positive relationship which seems logical to us. As we argue in the next paragraph, population growth will not track the strong historical growth rates seen in the past and so we reduce the historical estimate to 1.5% for our steady-state calculations.

2.2 Size of the labor force

The growth of the labor force has been an important stimulus for economic growth. Projections from the United Nations show that population growth will gradually fall from 1.2% per year in 2015 to 0.2% per year in 2100. The graph below gives a breakdown of the actual and projected population and labor-force growth in developed regions up to 2100.

In most analyses, the labor force is defined as the population aged between 15 and 64 years old. If we apply this definition, we see labor force growth projections for developed regions entering negative territory. However, we do not believe this definition is realistic. As people are expected to live longer, we can expect the retirement age to increase. For example, the life expectancy for a 65-year old living in 2015 is 19 years. For a 70-year old living in 2075 this figure is 20 years. Assuming the retirement period stays the same, it is unlikely that you will be able to retire at 65 in 2075. We assume that the retirement age will increase by 2/3 of the increase in life expectancy. Adjusting for this higher retirement age and for the number of youngsters remaining in education longer, we arrive at an adjusted labor force projection. This projection is remarkably close to 0% (see Figure 2.1).

Figure 2.1: Average population growth in developed regions



Source: United Nations, Robeco

The global labor-force growth projections will remain in positive territory. We calculate the average yearly increase to be 0.5% between 2020-2100. Much of the growth will take place in frontier markets. This global number will likely overstate the effect of population growth on financial markets as we believe we should give more weight to developed regions. For this reason, we use 0.25% as an estimate for labor-force growth in our further analysis.

2.3 Economic growth, earnings growth and dividend growth

Based on a productivity growth of 1.5% and a labor force growth of 0.25%, we end up with a steady-state growth rate of 1.75% for the world economy. The question is, how much of this growth will be translated into shareholder returns in the steady-state scenario. Much depends on the assumptions we make on the level of dilution that occurs at the various stages of transition between economic growth, earnings growth and actual returns.

The first form of dilution takes place at the earnings level and occurs right across the whole economy. Earnings are diluted in the form of taxes, reducing the potential growth for shareholders. Looking at the economy as a whole, you can present this as a transfer from the profit to the non-profit part of the economy. As we are looking at the returns in a steady-state environment, it seems logical to assume that the net earnings growth will be equal to the growth of the underlying economy. If this does not prove to be the case, it means either that earnings are becoming a dominant factor for the economy as a whole (if net earnings growth is consistently above economic growth), or that they have diminished to nothing. The notion that net earnings growth should equal economic growth is the central assumption taken in the literature.

The more relevant question here is: how much of the economy's earnings growth is linked to listed companies, as these form the basis for shareholders' returns. It stands to reason that the earnings growth available to shareholders in listed companies will be lower than that for non-listed companies. One reason is that listed companies are skewed towards the older, less dynamic parts of the economy. The rapid start-up growth seen in new industries mostly takes place outside the listed arena. More importantly, however, established listed companies issue new shares on a regular basis (either to finance acquisitions, or as part of payments schemes), which dilutes existing shareholders' claim to the earnings growth. This is the second stage of dilution.

So how is it possible that earnings growth for the economy as a whole is structurally higher than it is for listed companies? Doesn't this imply that listed companies are gradually being marginalized? This would be true if the split between listed and not-listed companies remained static, but of course this is not the case: successful companies normally eventually opt for a listing. Having missed out on the first high-growth phase, equity investors will only be able to tap into this new growth potential by rebalancing their portfolios.

One final point to address relates to the earnings and growth measures we should compare. As we are interested to see how much GDP growth will ultimately feed through to the equity investor, the logical measure for earnings would be earnings (or dividends) per share, as this takes new share issuance into account and adjusts for the changing composition of the general stock market. For the growth measure, real GDP seems to be a better option than per capita GDP: equity investors are not interested in what the direct source of growth is, but in the level of that growth. Most people seem to compare per capita GDP with earnings per share. But this seems to imply a link between 'capita' and 'share' which we find difficult to see. So we stick to a comparison between real GDP growth and earnings (or dividends) per share.

So how big is this dilution effect? Literature on this subject is relatively scarce, but the most relevant study was carried out by Bernstein and Arnott (2003). They find the dilution factor to be as high as 80% for the period 1900-2000, based on data on dividend growth versus real growth. To be more specific: equity investors only get 20% of the underlying earnings growth seen in the economy. We do not think that this is a realistic conclusion. For one, dividend payout ratios are far from static. Fundamental shifts in these and reforms in terms of tax treatment can lead to structural changes in the absolute and relative distribution to investors. A decline in the payout ratio (as seen in the US) will result in lower dividend growth, which is not related to dilution. Looking at data from the Shiller database, for example, the dividend payout ratio for US stocks had steadily declined from around 80% in the late 19th century to less than 40% at the start of the current century. Clearly this has an impact on the dividend growth calculations. In recent years, a preference for increased payouts to shareholders seems to indicate a reversal in this trend. We also have difficulty reproducing the numbers given for the US. According to the Shiller database, real dividends per share have risen by 1.3% annually, not the 0.6% Bernstein and Arnott present in their paper. Although this 1.3% is still way below the real GDP growth of 3.3%, if we were to adjust for the structural decline in the payout ratio, we would arrive at dividend growth of around 2.5%. Unfortunately, we have not been able to analyze other countries using another dataset from a different source to compare the outcome with the results of the Bernstein and Arnott study.

We have carried out an equity dilution analysis for the period 1871 to 2015 with earnings and dividend data from Robert Shiller's website and economic growth data from MeasuringWorth. Table 2.1 shows the compounded growth rates. Based on the US data, we find a dilution factor of 50% compared to GDP growth. This is in line with research carried out by Brightman (2012), who states that "Half of the growth in total corporate earnings flows to new investors through the formation of new companies and new share issuance by existing companies". This means that we expect earnings for equity investors to rise between 0.75% to 1% in the steady state.

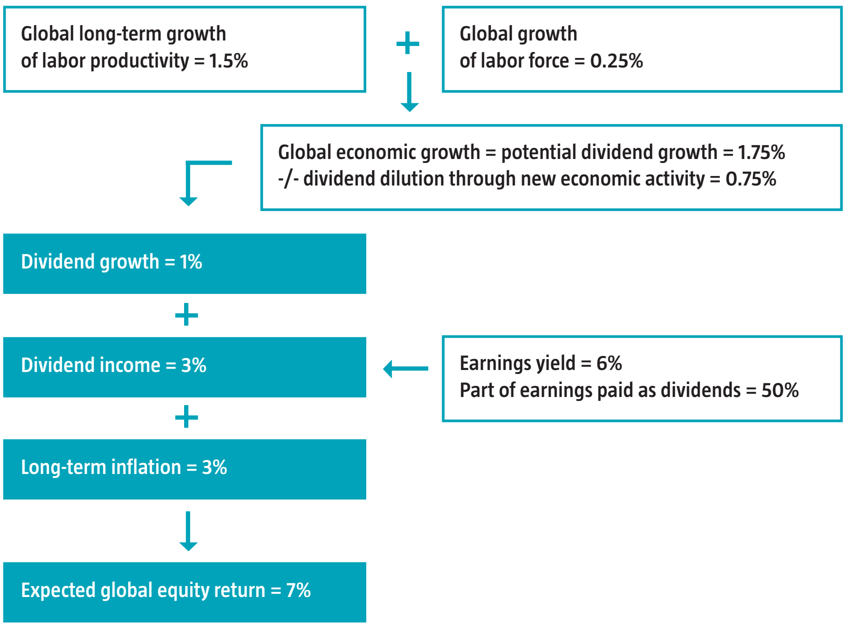
Table 2.1: Dilution of earnings per share (EPS) and dividends per share (DPS) in the United States

		Real			Dilution	
Period	Source	GDP	EPS	DPS	EPS	DPS
1900-2000	Robeco	3.3%	1.6%	1.3%	-52%	-60%
1871-2015	Robeco	3.4%	1.7%	1.5%	-50%	-55%
1900-2000	Bernstein and Arnott (2003)	3.3%	-	0.6%	-	-80%

Source: MeasuringWorth, Shiller, Robeco

Figure 2.2 presents a schematic overview of the theoretical building blocks for global equity returns. The components are derived from the growth model developed by Gordon (1959), in which the expected equity returns are split between dividend income and capital appreciation. As we assume no valuation changes in this steady-state equilibrium (meaning no structural P/E increases or decreases), the capital appreciation should be equal to the real diluted earnings growth we calculated at the end of the previous paragraph (P. growth = E. growth).

Figure 2.2: Schematic overview of the theoretical building blocks for global equity returns



Source: Robeco

This brings us to the second element of real returns: what is the equilibrium dividend yield we can expect in the steady state? As it turns out, this is a key question, as numerous reports underscore the importance of dividends in determining total return. Looking at Shiller's data, for example, the average (median) dividend yield for the US market over the period 1871 to 2015 was 4.4% (4.3%), comprising roughly two thirds of the real total return of 6.8% over that period. Although this sounds high, when compared with other areas of the world, the US is actually at the lower end of the scale. Dimson, Marsh and Staunton (2006) present a table with dividend yields for sixteen countries for the period 1900-2005. This shows that the geometrical mean for the whole sample was 4.5%, compared to a total real excess return over cash of 5.0%. This figure is to a certain extent misleading as it is an average, where a country like Belgium has the same weight as one like the US. Still, there is no denying that dividend yields have played an important if not dominant role in determining the overall level of returns.

So, what is the steady-state dividend yield? The way to assess this is to look at the payout ratio (D/E; the percentage of earnings that is being paid out in the form of dividends) and the earnings yield (E/P; the reversal of the P/E ratio). If you multiply these two yields you get the dividend yield (D/P). Looking at the Shiller database, the average payout rate has been 61%, while the median reached 58%. It is clear that these numbers have been inflated by the very high payout ratios in the first half of the period: if we look at the period after World War II, the average and median are 51%. This appears to be more in line with other periods, with average and median dividend payout ratios of 47% for the MSCI World since 1970. The average earnings yield for the US since 1871 is 7.4% and the median is 6.8%. Again, these numbers have been positively impacted by the first half of the sample: looking at the postwar period, the average (7.0%) and median (6.0%) earnings yields are much more in line with the longer-term averages we see for the world as a whole: since 1970 these figures for the MSCI World have been 6.5% and 5.9% respectively. Based on these observations we end up with an equilibrium dividend yield of 3 to 3.5%. If we combine this with the earlier 'neutrally priced' dividend yields, we feel that a dividend yield of 3% is a prudent longer-term assumption.

It is easy now to derive the real return on equities. We add the dividend yield of 3% and the dividend growth rate of 0.75 to 1% to arrive at a real return of close to 4% for global equities.

2.4 Economic growth and interest rates

The nominal interest rate can best be seen as the sum of the real interest rate and the expected rate of inflation (Fisher, 1930). Academic literature provides a link between economic growth and real interest rates (Ramsey, 1928). Cornell (2012) describes a model that gives the expected risk-free interest rate as a function of time preference, per capita consumption growth, aggregate risk aversion, and the volatility of per capita consumption growth. Generally, higher economic growth is expected to lead to higher interest rates and vice versa. For example, assuming that higher economic growth leads to higher future income and hence higher future consumption, a higher interest rate will be required to delay household consumption. If not, households will consume more today by borrowing against expected future growth. To expand this example slightly, if expected growth is uncertain or households are risk averse, one would expect them to be more cautious about increasing consumption today, which would lead to lower rates.

Rachel and Smith of the Bank of England (2015) provide a number of arguments for today's low interest rate environment. Most of these arguments can be incorporated into Cornell's model. For example, demographic changes have shifted weight from starters to employees closer to retirement in most developed countries. This has three effects. First, consumption growth is expected to decline as these employees have already experienced their biggest real income increases in an earlier phase of their career; second, there will be more need for consumption smoothing as retirement comes closer (i.e. time preference changes) and finally risk aversion is expected to rise as people get older. All these factors lead to lower interest rates. It should be noted that interest rates can rise again when the number of elderly increases and the uncertainty about future consumption growth diminishes as income (i.e. pension) becomes more certain.

For our steady-state estimate for nominal interest rates we need to look beyond today's market to establish what the expected rate will be in a world in equilibrium. Following Cornell's model, we first look at the historical compensation investors have demanded from real GDP growth (assuming this translates into consumption growth). We calculate the historical compensation to be 90% of real per capita GDP growth for developed markets. This implies that the expected real GDP per capita growth of 1.5% leads to a real return on bonds close to 1.35%. We believe this estimate to be a good indication for future compensation with one exception. The compensation is calculated using a dataset which is not in line with forward-looking demographics (see for example United Nations (2015)). Rachel and Smith (2015) calculated that changing demographics would have a severe impact on real rates, causing them to fall significantly. In looking to the future, we believe this correction to be too high as the number of elderly will increase substantially leading to higher interest rates. Depending on longevity and retirement age trends, the earlier correction could reverse. However, we do not believe there will be a complete reversal and so we incorporate a small correction to the historical estimates leading to a real return of 1.25% (i.e. 80% capture of real per capita GDP). This lower figure is also consistent with our belief that there is a relatively lower risk associated with investing in government bonds, than in investing in the growth of the real economy. Hence, there is a safety discount for investing in government bonds.

A real return of 4% for equities and 1.25% for government bonds, means that we expect a steady-state excess return of 2.75%, which is at odds with the historically observed excess return of 3.4% (see Table 1.5). It should be kept in mind though that this historical excess return figure is at least partly due to the fact that equities became more expensive during the period in question. From a steady-state perspective, we do not expect this price increase to be repeated and it might in fact be reversed. This will lead to a lower excess return on equities in our steady-state scenario.

2.5 Inflation

Most economic theories take a real (i.e. inflation-adjusted) perspective on economic growth. Money is often seen as a unit which reflects the prices of goods, but which carries no information in itself. There appears to be a growing consensus among central banks that 2.0% is an optimal level of consumer price inflation and that this target is not symmetrical. Deflation is generally considered to be a more serious threat that has to be prevented at all costs. This suggests a bias towards maintaining a somewhat loose monetary policy in a bid to err on the side of caution as illustrated by current circumstances. Representatives of the International Monetary Fund have even advocated an inflation target of 4.0%. All in all, we expect policymakers in a steady-state environment to actually have a preference for a higher level of inflation than the stated target of below but close to 2.0%. We should also take into account the fact that an inflation overshoot in one year, will almost certainly not be compensated by attempting an undershoot in later years, as this would increase deflationary risks. Finally, policy preferences have clearly shifted towards growth enhancement, even at the cost of somewhat higher inflation (as has been the experience in emerging markets). All in all, in our opinion, an inflation estimate in line with the empirically observed 3.0% is not a bad one.

References

Agur, I., Chan, M., Goswami, M. and Sharma, S., 2019. "On international integration of emerging sovereign bond markets", Emerging Markets Review 38, pp. 347-363. https://doi.org/10.1016/j.ememar.2018.11.006

Altman, E., 1998. "The anatomy of the high yield bond market: after two decades of activity-implications for Europe", working paper. https://dx.doi.org/10.2139/ssrn.164501

Amin, G. and Kat, H., 2005. "Welcome to the dark side: hedge fund attrition and survivorship bias 1994-2001", Journal of Alternative Investments 6(1), pp. 57-73. https://doi.org/10.3905/jai.2003.319083

Ang, A., Chen, B., Goetzmann, W. and Phalippou, L., 2018. "Estimating private equity returns from limited partner cash flows", Journal of Finance 78(4), pp. 1751-1783. https://doi.org/10.1111/jofi.12688

Asvanunt, A. and Richardson, S., 2017. "The credit risk premium", Journal of Fixed Income 26(3), pp. 6-24. https://doi.org/10.3905/jfi.2017.26.3.006

Bai, J., Bali, T. and Wen, Q., 2019. "Common risk factors in the cross-section of corporate bond returns", Journal of Financial Economics 131(3), pp. 619-642. https://doi.org/10.1016/j.jfineco.2018.08.002

Bekaert, G. and Harvey, C., 1995. "Time-varying world market integration", Journal of Finance 50(2), pp. 403-444. https://doi.org/10.1111/j.1540-6261.1995.tb04790.x

Bekkers, N., Doeswijk, R. and Lam, T., 2009. "Strategic asset allocation: determining the optimal portfolio with ten asset classes", Journal of Wealth Management 12(3), pp. 61-77. https://doi.org/10.3905/jwm.2009.12.3.061

Bektic, D., Wenzler, J., Wegener, M., Schiereck, D. and Spielmann, T., 2019. "Extending Fama–French Factors to Corporate Bond Markets", Journal of Portfolio Management 45(3), pp. 141-158. https://doi.org/10.3905/jpm.2019.45.3.141

Bhardwaj, G. and Janardanan, R. and Rouwenhorst, K., 2019. "The Commodity Futures Risk Premium: 1871–2018", working paper. http://dx.doi.org/10.2139/ssrn.3452255

Blanchard, O., Dell'Ariccia, G. and Mauro, P., 2010. "Rethinking macroeconomic policy", Journal of Money, Credit, and Banking 42(s1), pp. 199-215. https://doi.org/10.1111/j.1538-4616.2010.00334.x

Blitz, D., 2020. "Factor performance 2010-2019: a lost decade?", Journal of Index Investing 11(2), pp. 57-65. https://doi.org/10.3905/jii.2020.1.090

Blitz, D., and De Groot, W., 2014. "Strategic allocation to commodity factor premiums", Journal of Alternative Investments 17(2), pp. 103-115. https://doi.org/10.3905/jai.2014.17.2.103

Bongaerts, D., De Jong, F. and Driessen, J., 2011. "Derivative pricing with liquidity risk: theory and evidence from the credit default swap market", Journal of Finance 66(1), pp. 203-240. https://doi.org/10.1111/j.1540-6261.2010.01630.x

Campbell, J., Lo, A. and MacKinlay, A., 1997. The econometrics of financial markets. Princeton: Princeton University Press.

Damodaran, A., 2009. "Equity risk premiums (ERP): Determinants, estimation and implications – A post-crisis update", Financial Markets, Institutions and Instruments 18, pp. 289-370. https://doi.org/10.1111/j.1468-0416.2009.00151.x

De Grauwe, P. and Ji, Y., 2019. "Inflation targets and the zero lower bound in a behavioral macroeconomic model", Economica 86(342), pp. 262-299. https://doi.org/10.1111/ecca.12261

De Groot, W., Pang, J. and Swinkels, L., 2012. "The cross-section of stock returns in frontier emerging markets", Journal of Empirical Finance 19(5), pp. 796-818. https://doi.org/10.1016/j.jempfin.2012.08.007

Doeswijk, R., Lam, T. and Swinkels, L., 2020. "Historical returns of the market portfolio", Review of Asset Pricing Studies 10(3), pp. 521-567. https://doi.org/10.1093/rapstu/raz010

Driessen, J., Lin, T. and Phalippou, L., 2012. "A new method to estimate risk and return of non-traded assets from cash flows: the case of private equity funds", Journal of Financial and Quantitative Analysis 47(3), pp. 511-533. https://doi.org/10.1017/S0022109012000221

Driessen, J., Nijman, T. and Simon, Z., 2017. "The missing piece of the puzzle: Liquidity premiums in inflation-indexed markets", SAFE Working Paper 183. https://dx.doi.org/10.2139/ssrn.3042506

Elton, E., Gruber, M., Agrawal, D. and Mann, C., 2001. "Explaining the rate spread on corporate bonds", Journal of Finance 56(1), pp. 247-277. https://doi.org/10.1111/0022-1082.00324

Erb, C. and Harvey, C., 2006. "The strategic and tactical value of commodity futures", Financial Analysts Journal 62(2), pp. 69-97. https://doi.org/10.2469/faj.v62.n2.4084

Erb, C., Harvey, C. and Viskanta, T., 1996. "Expected returns and volatility in 135 countries", Journal of Portfolio Management 22(3), pp. 46-58. https://doi.org/10.3905/jpm.1996.409554

Errunza, V. and Losq, E., 1985. "International asset pricing under mild segmentation: theory and test", Journal of Finance 40(1), pp. 105-124. https://doi.org/10.1111/j.1540-6261.1985.tb04939.x

Francis, J. and Ibbotson, R., 2020. "Real estate returns", Journal of Alternative Investments. https://doi.org/10.3905/jai.2020.1.111

Frazzini, A. and Pedersen, L., 2014. "Betting against beta", Journal of Financial Economics 111(1), pp. 1-25. https://doi.org/10.1016/j.jfineco.2013.10.005

Fuertes, A., Miffre, J. and Fernandez- Perez, A., 2015. "Commodity strategies based on momentum, term structure, and idiosyncratic volatility", Journal of Futures Markets 35(3), pp. 274-297. https://doi.org/10.1002/fut.21656

Fugazza, C., Guidolin, M. and Nicodano, G., 2006. "Investing for the long-run in European real estate", Journal of Real Estate Finance and Economics 34(1), pp. 35-80. https://doi.org/10.1007/s11146-007-9002-5

Fung, D. and Hsieh, D., 2000. "Performance characteristics of hedge funds and commodity funds: natural vs. spurious biases", Journal of Financial and Quantitative Analysis 35(3), pp 291-307. https://doi.org/10.2307/2676205

García, J. and Werner, T., 2010. "Inflation risks and inflation risk premia", ECB Working Paper Series 1162. https://ssrn.com/abstract=1569383

Giesecke, K., Longstaff, F.A., Schaefer, S. and Strebulaev, I., 2011. "Corporate bond default risk: A 150-year perspective", Journal of Financial Economics 102(2), pp. 233-250. https://doi.org/10.1016/j.jfineco.2011.01.011

Gorton, G. and Rouwenhorst, K., 2006. "Facts and fantasies about commodity futures", Financial Analysts Journal 62(2), pp. 47- 68. https://doi.org/10.2469/faj.v62.n2.4083

Grishchenko, O. and Huang, J., 2013. "The inflation risk premium: evidence from the TIPS market", Journal of Fixed Income 22(4), pp. 5-30. https://doi.org/10.3905/jfi.2013.22.4.005

Hallerbach, W. and Houweling, P., 2013. "Ibbotson's default premium: risky data", Journal of Investing 22(2), pp. 95-105. https://doi.org/10.3905/joi.2013.22.2.095

Hammond, P., Fairbanks, A. and Durham, J., 1999. "Understanding the Inflation Risk Premium," in Brynjolfsson, J., and Fabozzi, F., (eds.), Handbook of Inflation Indexed Bonds. New Hope, PA: Frank J. Fabozzi Associates.

Hanauer, M. and Lauterbach, J., 2019. "The cross-section of emerging market stock returns", Emerging Markets Review 38, pp. 265-286. https://doi.org/10.1016/j.ememar.2018.11.009

Harris, R., Jenkinson, T. and Kaplan, S., 2014. "Private equity performance: what do we know?", Journal of Finance 69(5), pp. 1851-1882. https://doi.org/10.1111/jofi.12154

Higson, C., and Stucke, R., 2012, "The performance of private equity", working paper. https://dx.doi.org/10.2139/ssrn.2009067

Hoesli, M., Oikarinen, E. and Serrano, C., 2015. "Do public real estate returns really lead private returns?", Journal of Portfolio Management 41 (6) 105-117. https://doi.org/10.3905/jpm.2015.41.6.105

Holston, K., Laubach, T. and Williams, J., 2017. "Measuring the natural rate of interest: International trends and determinants", Journal of International Economics 108(S1), pp. S59-S75. https://doi.org/10.1016/j.jinteco.2017.01.004

Houweling, P., 2012. "On the performance of fixed-income exchange-traded funds", Journal of Index Investing 3(1), pp. 39-44. https://doi.org/10.3905/jii.2012.3.1.039

Houweling, P. and Mentink, A., and Vorst, T., 2005. "Comparing possible proxies of corporate bond liquidity", Journal of Banking and Finance 29(6), pp. 1331-1358. https://doi.org/10.1016/j.jbankfin.2004.04.007

Houweling, P. and Swinkels, L., 2019. "Pension and Insurance Solvency Regulations and Low-Risk Investing: A Comparative Analysis of the Nordic Countries and the Netherlands", Nordic Journal of Business 68(4), pp. 25-39.

Houweling, P. and Van Zundert, J., 2017. "Factor investing in the corporate bond market", Financial Analysts Journal 73(2), 100-115. https://doi.org/10.2469/faj.v73.n2.1

Idzorek, T., Barad, M. and Meier, S., 2006. Commercial real estate: the role of global listed real estate equities in a strategic asset allocation, Ibbotson Associates: Chicago IL, United States.

Ilmanen, A., Byrne, R., Gunasekera, H., and Minikin, R., 2004. "Which risks have been best rewarded?" Journal of Portfolio Management 30 (2), pp. 53-57. https://doi.org/10.3905/jpm.2004.319930

Israel, R., Palhares, D. and Richardson, S., 2018. "Common factors in corporate bond returns", Journal of Investment Management 16(2), pp. 17-46.

Jordà, Ò, Schularick, M. and Taylor, A., 2017. "Macrofinancial history and the new business cycle facts" in NBER Macroeconomics Annual 31, edited by Eichenbaum and Parker. Chicago: University of Chicago Press. https://doi.org/10.1086/690241

Jordà, Ò, Knoll, K., Kuvshinov, D., Schularick, M. and Taylor, A., 2019. "The Rate of Return on Everything, 1870–2015." Quarterly Journal of Economics 134(3), pp. 1225-1298. https://doi.org/10.1093/qje/qjz012

Kaplan, P. and Lummer, S., 1998. "Update: GSCI collateralized futures as a hedging and diversification tool for institutional portfolios", Journal of Investing 7(4), pp. 11-17. https://doi.org/10.3905/joi.1998.408472

Kaplan, S. and Schoar, A., 2005. "Private equity performance: returns, persistence, and capital flows", Journal of Finance 60(4), pp. 1791-1823. https://doi.org/10.1111/j.1540-6261.2005.00780.x

Korteweg, A., 2019. "Risk adjustment in private equity", Annual Review of Financial Economics 11, pp. 131-152. https://doi.org/10.1146/annurev-financial-110118-123057

Korteweg, A. and Sorensen, M., 2017. "Skill and luck in private equity performance", Journal of Financial Economics 124(3), pp. 535-562. https://doi.org/10.1016/j.jfineco.2017.03.006

Levine, A., Ooi, Y., Richardson, M. and Sasseville, C., 2018. "Commodities for the Long Run", Financial Analysts Journal 74(2), pp. 55-68. https://doi.org/10.2469/faj.v74.n2.4

Lummer, S. and Siegel, L., 1993. "GSCI collateralized futures: a hedging and diversification tool for institutional portfolios", Journal of Investing 2(2), pp. 75-82. https://doi.org/10.3905/joi.2.2.75

Mehra, R. and Prescott, E., 1985. "The equity premium: a puzzle", Journal of Monetary Economics 15, pp. 145-161. https://doi.org/10.1016/0304-3932(85)90061-3

Miffre, J. and Rallis, G., 2007. "Momentum strategies in commodity futures markets", Journal of Banking and Finance 31(6), pp. 1863-1886. https://doi.org/10.1016/j.jbankfin.2006.12.005

Ng, K. and Phelps, B., 2011. "Capturing credit spread premium", Financial Analysts Journal 67(3), pp. 63-75. https://doi.org/10.2469/faj.v67.n3.4

Norman, E., Sirmans, G. and Benjamin, J., 1995. "The historical environment of real estate returns", Journal of Real Estate Portfolio Management 1(1), pp. 1-25. https://doi.org/10.5555/repm.1.1.m5100008ur261012

Phalippou, L. and Gottschalg, O., 2009. "The performance of private equity funds", Review of Financial Studies 22(4), pp. 1747-1776. https://doi.org/10.1093/rfs/hhn014

Posthuma, N. and Van der Sluis, P., 2003. "A reality check on hedge funds returns", working paper. https://dx.doi.org/10.2139/ssrn.438840

Robinson, D. and Sensoy, B., 2016. "Cyclicality, performance measurement, and cash flow liquidity in private equity", Journal of Financial Economics 122(3), pp. 521-543. https://doi.org/10.1016/j.jfineco.2016.09.008

Rouwenhorst, K., 1998. "International momentum strategies", Journal of Finance 53(1), pp. 267-284. https://doi.org/10.1111/0022-1082.95722

Rouwenhorst, K., 1999. "Local return factors and turnover in emerging stock markets", Journal of Finance 54(4), 1439-1464. https://doi.org/10.1111/0022-1082.00151

Salomons, R. and Grootveld, H., 2003. "The equity risk premium: emerging vs. developed markets", Emerging Markets Review 4(2), pp. 121-144. https://doi.org/10.1016/S1566-0141(03)00024-4

Shen, Q., Szakmary, A. and Sharma, S., 2007. "An examination of momentum in commodity futures markets", Journal of Futures Markets 27(3), pp. 227-256. https://doi.org/10.1002/fut.20252

Stucke, R., 2011. "Updating history", working paper. https://dx.doi.org/10.2139/ssrn.1967636

Svensson, L., 2010. "Inflation targeting", Chapter 22 in Friedman, B., and Woodford, M. (eds.), Handbook of Monetary Economics, Volume 3b, Elsevier: North Holland. https://doi.org/10.1016/B978-0-444-53454-5.00010-4

Swinkels, L., 2012. "Emerging markets inflation-linked bonds", Financial Analysts Journal 68(5), pp. 38-56. https://doi.org/10.2469/faj.v68.n5.2

Swinkels, L., 2018. "Simulating historical inflation-linked bond returns", Journal of Empirical Finance 48, pp. 374-389. https://doi.org/10.1016/j.jempfin.2018.06.005

Swinkels, L., 2020. "Global financial market returns, 1800-1914", Robeco working paper.

Tang, K. and W. Xiong, 2012. "Index investment and the financialization of commodities", Financial Analysts Journal 68(6), pp. 64-74. https://doi.org/10.2469/faj.v68.n6.5

Van der Hart, J., Slagter, E. and Van Dijk, D.J., 2003. "Stock selection strategies in emerging markets", Journal of Empirical Finance 10(1-2), pp. 105-132. https://doi.org/10.1016/S0927-5398(02)00022-1

Van der Hart, J., De Zwart, G.J. and Van Dijk, D.J., 2005. "The success of stock selection strategies in emerging markets: Is it risk or behavioral bias?", Emerging Markets Review 6(3), pp. 238-262. https://doi.org/10.1016/j.ememar.2005.05.002

Wicksell, K., 1898. "The influence of the rate of interest on commodity prices," reprinted in Erik Lindahl, ed., Selected Papers on Economic Theory by Knut Wicksell (1958), pp. 67-92. Routledge: London. https://doi.org/10.4324/9781315436654

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 document is solely intended for professional investors. 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.

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. It is intended to provide the professional investor with general information on 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 and/or to adopt any investment strategy and/or legal, accounting or tax advice.

ROBECO
The Investment Engineers

Contact

Robeco
P.O. Box 973
3000 AZ Rotterdam
The Netherlands

T +31 10 224 1 224
I www.robeco.com