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Abstract

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JEL Classification: G12, G15, E43, E44, N20

Keywords: expected returns, risk premia, real interest rates, return predictability, long-run trends

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The Expected Return on Risky Assets: International Long-run Evidence [*]

Dmitry Kuvshinov and Kaspar Zimmermann[§]

December 2020

Abstract

This paper estimates the expected return on equity and housing for 17 advanced economies between years 1870 and 2015. We show that the expected risky return has been in steady decline, but its trend is markedly different to that in the safe rate. As a consequence, the ex ante risk premium exhibits large secular movements, and risk premia and safe rates are strongly negatively correlated. Our findings suggest that time-varying risk appetite is a key driver of expected risky and safe returns – not only in the short, but also in the long run.

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1. Introduction

Safe interest rates have declined markedly over the past 30 years (Holston, Laubach, and Williams, 2017). But households and firms cannot raise funds at the government borrowing rate. This makes the expected risky return – the sum of the safe rate and the market risk premium – a key input into most economic decisions. But despite some evidence of recent divergence between expected risky and safe returns (Caballero, Farhi, and Gourinchas, 2017b), we know little about their joint evolution over the long run.

This paper studies long-run trends in the expected risky return and its relationship with the safe rate. We use new data from Jordà, Knoll, Kuvshinov, Schularick, and Taylor (2019) to estimate the expected return directly, as the sum of expected yield and long-run cashflow growth. While previous studies have focussed on the US stock market (Blanchard, 1993; Fama and French, 2002), our estimates cover 17 countries, two major asset classes – equity and housing – and 145 years. Our direct expected return estimate has several advantages relative to averages of past realised returns examined in much previous work (for example, Jordà et al., 2019). First, it looks through large information surprises and unexpected shocks which tend to dominate the realised return series (Elton, 1999). The volatility of our expected return measure is an order of magnitude lower than that of realised returns. Second, it gives us a forward-looking estimate of the rate of return required by potential investors in risky projects. It is this rate, rather than returns realised by investors who already hold the asset, which characterises the financing conditions of households and firms.

We find that the expected risky return has been declining steadily throughout the last 145 years. This decline is largely unrelated to movements in the real safe rate and, as a consequence, the risk premium exhibits large secular variation. The risky-safe rate disconnect carries important implications for asset pricing theory. Standard theory puts forward two key drivers of expected returns: growth and risk. These entail opposing predictions for the relationship between risky and safe rates. While the growth channel pushes risky and safe rates in the same direction by affecting the general willingness to save, the risk channel pushes safe rates and risk premia in opposite directions with ambiguous overall effect on the risky rate.

We show that risk premia and safe rates are, in general, strongly negatively correlated. This suggests that risk, rather than growth, is the key driver of expected risky and safe returns over the long run. Consistent with this view, we show that secular movements in the risk premium can be explained by changes in macroeconomic risk in ways consistent with standard theory (Lettau, Ludvigson, and Wachter, 2008). We document that consumption volatility halved between 1870 and 1990, rationalising the observed 50% decline in the risk premium. After 1990, risk premia increased somewhat – a trend that can be rationalised by sharp increases in macroeconomic tail risks and higher co-movement between risky asset returns and the macroeconomy. Existing literature puts risk as a key driver of short-run variation in expected returns (Cochrane, 2017; Pflueger, Siriwardane, and Sunderam, 2020). Our findings suggest that risk is key not only in the short-run, but also when it comes to long-run trends in both risky and safe interest rates.

We start by documenting the trend in the risky asset yield – the average of the dividend- and rent-price ratios and a common proxy for the expected return. The risky yield has fallen from 6.5% in the 1870s to 3.3% in 2015. This decline holds across countries, assets, and alternative yield measures such as earnings yields, and is somewhat stronger for housing than for equity. It means that valuations of risky assets relative to fundamentals have doubled over the long run, and are now at an all-time historical high. But risky asset yields are only an imperfect proxy for expected returns. Low asset yields could mean that the discount rate – i.e. the expected return – is unusually low, but also that future cashflow growth is unusally high (Campbell and Shiller, 1988).

Our expected return estimate is based on the dynamic Gordon growth model, and is equal to the sum of the expected yield and long-run cashflow growth for the respective asset class (Gordon, 1962; Blanchard, 1993). To estimate these expectations, we follow the standard practice in the literature and forecast future yields and cashflows using today's asset price data using a flexible VAR specification building on Golez and Koudijs (2017). We find that a little over half of the asset yield variation corresponds to predictable changes in future returns, with the rest accounted for by predictable changes in future cashflows. Consequently, our analysis assigns more than half of the long-run asset yield decline to a lower expected return. The results are similar under several alternative forecasting methods: forecasting long-run cashflow growth directly rather than through a VAR as in Blanchard (1993), using a GDP growth forecast in place of cashflows as in Farhi and Gourio (2018), and assuming constant cashflow growth as in Fama and French (2002).

Our baseline estimate of the expected risky return shows a steady and gradual long-run decline, from about 8% in the 1870s to 6% in 2015. This decline is evident in almost every country in our sample, including the US, and holds up under various alternative methods for estimating expected cashflow growth. The decline is somewhat stronger for housing than for equity owing to the larger rental yield decline and weaker rental growth predictability. Our baseline estimate of the decline is, however, conservative, since it assumes above-average long-run growth in profits and rents despite a slowing growth in GDP and productivity (Fernald, 2015). Bringing cashflow growth expectations in line with GDP growth reduces the current expected return estimate to 5%, with long-run declines of up to 5 percentage points observed in individual countries.

Regardless of the method we use, expected returns remain substantially above estimates of the trend real safe rate which are currently close to zero. At the same time, expected returns were already low in the 1980s, a period when safe rates were high. This suggests that the ex ante risk premium displays substantial secular movements. To study these movements, we first estimate the trend real safe rate using the Bayesian time series model of Del Negro, Giannone, Giannoni, and Tambalotti (2019), extending their estimates of the trend long-term government bond yield to the 17 countries in our sample. We then calculate the risk premium as the difference between our expected return measure and the trend real interest rate on long-term government bonds.

We find that the steady decline in the expected return masks sharply different trends in risk premia and safe rates. Between 1870 and 1990, risk premia more than halved from 6% to 2.5%, but the safe rate actually increased by 1.5 percentage points, offsetting a large part of the decline in the risk premium. After 1990, safe rates fell sharply towards zero, but an almost equally sharp increase in the risk premium ensured that the expected return decline was, again, modest at less than 1 percentage point. As before, these findings hold across countries and under alternative methods for calculating risky and safe rates. We use long-run trends in corporate bond spreads as an alternative proxy for the economy wide risk premium to make sure that our results are not dependent on the estimation of future cashflow growth. The corporate bond premium also follows a U-shaped long-run trend.

What are the drivers of observed trends in expected risky and safe returns? The large secular variation in the risk premium, and the differential trends displayed by risky and safe returns suggest that changes in risk – which should push safe rates and risk premia in opposite directions – are key. Consistent with the importance of the risk channel, we show that risky and safe rates are disconnected and safe rates and risk premia are strongly negatively correlated, to the extent that a 1 percentage point increase in the safe rate implies a 0.8–1 percentage point fall in the risk premium and no corresponding movement in the risky return. These relationships hold over time, across asset classes, in changes as well as in levels, and across different regression specifications and definitions of expected return. Realised risky and safe returns are also only weakly correlated, and ex post risk premia and safe rates are negatively correlated. But the extent of the risky-safe rate disconnect is both stronger and more stable over time for expected than for realised returns.[1]

Asset pricing theory predicts that reductions in macroeconomic risk should increase risk tolerance and reduce the risk premium, while also reducing the desire for precautionary savings and hence increasing the safe rate (Cochrane, 2009). We show that indeed, consumption volatility – proxied as the annual standard deviation of real consumption growth – more than halved between 1870 and 1990, helping explain the observed decline in the risk premium and increase in the safe rate. In line with theory, the magnitude of the decline in consumption volatility broadly matches that of the risk premium decline.

After 1990 however, risk premia increased while consumption volatility remained low. We argue that one reason for this is that despite lower volatility, large negative falls in consumption are much more likely – i.e. macroeconomic *tail risk* has increased. Consistent with this view, we show that the recent decades saw an increase in the probability of systemic banking crises alongside a lower skew and higher kurtosis of realised GDP growth. Other factors which may have increased the price of risk include changes in cross-sectional risk tolerance through population ageing – with older households favouring savings in safer assets (Kopecky and Taylor, 2020) – and increasing safe asset scarcity (Caballero and Farhi, 2014). In addition, we document an increased comovement of risky assets and the business cycle after 1980, while safe assets have started to co-move less. These changes in the quantity of risk offer an additional channel for the recent rise in the risk premium.

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[1] Existing literature has offered several competing explanations for the low and time-varying co-movement between realised stock and bond returns in the US (Baele, Bekaert, and Inghelbrecht, 2010; Campbell, Pflueger, and Viceira, 2020). Our findings suggest that while the overall lack of co-movement is largely driven by differences in expected returns and ex ante risk appetite, its time-varying nature is most likely driven by unanticipated shocks and information surprises.

If risk is an important driver of long-run risky and safe rate trends, we would expect to see some divergence between expected risky and safe returns on one hand, and the rate of economic growth on the other. As a consequence, the ex ante risky and safe r – g gaps may be time varying. Indeed, in the early part of our sample, safe rates and growth were increasing while expected returns were falling, leading to a fall in the ex ante risky $r - g$ gap alongside a rise in the gap between safe returns and growth. Over recent decades, safe rates have declined sharply, while both risky rates and growth have only declined a little. This led to a sharp fall in the safe $r - g$ gap, which now stands at a negative 1%, and relatively little change in the risky $r - g$ gap which remains close to its historical average of 4%.

These secular movements carry important implications for the dynamics of capital accumulation, public debt and wealth inequality. In line with Blanchard (2019), low safe $r - g$ gaps – both now and historically – suggest that the cost of financing public debt is generally low, but the high risky $r - g$ gap points to a high opportunity cost of public borrowing in the form of crowded out private investment. A positive gap between expected risky returns and growth also implies that our selection of advanced economies remain dynamically efficient (Barro, 2020), with little evidence of diminishing returns to capital despite the sharp increases in wealth-to-income ratios observed over recent decades (Piketty and Zucman, 2014). The fact that returns on risky wealth are likely to remain substantially above income growth in the foreseeable future also means that equilibrium levels of wealth inequality are likely to remain high (Piketty, 2014).

Our findings relate to three strands of existing literature. The first strand studies trends in risky and safe returns. The consensus is that safe rates have declined in recent decades (Holston et al., 2017) and over the longer run (Del Negro et al., 2019; Schmelzing, 2020), and that there is evidence of a declining equity premium in the US (Blanchard, 1993; Jagannathan, McGrattan, and Scherbina, 2000; Fama and French, 2002). We show that the expected return decline goes further back in time and is more widespread, that risky and safe rates follow markedly different long-run trends, and that a recent increase in the risk premium has kept expected returns high despite low safe rates across advanced economies. Our estimation of the risky and safe returns also contributes to the extensive return predictability literature (Cochrane, 2008). We confirm the findings in Kuvshinov (2020) that both equity and housing returns and cashflows are predictable, and show that the strength of these predictability relationships varies substantially over time, in line with evidence in Chen (2009) and Golez and Koudijs (2018).

The third strand focuses on the relationship between risky and safe returns and their underlying drivers. There is evidence that ex ante risky and safe returns have diverged recently (Gomme et al., 2015; Farhi and Gourio, 2018; Caballero et al., 2017a), that co-movement between realised risky and safe returns is low and time-varying (Shiller and Beltratti, 1992; Baele et al., 2010; David and Veronesi, 2013; Song, 2017; Campbell et al., 2017), that variation in risk perceptions is an important driver of short-run movements in risky and safe returns and the business cycle (Pflueger et al., 2020; Caballero and Simsek, 2020), and that gaps between realised risky returns and growth are large and time varying (Jordà et al., 2019). Lettau et al. (2008) and Bianchi, Lettau, and Ludvigson (2016) link a structural decline in the US equity premium during the 1990s to changes in macroeconomic risk in the form of, respectively, lower consumption volatility and more stable conduct of monetary policy. We show that the risky-safe rate disconnect goes far beyond the recent data, that the co-movement across expected risky and safe returns is both lower and more stable than that across realised returns, and that risk is a key driver not just of short run movements, but also long-run trends in risky and safe rates.

2. MEASURING EXPECTED RETURNS

Expected return is the amount of compensation investors demand for holding risky assets. Today's price of a risky asset i, P_i, should equal the present value of expected future cashflows CF_i discounted at this expected rate of return $\mathbb{E}(R_i)$:

$$P_{i,t} = \mathbb{E}\left[\sum_{\tau=1}^{\infty} \frac{CF_{i,t+\tau}}{(1+R_{i,t+1})^{\tau}}\right], \tag{1}$$

A low discount rate means that asset prices are high, and expected future returns are low. Discount rates vary because investor willingness to save and bear risk varies. The expected return is, therefore, equal to the sum of the safe rate R^{safe} – which depends on the investor willingness to save – and the ex ante risk premium RP – which depends on the investor willingness to hold risky as opposed to safe assets:

$$\mathbb{E}\left(R_{i,t+1}\right) = \mathbb{E}\left(R^{safe}_{t+1}\right) + \mathbb{E}\left(RP_{i,t+1}\right) \tag{2}$$

Expected returns differ considerably from realised returns. Expected return is an ex ante measure of what a potential investor would demand to entice her to hold risky assets. Realised return is the income of an investor who already holds the asset and reflects any unanticipated shocks to asset valuations as well as the ex ante expected return. These unanticipated shocks can arise from new information I or other unanticipated changes in the supply and demand for funds giving rise to an unexpected return ϵ (Elton, 1999):

$$R_{i,t+1} = \mathbb{E}_t\left(R_{i,t+1}\right) + I_{i,t+1} + \epsilon_{i,t+1} \tag{3}$$

On the margin, it is expected rather than realised returns which reflect investor willingness to finance risky projects and hence drive the financing decisions of households and firms. But since realised returns R contain information on expected returns, one could in principle us it as a proxy for $\mathbb{E}(R)$. Empirically, however, realised returns offer a rather poor proxy for expected returns because their variation is driven by the unexpected components I and ϵ, rather than the expected return (Elton, 1999). Jordà et al. (2019) show that variation in realised equity and housing returns – even over periods stretching to multiple decades – is dominated by unanticipated large shocks.

We may expect the variation in I and ϵ to average out over very long time horizons, meaning that realised returns can provide a useful proxy of the *average level* of the expected return. But because the variation in realised returns – even across decades – is both sizeable, with standard deviations of 10–20 ppts per year, and largely driven by unanticipated shocks, realised returns are generally unsuitable for mapping out the *trend* in the expected return. The noise in I and ϵ aside, trends in realised returns yield a fundamentally biased estimate of the expected return trend. Whenever expected returns and discount rates *decline*, the present value of cashflows – and hence asset prices and realised returns – *increase*, driving expected and realised returns in opposite directions. This bias is far from hypothetical: as Fama and French (2002) show, a sharp decline in the ex ante US equity premium after 1950 boosted realised returns such that the ex post equity premium remained broadly flat. The above-mentioned drawbacks also apply to estimates of the rate of return on capital in the national accounts, which are inherently backward-looking and include any unanticipated shocks to capital income and wealth.

In this paper, instead of eliciting proxies of expected returns using the noisy realised return data, we seek to measure the expected return directly. We do this for the two major classes of risky assets – equity and housing – across 17 countries over the time period 1870–2015. To construct a direct expected return estimate for each of these two assets, we follow the literature and use a linearised version of the present value relationship in equation (1) – the dynamic Gordon growth model – derived, for example, by Blanchard (1993):

$$\mathbb{E}\left(R_{i,t+1}\right) \approx \mathbb{E}\left(CF_{i,t+1}/P_{i,t}\right) + \mathbb{E}\left(\tilde{g}_{i,t+2}\right) \tag{4}$$

Above, expected returns on asset i are the sum of the expected *asset yield* $CF_{i,t+1}/P_{i,t}$ – the dividend- or the rent-price ratio – and expected long-run *cashflow growth* in dividends or rents $\mathbb{E}\left(\tilde{g}_{t+2}\right)$.[2]

Our main task in this paper is, therefore, to calculate the two components of the direct expected return estimate: the expected asset yield $\mathbb{E}(CF_{i,t+1}/P_{i,t})$ and expected cashflow growth $\mathbb{E}\left(\tilde{g}\right)$. Since we do not have data on actual investor expectations for our extensive sample period, we instead use empirical forecasts of the yield and cashflow growth derived by exploiting the correlations between current and future yields, cashflows and returns. Our baseline approach uses theory and the present value identity in (1) to guide both our choice of predictors and the forecasting technique. For this, we consider the log-linearised version of the present value identity derived by Campbell and Shiller (1988):

$$dp_{i,t} \approx \mathbb{E}\sum_{s=0}^{\infty}\rho_i^s r_{i,t+1+s} - \mathbb{E}\sum_{s=0}^{\infty}\rho_i^s dg_{i,t+1+s} \tag{5}$$

Here $\mathbb{E}\sum\limits_{s=0}^{\infty}\rho_i^s dg_{i,t+1+s}$ is the present value of expected future log dividend growth rates, with

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[2] $\tilde{g}_{i,t+2}$ is the annuity value of future cashflow growth, which is a weighted average of expected future cashflow growth rates calculated as $\tilde{g}_{i,t+2} = w_{i,1}\mathbb{E}g_{i,t+2} + w_{i,2}\mathbb{E}g_{i,t+3} + ... + w_{i,\tau}\mathbb{E}g_{i,t+\tau+1}$. Here $g_{i,t} = CF_{i,t}/CF_{i,t-1} - 1$ is the year-on-year cashflow growth, and the weights are $w_{i,t} = (1+g_i)^{\tau-1}(r_i - g_i)/(1+r_i)^{\tau}$, where g_i and r_i are the average cashflow growth and return rates for asset i.

$exp\left[(1-\rho_i)\mathbb{E}\sum_{s=0}^{\infty}\rho_i^s dg_{i,t+1+s}\right]-1 \approx \tilde{g}_{i,t+2}$ in the level linearisation in (4). $\mathbb{E}\sum_{s=0}^{\infty}\rho_i^s dg_{i,t+1+s}$ is the present value of expected future log returns, and $\rho_i = \frac{P_i/CF_i}{1+P_i/CF_i}$ is a linearisation constant. Equation (5) is similar to the level linearisation in (4): both tell us that asset yields will be high, and asset prices will be low whenever the expected return is high or expected future cashflows are low. But equation (5) has the relative advantage that we can estimate its different components directly from the data in a way that respects their co-dependence induced by the present value identity.

For our estimation, we follow the standard procedure in the literature (see, for example Golez and Koudijs, 2017), and run a VAR in three variables $[r_{i,t}, dg_{i,t}, dp_{i,t}] \equiv z_{i,t}$ for each of the two asset classes i, equity and housing. The VAR is estimated using 6-equation GMM accounting for time and cross-sectional dependence in standard errors and respecting the present value moment constraints. The 6 equations capture the 9 moment conditions (from $3\ X\ 3$ variables) subject to 3 restrictions imposed by the present value identity. Existing studies show that the strength of such predictability relationships can change materially over time (Chen, 2009). To account for such time variation, we estimate the VAR using rolling 40-year windows, the same time window as in Blanchard (1993).

$$\begin{aligned}\text{VAR:} \quad & z_{i,t} = A_{i,T} z_{i,t-1} + u_{i,t}, \qquad z_{i,t} \equiv [r_{i,t}, dg_{i,t}, dp_{i,t}] \\ \text{Moment conditions:} \quad & E[(z_{i,t+1} - A_{i,T} z_{i,t}) \otimes z_{i,t}] = 0 \\ \text{Restrictions:} \quad & (e1' - e2' + \rho_i e3') A_{i,T} = e3'\end{aligned}$$

Here, $e1$ and $e2$ are the first two columns of the identity matrix I, and T is the 40-year rolling time period under consideration.

The long-run forecasts for discount rate news $\mathbb{E}\sum_{s=0}^{\infty}\rho_i^s r_{i,t+1+s}$, cashflow news $\mathbb{E}\sum_{s=0}^{\infty}\rho_i^s dg_{i,t+1+s}$, and the year-ahead forecast for $dp_{i,t+1}$ can then be estimated as follows:

$$\begin{aligned}\text{Discount rate news :} \quad & \hat{\mathbb{E}}\sum_{s=0}^{\infty}\rho_i^s r_{i,t+1+s} = e1'\hat{A}_{i,T}(I-\rho_i\hat{A}_{i,T})^{-1}z_{i,t} \\ \text{Cashflow news :} \quad & -\hat{\mathbb{E}}\sum_{s=0}^{\infty}\rho_i^s dg_{i,t+1+s} = e2'\hat{A}_{i,T}(I-\rho_i\hat{A}_{i,T})^{-1}z_{i,t} \\ \text{Expected yield :} \quad & \hat{\mathbb{E}}\ dp_{i,t+1} = \hat{a}_{3,i,T} z_{i,t},\end{aligned}$$

where $\hat{a}_{3,i,T}$ is the third row of the estimated $\hat{A}_{i,T}$ coefficient matrix. We use the VAR estimated over the window $[t-40, t]$ to calculate the forecasts for $t+1$, and use the VAR estimated for the window 1870–1910 to produce forecasts for the first 40 years of our sample.

The Campbell-Shiller decomposition gives us an estimate of the expected log asset yield and the present value of the expected log future cashflow growth, both demeaned at the country level. To convert these into the estimate of the expected return level in equation (4), we add back the country-specific means for the dp and dg variables and convert the present value cashflow growth estimate to annual year-on-year equivalent by multiplying it by $1-\rho_i$:

$$\hat{\mathbb{E}}\left(R_{i,t+1}\right) = \underbrace{exp\left[\hat{\mathbb{E}}dp_{i,t+1} + \overline{dp}_{i,j}\right]}_{\mathbb{E}(CF/P)} + \underbrace{exp\left[(1-\rho_i)\hat{\mathbb{E}}\sum_{s=0}^{\infty}\rho_i^s dg_{i,t+1+s}\right] + \overline{DG_{i,j}} - 1}_{\mathbb{E}(\tilde{g})} \tag{6}$$

Above, indices i and j refer to asset and country respectively, and $DG_{i,t+1} = CF_{i,t+1}/CF_{i,t} - 1$ refers to absolute rather than log cashflow growth. This gives us an estimate of the level of the expected return at $t+1$. Adding back the mean of log cashflow growth instead would give us an estimate of expected log return, which displays the same trend as the absolute return but a lower sample mean. Note also that replacing the forecast $\hat{\mathbb{E}}dp_{i,t+1}$ with observed $dp_{i,t+1}$ gives us the discount rate news component in the Campbell-Shiller decomposition in equation (5), which – since yields are very persistent and hence differences between $\hat{\mathbb{E}}dp_{i,t+1}$ and $dp_{i,t+1}$ are small – displays a very similar trend to our baseline expected return estimate.

The intuition behind our estimation is the following. We can observe the trend in the risky asset yield dp, but we do not know if it is driven by trending expected returns or cashflows. The predictive regressions allow us to decompose year-on-year variation in dp into future cashflow and discount rate movements. From equation (5), the variance of dp_i is the sum of variances of discount rate and cashflow news. The VAR allows us to estimate these variance shares.[3] We then apply these variance shares to the overall trend in the yield to determine the relative contribution of trend changes in expected returns and cashflows. If these shares are, say, 50-50, yields are equally good at predicting future cashflows and returns and hence a 1 percentage point trend decline in the yield will be interpreted as a 0.5 ppts trend decline in the expected return and a 0.5 ppts trend increase in the expected cashflow growth rate. If the shares are 100-0 and yields only forecast returns and not cashflows, a 1 percentage point trend decline in the yield will mean a 1 percentage point trend decline in the expected return.

We estimate the VAR separately for the two asset classes in our study, equity and housing, with the expected risky return equal to the average of the two:

$$R_{t+1}^{risky} = \left[\hat{\mathbb{E}}\left(R_{t+1}^{\text{equity}}\right) + \hat{\mathbb{E}}\left(R_{t+1}^{\text{housing}}\right)\right]/2 \tag{7}$$

As well as the baseline Campbell-Shiller forecast, we also consider several alternative expected cashflow growth estimates. First, we draw on Blanchard (1993) and directly forecast the annuity value of future cashflow growth $\tilde{g}_{t+2}$ in equation (4) using the time t risky asset yield. Second, we set expected cashflow growth to a constant country-specific mean, similarly to Fama and French (2002). Third, similarly to Farhi and Gourio (2018), we use the long-run expected GDP growth as a proxy for cashflow growth in the Gordon model. To do this, we forecast the annuity value of real

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[3] This variance decomposition can be directly estimated from the VAR as follows:

$$\text{Var}(dp_{i,t}) = e3'\Gamma e3 = \underbrace{e1'\hat{A}_{i,T}(I-\rho_i\hat{A}_{i,T})^{-1}\Gamma e3}_{\text{Discount rates}} - \underbrace{e2'\hat{A}_{i,T}(I-\rho_i\hat{A}_{i,T})^{-1}\Gamma e3}_{\text{Cashflows}}, \quad \Gamma = \mathbb{E}(zz')$$

GDP growth using two lags of real GDP growth, the term premium and the dividend-price ratio.[4]

The final step is to decompose expected returns into the ex ante risk premium and safe rate according to equation (2). To do this, we take a best-practice off-the-shelf estimate of the trend long-term real safe rate from Del Negro et al. (2019). Their method is based on a Bayesian VAR model and allows us to extract slow-moving real safe rate trends from cross-country long-run data on short-term rates, long-term rates and inflation. Del Negro et al. (2019) compute safe rate estimates for 7 advanced economies, and we use their method to extend their estimates to our sample of 17 countries. As with expected returns, we also check our results against alternative safe rate estimates: a short-term rather than long-term real safe rate, and the natural rate estimates of Holston et al. (2017).

We calculate the ex ante risk premium as the difference between the expected risky return and the trend real safe rate. As a further robustness check, we compare our ex ante risk premium estimates for the housing and equity market to a direct forward-looking risk premium measure from the corporate bond market – the yield-to-maturity spread between corporate and government bonds. The credit spread measure does not depend on assumptions about cashflow growth, inflation expectations and the specific modelling techniques used to estimate the expected risky return and the trend real safe rate. However, it is based on a relatively narrow market segment, and may not fully capture risk premium movements in the broader macroeconomy.[5]

Our estimates of expected risky returns and risk premia cover 17 countries – Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK and USA – on an annual basis between 1870 and 2015. The raw data on realised returns, risky asset yields and cashflows come from Jordà et al. (2019), extended to also include Canadian equities. The equity series are generally market cap weighted averages of the dividend-price ratio and dividend growth for all listed shares. In some of the earlier sample periods, value-weighted blue-chip indices covering a smaller number of shares are used. The dividend-price ratio is measured as dividends paid over the course of the year divided by the year-end share price.

The housing data are constructed to, wherever possible, cover both owner-occupiers and renters, cover the national housing stock, and adjust for quality changes, maintenance costs, depreciation and other non-tax housing expenses. The rent-price ratio is calculated as net rent received over the course of the year in proportion to the house price. These data are complemented by estimates of the real safe rate based on short and long term government bond yields, and corporate bond spread data from Kuvshinov (2020). Returns and growth rates are deflated using the consumer price data from the latest vintage of the Jordà-Schularick-Taylor macrohistory database (Jordà, Schularick, and Taylor, 2016). The dividend growth series is affected by several outliers mostly relating to near-zero

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[4] Similar to $\tilde{g}_{i,t+2}$ in equation (4) (see footnote 2), we estimate the annuity value of real GDP growth from the year ahead onward, discounted at the country average real risky return rate r. To calculate the annuity value, we compute expected growth after 2015 using the OECD Economic Outlook forecast for GDP in 2060.

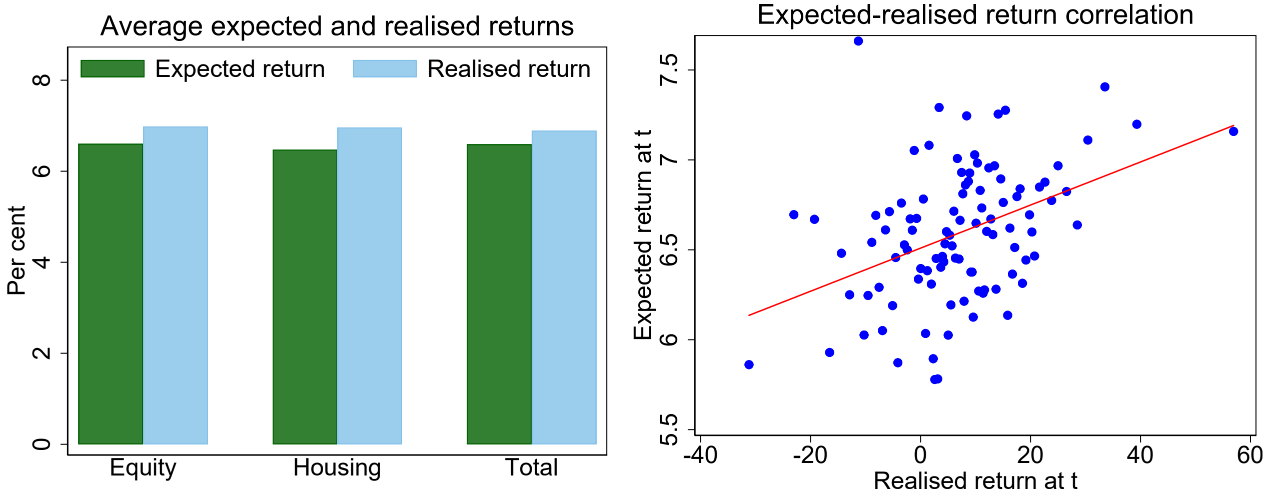
[5] Changes in corporate bond spreads can also reflect time-varying credit quality or default probabilities. However, Giesecke, Longstaff, Schaefer, and Strebulaev (2011) show that in long-run US data, variation in default rates is not an important driver of changes in credit spreads.

Table 1: *Expected risky return and its components*

	(1) Equity	(2) Housing	(3) Total
Expected return	6.62 (2.05)	6.47 (1.83)	6.58 (1.60)
Components of the expected return:			
Ex ante risk premium	4.06 (2.11)	3.97 (1.94)	4.03 (1.70)
Ex ante safe rate	2.55 (1.13)	2.51 (1.14)	2.55 (1.13)
Realised return	7.12 (21.28)	7.14 (9.66)	7.12 (12.72)
Observations	1759	1645	1759

Notes: Unweighted arithmetic averages of annual country-specific data, 17 countries, 1870–2015. Annual standard deviation in parentheses. The expected return is the sum of the expected yield and expected cashflow growth obtained using a predictability VAR. The risk premium is the difference between the expected return and ex ante safe rate. Ex ante real safe rate is estimated using a Bayesian VAR with slow-moving trends as in Del Negro et al. (2019). For Canada, we use equity data to a proxy for total risky returns and risk premia.

Figure 1: *Levels and correlations between expected and realised returns*



Notes: Pooled data for 17 countries. Left-hand panel: average levels of expected and realised risky returns, computed as the average of equity and housing. Right-hand panel: binned scatter plots of the correlation between realised and expected risky return in the specific country and year.

dividend payments during war time and their subsequent resumption, which leads to very high growth rates that could bias the average expected return calculation in (4). To deal with these, use the same procedure as Kuvshinov (2020) and winsorize dividend and rental growth at 1% level, adjusting the yield and total return series accordingly.

Table 1 shows the basic summary statistics of expected returns, risk premia and safe rates, and Figure 1 plots the corresponding expected return levels and their correlation with realised returns. Expected returns on both housing and equity are high – around 6.5% p.a. – and considerably above those earned on safe investments. The average levels of expected returns are similar to those of realised returns, but the volatility is an order of magnitude lower. This shows that – as suggested by Elton (1999) – variation in year-on-year realised returns is primarily driven by unanticipated shocks to asset valuations rather than the expected return, making realised returns a realively poor expected return proxy. The right-hand panel of Figure 1 shows a binned scatter plot of expected versus realised returns for all the country-year observations in the sample split into 100 bins for each measure. Consistent with equation (3), expected and realised returns are positively correlated. But as discussed above, the correlation is far from perfect, with realised return bins of between -40% and +60% p.a. corresponding to expected return bins of between 5.5% and 7.5% p.a.

3. LONG-RUN TRENDS IN EXPECTED RETURNS AND RISK PREMIA

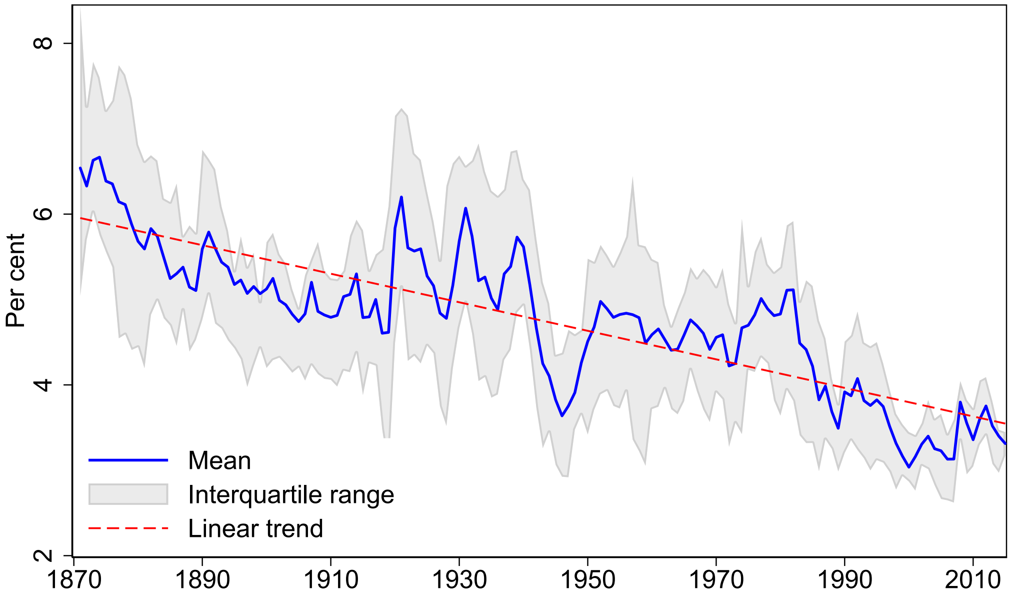
3.1. Trends in risky asset yields

Figure 2 shows the evolution of the risky yield – the average of the the dividend-price and rent-price ratios – over time. The solid blue line is the median yield across the 17 countries in our sample, the shaded area indicates the interquartile range, and the dashed red line – the implied long-run linear trend. Over the last 145 years, risky asset yields have undergone a steady decline. Altogether, the average yield fell from 6.5% in the 1870s to 3.3% in 2015, meaning that risky asset valuations relative to fundamentals have doubled over the long run.

Figure 3 shows that this decline is evident across both asset classes and across different countries. The left-hand panel of Figure 3 shows that both equity and housing yields have fallen substantially. Much of the early decline in the aggregate yields is driven by housing, whereas the sharp drop during the 1980s is mostly attributable to rising equity valuations. The right-hand panel of Figure 3 plots the total change in the risky yield (average of equity and housing) over the full sample in individual countries. In all but two countries this change is negative, with some countries documenting drops of around 4 percentage points. No country registers a large yield increase.

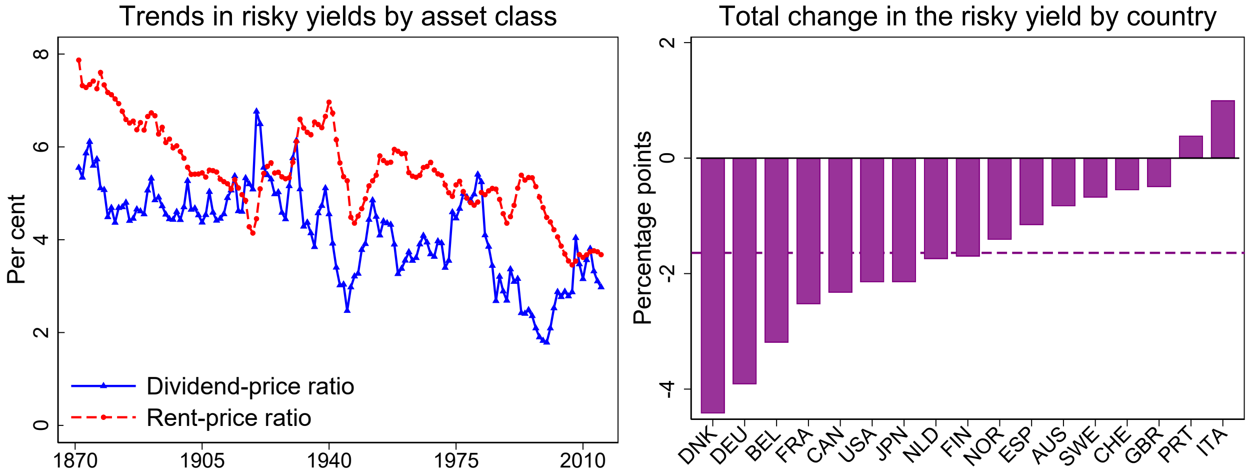
Appendix Figures A.1–A.3 show that the downward trend in yields is robust to different methods of calculating the yield and alternative groupings of countries. Appendix Figure A.1 compares our benchmark housing yield estimates to those that can be obtained from national accounts data as the ratio of rents paid minus non-tax, non-utility housing costs to housing wealth. The national accounts estimates are slightly lower throughout the sample but display a very similar long-run

Figure 2: *The risky asset yield*



Notes: Data for 17 countries. The yield is the average of the dividend-price and rent-price ratios. The solid line and the shaded area are, respectively, the mean and interquartile range of the individual country data in each year. The dashed line represents the linear trend.

Figure 3: *Changes in yields by asset and country*



Notes: The left-hand panel shows unweighted averages of 17 countries. The right-hand panel shows the difference between the average yield in the last decade of the sample and the first decade of the sample, with countries ordered from the most negative to the most positive change and dashed line showing the average change in the yield across countries.

trend to our baseline series.

The main concern with our dividend yield estimates is that they underestimate total cashflows to shareholders – especially in recent data – because they do not account for stock buybacks, which have become an increasingly important form of shareholder compensation in the US (Grullon and Michaely, 2002). The left-hand panel of Appendix Figure A.2 shows that the total earnings yield in the US – which is unaffected by buybacks – displays a similar long-run decline to the dividend yield. Kuvshinov and Zimmermann (2020) further show that in post-1990 Compustat data covering our cross-section of countries, earnings- and dividend-price ratios follow similar trends. Finally, the left-hand panel of Appendix Figure A.3 shows that the downward trend in the yield is not a result of time-varying sample composition, and also holds across different time-invariant samples where we, for example, limit the sample to only include those countries where we have data going back to the 1870s.

3.2. Trends in expected returns

The decline in the risky asset yield does not necessarily mean that expected returns have declined. It could, instead, be driven by higher expected cashflow growth. To assess whether this is the case, we follow Golez and Koudijs (2017) and run a predictability VAR in three variables: log real total returns, log real cashflow growth and log of the asset yield. If movements in yields are driven by changes in expected cashflow growth, yields should predict future cashflows. If changes in expected returns are important, yields should predict future returns. We run a separate VAR for the two asset classes, equity and housing. Because the strength of the predictability relationships can change over time, we estimate the VAR over 40-year rolling windows. After establishing the relative importance of variation in expected returns and cashflows, we use the VAR to construct a long-run forecast of real cashflow growth which we use as a proxy for expected cashflows $\mathbb{E}\left(\tilde{g}_{i,t+2}\right)$ in our expected return calculation in equation (4). Section 2 spells out the method in more detail.

Table 2 shows the most important VAR coefficients (top panel) and the relative strength of cashflow and return predictability (bottom panel) for selected benchmark periods. Appendix Table A.2 shows all the estimated VAR coefficients for these benchmark periods. The top row of Table 2 displays the predictive coefficient of year-ahead realised total return on today's dividend-price ratio (columns 1–4) or rent-price ratio (columns 5–8). The second row shows predictive coefficients on the log real dividend and rental growth. The VAR for 1910 uses the data for 1870–1910, for 1940 – the data for 1900–1940, and so on. For both equity and housing, yields generally forecast both future returns and cashflows. The magnitudes are statistically significant and economically large. For equity, a 1 percentage point increase in the dividend-price ratio generally predicts 1–3 percentage points lower returns one year ahead, and 1–3 percentage points higher real dividend growth.[6] For

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[6] A 1 percentage point increase in the dividend-price ratio is roughly a 25% relative increase, meaning that year-ahead returns are expected to fall by 1.07 (mean return) * 0.06 (regression coefficient) * 0.25 $\approx$ 1.6 percentage points, for case of the the 1910 VAR.

Table 2: *Return and cashflow predictability through time*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Equity				Housing			
	1910	1940	1980	2010	1910	1940	1980	2010
Predictive coefficient on dp_t:								
r_{t+1}	0.06***	0.05**	0.15***	0.05***	0.13***	0.07***	0.07***	0.05***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
g_{t+1}	-0.09***	-0.14***	-0.03	-0.10***	0.00	-0.03***	-0.05***	-0.02***
	(0.02)	(-0.02)	(0.04)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Variance decomposition of dp_t:								
DR news	51	29	82	35	97	48	41	78
CF news	49	71	18	65	3	52	59	22
Observations	545	648	667	693	304	507	577	649

Note: Rolling window VAR estimates for years $t - 40$ to t. VAR estimated using GMM subject to present value moment constraints, accounting for cross-sectional and time dependence in standard errors. Variables are log real total return r, log real dividend or rent growth dg, and log of dividend-price or rent-price ratio dp, demeaned at country level. DR share is the proportion of variation in dp_t that is due to discount rate news. CF share is the proportion of variation in dp_t that is due to expected cashflow movements. *: $p < 0.1$ **: $p < 0.05$ ***: $p < 0.01$.

housing, a 1 percentage point lower rent-price ratio forecasts 1.5–3 percentage point lower returns and 0–1.5 percentage points higher real rental growth.[7]

Because both cashflows and returns are predictable, the long-run decline in yields is likely to be attributable to a mixture of higher expected cashflows and lower expected returns. The key question is – how much of each? To determine this, the bottom panel of Table 2 and Figure 4 compare the relative strength of return and cashflow growth predictability by decomposing the variation in the dividend-price ratio into discount rate news (expected returns) and cashflow news. For example, Table 2 column 1 shows that during 1870–1910, around 50% of the variation in the dividend-price ratio was attributable to changes in future dividends, and the other 50% – to changes in future equity returns. This means that if the dividend-price is 2 percentage points above its long-run mean during this period, around half of that will be attributed to below-mean expected cashflows and the other half to above-mean expected returns. Correspondingly, our expected return estimate will equal the expected yield (in practice, very close to the actual yield) plus average cashflow growth in the sample minus about half of the distance between the yield and its long-run mean (equation (6)).

Figure 4 shows that the relative importance of cashflow and discount rate news varies substantially over time and across asset classes. The discount rate news share was high for equity during

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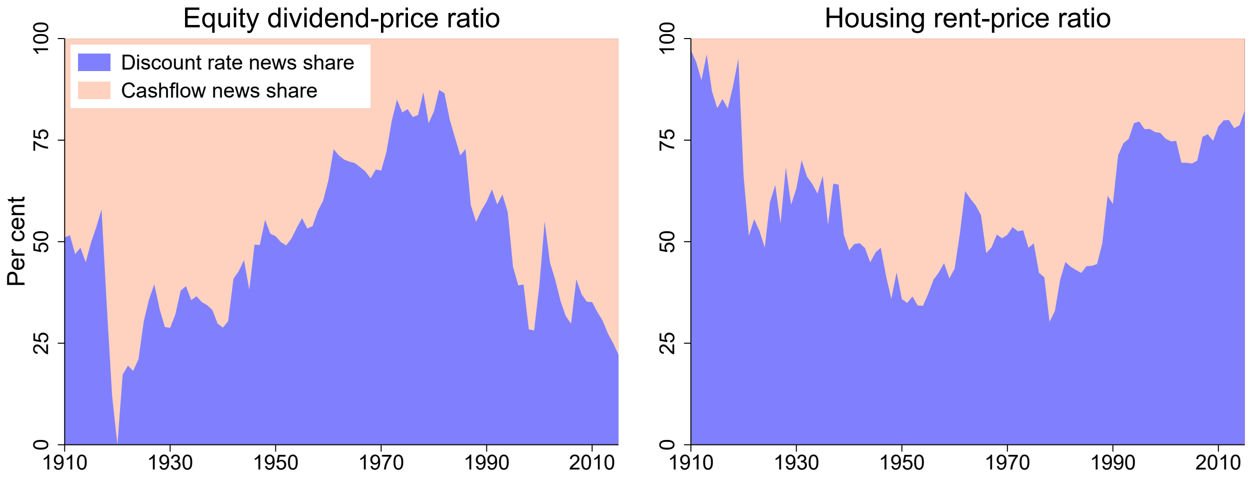
[7] Because both dividend- and rent-price ratios are very persistent, (see the predictive coefficients of $dp_t + 1$ on dp_t in the Appendix Table A.2) these return and cashflow growth increases tend to cumulate over time, such that together long-run cashflow and discount rate innovations explain the variance of the dividend- and rent-price ratios, as also shown in the decomposition in the bottom panel of Table 2.

Figure 4: *Variance decomposition of the dividend- and rent-price ratios through time*



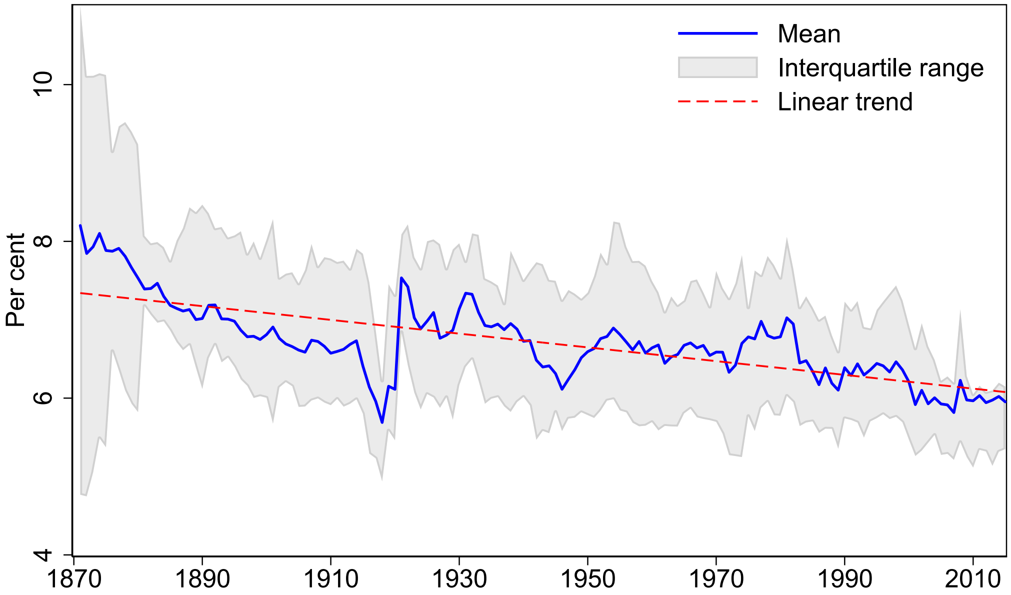
Notes: Estimates using a 40-year rolling window VAR in real returns, cashflows and valuations. Discount rate news share is the proportion of variation in $dp_{i,t}$ of asset i attributable to changes in the long-run VAR forecast of return, $\mathbb{E}_t \sum_{k=0}^{\infty} \rho_i^k r_{i,t+k+1}$. Cashflow news share is the proportion attributable to changes in the long-run VAR forecast of cashflow growth $\mathbb{E}_t \sum_{k=0}^{\infty} \rho_i^k dg_{i,t+k+1}$.

much of the 20th century, in particular during the 1970s and 1980s, a period when the dividend-price ratio registered sharp falls (Figure 3). For the rent-price ratio, the discount rate share is always high but is somewhat higher today than in the mid-20th century. The current discount rate news share is around 25% for equity and 75% for housing. This means that around one-quarter of the difference between the current and sample-average dividend-price ratio will be interpreted as lower expected returns and three-quarters – as higher expected cashflows, with the converse true for housing. As we subsequently show in Figure 7, this makes our estimates of the expected return decline somewhat conservative, especially for equities, since it assumes that the high cashflow growth of the recent decades can be sustained into the future, pushing up today's estimates of the expected return.

As a final step, we calculate the expected risky return as the sum of the yield and the VAR long-run cashflow growth forecast for the specific asset class. Appendix Figure A.5 shows that our cashflow forecasts follow a similar trend to the annuity-valued growth in realised cashflows $\tilde{g}$, while also looking through some of the booms and busts in the realised growth data. Over the long run, both expected dividend and rent growth have increased, but the magnitude of these increases is smaller than that of the declines in the dividend-price and rent-price ratios. This means the sum of the yield and cashflow growth expectations – the expected return – has declined over the long run.

Figure 5 shows the evolution of the expected risky return – the average of the equity and housing series – over time. The solid line shows the cross-country average, the shaded area – the interquartile range, and the dashed line shows the linear trend. Individual country series can be found in the Appendix Figure A.6. Over the last 145 years, expected risky returns have been in steady decline, falling from close to 8% p.a. in the 1870s to roughly 6% p.a. in 2015. The pace of this decline has

Figure 5: *The expected return on risky assets*



Notes: Data for 17 countries. The expected risky return is the average of expected returns on equity and housing, each computed as the sum of the yield and long-run cashflow growth forecasts from a VAR in returns, cashflows and asset yields. The solid line and the shaded area are, respectively, the mean and interquartile range of the individual country data in each year; the dashed line is the linear trend.

been rather gradual and stable over time, with somewhat sharper drops recorded in the late 19th century and after 1980. The dip in the expected returns around World War I is largely attributable to unusually low wartime rent levels which resulted in low yields.[8]

Appendix Figures A.2 and A.3 show that, similarly to asset yields, the downward aggregate trend in expected returns is not affected by the definition of the yield – for example, using earnings yields instead of dividend yields for the US equity market – or time-varying sample composition, with aggregate expected return estimates basically unchanged as we switch between different time-invariant country groupings.[9]

Figure 6 compares our expected return estimates to annual and 10-year-average realised returns. Even though there is some correspondence between the two measures, realised returns are simply

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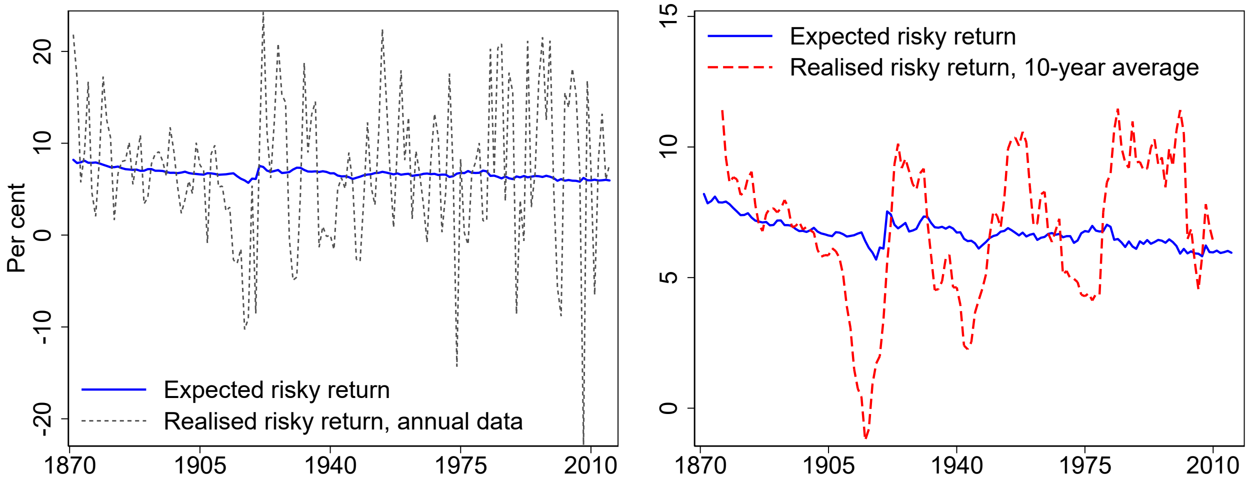
[8] The risky yield in Figure 2 does not show a comparative dip because the dividend-price ratio increased during World War I, offsetting the housing yield decline. But because during this time period equity return predictability was weak and housing return predictability was strong (Table 2), the increase in the dividend-price ratios does not translate to higher expected equity returns whereas low rent-price ratios translate to lower housing returns, resulting in an overall wartime dip in the expected risky return.

[9] The main advantage of earnings yields is that they look through changes in how earnings are distributed – such as a switch from dividends to stock buybacks – and focus on underlying profitability. We follow Fama and French (2002) and calculate the earnings-based expected equity return for the US stock market as the sum of the dividend-price ratio and expected earnings growth. Earnings growth expectations are computed as the 40-year rolling window forecast of annuity-value earnings growth using today's earnings-price ratio. To further correct any buyback-related bias, we fix the changes in the US dividend-price ratio to equal those in the earnings-price after 1982, since using buybacks to compensate shareholders was relatively rare before a change in the SEC regulations in 1982 (Grullon and Michaely, 2002).

Figure 6: *Trends in expected and realised returns*



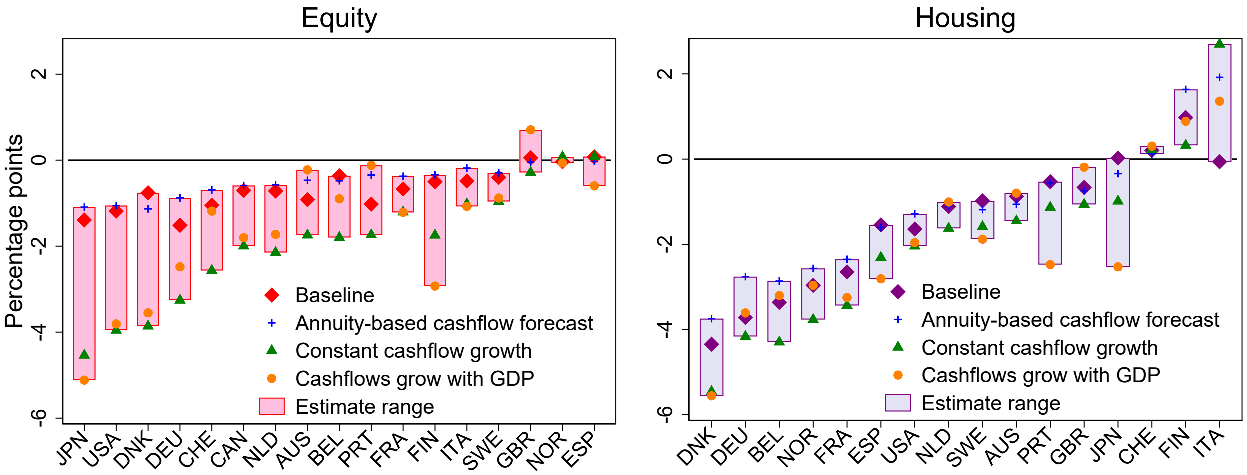
Notes: Data for 17 countries. The expected risky return is the average of expected returns on equity and housing. The realised risky return is the average of total real returns on equity and housing. 10-year average realised return is a centered rolling-window mean of realised returns between years $t - 4$ and $t + 5$.

too volatile to elicit a sensible estimate of the expected return trend, even when averaged over decadal periods. Put differently, if one observes a low trend realised return level – such as during the two World Wars and the 1970s stagflation – or a high trend realised return such as the late 19th century or the 1990s period – it is much more likely to correspond to unexpected good or bad news, or other unexpected shocks to asset values rather than changes in the expected return.

Figure 7 investigates whether the long-run expected return decline persists through several alternative estimation methods, across countries and across asset classes. Each dot shows the difference between the average expected return in the last and first decade of the sample for selected method, asset and country, and the bars show the range of the alternative estimates. Starting with the baseline estimates (red and purple diamonds), these show a near-universal decline across both equity and housing, and in the vast majority of countries in our sample. The magnitude of the decline is larger for housing than for equity, with expected housing returns in some countries falling by roughly 4 percentage points over the long run.

Turning to the different estimation methods, the blue crosses directly forecast the annuity value of dividend or rental growth directly as in Blanchard (1993), using today's dividend or rental yield as the predictor. This direct forecast imposes less structure on the data than the VAR, but is relatively inefficient and has to assume a value for cashflow growth after 2015 in order to estimate the annuity-valued growth rate $\tilde{g}$. The green triangles in Figure 7 instead assume constant cashflow growth, as in the study of Fama and French (2002). This estimate allows us to abstract from estimation errors in future cashflows, but may be biased since future cashflows are positively correlated with risky yields in the data. The orange circles assume that long-run cashflows grow at the same rate as GDP as in Farhi and Gourio (2018). To this end, we forecast the annuity value of GDP growth – with post-2015

Figure 7: *Long-run change in the expected return by country, asset class and estimation method*

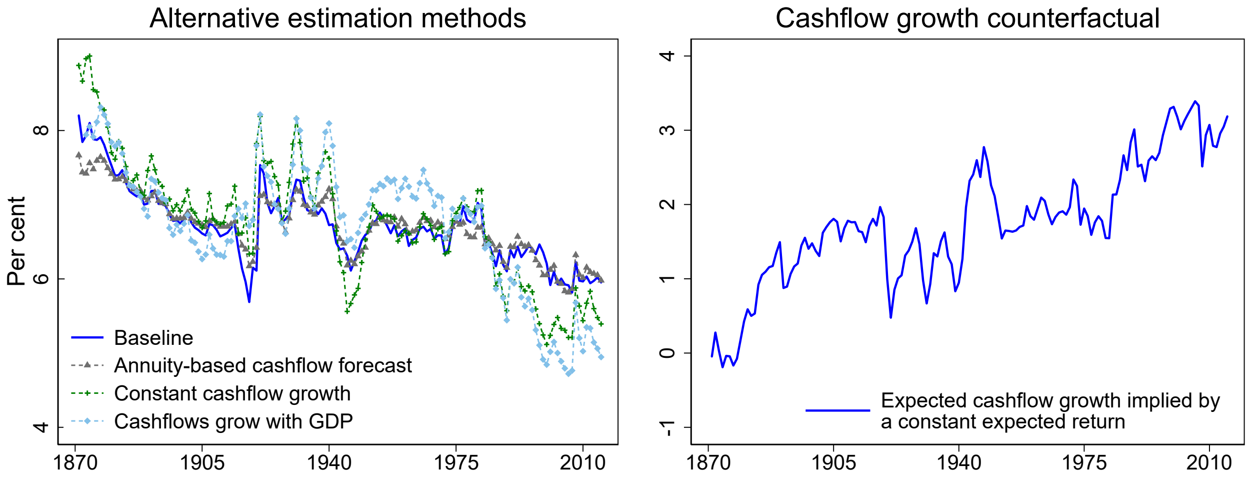


Notes: Difference between expected returns in the last and first decade of the sample for each country and asset class. The expected return is the sum of the expected yield and expected cashflow growth obtained using a predictability VAR. The "annuity-based cashflow forecast" specification uses this year's yield to directly forecast the year-ahead annuity value of cashflow growth for each asset class, as well as next period's yield, similarly to Blanchard (1993). The "constant cashflow growth" specification sets expected cashflow growth equal the sample average for each country, as in Fama and French (2002). The "cashflows grow with GDP" specification sets expected cashflow growth equal to expected long-run GDP growth as in Farhi and Gourio (2018), with the GDP growth rate, term premium and the dividend-price ratio as predictor variables.

growth rates tied down by the *OECD Economic Outlook* GDP forecast for 2060 – using two lags of the current real GDP growth, the term premium and the dividend-price ratio, and use this value as a proxy for $\mathbb{E}(\tilde{g})$ for both housing and equity. This method has the advantage of keeping our estimates in line with long-run productivity trends, but ignores long-run changes in factor shares which can drive a wedge between growth in capital income and GDP (Karabarbounis and Neiman, 2014).

The range of alternative estimates in Figure 7 shows that our baseline expected return measure is, if anything, rather conservative. While the annuity-based cashflow forecast measure tends to be quite similar, assuming that cashflows are constant or grow with GDP results in substantially more pronounced declines in expected returns, particularly for equities. For some countries, asset classes and measures, the resulting decline in expected returns more than doubles. The reason for this is the following. Under our baseline estimates, every 1 percentage point of the long-run decline in the yield is partially offset by a 0.25–0.75 ppt increase in expected cashflow growth. The justification for this offset is that yields have strong predictive power for future cashflows in the VAR (Table 2). If we assume that cashflow growth is constant or follows GDP, this offset is no longer there. Indeed, recent decades have seen rising risky asset valuations and profits at the same time as GDP growth has declined (Greenwald, Lettau, and Ludvigson, 2019; Kuvshinov and Zimmermann, 2020). These higher cashflows are then associated with higher profit and rent shares in GDP rather than higher GDP growth (Barkai, 2020; Rognlie, 2015). Assuming these profit and rent share increases cannot

Figure 8: *Alternative measures of expected returns*



Notes: Unweighted averages of 17 countries. The "annuity-based cashflow forecast" specification uses this year's yield to directly forecast the year-ahead annuity value of cashflow growth for each asset class, as well as next period's yield, similarly to Blanchard (1993). The "constant cashflow growth" specification sets expected cashflow growth equal the sample average for each country, as in Fama and French (2002). The "cashflows grow with GDP" specification sets expected cashflow growth equal to expected long-run GDP growth as in Farhi and Gourio (2018), with the GDP growth rate, term premium and the dividend-price ratio as predictor variables. The cashflow growth counterfactual assumes expected returns are constant and equal to the sample mean, and then backs out the counterfactual expected cashflow growth as the difference between the constant expected return and the yield.

continue indefinitely would bring our long-run cashflow growth forecast closer to GDP growth, and result in larger expected return declines similar to the corresponding orange-circle estimates in Figure 7.

The left-hand panel of Figure 8 compares the time series evolution of expected returns under the four alternative estimates discussed above. The time trend is similar across all measures. The baseline and annuity-based forecast estimates are more stable over time, with movements in the dividend- and rent-price ratios partially offset by changing cashflow growth expectations. Assuming constant or GDP-driven cashflow growth results in larger long-run declines in expected returns, of up to 4 percentage points on average. As an additional check on our estimates, we ask the following question: if expected returns were in fact constant, by how much would expected long-run cashflow growth have to increase to justify this? The answer is, quite a lot. The right-hand panel of Figure 8 shows the counterfactual cashflow growth necessary for a constant expected return equal to our estimated sample average. This counterfactual growth displays a pronounced upward time trend, increasing from around zero to 3 percentage points per year. This counterfactual increase is difficult to rationalise in light of the relatively modest variation in trend real GDP growth and factor shares throughout our sample.

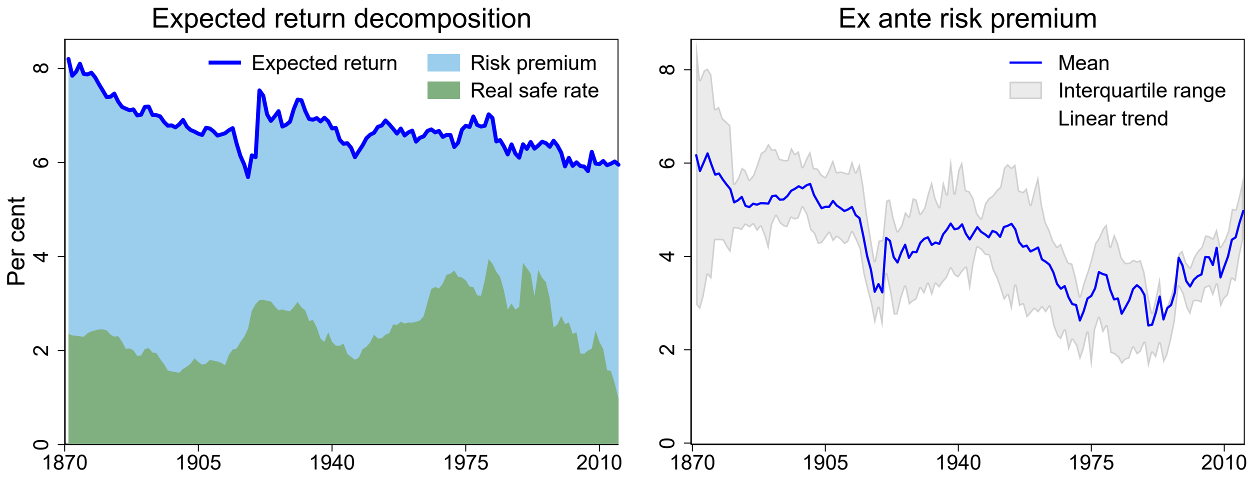
3.3. Trends in safe rates and risk premia

Does the decline in expected risky returns simply mirror the well-documented fall in the natural safe rate, or does it represent a separate and distinct phenomenon? To assess this, we decompose our aggregate expected return measure into a risk premium and a safe rate component. To measure the ex ante safe rate, we estimate the trend real long-term government bond yield by applying the Bayesian VAR model of Del Negro et al. (2019) to our data series. The risk premium is computed as the difference between the expected risky return and the safe rate. Figure 9 displays the evolution of cross-country average expected return decomposed into these two components (left-hand panel), and the time trend in the ex ante risk premium (right-hand panel). Table 3 shows the levels of the expected risky return and its components for selected benchmark years.

The trend in expected returns is largely unrelated to long-run movements in the safe rate: while expected returns show a steady modest decline, safe rates follow a hump shape, increasing up to the 1980s and falling sharply thereafter. Table 3 shows that between 1880 and 1990, expected returns fell by 1.2 percentage points, while the safe rate actually increased by 1.7 ppts. After 1990, safe rates declined dramatically by some 2.9 ppts but expected returns only fell by 0.4 ppts. This means that the ex ante risk risk premium exhibits large movements at secular frequency. The long-run trend in the risk premium follows a U shape: a high of 6% in the 1870s followed by a sharp decline to 2.5% in 1990, and an increase to 5% thereafter. Taking stock of these long-run movements, in the late 19th century expected risky returns and risk premia were at historically high levels, while real safe rates were close to their historical average of around 2%. Today, safe rates are at their all-time historical low and approaching negative territory. Expected risky returns are also low, but are substantially higher than safe rates at some 6% thanks to the large positive risk premium.

To check the accuracy of the risk premium trends, the left-hand panel of Figure 10 re-estimates these under alternative assumptions for expected cashflow growth and real safe rate. All the estimates follow the same U-shape pattern as the baseline risk premium measure in the right-hand panel of Figure 9, with risk premium measures based on short-term interest rates registering larger long-run variation with sharper drops during the 1970s and 1980s and more pronounced increases thereafter. The right-hand panel of Figure 10 compares our equity and housing risk premium to the yield-to-maturity credit spread between long-term corporate and government bonds sourced from Kuvshinov (2020). The bond spread is a direct measure of the difference between ex ante discount rates on risky and safe bonds, which gives us a risk premium proxy that does not rely on assumptions about cashflow growth and inflation expectations embedded in our baseline measure. The level of the corporate bond spread is lower than that of the equity and housing premium, largely owing to the lower riskiness of this asset class. But the credit spread follows the same U-shape trend as our baseline risk premium measure, while also showing notable spikes during the two major global financial crises in the 1930s and 2008-09. As a final check, Appendix Figure A.4 shows that similarly to expected returns, using alternative cross-country or cross-asset weighting schemes generally results in a somewhat stronger downward trend for the risk premium.

Figure 9: *Expected returns, safe rates and risk premia*



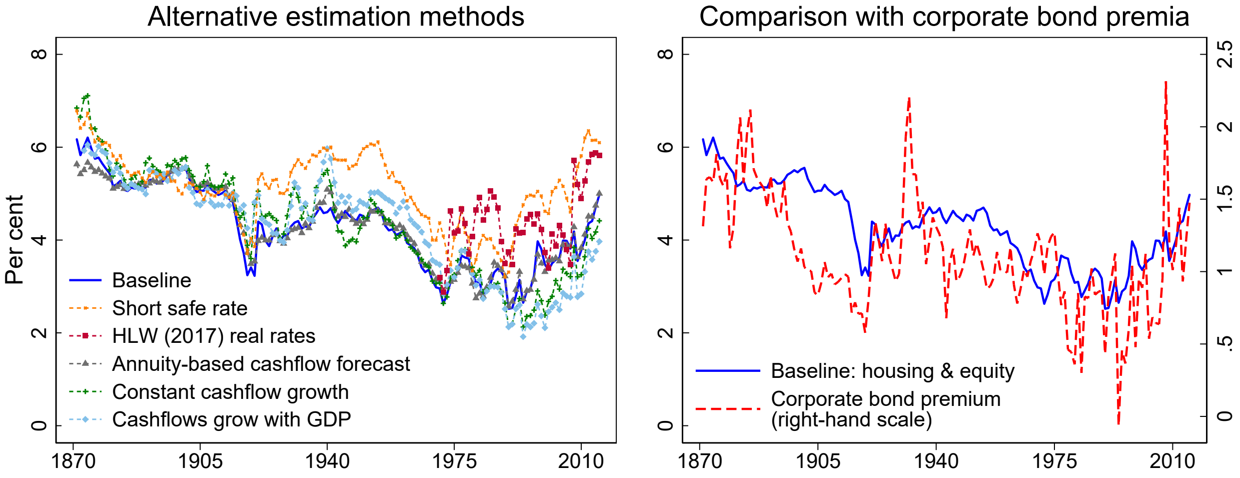
Notes: The left-hand panel shows unweighted averages of 17 countries. The expected return is the sum of the expected yield and expected cashflow growth obtained using a predictability VAR. The risk premium is the difference between the expected return and ex ante safe rate. Ex ante real safe rate is estimated using a Bayesian VAR with slow-moving trends as in Del Negro et al. (2019). In the right-hand panel, the solid line is the cross-country mean and the shaded area is the interquartile range of individual country data. The dashed line represents the linear trend.

Table 3: *Expected returns and risk premia through time*

	(1)	(2)	(3)	(4)	(5)
		Level		Absolute change	
	1880	1990	2015	1880-1990	1990-2015
Expected risky return	7.58	6.39	5.95	-1.19	-0.44
Components of the expected return:					
Ex ante risk premium	5.40	2.52	4.97	-2.88	2.45
Ex ante safe rate	2.19	3.87	0.98	1.68	-2.89

Notes: Unweighted averages of all cross-country observations during the specific time period. The expected return is the sum of the expected yield and expected cashflow growth obtained using a predictability VAR. The risk premium is the difference between the expected return and ex ante safe rate. Ex ante real safe rate is estimated using a Bayesian VAR with slow-moving trends as in Del Negro et al. (2019).

Figure 10: *Alternative measures of risk premia*



Notes: Unweighted averages of 17 countries. The baseline risk premium estimate uses the safe rate in Del Negro et al. (2019) and expected cashflow growth in the predictability VAR. The annuity-based, constant and GDP-based cashflow growth forecast measures use alternative expected return estimates which forecast cashflows directly, assume they are constant or use a GDP growth forecast instead. The "short safe rate" specification uses the real ex ante short-term rate instead of the long safe bond yield. The "HLW (2017) real rates" specification uses the safe interest rate estimates of Holston et al. (2017) from 1971 onwards. The corporate bond spread measures the difference between the 10-year corporate bond and government bond yields, from Kuvshinov (2020).

4. Drivers of expected returns

What are the drivers of observed trends in expected returns and risk premia? Expected risky returns are the sum of the safe interest rate, reflecting a general willingness to save, and a risk correction reflecting the ex ante market risk premium for holding risky assets. The standard consumption-based model offers more precise expressions for both of these terms, linking the desire to save to expected future growth of consumption and the willingness to bear risk to macroeconomic volatility and the asset's consumption beta. For an investor with power utility $u(c) = c^{1-\gamma}/(1-\gamma)$ and fixed relative risk aversion γ, the expected risky return is then determined as follows (see, for example, Cochrane, 2009):

$$\mathbb{E}(R^{risky}_{t+1}) = \underbrace{\rho + \underbrace{\gamma \mathbb{E}[g^c_{t+1}]}_{\substack{\text{consumption}\\ \text{smoothing}}} - \underbrace{0.5\gamma^2 Var(g^c_{t+1})}_{\substack{\text{precautionary}\\ \text{savings}}}}_{R^{safe}} + \underbrace{\underbrace{\gamma Var(g^c_{t+1})}_{\substack{\text{price of}\\ \text{risk, } \Lambda}} \; \underbrace{\beta_{R,g^c}}_{\substack{\text{quantity}\\ \text{of risk}}}}_{\text{Risk premium}} \tag{8}$$

Above, ρ is the rate of impatience, g^c is consumption growth and $\beta_{R,g^c} = cov(R, g^c)/var(g^c)$ measures the co-movement of asset returns and consumption. Equation (8) tells us that expected risky and safe returns will be high if investors expect high future economic growth, increasing their desire to bring forward consumption. If macroeconomic risk is high (a high $Var(g^c)$), investors will want to save more to insure against future consumption movements, driving down the safe rate via the precautionary saving motive. They will also prefer to save in safe assets which provide a better hedge against consumption risk, driving up the risk premium. Risk premia will also be high if risky assets provide a poor hedge against consumption risk (high β_{R,g^c}).

Equation (8) allows us to divide up the potential drivers of expected returns and risk premia into two distinct channels, which have the opposite effect on risky versus safe rates. The *growth channel* – changes in $\mathbb{E}[g^c]$ – pushes risky and safe rates in the same direction: high future growth makes investors unwilling to save, in either safe or risky assets. The *risk channel* – or changes in $Var(g^c)$ – pushes safe rates and risk premia in opposite directions, and entails that risky and safe rates are disconnected. High macroeconomic volatility or low risk tolerance will tend to both reduce the safe rate and increase the risk premium. Note that the delineation of risky and safe rate drivers into these two channels applies to a much broader class of models including, for example, more sophisticated consumption-based theories such as those with long-run risk (Bansal and Yaron, 2004), models with time varying risk perception (Pflueger et al., 2020), and models allowing for changes in the relative supply as well as demand for risky assets (Caballero and Simsek, 2020; Krishnamurthy and Vissing-Jorgensen, 2012). All of these theories essentially provide additional means through which the price of risk Λ in equation (8) can vary.

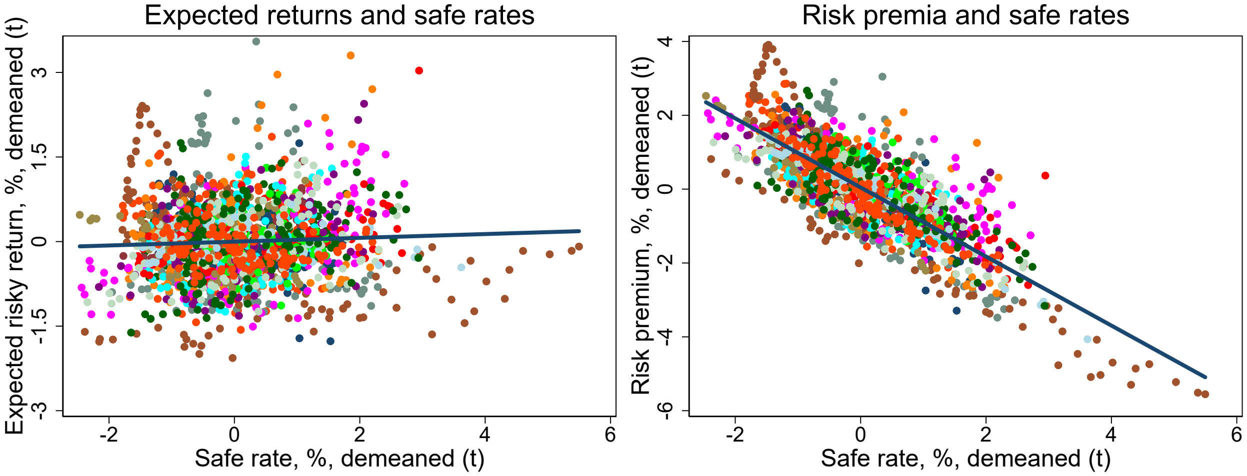
Section 3.3 shows that trends in risky and safe rates are disconnected, with risk premium and safe rate trends typically moving in opposite directions. This suggests that the risk channel plays an important role in driving long-run trends in expected risky and safe returns. The next section examines this proposition further by looking more closely at the correlations between risky returns, safe rates and risk premia.

4.1. The risky-safe rate disconnect

Figure 11 and Table 4 analyse the co-movement between expected risky returns, real safe rates and risk premia. The the left-hand panel of Figure 11 shows a scatterplot of expected returns and safe interest rates and the right-hand panel shows the corresponding graph for risk premia and safe rates. The individual observations are demeaned and coloured by country. Table 4 regresses, respectively, the expected risky return (top panel) and the risk premium (bottom panel) on the level of the safe rate. Column 1 runs the full-sample country fixed effects regression, column 2 adds year fixed effects, column 3 considers 5-year changes, and column 4 abstracts from cashflow growth expectations by taking the yield component of expected return only. Columns 5 and 6 run separate regressions for equity and housing, and column 8 correlates realised risky and safe returns.

The correlation between expected returns and safe rates is very weak and close to zero for all regression specifications. As a consequence, risk premia and safe rates are strongly negatively correlated. The magnitude of this negative correlation is rather stark: under the baseline specification in Table 4 column 1, an increase in the safe rate brings an almost one-for-one decline in the ex ante risk premium and vice versa, such that the expected return remains broadly unchanged. This lack of

Figure 11: *Correlation between expected returns, safe rates and risk premia*



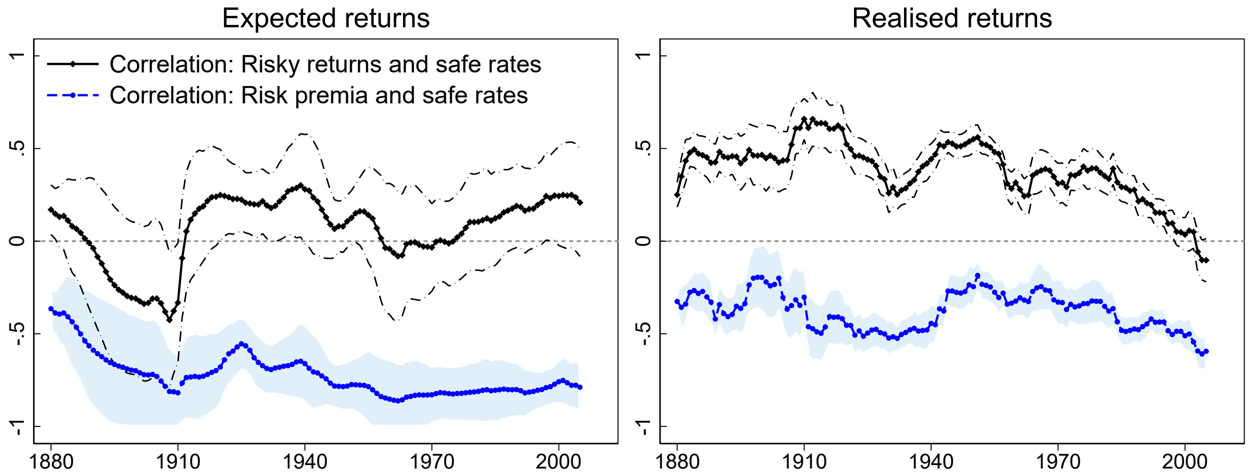
Notes: Scatterplots of expected returns, safe rates and risk premia. Fitted regression lines illustrate the correlation between safe rates and expected returns (left-hand panel) and risk premia (right-hand panel). The individual observations are demeaned and colored by country.

Table 4: *Co-movement of expected returns, safe rates and risk premia*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable: Expected return on risky assets						
	Baseline	Year effects	5-year changes	Yield only	Equity	Housing	Realised returns
Safe rates	0.03 (0.08)	0.04 (0.07)	0.18*** (0.04)	0.04 (0.13)	0.08 (0.05)	0.01 (0.13)	0.38*** (0.06)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓
Year fixed effects		✓					
R^2	0.00	0.31	0.04	0.00	0.01	0.00	0.11
Observations	1882	1882	1750	1906	2273	1817	1890
	Dependent variable: Risk premia on risky assets						
	Baseline	Year effects	5-year changes	Yield only	Equity	Housing	Realised returns
Safe rates	-0.97*** (0.08)	-0.96*** (0.07)	-0.82*** (0.04)	-0.96*** (0.13)	-0.92*** (0.05)	-0.99*** (0.13)	-0.57*** (0.07)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓
Year fixed effects		✓					
R^2	0.68	0.78	0.48	0.40	0.61	0.46	0.20
Observations	1882	1882	1750	1906	2273	1817	1890

Notes: Regressions of expected returns or risk premia on the safe rate. The expected return and risk premium is defined as the average of the corresponding series for housing and equity. Ex ante real safe rate is estimated using a Bayesian VAR with slow-moving trends as in Del Negro et al. (2019). Column (1) includes only country fixed effects and Column (2) adds year fixed effects. Column (3) considers 5-year changes, and column (4) uses yield *dp* only as a proxy for expected return. Columns (5) and (6) consider housing and equity returns separately. Realised risky return is the average of total real returns on housing and equity; realised safe return is the real government bond return. Standard errors are clustered by country and year. *: $p < 0.1$ **: $p < 0.05$ ***: $p < 0.01$.

Figure 12: *Correlation between expected returns, safe rates and risk premia through time*



Notes: Left-hand panel: Pairwise correlation coefficients between the expected risky return and safe rate, and ex ante risk premium and safe rate. Right-hand panel: pairwise correlation coefficients between realised risky returns, risk premia and real government bond returns. Rolling centered 20-year windows. Shaded areas are 90% confidence intervals, using country-clustered standard errors. Underlying data are demeaned at country level.

correlation between expected returns and risk premia, and the strong negative correlation between safe rates and risk premia, hold up under all the alternative specifications in columns 2–4 of Table 4, and hold separately for equity and housing. This shows that not only do risky and safe rates follow different trends, but they are more generally disconnected. Column 8 shows that realised risky and safe returns are somewhat more correlated than expected returns, but this correlation remains low and realised risk premia and safe rates are strongly negatively correlated. Appendix Table A.3 shows that the correlation between realised returns and safe rates remains weak under alternative regression specifications, and separately for equity and housing.

Figure 12 examines how the correlation between risky returns, safe rates and risk premia has changed over time. The left-hand panel shows the 20-year rolling window correlation coefficients between expected risky returns and safe rates (black diamonds) alongside those between risk premia and safe rates (blue circles), together with the corresponding 90% confidence intervals. For example, the data point for 1880 shows the correlation between risky and safe returns in the pooled sample covering the time period 1871–1890. The right-hand panel shows the corresponding correlations for realised returns. The absence of expected return co-movement is remarkably stable over time: throughout the whole sample, the correlation between risky and safe returns is around zero and the correlation between risk premia and safe rates is close to -1. The risky-safe rate disconnect in Figure 11 and Table 4 is not driven by some distant historical time period: if anything, risky and safe rates were somewhat less disconnected in late 19th century than today. The realised risky and safe return co-movement also remains low through time, but displays larger variation. The two world wars saw high co-movement with low returns on both risky and safe assets during this period, while the recent decades have seen an increasing divergence between the two.

Existing literature has highlighted the low and time-varying nature of the correlation between realised equity and bond returns in the US, but the sources behind this lack of co-movement and its variation over time remain difficult to pin down (Shiller and Beltratti, 1992; Baele, Bekaert, and Inghelbrecht, 2010; Campbell, Pflueger, and Viceira, 2020). We confirm that these patterns of realised return co-movement extend to broader cross-country data including housing as well as equity. Our findings also help shed some light on the likely drivers of the realised return co-movement. The overall lack of co-movement found in the literature is likely to reflect the general disconnect between expected risky and safe returns, and is an indicator that changes in the price of risk are an important driver of the returns on these two asset classes. The time-varying nature of realised return co-movement is, however, likely driven by unexpected shocks affecting both asset classes.

Expected risky returns are disconnected from safe rates. This suggests that variation in risk and risk premia – either through time-varying price of risk Λ or quantity of risk β in equation (8) – is a key driver of the expected risky return. Moreover, since the price of risk can affect the safe rate through the precautionary saving motive, changes in risk can also be a key driver of the safe rate. In fact, as equation (8) shows, increases in the price of risk drive the safe rate down at the same time as driving up risk premia, meaning that overall effect on expected returns is muted. These partly offsetting movements help explain both the near-zero safe-risky rate correlation and the strongly negative risk premium – safe rate correlation in the data. They also help reconcile the substantial secular safe rate and risk premium variation with the relative stability of the expected risky return (Figure 9). The next section maps out the trends in the price and quantity of risk and investigates their contribution to long-run changes in expected risky returns, safe rates and risk premia.

4.2. Expected returns and risk

We have shown that risky and safe rates follow different trends and are disconnected at shorter time horizons. This suggests that changes in the *price of risk*, which drive up the risk premium and drive down the safe rate, are a key driver of expected risky and safe returns. As shown in equation (8), the underlying driver of the price of risk in standard macro-finance theory is consumption volatility. High volatility of consumption means that investors should be willing to pay a high price for hedging consumption movements, which drives up the risk premium. At the same time, a greater desire to hedge against large consumption drops increases the precautionary saving motive and reduces the safe rate.

Figure 13 shows how consumption volatility in the 17 countries in our sample has evolved over the long run. The left-hand panel plots the standard deviation of real consumption growth in annual data stretching back to 1870 using 20-year centered rolling windows, and the right-hand panel shows the post-1950 quarterly real GDP growth volatility over 5-year rolling windows. Both the annual and the more recent quarterly data paint the picture of a long-run decline in consumption volatility, with standard deviation of annual real consumption growth falling from more than 4 ppts per year in the late 19th century to 1–2 ppts per year today. Equation (8) tells us that the risk premium should move proportionally with the variance of consumption growth:

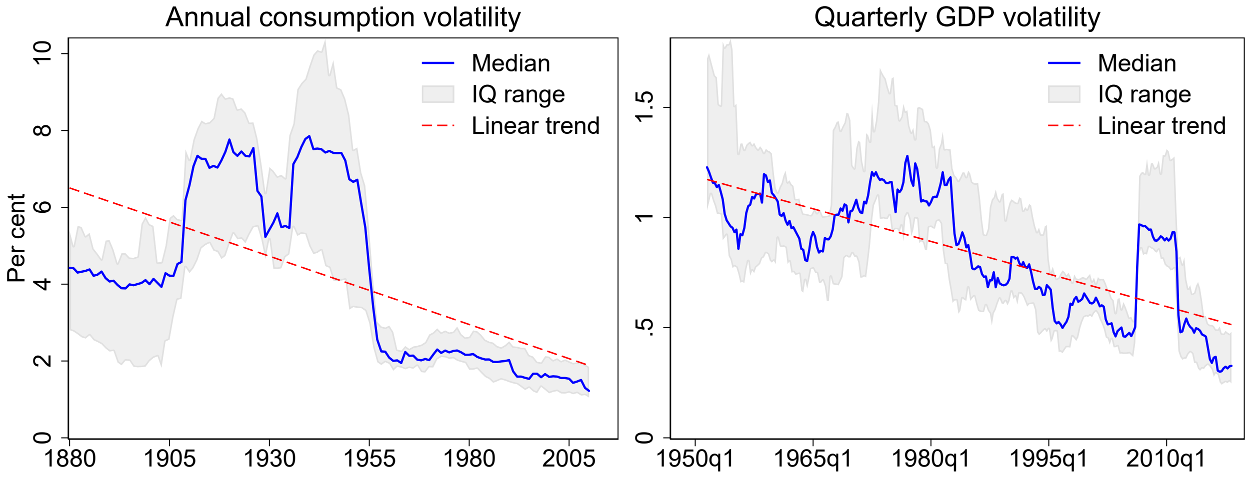
$$\Delta RP \approx \Delta Var(g^c)\gamma\beta_{R,g^c} \tag{9}$$

This means that, all other things being equal, a halving in consumption growth variance should bring about a halving in the risk premium. Columns 1–3 of Table 5 show three snapshots of the levels of the risk premium and variance of annual consumption growth: 1880, corresponding to high historical risk premium levels; 1990, corresponding to the trough in the long-run risk premium trend; and 2010 corresponding to the recent uptick. The risk premium is for the specific year and consumption growth variance is for the 20-year centered window around that year. Columns 4 and 5 show the changes in these variables between these selected years (with -50% a halving and +100% a doubling). Table 5 shows that between years 1880 and 1990, the risk premium more than halved, falling from 5.4 to 2.5 ppts. The variance of consumption growth fell by even more – roughly four-fifths. This means that, within the framework of standard asset pricing theory, the entirety of the risk premium decline during the first 100 years of our data can be accounted for by the decrease in consumption volatility. This lower consumption volatility should have also increased the safe rate as investors became less willing to hedge against consumption drops, thereby muting the overall impact on the expected return.

Standard macro-finance theories struggle to match the average level of the equity premium (Mehra and Prescott, 1985), and short-run variation in the risk premium is difficult to reconcile with market expectations of future volatility (Dew-Becker, Giglio, Le, and Rodriguez, 2017). But when it comes to long-run trends, our results show that standard theory actually does a good job of explaining the observed risk premium movements in the data. The implications of our findings are consistent with those of Lettau, Ludvigson, and Wachter (2008), who use an asset pricing model with long-run risk to show that the decline in US consumption volatility during the 1990s can explain the fall in the equity premium during this time period.

Even though declining consumption volatility can explain the long-run decline in the risk premium, it does not explain the recent uptick. Column 5 of Table 5 shows that between 1990 and 2010, risk premia increased by half while the variance of annual consumption growth rates declined further. One force which may be driving the risk premium up over recent decades is an increase in macroeconomic tail risk. Even though consumption is less volatile now than historically, large negative changes in consumption growth are now much more likely than, say, 50 years ago. This can be seen from Figure 5, which shows estimates for the kurtosis and skewness of quarterly GDP growth rates. The GDP growth distribution was close to normal at the beginning of the sample (kurtosis of around 3 and skewness of zero), but over recent decades the skew has become more negative and the tails have widened. In line with long-run risk and disaster risk models (Bansal and Yaron, 2004; Gabaix, 2012), these increases in tail risk should have increased the risk premium throughout recent decades.

Figure 13: *Macroeconomic volatility over the long run*



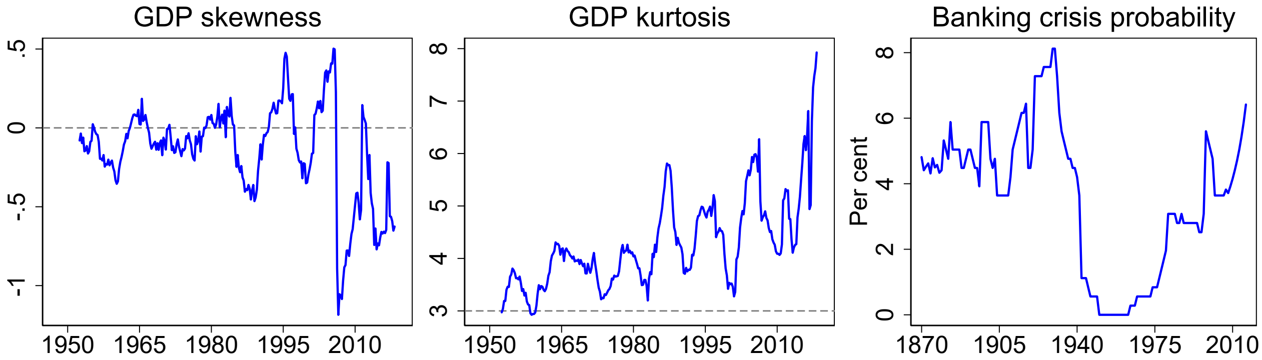
Notes: Data for 17 countries. Left-hand panel: centered rolling 20-year windows; right-hand panel: centered 5-year windows. Underlying data are winsorised at the 0.5% level.

Table 5: *Long-run changes in the risk premium and macroeconomic risk*

	(1)	(2)	(3)	(4)	(5)
	Level			Relative change	
	1880	1990	2010	1880–1990	1990–2010
Ex ante risk premium, %	5.40	2.52	3.78	-53%	+50%
Consumption variance, $\%^2$	20.59	3.76	2.07	-82%	-45%

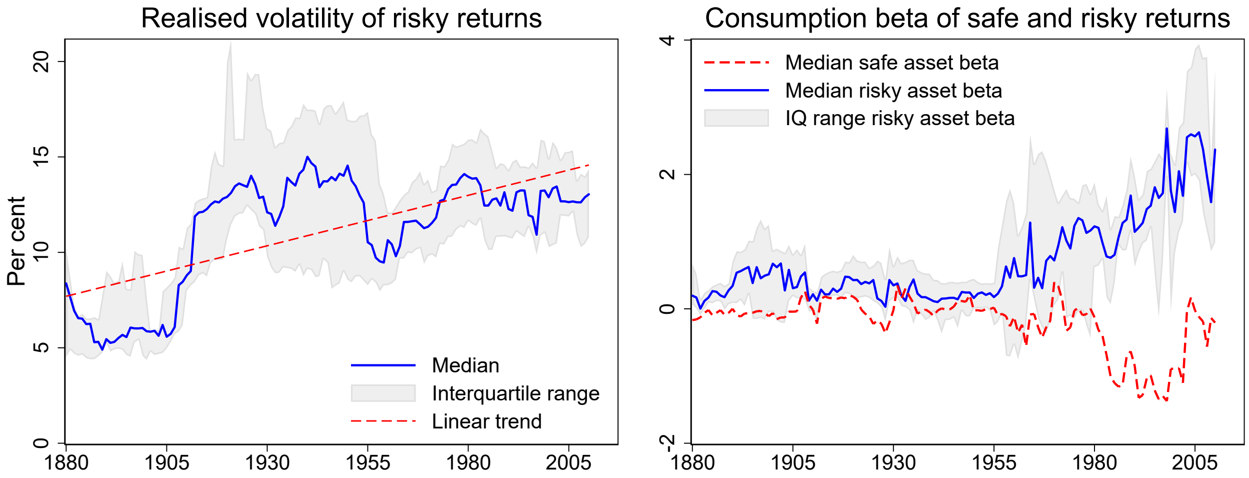
Notes: Annual data for 17 countries. Ex ante risk premium is the cross-country average risk premium level in that year. Consumption variance is the square of average country-level volatility in the 20-year window around that year. Levels in percentage points and percentage points squared, relative changes in percent.

Figure 14: *Macroeconomic tail risks*



Notes: Data for 17 countries. Left-hand panel: annual unconditional crisis probability calculated using centered 20-year windows. Middle- and right-hand panels: skewness and kurtosis of quarterly GDP growth based on centered 5-year windows. Underlying GDP growth data are winsorised at the 0.5% level.

Figure 15: *Trends in the quantity of risk*



Notes: Data for 17 countries. Centered rolling 20-year windows. Underlying data are the average of real equity and housing return. Realised volatility is the rolling standard deviation of annual real returns within the 20-year window. Consumption beta is the covariance of real returns with consumption growth, scaled by the variance of consumption growth: $\beta_{R,g^c} = Cov(R, g^c)/Var(g^c)$. The solid line and the shaded area are, respectively, the mean and interquartile range of the individual country data in each year. The dashed line represents the linear trend.

Recent decades also saw systemic financial risks reappear after being more or less absent during the middle of the 20th century. The left-hand panel of Figure 5 shows the average systemic banking crisis probability calculated using twenty year windows, using the narrative-based crisis definition of Schularick and Taylor (2012). A value of, for example, 4% in 1990 means that crisis observations comprise 4% of total country-year observations in years 1980–2000.[10] Systemic risk was high between 1870 and 1940 with banking crises happening about once every 20 years (5 percent probability), but seemingly disappeared during the Bretton Woods era. Recent decades have seen the return of systemic risks, first in individual countries (Japanese and Scandinavian banking crises) and then more generally with the global financial crisis. Since crises are typically followed by low GDP growth, this re-emergence has contributed to the increasing macroeconomic tail risks in the left-hand panels of Figure 14. A higher crisis probability can also increase the risk premium level directly. Muir (2017) shows that financial crises tend to be associated with risk premium increases above and beyond any drops in GDP, a fact that can be explained by crises impairing the risk bearing capacity of intermediaries which price financial assets.

In addition, our evidence suggests that the riskiness of the assets themselves, represented by β_{R,g^c} in equation (8), increased in recent decades. Figure 15 shows the long-run trends in two proxies for the quantity of risk β: simple unconditional return volatility and consumption beta, again calculated over rolling 20-year periods. The unconditional return volatility is near its historical high,

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[10] Note that we only count the first year of the crisis as a crisis observation, so the figure is more exactly interpreted as the probability of the emergence of a new systemic banking crisis.

but shows little change over the past three decades. Consumption beta of risky assets has, however, increased markedly from around 1 in 1980 to close to 2 today. Further to this, the government bond beta (dashed red line in Figure 15 right-hand panel) has fallen sharply and actually turned negative, suggesting that safe assets have become a better hedge for macroeconomic risk. The increasing risky and declining safe asset beta help explain the low levels of the safe rate and the high risk premium we observe today.

Other factors are, of course, likely to also be at play. Kopecky and Taylor (2020) argue that the recent risk premium increase and safe rate decline can be explained by population ageing with older households preferring to save in safer assets. Turning to supply rather than demand for assets, Caballero, Farhi, and Gourinchas (2017b) argue that a shortage of safe assets may have reduced the safe rate and increased the risk premium over the past decade. A safe asset shortage should also have increased the convenience premium on safe government debt, further driving down the safe rate without a corresponding reduction in the risky rate (Krishnamurthy and Vissing-Jorgensen, 2012; Del Negro et al., 2019). Even aside from these other influences, however, trends in macroeconomic volatility and asset riskiness can together account for the long-run changes in prices of risky and safe assets as stipulated by standard asset pricing theory.

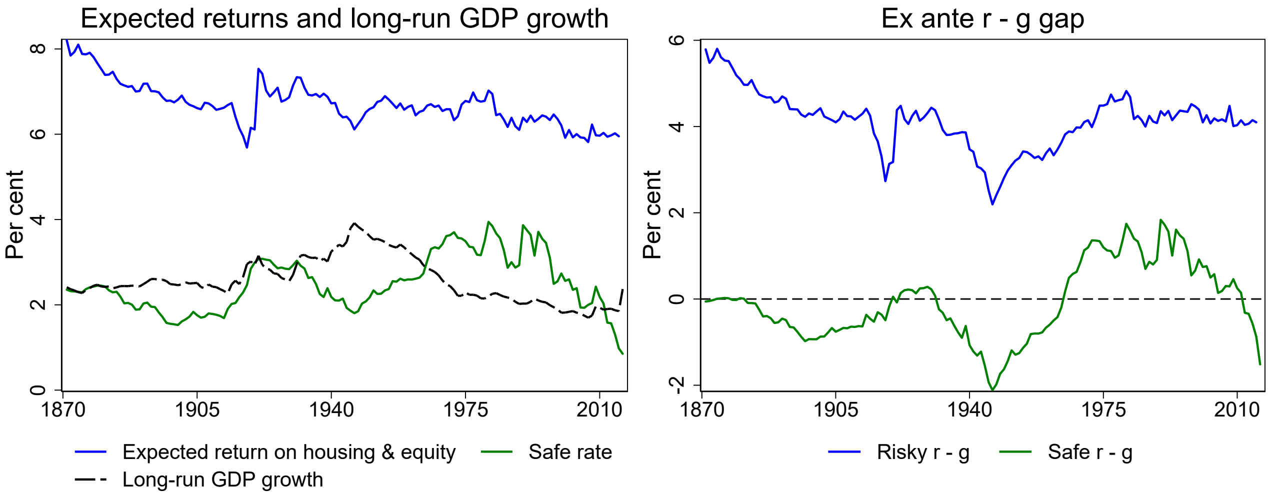
4.3. Expected returns and growth

A growing literature on the secular stagnation hypothesis has linked the recent safe rate decline to a slowdown in growth and increased willingness to save (Baldwin and Teulings, 2014; Rachel and Summers, 2019; Holston et al., 2017). But if risk is an important driver of long-run risky and safe rate trends, we would expect to see some divergence between expected risky and safe returns on one hand, and the rate of economic growth on the other. Put differently, the *ex ante* risky and safe $r - g$ gaps may be time varying. This time variation, in turn, carries important implications for the dynamics of wealth inequality (Piketty, 2014), the costs and benefits of issuing public debt (Blanchard, 2019) and the economy's dynamic efficiency (Barro, 2020).

When examining these issues, existing research has mostly focussed on the *ex post* $r - g$ gaps between realised returns and growth rates (Piketty, 2014; Jordà et al., 2019). While these realised gaps are informative about the past evolution of inequality, public debt and returns on capital, they tell us relatively little about how these variables are likely to evolve going forward, and whether these past changes are driven by ex ante risk and saving preferences or unexpected shocks. We therefore estimate *ex ante* $r - g$ *gaps* by combining our expected return estimates with an estimate of the long-run growth in GDP. To do this, we compute the annuity value of GDP growth from year $t + 1$ onwards in the same way we computed long-run cashflow growth $\tilde{g}$ in Section 2, by summing future realised growth rates at exponentially decaying weights (see footnote 2). We use realised GDP growth for years up to 2015, and compute expected growth after 2015 using the *OECD Economic Outlook* forecast for GDP in 2060.

The left-hand panel of Figure 16 shows the expected return and trend real safe rate estimates

Figure 16: *Expected returns and GDP growth*



Notes: Unweighted averages of 17 countries. Expected risky return is the expected yield plus expected real cashflow growth, averaged across equity and housing. Trend real safe rate is estimated using the method of Del Negro et al. (2019). Long-run GDP growth is the annuity value of real GDP growth from the next year onwards, with post-2015 growth computed using the 2060 GDP forecast from the *OECD Economic Outlook*.

from Section 3 alongside the annuity value of real GDP growth, and the right-hand panel shows the corresponding ex ante $r - g$ gaps. Table 6 additionally shows the levels of the gap at selected points in time as well as the corresponding changes. Neither the risky nor the safe rate trend show a strong correspondence with trend long-run GDP growth. This means that both risky and safe $r - g$ gaps vary substantially over time. The safe $r - g$ gap (solid green line) displays no clear trend for most of the sample, but shows a sharp increase in the 1970s/80s and a pronounced decline afterwards. The current safe $r - g$ gap level is around -0.9%, close to the historical low observed during World War 2 and below its historical average of around zero. In line with the declining expected return, the risky $r - g$ gap has also declined from 5.4% in 1880 to 3.0% in 2015 (Table 6). Despite this decline, however, it remains high and positive. Appendix Figure A.8 shows the corresponding trends and gaps for realised risky and safe returns. These data confirm that the risky $r - g$ gap is highly positive, and the safe $r - g$ gap is close to zero on average, but as before, the large volatility of realised returns makes it difficult to infer the corresponding trends.

Table 7 shows shows the full-sample average $r - g$ gaps in individual countries alongside their levels at the end of our sample in 2015. The full-sample ex ante $r - g$ gaps are unambiguously positive for risky assets and around zero for safe assets. In around half the countries, the full-sample safe $r - g$ gap is negative whereas the risky $r - g$ gap is positive in every country. Risky $r - g$ gaps also display larger cross-country variation than safe $r - g$ gaps, ranging from 1.5% in France to 8% in Finland. The risky $r - g$ gap today is close to its historical average of around 4%. The safe $r - g$ gap is, however, close its historical row at around -0.9%, and as low as -2% in some countries.

The observed trends in ex ante $r - g$ gaps are difficult to square with a growth-centric view of secular stagnation and low interest rates. Low growth should simultaneously affect risky and safe

Table 6: *Ex ante $r - g$ gaps through time*

	(1)	(2)	(3)	(4)	(5)
	Level			Absolute change	
	1880	1990	2015	1880–1990	1990–2015
Safe $r - g$ gap	-0.04	1.81	-0.92	+1.85	-2.73
Risky $r - g$ gap	5.36	4.29	4.01	-1.07	-.28
equity $r - g$	4.30	4.43	4.59	+.14	+.15
housing $r - g$	6.43	4.15	3.43	-2.28	-.71

Notes: Averages of 16 countries, percentage points. Columns 1–3 show the levels of the variable in that year, and columns 4–5 show the absolute percentage point change between the cross-country averages in the respective years. Risky r is the average of expected returns on equity and housing, with expected returns calculated as the sum of expected yield and cashflow growth. Safe r is the long-term trend real safe rate computed using the method of Del Negro et al. (2019). g is the annuity value of economic growth from year $t + 1$ onwards, with post-2015 growth computed using the 2060 GDP forecast from the *OECD Economic Outlook*. To maintain sample consistency, the table excludes Canada, for which we have no housing data.

rates. Yet, while the risky $r - g$ has fallen over the long-run, it has only mildly decreased in recent decades, a period of sharp safe $r - g$ declines. The recent relative stability of the expected return on risky wealth is also mirrored in estimates of the marginal product of capital computed using national accounts data (Gomme et al., 2015).

Taken together, these trends carry important implications for the dynamics of capital accumulation, public debt and wealth inequality. In a wide range of neoclassical growth models, a positive gap between the return on productive capital and the economy's growth rate means that investment and capital accumulation increase long-run consumption growth, and hence the economy is dynamically efficient (Ramsey, 1928; Diamond, 1965; Abel et al., 1989). Barro (2020) extends the standard model to incorporate both risky and safe assets, and shows that the $r - g$ condition applies to the expected risky return, while dynamic efficiency is compatible with safe $r - g$ gaps being below zero. We show that despite the substantial increase in capital-to-income ratios during the final few decades of the 20th century (Piketty and Zucman, 2014), the increase in the ex ante risk premium has meant that the expected return on capital has remained high, the risky $r - g$ gap has remained positive, and advanced economies in our sample are far from dynamically inefficient.

Blanchard (2019) argues that while low safe $r - g$ gaps make government borrowing cheap to finance, a high risky $r - g$ gaps means that additional public debt would incur a high opportunity cost in terms of foregone private investment, since this foregone investment would yield a high rate of return r. We confirm Blanchard (2019)'s finding of a low safe $r - g$ gap, both now and historically. But the high risky $r - g$ gap means that even though public debt is cheap to finance, it carries a high opportunity cost. Turning to the dynamics of wealth inequality, a high risky $r - g$ gap means that wealth growths at a much higher rate than income and equilibrium wealth inequality will tend to be high (Piketty, 2014; Benhabib and Bisin, 2018). The trends in our risky $r - g$ gap do show some

Table 7: *Ex ante $r - g$ gaps by country*

Country	Full Sample		2015	
	$r^{\text{risky}} - g$	$r^{\text{safe}} - g$	$r^{\text{risky}} - g$	$r^{\text{safe}} - g$
Australia	3.10	-0.57	2.94	-1.54
Belgium	4.15	0.51	3.21	-1.16
Canada	4.42	-0.32	5.53	-0.22
Denmark	4.97	0.61	3.80	-1.35
Finland	7.69	-0.09	8.43	-1.10
France	1.75	-0.53	1.11	-0.69
Germany	6.52	0.74	6.12	-0.51
Italy	3.99	0.31	4.91	0.55
Japan	3.19	-0.50	4.73	-0.98
Netherlands	5.37	-0.06	5.00	-1.72
Norway	3.70	-0.39	3.47	-1.97
Portugal	2.12	0.26	2.82	0.84
Spain	3.35	-0.62	3.58	-1.00
Sweden	4.55	-0.14	3.32	-1.46
Switzerland	3.88	0.07	3.91	-1.37
UK	3.54	0.12	2.93	-0.56
USA	3.19	-0.62	3.88	-0.66
Average, unweighted	4.15	-0.08	4.10	-0.88
Average, weighted	3.84	-0.17	4.02	-0.69

Note: r^{risky} is the expected return on housing and equity. r^{safe} is the trend real safe rate. g is the annuity value of future economic growth. Canadian data are for equities only. The average, unweighted and average, weighted figures are respectively the unweighted and real-GDP-weighted arithmetic averages of individual country gaps. The averages are slightly different to those in Table 6 because data in Table 6 exclude Canada to ensure consistency across the housing and equity asset classes.

correspondence with the long-run evolution of wealth inequality, with high levels in the late 19th century followed by a fall up until the 1950s and a subsequent increase.

The impact of return differentials on wealth inequality is further exacerbated by the variation in $r - g$ gaps across individual asset classes. Existing research suggests that households in the lower part of the wealth distribution hold most of their wealth in safe assets such as deposits, the middle of the wealth distribution holds mostly housing wealth and the top part – mostly equity wealth (Garbinti, Goupille-Lebret, and Piketty, 2020; Kuhn, Schularick, and Steins, 2020; Martínez-Toledano, 2020). Table 6 shows that out of these three asset classes, the safe $r - g$ gap has declined the most, while the equity $r - g$ gap has changed very little. In the late 19th century, the housing $r - g$ gap was larger than that on equity, but the current equity $r - g$ gap of 4.6% is higher than the housing gap of 3.4%, and both are substantially higher than the safe $r - g$ gap of -0.9%. This means that not only is wealth more likely to grow faster than income on average, but asset holdings of the wealthy are likely to yield higher returns, further exacerbating existing inequality. Taken together, these facts imply that wealth of the rich is likely to continue growing substantially faster than income, and steady-state levels of wealth inequality are likely to remain high.

5. Conclusion

The expected return on risky assets has been declining for the past 145 years, falling from 8% in the 1870s to 6% today. This long-run decline means that past realised returns are likely to somewhat overstate future returns to potential investors. Still, expected returns remain high and risk premia – far above zero, so there is little sign of the equity and housing premium puzzles disappearing. This high expected return level also means that the ex ante risky $r - g$ gap remains high, meaning that despite recent increases in advanced-economy wealth-to-income ratios, capital accumulation is yet to run into sharply diminishing returns.

Even though safe rates have also declined over recent decades, their movements are in general disconnected from the risky rate. This means that changes in risk are a key determinant of both risky and safe rates, and in fact much of the historical expected return decline can be linked to a fall in the risk premium and a corresponding decline in consumption volatility. Other factors which affect the relative demand and supply of risky and safe assets – such as safe asset shortages (Caballero and Farhi, 2014) and changes in market access (Iachan, Nenov, and Simsek, 2020) – provide additional channels through which changes in the price of risk can drive risky and safe returns in opposite directions. A further investigation of these other risk-based channels and their role in shaping long-run risky and safe rate trends offers a fruitful avenue for future research.

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APPENDIX

A. Summary statistics

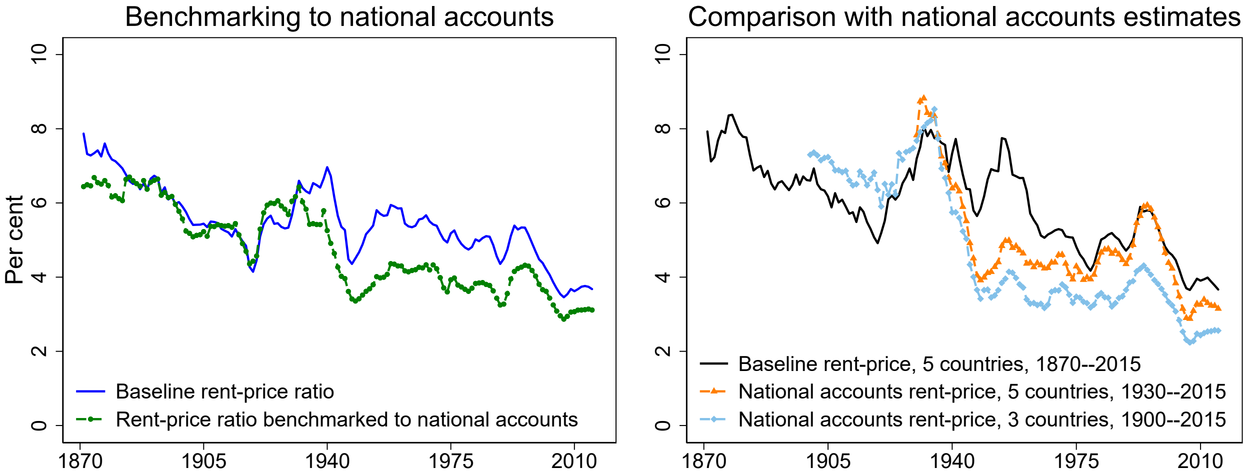
Table A.1: *Summary statistics*

	Obs.	Mean	S.D.	Min	Max
Expected return on risky assets	1759	6.58	1.60	2.74	12.51
Expected return on equity	1759	6.62	2.05	1.10	14.47
Expected return on housing	1645	6.47	1.83	3.05	14.22
Ex ante risk premia on risky assets	1759	4.03	1.70	-2.35	9.69
Ex ante risk premia on equity	1759	4.06	2.11	-2.80	10.84
Ex ante risk premia on housing	1645	3.97	1.94	-2.79	10.55
Discount rate on risky assets	1759	4.54	1.43	0.56	11.74
Equity dividend yield	1759	3.96	1.65	0.07	14.19
Housing rental yield	1645	5.21	1.98	0.50	13.08
Long real safe rate (Del Negro et al., 2019)	1759	2.55	1.13	0.10	8.55
Short real safe rate (Del Negro et al., 2019)	1759	1.59	1.10	-1.16	7.20
Annuity value of real GDP growth	1759	1.99	0.67	0.45	4.71
Dividend growth rate (winsorized at 1% level)	1759	3.04	21.70	-49.76	95.95
Rent growth rate (winsorized at 1% level)	1645	1.55	6.85	-17.94	33.26

Notes: Annual data, 1870–2015, per cent.

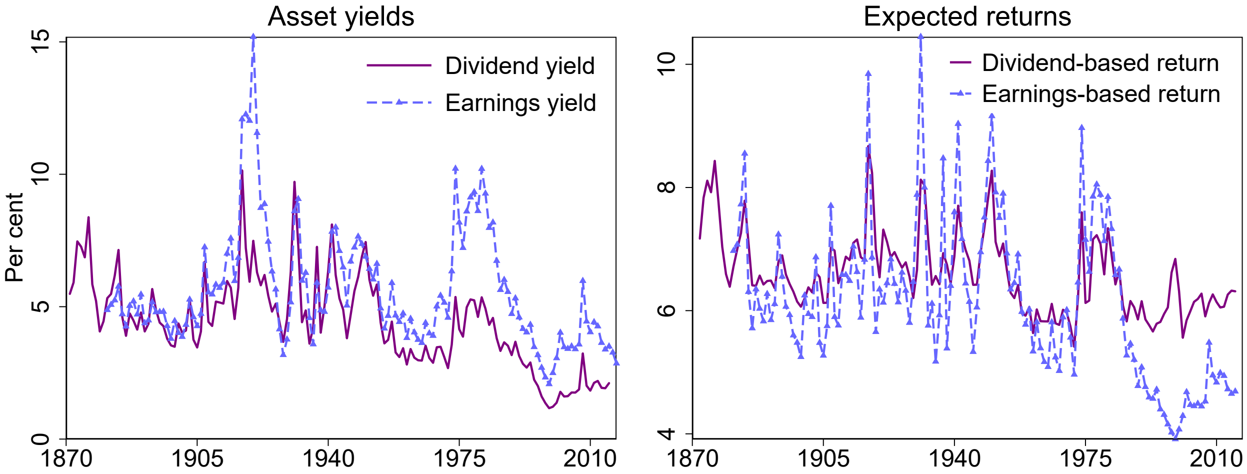
B. Trends in expected returns and risk premia: additional details

Figure A.1: *Comparison of rent-price ratios to national accounts data*



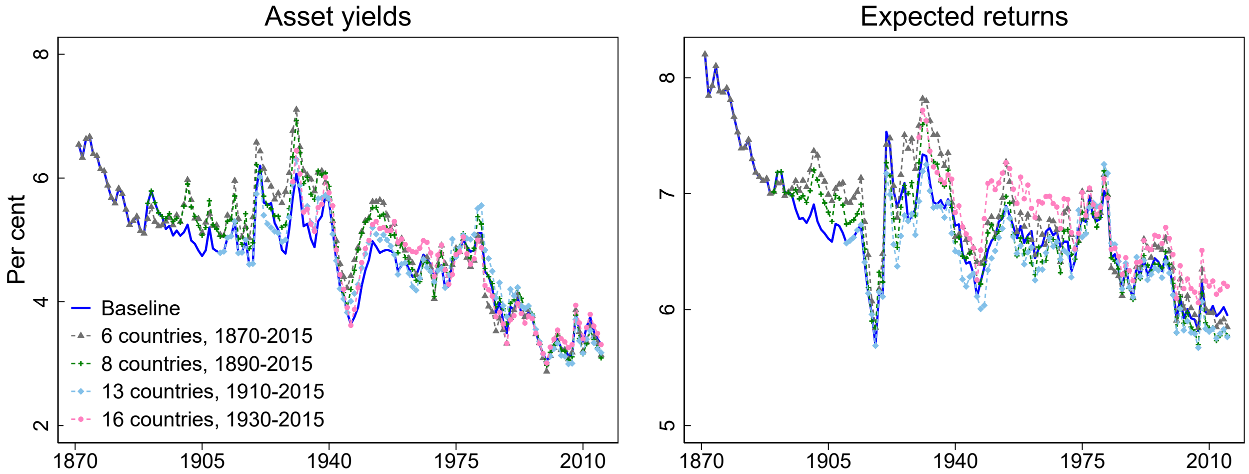
Notes: Left-hand panel: unweighted averages of 16 countries. The baseline uses the rent-price approach of Jordà et al. (2019) to construct historical rent-price ratios. The series benchmarked to national accounts uses the balance sheet approach estimates where possible, extrapolating using the growth in house prices and rents where these are not available. Right-hand panel: averages of countries for which we have long-run balance sheet approach data. The group of 5 countries includes Denmark, France, Germany, Sweden and USA. The group of 3 countries includes Denmark, France and Germany. The balance sheet approach yield is calculated as total rental income minus running costs (all non-tax housing expenditures and depreciation) as a share of housing wealth. Balance sheet approach measures in the right-hand panel do not rely on house price and rent growth extrapolation.

Figure A.2: *Comparison of dividend and earnings yields for the US*



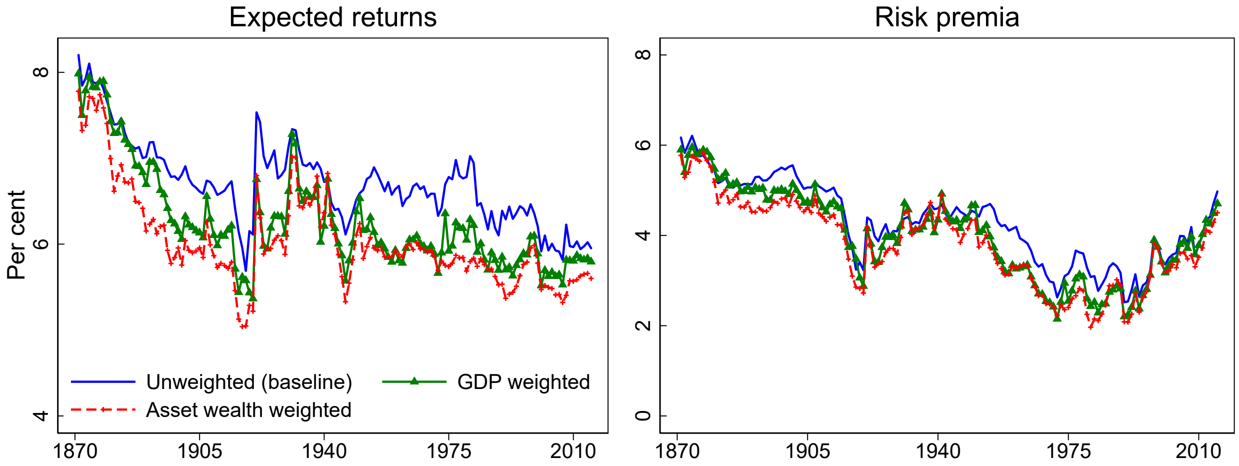
Notes: US data. The earnings yield is the the cyclically adjusted total return earnings-price ratio (inverse of P/E10 CAPE) from Shiller (2015), December values. The dividend-based expected return is our baseline estimate. The earnings-based expected return is the sum of the dividend-price ratio and expected earnings growth. To guard against the potential effects of share buybacks on total asset yields, we fix the growth of the dividend-price ratio to equal that of the earnings-price ratio from 1982 onwards.

Figure A.3: *Alternative sample groupings*



Notes: Unweighted averages of groups of countries for which we have the data on both housing and equity yields and expected returns over the selected time period. Data for Canada use equities only. The 6 countries with long-run data going back to the 1870s are Canada, Denmark, France, Germany, Norway and Sweden. The 2 additional countries with data from 1890 onwards are Belgium and USA. The 5 additional countries with data from 1910 are Australia, Netherlands, Spain, Switzerland and the UK. The 3 additional countries with data from 1930 onwards are Finland, Italy and Japan. Portugal is only included in baseline estimates, from 1948 onwards.

Figure A.4: *Alternative weighting schemes*



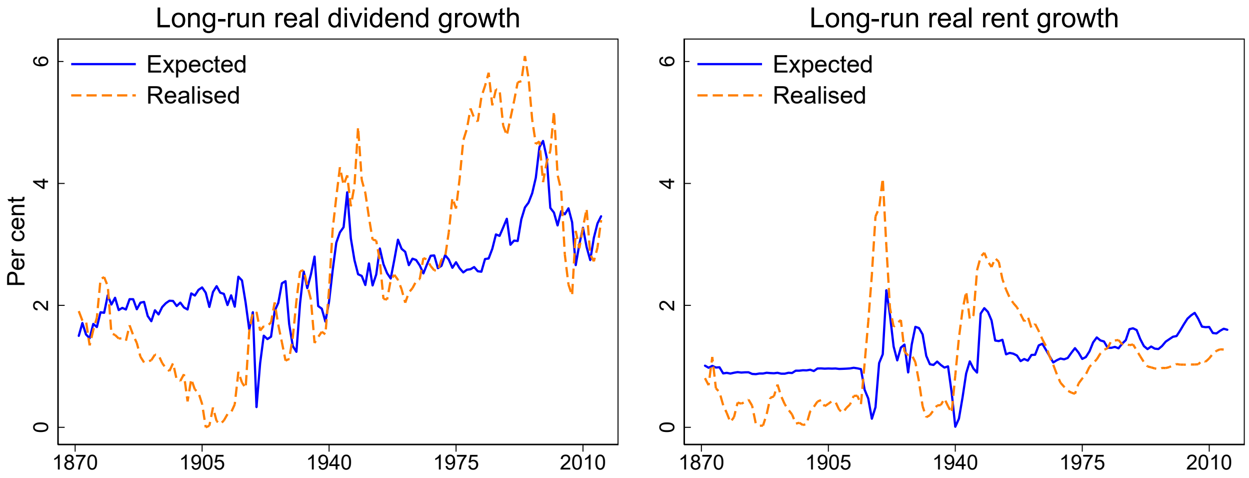
Notes: Baseline is the unweighted average of 17 countries. GDP-weighted average weights country-level observations by the respective country's real GDP level. Wealth-weighted average weights equity and housing returns within country by equity and housing market capitalization, and weights country-level returns by the level of risky wealth of the respective country.

Table A.2: *Return and cashflow predictability: full VAR results for selected time periods*

	(1)	(2)	(3)	(4)	(5)	(6)
	Equity			Housing		
	r_t	dg_t	dp_t	r_t	dg_t	dp_t
VAR for years 1870–1910:						
r_{t+1}	0.09*	-0.01	0.06***	-0.23**	0.16	0.13***
	(0.05)	(0.02)	(0.02)	(0.10)	(0.15)	(0.02)
dg_{t+1}	0.23***	-0.19***	-0.09***	-0.05*	0.01	0.00
	(0.07)	(0.05)	(0.02)	(0.03)	(0.13)	(0.01)
dp_{t+1}	0.14**	-0.19***	0.88***	0.19*	-0.16	0.91***
	(0.06)	(0.06)	(0.02)	(0.10)	(0.11)	(0.02)
Observations	545	545	545	304	304	304
VAR for years 1910–1940:						
r_{t+1}	0.24***	0.00	0.05**	0.08	0.29***	0.07***
	(0.05)	(0.04)	(0.02)	(0.09)	(0.08)	(0.01)
dg_{t+1}	0.24***	-0.06	-0.14***	-0.02	0.53***	-0.03***
	(0.07)	(0.07)	(-0.02)	(0.04)	(0.06)	(0.01)
dp_{t+1}	-0.01	-0.07	0.84***	-0.10	0.25***	0.94***
	(0.06)	(0.06)	(0.03)	(0.08)	(0.06)	(0.02)
Observations	648	648	648	507	507	507
VAR for years 1940–1980:						
r_{t+1}	0.16***	-0.03	0.15***	0.17**	0.18***	0.07***
	(0.05)	(0.04)	(0.02)	(0.07)	(0.06)	(0.01)
dg_{t+1}	-0.02	0.11	-0.03	0.00	0.46***	-0.05***
	(0.07)	(0.08)	(0.04)	(0.06)	(0.07)	(0.01)
dp_{t+1}	-0.18**	0.15**	0.85***	-0.18**	0.29***	0.92***
	(0.07)	(0.07)	(0.04)	(0.08)	(0.08)	(0.01)
Observations	667	667	667	577	577	577
VAR for years 1970–2010:						
r_{t+1}	0.04	-0.00	0.05***	0.56***	-0.01	0.05***
	(0.04)	(0.04)	(0.02)	(0.07)	(0.07)	(0.01)
dg_{t+1}	-0.01	-0.20***	-0.10***	-0.00	0.31***	-0.02***
	(0.05)	(0.07)	(0.02)	(0.02)	(0.09)	(0.01)
dp_{t+1}	-0.05	-0.20***	0.88***	-0.60***	0.33***	0.98***
	(0.05)	(0.07)	(0.03)	(-0.07)	(0.10)	(0.01)
Observations	693	693	693	649	649	649

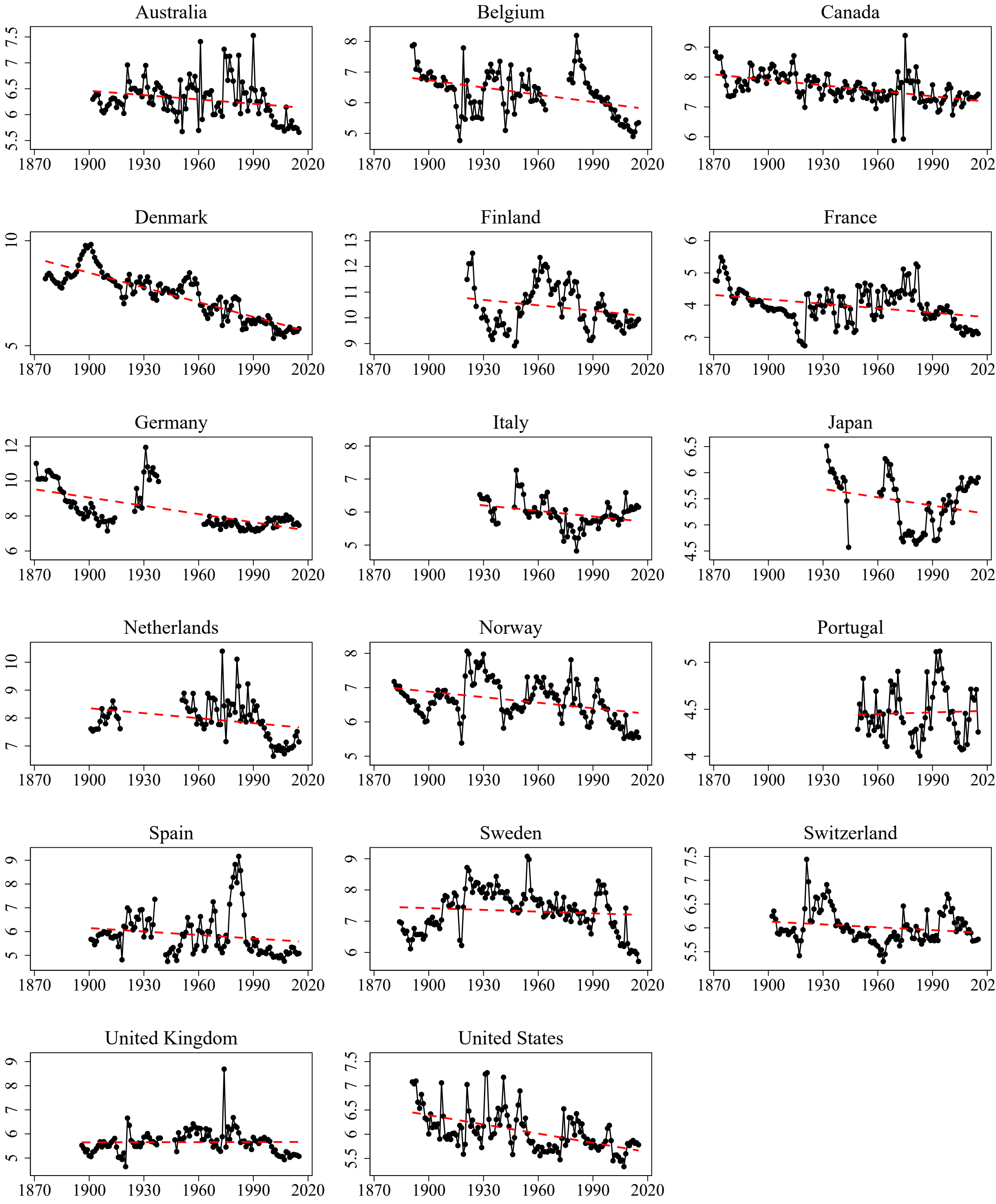
Note: Rolling window VAR estimates using GMM subject to present value moment constraints, accounting for cross-sectional and time dependence in standard errors. Variables are log real total equity or housing return r, log real dividend or rent growth dg, and log of dividend-price or rent-price ratio dp, demeaned at country level. *: $p < 0.1$ **: $p < 0.05$ ***: $p < 0.01$.

Figure A.5: *Expected and realised cashflow growth*



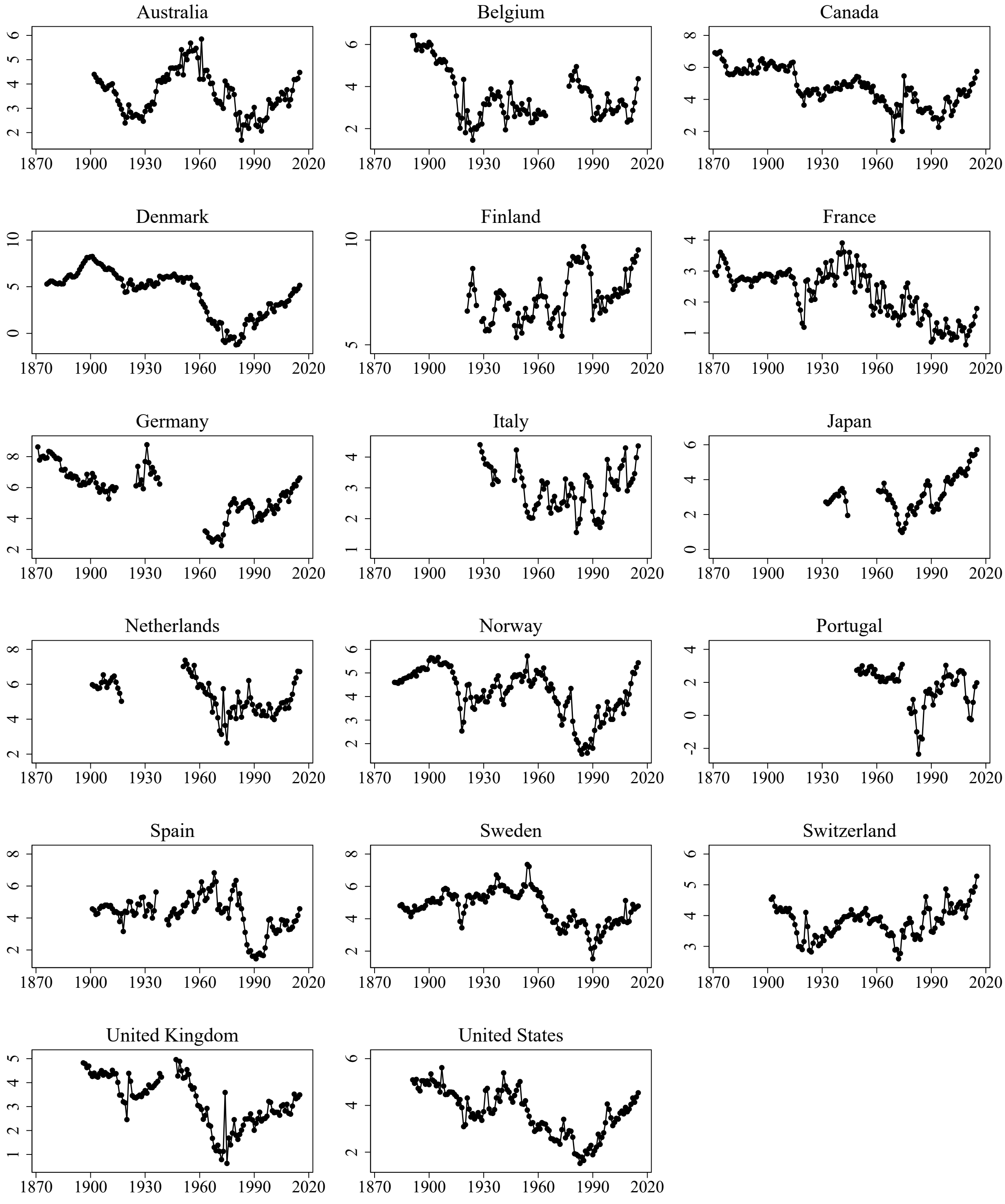
Notes: Expected cashflow growth is the VAR forecast of the present value of future cashflow growth using today's dividend- or rent-price ratio, returns and cashflows, $\left[(1-\rho_i)\hat{\mathbb{E}}\sum_{s=0}^{\infty}\rho_i^s dg_{i,t+1+s}\right] + \overline{DG_{i,j}} - 1$, with the VAR estimated over a 40-year rolling window from $t-40$ to t (apart from the first 40 years, where the VAR for 1870–1910 is used to make the forecast for e.g. 1890). Realised cashflow growth is the annuity value of future cashflow growth from $t+1$ onwards, discounted at the asset-specific sample average rate of return r. Realised cashflow growth data are winsorized at 1% level.

Figure A.6: *Expected returns in individual countries*



Notes: The expected return is the average of housing and equity, measured as the yield plus expected cashflow growth. Dashed lines show the country-specific linear trends. All data are in percent. Data for Canada are for equities only.

Figure A.7: *Ex ante risk premia in individual countries*



Notes: The risk premium is the average of housing and equity, measured as the expected return minus the real ex ante safe rate. Dashed lines show the country-specific linear trends. All data are in percent. Data for Canada are for equities only.

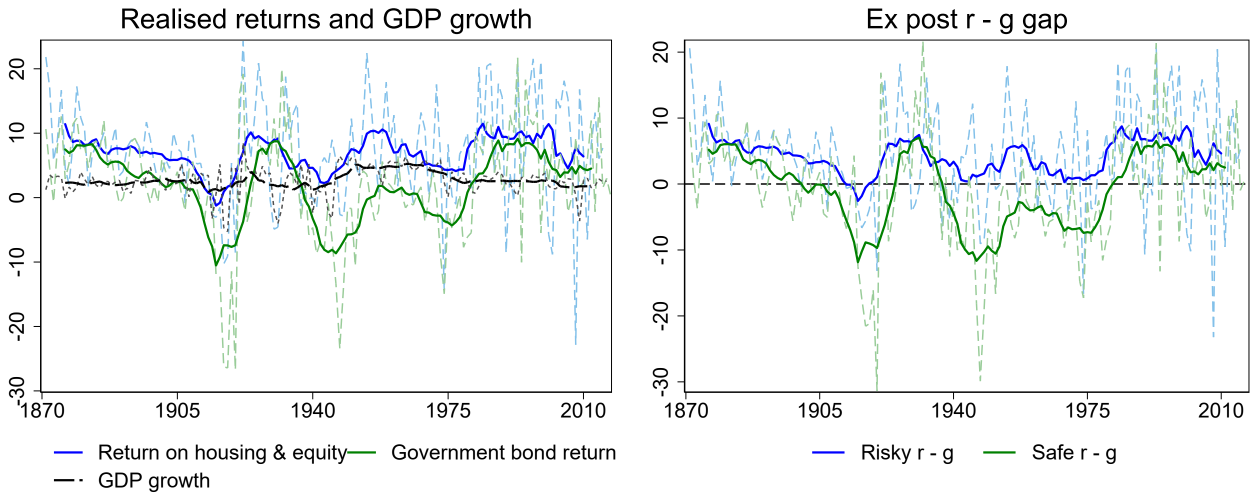
C. Drivers of expected returns: additional details

Table A.3: *Co-movement of realised returns, safe rates and risk premia*

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: Realised real return on risky assets					
	Baseline	Year effects	Equity	Housing	3-year MA	10-year MA
Safe rates	0.38^{***}	0.38^{***}	0.55^{***}	0.17^{***}	0.43^{***}	0.39^{***}
	(0.06)	(0.05)	(0.06)	(0.05)	(0.05)	(0.05)
Country fixed effects	✓	✓	✓	✓	✓	✓
Year fixed effects		✓				
R^2	0.11	0.47	0.10	0.04	0.18	0.30
Observations	1890	1890	2275	1818	1832	1631
	Dependent variable: Ex post risk premia on risky assets					
	Baseline	Year effects	Equity	Housing	3-year MA	10-year MA
Safe rates	-0.57^{***}	-0.54^{***}	-0.34^{***}	-0.81^{***}	-0.52^{***}	-0.55^{***}
	(0.07)	(0.06)	(0.07)	(0.06)	(0.07)	(0.06)
Country fixed effects	✓	✓	✓	✓	✓	✓
Year fixed effects		✓				
R^2	0.20	0.51	0.04	0.45	0.23	0.42
Observations	1890	1890	2274	1818	1832	1631

Notes: Regressions of realised risky returns and risk premia on the safe return. Realised returns are the sum of capital gain and yield, averaged across equities and housing and net of inflation. Safe return is the real total government bond return. Baseline specification in column 1 has country fixed effects only, column 2 adds year fixed effects, columns 3 and 4 consider equity and housing separately and columns 5 and 6 use 3-year and 10-year moving averages of both risky and safe returns. Standard errors in parentheses are clustered by country and year. *: $p < 0.1$ **: $p < 0.05$ ***: $p < 0.01$.

Figure A.8: *Realised returns and GDP growth*



Notes: Unweighted averages of 17 countries. Dashed lines are annual data and solid lines are centered 10-year moving averages. Realised risky return is the average of total real holding period returns on equity and housing, realised safe return is the real return on long-term government bonds.