Equity Yields*

Jules H. van Binsbergen†
Northwestern Kellogg
and Stanford GSB
and NBER

Wouter H. Hueskes‡
APG Asset Management

Ralph S.J. Koijen§
Chicago Booth
and NBER

Evert B. Vrugt¶
Free University Amsterdam

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Abstract

We use a new data set on dividend futures with maturities up to 10 years to uncover expected dividend growth rates across three major regions around the world: the US, Europe, and Japan. We use these futures to derive equity yields, analogous to bond yields, and decompose these yields into expected growth rates of dividends and a risk premium component. We find that both risk premia as well as expected growth rates exhibit substantial variation over time. Further, we find that equity yields are important leading indicators of economic growth as measured by GDP growth, consumption growth, and dividend growth, particularly in periods when nominal bond yields are near the zero lower bound. We relate the dynamics of growth expectations to recent events related to the financial crisis and the recent turmoil following the earthquake in Japan.

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†j-vanbinsbergen@kellogg.northwestern.edu, (847) 491-3838, http://www.stanford.edu/ jvb2/

‡wouter.hueskes@apg-am.nl, +31 (0) 20 604 8309

§ralph.koijen@chicagobooth.edu, (773) 834-4199, http://faculty.chicagobooth.edu/ralph.koijen/. Koijen is also associated with Netspar (Tilburg University)

¶evrugt@xs4all.nl, http://www.evertvrugt.com

We use a new data set on dividend futures with maturities up to 10 years to uncover economic growth expectations across three major regions around the world: the US, Europe, and Japan. At the turn of the century, a new and growing market has developed where dividends are traded separately from their underlying index. An index dividend future is a standardized contract where at a future time T, the owner pays the futures price, which is determined today, and receives the index dividends paid during calendar year T. We use these futures to derive equity yields, analogous to bond yields, and decompose these yields into expected growth rates of dividends and a risk premium component. We find that both expected growth rates as well as risk premia vary substantially over time. Further, we show that equity yields are important leading indicators of economic growth as measured by GDP growth, consumption growth, and dividend growth. We relate the dynamics of growth expectations to recent events related to the financial crisis and the recent turmoil following the earthquake in Japan.

Our paper contributes to a large literature which addresses the predictability of economic growth. Expectations about future economic growth are of central importance for the decisions of households, firms, and governments. However, a large empirical literature documents that predicting economic growth, as measured by consumption and dividend growth, seems challenging.[1] In this paper, we explore whether the information contained in equity yields across maturities is useful to forecast various measures of economic growth across different horizons, and we compare the empirical performance of equity yields with those of bond yields, and find that equity yields perform better than bond yields in predicting economic growth, particularly when the short rate is at the zero lower bound.

To this end, we study a novel data set of dividend futures with maturities up to 10 years across three major world regions: the United States, Europe, and Japan. These data provide equity yields, which are risk-neutral growth rates of dividends with one-year intervals. This implies that equity yields are equal to average expected dividend growth rate plus a risk premium component. We use a Vector Autoregressive model to decompose equity yields into actual (physical) expectations and a risk premium component. We show that these asset prices are important leading indicators (predictors) of economic growth as measured by GDP growth, consumption growth, and dividend growth. In terms of the risk premium component, we find that the risk premia are strongly counter-cyclical. In addition, we find that the risk premium embedded in the shorter-maturity equity yields increase more than the ones in the longer-maturity equity yields.

Our daily data set covers the time period between October 2002 and April 2011 and comes from several major banks who are important players in the market for dividends.

[1]See for instance Campbell and Mankiw (1987), Cochrane (1994), Cochrane and Piazzesi (2005), Lettau and Ludvigson (2005), Cochrane (2008), and Binsbergen and Koijen (2010).

These banks have provided us with their proprietary dividend databases, which they use firm-wide both as a pricing source and to mark the internal trading books to the market. Before 2008, index dividend futures and swaps were traded in over-the-counter (OTC) markets. Since 2008, dividend futures are exchange traded for several major indexes in an increasingly liquid market. They are available for every future calendar year with maturities up to ten years.

The term structure of growth rates we present provides a new way of assessing the short-term and long-term influences of specific world events and policy decisions. For example, we can assess how Central Bank monetary policy and government's fiscal policy decisions affect growth expectations of investors across different horizons. As an application of our framework, we study in this paper the time line of the financial crisis and how growth expectations altered as the crisis unfolded. For instance, this allows us to contribute to the debate which event triggered the financial crisis. One view contends that the default of Lehman Brothers was the major event, whereas the alternative view contends that the announcements by (former) policy makers such as Ben Bernanke and Alan Greenspan had a large impact on future growth expectations. Consistent with the second view, we find the largest decline in expected growth rates on the day of a congressional hearing with Alan Greenspan.

More broadly, the term structure of growth expectations we uncover can improve our understanding of the nature of macro-economic shocks. There is a long-standing debate in macro economics and finance to what extent macro-economic shocks are permanent or transitory. Important contributions by Campbell and Mankiw (1987), Campbell and Shiller (1988), and Cochrane (1994) suggest that shocks to dividends and consumption are largely permanent. Such conclusions either follow from higher-order ARMA models or multivariate models of consumption and income, or dividends and asset prices. We enrich the information set to address this question with growth rates implied by dividend growth rates.

As expectations about future growth are an important determinant of asset prices, an alternative way to uncover market expectations is to use financial markets data. The level of the stock market over time and across countries is affected by growth prospects of cash flows or dividends and could therefore be informative about such expectations (Campbell and Shiller (1988)). In practice, inferring expected growth rates from aggregate stock market data has turned out to be challenging for several reasons. First, the value of the stock market is influenced by both short and long-term expected growth rates. That is, ceteris paribus, the value of the stock market will go up regardless of whether either short-term or long-term expected growth rates (or both) increase, and a time series model is required when trying to disentangle the two. The mere fact that our data has a maturity structure contains important information about growth rates across different horizons.

Second, the valuation and fluctuations of the stock market are not only determined by expected growth rates, but also by time-varying discount rates. This discount rate consists of two parts: a risk free interest rate, which can be observed through the term structure and can therefore be controlled for, and a risk premium component, which is not observable. Empirically, many studies have found that fluctuations of the discount rate seem to dominate when decomposing the variance of stock prices normalized by current dividends (Campbell and Shiller (1988), Cochrane (2008), and Binsbergen and Koijen (2010)).

Most of the stock market literature has either focused on the cross-section of stock returns and cash flows, or on the value of the aggregate stock market, which equals the sum of discounted aggregate cash flows. However, when studying the aggregate market, the individual terms in the sum of discounted dividends, also called dividend strips, provide a wealth of information about growth expectations and discount rates over different horizons. A simple no-arbitrage condition links dividend strip prices to dividend futures prices, requiring a risk-free interest rate as the only additional input. As such, the dividend futures market allows us to break up the index into pieces, and study the properties of the pieces separately. In this paper we focus on studying the risk adjusted growth rates related to each piece and we relate those to the crisis. In Binsbergen, Hueskes, Koijen, and Vrugt (2010) we focus on the return characteristics of dividend strips.

We also link our equity yields to nominal and real bond yields. For all three term structures, we find that a single factor, namely the first principal component, explains about 90% of the fluctuations for the first five years. However, the principal components are fairly uncorrelated across term structures. The first principal component that we extract from real bond yields hardly explains any of the variation of equity yields. This implies that we uncover a common predictable component in GDP growth, consumption growth, and dividend growth that appears to be absent in real bond yields.

Our paper relates to Binsbergen, Brandt, and Koijen (2010) who use options on the S&P500 index (LEAPS) to study the asset pricing properties of short-term dividend strips. Using put-call parity, they uncover the prices of short-term dividend strips. An advantage of using index options is that these derivatives have been exchange-traded since 1996 which allows the authors to study a longer time series. They document several return properties for short-term dividend strips in comparison with the aggregate stock market. An important disadvantage, however, is that index options have fairly short maturities of up to three years. The advantage of our data set is that dividend futures contracts have maturities up to ten years and that we use data from three major markets.

1 Financial markets and expected growth rates

An index dividend future is a standardized contract where at maturity, the buyer pays the futures price, which is determined today, and the seller pays the dollar amount of dividends during a certain calendar year. Take for example the 2019 dividend future on the DJ Eurostoxx 50 index, which on October 13th 2010 traded for 108.23 Euros. On the third Friday of December 2019, the buyer of the futures contract will pay 108.23 Euros, and the seller of the futures contract will pay the cash dividend amount on the Eurostoxx 50 index that has been paid out between the third Friday in December of 2018 and the third Friday in December of 2019.

Let D_{t+n} denote the stochastic dividend paid out in n years from todays date t. Further, let $\mu_t^{(n)}$ denote the appropriate per-period discount rate for that dividend. Then the present value $P_{t,n}$ of D_{t+n} is given by:

$$P_{t,n} = E_t\left(D_{t+n}\right)\exp\left(-n\mu_{t,n}\right). \tag{1}$$

Splitting up the discount rate $\mu_{t,n} = r_{t,n} + \theta_{t,n}$ into the interest rate for period n, denoted by $r_{t,n}$, and the risk premium for period n, denoted by $\theta_{t,n}$, we can rewrite equation (1) as:

$$P_{t,n} = E_t\left(D_{t+n}\right)\exp\left(-n[r_{t,n} + \theta_{t,n}]\right). \tag{2}$$

Further, by defining $g_{t,n}$ as the per-period expected growth rate of dividends over the next n periods, we can rewrite expression (2) as:

$$P_{t,n} = D_t \exp\left(n[g_{t,n} - r_{t,n} - \theta_{t,n}]\right).$$

Finally, define the equity yield as:

$$g^{\star}_{t,n} \equiv g_{t,n} - \theta_{t,n}. \tag{3}$$

The equity yield, $g^{\star}_{t,n}$, can also be interpreted as a risk-adjusted expected growth rate, as it is the difference between the expected growth rate $g_{t,n}$ and the risk premium. We can compute $g^{\star}_{t,n}$ using two observables, the price-dividend ratio of dividend strip n and the interest rate for period n:

$$g^{\star}_{t,n} = \frac{1}{n}\left(\ln P_{t,n} - \ln D_t\right) + r_{t,n}. \tag{4}$$

In reality, the way the contract is quoted, is not in terms of the "spot" price $P_{t,n}$, but in terms of the futures price, which we will denote by $F_{t,n}$. Under no arbitrage, the following relationship holds:[2]

$$F_{t,n} = P_{t,n} \exp(n r_{t,n}).$$

This implies that the equity yields follow directly from the futures prices:

$$g^{\star}_{t,n} = \frac{1}{n} \left(\ln F_{t,n} - \ln D_t \right). \tag{5}$$

Note that the equity yield $g^{\star}_{t,n}$ is the per-period risk adjusted expected growth rate for the next n-years. As such it represents an average expected growth rate. However, when considering a 10-year horizon, for example, it may also be interesting to compute the expected growth rate between periods 5 and 10, which we will call the forward growth rate. The forward equity yield between period n_1 and n_2, where $n_2 > n_1$, is defined as:

$$f_{t,n1,n2} \equiv \frac{1}{n_2 - n_1} \left(\ln F_{t,n2} - \ln F_{t,n1} \right). \tag{6}$$

2 Data

2.1 Equity indices across three world regions

We focus our analysis on three major stock indices representing three world regions: the US, Europe and Japan. For Europe, we focus on the EURO STOXX 50 Index. This index is a leading blue-chip index for the Eurozone. The index covers 50 stocks from 12 Eurozone countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain traded on the Eurex. In February 2011, the index has a market capitalization of 2 Trillion Euros (2.8 Trillion dollars) and captures approximately 60% of the free float market capitalization of the EURO STOXX Total Market Index (TMI), which in turn covers approximately 95% of the free float market capitalization of the represented countries. As such, the index seems fairly representative for the euro area despite the fact that it only includes 50 stocks. For Japan, we focus on the Nikkei 225 index, which is the major stock index for the Tokyo Stock Exchange in Japan. The Nikkei 225 has a market capitalization of over 2 Trillion dollars. It is comprised of 225 blue chip stocks on the Tokyo Stock Exchange. Finally, we use the S&P500 index for the US. The S&P 500 is a capitalization-weighted index of the prices of 500 large-cap common stocks actively traded in the United States. The stocks included in the S&P 500 are those of large publicly held companies that trade on

[2]Note that this formula holds for non-dividend paying assets. At first sight this may be confusing, as the focus of the paper is on dividends. Note that the index does indeed pay dividends, and therefore futures on the index are affected by these dividend payments. However, the futures contracts we study are not index futures, but dividend futures. These dividend futures have the dividend payments as their underlying, not the index value. As dividends do not pay dividends, the formula below is the appropriate formula.

one of the two largest American stock market exchanges; the NYSE and the NASDAQ. The market capitalization is just over 12 Trillion dollars. As a comparison, the S&P1500 index, which also includes mid-cap and small-cap companies, has a market capitalization of about 13 Trillion dollars, suggesting that the S&P500 index is a representative index for the US economy.

2.2 Dividend futures data

Our daily dividend future data comes from BNP Paribas and Goldman Sachs International, two major players in the market for dividends. It covers the US, Europe, and Japan. These banks have provided us with their internal implied dividend database, which they use firm-wide both as a pricing source and to mark the internal trading books to the market.

The market for dividends is relatively young and started around the turn of the century. With increased trading activities in options, forwards, and structured products, dividend exposures increased on investment banks' balance sheets. By selling structured products to investors that have an implicit long forward position in it (long out-of-the-money call options and/or short out-of-the-money put options), investment banks accumulate significant long dividend positions. However, the hedging is done with the underlying index constituents, which pay uncertain dividends. This exposes investment banks to dividend risk, the risk between anticipated and actual dividends, which they prefer to offload to free up capital. Other than investment banks and dealers, hedge funds are important participants in this market. Also, several pension funds are active in the dividend market. For them, dividend futures may be useful tools to match the duration of assets and liabilities, particularly for defined benefit plans that (partially) index pension payments with wage or GDP growth. Most of the trading in dividends occurs over-the-counter (OTC) in the inter-broker market. Since mid 2008, however, exchange traded dividend futures markets have started; first in Europe (SX5E) and later in Japan (NKY).

The current size of the exchange traded dividend future market is substantial, particularly in Europe, with a total open interest of $10 billion for the DJ Eurostoxx 50 index. This is in addition to a large OTC market. For example, by mid October 2010, the open interest in the exchange-traded Dec 2010 dividend future on the DJ Eurostoxx 50 was 1.7 billion dollars. The open interest in the Dec 2011 contract was 2.5 billion dollars. The open interest decreases for longer maturity contracts, but even the Dec 2019 contract has a 200 million dollar open interest.

Index dividend contracts are traded in exposure per (dividend) point. Formally, the pay-off of a contract is the sum of the declared ordinary gross dividends on index constituents that go ex-dividend during the period as stipulated in the contract, which is usually a year. Special or extraordinary dividends are excluded.[3] The decision on in- or exclusion of dividends is guided by the exchange or the index provider. By entering a long dividend swap or future, an investor will receive the actual dividends against the market-implied level at inception of the contract. Contracts are cash-settled at the expiration date and there are no interim cash flows.

2.3 Dividend data

To compute daily dividends, we obtain daily return data with and without distributions (dividends) from S&P index services for the S&P500 index. We use Global Financial Data and Bloomberg to obtain the same objects for the DJ Eurostoxx50 index and the Nikkei 225 index. Cash dividends are then computed as the difference between the return with distributions and the return without, multiplied by the lagged value of the index. As the dividend futures prices are based on a full calendar year of dividends, we use the past year of dividends as the denominator in equation (5). For example, if we want to compute the equity yields on October 15th 2010, we use as the denominator the sum of the dividends paid out between October 16th 2009 and October 15th 2010. This also reduces concerns related to seasonalities, as both the future dividend price as the current dividend level refer to a whole year of dividends.

2.4 Bond yields

We use monthly Fama-Bliss bond yields with maturities of 1,. . . , 5 years from the Center for Research in Security Prices (CRSP). We use the data from Gurkaynak and Wright (2008), which is updated until March 2011.[4]

2.5 GDP growth and consumption growth

We seasonally-adjusted real GDP growth and real consumption growth from the NIPA tables of the Bureau of Economic Analysis. For real consumption growth, we construct a chain-weighted index of non-durable consumption and services.

2.6 Financial crisis timeline

We obtain detailed data on the timeline of the financial crisis from the St. Louis Fed.[5]. We also use an alternative timeline of the crisis as provided by the New York Fed.[6] We use

[3]Over time, the share of special dividends as a fraction of total dividends, has decreased and is negligible for the sample period that we consider, see DeAngelo, DeAngelo, and Skinner (2000).

[4]The data is available from `http://www.federalreserve.gov/econresdata/researchdata.htm`.

[5]See also http://timeline.stlouisfed.org/index.cfm?p=timeline

[6]See http://www.ny.frb.org/research/global_economy/Crisis_Timeline.pdf

this data to assess which events most affected investors' short and long-term expectations during the financial crisis.

3 Dividends and economic activity

Dividend markets provide us with a term structure of expected dividend growth. One may wonder to what extent aggregate dividends and aggregate dividend growth are related to more common measures of economic activity such as real consumption and GNP growth. To illustrate this relationship, we plot in Figure 1 the cyclical residuals of the Hodrick-Prescott filtered series for annual real consumption (levels), annual real GNP, and annual dividends, at a quarterly frequency. We set the smoothing parameter to $\lambda = 1,600$.

The graph shows that for many periods of expansions and recessions, the cyclical components of dividends, GNP, and consumption align. However, they are not perfectly aligned. Sometimes dividends lead consumption and GNP, and sometimes consumption and GNP lead dividends. The series align for the recent financial crisis as well as the recession in the early 2000s.

To illustrate the correlation between the cyclical components of consumption, GNP, and dividends, we compute the 10-year rolling time-series correlation between the series. The results are reported in Figure 2. First, the figure indicates that the correlation between the cyclical components of consumption and dividends or GNP and dividends are very similar. The time series of the rolling correlations strongly co-move. Second, apart from the early sixties and the nineties, the time-series correlation appears well above 0.5 and peaks in periods with deep recessions. This suggests that dividends and other measures of economic activity are strongly related.

4 Decomposing equity yields

We show in Section 1 that equity yields depend on expected dividend growth rates ($g_{t,n}$) and a risk premium component ($\theta_{t,n}$), see equation (3). In this section, we develop a simple approach to decompose equity yields into both components.

In the equations below, a time period corresponds to one month. We first define annual log dividend growth as:

$$\Delta d_{t+12} = \ln\left(\sum_{i=1}^{12} D_{t+i}\right) - \ln\left(\sum_{i=1}^{12} D_{t-12+i}\right).$$

We are mainly interested in forecasting annual dividend growth, up to n years into the future. That is, we want to compute $E_t\left(\Delta d_{t+12n}\right)$. To this end, we first predict annual dividend growth using a vector of equity yields, x_t:

$$\Delta d_{t+12} = \psi_0 + \psi_1' x_t + u_{t+12}. \tag{7}$$

To compute the $n-$year expectations, we model the time-series dynamics of equity yields as a first-order vector autoregressive (VAR) model:

$$x_{t+1} = \mu + \Gamma x_t + \varepsilon_{t+1}. \tag{8}$$

The monthly VAR model implies and annual VAR model:

$$x_{t+12} = \mu_A + \Gamma_A x_t + \varepsilon_{A,t+12},$$

where:

$$\mu_A \equiv \left(\sum_{i=0}^{11} \Gamma^i \right) \mu, \; \Gamma_A \equiv \Gamma^{12}, \; \varepsilon_{A,t+12} \equiv \sum_{i=1}^{12} \varepsilon_{t+i}.$$

We estimate the parameters in (7) and (8) using ordinary least squares (OLS). To use as much information, we use overlapping data.

Using the joint dynamics for dividend growth and the equity yields in (7) and (8), we can compute the conditional expectation of one-year dividend growth as:

$$\begin{aligned} E_t\left(\Delta d_{t+12}\right) &= \psi_0 + \psi_1' x_t \\ &\equiv \gamma_{0(1)} + \gamma_{1(1)}' x_t. \end{aligned}$$

as well the expectation of annual dividend growth n years ahead ($n > 1$):

$$\begin{aligned} E_t\left(\Delta d_{t+12n}\right) &= E_t\left(\psi_0 + \psi_1' x_{t+12(n-1)}\right) \\ &= \psi_0 + \psi_1' \left(\left[\sum_{i=0}^{n-2} \Gamma_A^i \right] \mu_A + \Gamma_A^{(n-1)} x_t \right) \\ &\equiv \gamma_{0(n)} + \gamma_{1(n)}' x_t. \end{aligned}$$

The equity yield can now be written as:

$$\begin{aligned} g_{t,n}^{\star} &= g_{t,n} + \theta_{t,n} \\ &= \frac{1}{n} \sum_{i=1}^{n} \left(\gamma_{0(n)} + \gamma_{1(n)}' x_t \right) + \theta_{t,n}. \end{aligned}$$

We observe the left-hand side, $g_{t,n}^{\star}$, and we estimate the first term on the right-hand side, which implies that we can also uncover the risk premium component, $\theta_{t,n}$.

In the same way as we use this framework to obtain expectations of future dividend growth, we can apply it to consumption and GDP growth expectations by changing the dependent variable in equation (7).

5 Summary statistics of equity yields

In this section, we summarize the properties of the equity yields for all three indices.

5.1 Equity yields of the S&P 500

The equity yields for the S&P 500 index between October 2002 and April 2011 are plotted in Figure 3. The four lines (in color) in each graph represent the equity yields for four horizons: 1, 2, 5, and 7 years. The graph shows that between 2003 and 2007, short-maturity equity yields were higher than long-maturity equity yields. During the financial crisis this pattern reversed and short-maturity equity yields plummeted compared to long-maturity equity yields. However, long-maturity equity yields also decreased substantially.

The 1-year equity yield for the S&P500 index displays a double dip, the first occurring on December 15th 2008 and the second occurring on March 4th of 2009, with values of -25.4% and -29.8%, respectively. The S&P 500 index level also exhibits a double dip, but the troughs occurred on November 20th 2008, with a level of 752.44 and March 5th with an index level of 682.55. The 2, 5, and 7 year equity yields do not exhibit a double-dip pattern and coincide with the second dip of the 1-year growth rate on March 4th, with values of -25.6%, -10.0% and -6.7% respectively. Finally, a very steep decline in the one-year rate occurred in October 2008 when the rate dropped from -6.3% on October 1st to -24.4% on October 30th. Interestingly, the S&P 500 index level during this period only dropped from 1161.1 on October 1st to 954.1 on October 30th, which is substantially higher than its two troughs of 752.44 and 682.55. Long-maturity equity yields decline further between October 30th 2008 and November 20th 2008 when the index dropped another 22% from 968.8 to 752.44, but short maturity equity yields, stay roughly constant.

In Figure 4, we plot the forward equity yields for maturities between 1 and 2 years ($n1 = 1$ and $n2 = 2$), 2 and 5 years ($n1 = 2$ and $n2 = 5$), and 5 and 7 years ($n1 = 5$ and $n2 = 10$). Interestingly, forward equity yields between 2 and 5 years and 5 and 7 years initially did not decrease during the crisis but increased instead, which suggests that market participants priced in a relatively fast recovery after the initial steep decline.

5.2 Equity yields of the Eurostoxx 50 Index

In Figure 5, we plot the equity yields for the Eurostoxx 50 index. As before, the four lines (in color) in each graph represent the equity yields for four horizons: 1, 2, 5, and 7 years.

The trough of the one-year rate occurs on March 31st 2009 with an equity yield of -41.1%. Similar to the S&P 500 index, the trough of the 1-year rate occurred after the trough of the index, with the latter occurring on March 9th 2009, when the index value hit 1810 Euros. Compared to the troughs of the S&P500 index, the troughs of the Eurostoxx 50 index occurred later, both for the index and for the 1-year expected growth rate.

As with the S&P500 index, there is one particular period of very steep decline for the one-year rate. Between October 1st and October 24th 2008 the one-year equity yield decreased from -8.4% to -39.7%. In Figure 6, we plot the forward equity yields. Similar to the expected forward growth rates of the S&P500 index, forward rates between 2 and 5 years and 5 and 7 years did not decrease during the crisis but increased instead.

5.3 Equity yields of the Nikkei 225

In Figure 7, we plot the equity yields for the Nikkei 225 index. The trough of the one-year rate occurs on March 25th 2009 with an equity yield of -44.3%. The index reached its trough on March 10th 2009 with an index level of 7055.0, which as with the other two indexes is before the 1-year growth rate reached its trough.

Between October 1st and October 30th 2008, the one-year equity yield decreased from -5.4% to -25.6%. Apart from this steep decline, there is no particular period over which the growth rate declined abruptly and the growth rate drifts downward gradually to its trough of -44.3%.

In Figure 8, we plot the forward equity yields. As for the S&P500 and the Eurostoxx 50 index, forward equity yields between 2 and 5 years and 5 and 7 years did not decrease during the crisis but increased instead.

5.4 Summary Statistics

In Table 1 we report the summary statistics of the equity yields for all three indexes and for all ten maturities. The average 1-year equity yield is highest for Japan (5.31%) and lowest for Europe (-1.2%). The average 1-year equity yield for the US is 3.4%. The average 7-year equity yield 2.6% for the US and Japan and -0.6% for Europe.

The volatilities of the equity yields decline monotonically with maturity for all three indices, reminiscent of bond yields (see for instance Dai and Singleton (2003)). The volatility of equity yields is highest for Japan and lowest for the US at all maturities. Further, over this sample period the equity yields are negatively skewed, which is induced by the large negative numbers during the financial crisis.

6 Do equity yields contain other information than bond yields?

To assess whether equity yields contain information beyond and above the information contained in bond yields, we compute the principal components of nominal and real bond yields and regress each of the equity yields on these principal components. In all cases, the first principal component explains more than 95% of the variation in either equity, nominal bond or real bond yields. Table 2 reports the R^2 values of these regressions. We only report results for the first two principal components for nominal and real bonds, because adding the third component leads to almost identical results as using two principal components. Furthermore, nearly all variation in nominal and real bond yields is captured by their first two principal components.

The table shows that the R^2-values when including the first two principal components of nominal yields are between 30 and 39%. The R^2 values are increasing in the maturity. The largest share of the variation is explained by the first principal component, and the second principal component does not seem to add much. When using the principal components of real yields, we find very low R^2 values, never exceeding 5%. However when we include the first two principal components of real yields and the first two principal components of nominal yields in one regression, the R^2 values jump up to 73% for the 1-year equity yield, and 60% for the 5-year equity yield. This still leaves a substantial fraction of the variation in equity yields that is unexplained by the term structure of interest rates.

To further assess the relation between bond yields and equity yields, Table 3 describes the correlations between the first two principal components of equity yields, the first two principal components of bond yields and the first two principal components of real yields. We find that equity yields seem generally positively correlated with nominal bond yields, but negatively correlated with real yields, both in levels as in innovations.

7 Predicting macro-economic growth

In this section, we study the predictability of dividend, consumption, and GDP growth by equity yields. This approach follows a long tradition in macro-finance using yield-based variables to forecast either returns or cash flows. Examples include Fama (1984) and Lustig, Roussanov, and Verdelhan (2010) for currency markets, Fama and Bliss (1987), and Campbell and Shiller (1991), and Cochrane and Piazzesi (2005) for bond markets, and Campbell and Shiller (1988), Cochrane (1991), and Binsbergen and Koijen (2010) for the aggregate stock market. In this paper, we explore whether the information contained in equity yields across maturities is useful to forecast various measures of economic growth across different horizons.

7.1 Predicting annual macro-economic growth

Dividend growth We first focus on the predictability of dividend growth by estimating equation (7). We focus on annual dividend growth to avoid the impact of seasonal patterns in corporate payout policies, but we use overlapping monthly observations to improve the power of our tests. The summed dividends within the year measure the annual aggregate dividend.[7]

We use either the 1-year, ..., 5-year equity yields to predict dividend growth, that is, $n = 1, \ldots, 5$. If the risk premium on short-term dividend strips is constant, then it holds that $\beta_1 = 1$. The evidence in Binsbergen, Brandt, and Koijen (2010) suggests, however, that the risk premium tends to fluctuate over time, which may induce a deviation from one. However, annual dividend growth reached a minimum -23% for the S&P500, -35% for the Eurostoxx 50, and -32% for the Nikkei 225. This unusual shift in growth rates, as so far anticipated, may help us uncover cash-flow predictability. In addition, how the predictive coefficient is affected also depends on the correlation between expected returns and expected growth rates.

The results are presented in Table 4. Panel A reports the results for the S&P500, Panel B for Eurostoxx 50, and Panel C for the Nikkei 225. The first column reports the point estimate. The second column reports the Newey-West test statistics using 12 lags. The final column reports the R-squared value. We find that all equity yields have strong predictive power for future dividend growth. The R-squared values are high, suggesting that dividend growth rates, at least during this sample period, are strongly predictable.

Second, we find that the predictive coefficients are monotonically increasing in maturity. As a point of reference, it may be useful to derive what these coefficients look like under two, admittedly strong, assumptions. Namely, if we assume that the risk premium on short-dividend strips is constant and expected dividend growth is an AR(1) process with autoregressive coefficient ρ, then it is straightforward to show that:

$$\beta_n \simeq \frac{n(1-\rho)}{1-\rho^n}. \tag{9}$$

This expression directly implies $\beta_1 = 1$, as discussed before. We can also solve for ρ for $n = 5$ given $\beta_5 = 2$. This corresponds to an annual autoregressive coefficient of $\rho = 0.64$.[8]

[7]We follow Fama and French (1988) and sum all dividends within the year. Alternatively, we can reinvest dividends at the 1-month T-bill as in Binsbergen and Koijen (2010). We obtain very similar results for both reinvestment policies.

[8]This calculation approximately results in the persistence of the equity yield if the persistence of expected returns and expected growth rates is identical.

Consumption growth The previous results show that our newly-constructed data is useful in forecasting future dividend growth. We now extend these results for the US and show that S&P500 equity yields also predict future annual consumption growth. We study the same forecasting regressions as before:

$$\log\left(\sum_{i=1}^{12} C_{t+12+i}\right) - \log\left(\sum_{i=1}^{12} C_{t+i}\right) = \gamma_n + \delta_n g^{\star}_{t,n} + \varepsilon^{C}_{t+24}, \tag{10}$$

where C_t is now quarterly consumption.[9]

We present the results in Panel A of Table 5. The structure of the table is the same in Table 4. Consistent with our results for dividend growth predictability, we uncover predictability of one-year consumption growth as well, using overlapping quarterly data. The coefficients are much smaller in this case, which follows from the fact that dividend growth is more volatile than consumption growth during our sample period. As expected, the coefficients are increasing with maturity as long-term equity yields are less exposed to fluctuations in short-term expected growth rates.

As a point of reference, we use in Panel B of Table 5 bond yields to forecast annual consumption growth. We use either the 1-year or the 5-year bond yield, or the yield spread between the 5-year and 1-year bond yields. Even though the 5-year bond yield is a fairly strong predictor of consumption growth, it is not nearly as powerful as the equity yields as reported in Panel A.

GDP growth In Panel A of Table 6, we study the predictive power of S&P500 equity yields for US GDP growth. We predict annual GDP growth, using quarterly overlapping data in estimation. Panel A reveals that equity yields are also strong predictors of annual GDP growth. For comparison, we report in Panel B of the same table the predictive power of bonds yields. The results resonate with our findings for consumption growth; equity yields appear to be better forecasters of future macro-economic growth than bond yields during our sample period.

8 Decomposing Equity Yields and Risk-premium dynamics

Figures 12 and 13 already suggest that the risk premium component may be quite large when expected growth rates do not fluctuate too much. This is consistent with Binsbergen, Brandt, and Koijen (2010) who show that short-maturity discount rates fluctuate substantially, which results in excess volatility for short-term dividend claims.

[9] We use real personal consumption expenditures (PCE) on nondurables and services.

In Figure 14, we plot the dynamics of the risk premium component, $\theta_{t,n}$, for the S&P500 data for 1-, 2-, and 5-year equity yields.

We find that all risk premium estimates fluctuate substantially over time. In fact, the estimates imply that the short-term risk premium component in fact fluctuates more than the longer-maturity component.[10] Perhaps most interestingly, we find that the term structure of risk premia is more inverted during the recession. The results in Binsbergen, Brandt, and Koijen (2010) already suggest that the risk premium component on the short-maturity dividend claims is on average higher than on the long-maturity dividend claims.[11] We extend this evidence by showing that the steepness of the decline in the term structure of risk premia is counter-cyclical.

In Figures 15, 16 and 17, we decompose the 2-year equity yields into expected growth rates and risk premia for all three regions. The plots clearly show that both risk premia and expected growth rates vary substantially over time. Furthermore, during the financial crisis, expected growth rates went down, whereas risk premia sharply increased.

9 Applications

9.1 Economic outlook around the world

Next, we use the framework we develop in Section 4 to compute longer-term growth expectations. Instead of using a single equity yield, we use two equity yields with maturities equal to 2 and 5 years, respectively. We use multiple equity yields as there may be separate factors driving expected growth rates and the risk premium component, as suggested by the models of Bansal and Yaron (2004), Lettau and Wachter (2007), Lettau and Wachter (2010), and Menzly, Santos, and Veronesi (2004).[12]

In Figures 9 and 10, we plot the 2-year and 5-year expected growth rates across regions. First, the troughs of the financial crisis for the 2-year expected growth rate were more severe for Japan and Europe than for the US. Second, 2-year expected growth rates decline by as much as 15% in Europe in the bottom of the crisis. Even during a 5-year period (Figure 10), the average decline in growth is still around 4% in the first months of 2009.

[10] The one-year risk premium component turns somewhat negative during the period 2006-2007, which is attributable to the short sample we have available. As an extension, one can consider to estimate the model under the condition that the risk premium component needs to be positive, see also Campbell and Thompson (2007).

[11] This is consistent with the models developed in Lettau and Wachter (2007), Lettau and Wachter (2010), Croce, Lettau, and Ludvigson (2009), Barro, Nakamura, Steinsson, and Ursua (2011), Lynch and Randall (2011), and Buraschi, Porchia, and Trojani (2010). However, this fact is challenging to other leading asset pricing models as suggested by Campbell and Cochrane (1999), Bansal and Yaron (2004), and Gabaix (2009).

[12] Other examples include Croce, Lettau, and Ludvigson (2009) and Bekaert, Engstrom, and Xing (2009).

We plot the term structures of expected growth during the last day of our sample period in Figure 12. For comparison, we plot in Figure 13 the equity yields, which is a combination of expected growth rates and a risk premium component. Even though the equity yields are quite different across maturities, the growth expectations are much closer together across regions. In all cases, there is a period of accelerated growth, corresponding to transitory shocks to dividends. Long-maturity growth expectations are closer to historical average dividend growth rates around 6-7% in the US, for instance.

9.2 Growth expectations and the financial crisis

In this section we study the term structure of growth during the financial crisis. We focus on particular months in which there was a large decline in either the short-term or the long-term growth rates (or both). Our main focus is on the S&P500 index.

9.2.1 November 2007

Between October 31st and November 29th 2007, the one-year equity yield (risk-neutral growth rate) for the S&P500 index decreased from 9.4% to 2.7%. The 5-year equity yield dropped from 5.5% to 3.6%, the 10-year equity yield dropped from 4.1% to 3.2% and the index value changed from 1549.4 to 1469.7, a drop of 5%. During this period several major events occurred. First, on October 31st, Meredith Withney, an analyst at Oppenheimer and Co. predicted that Citigroup had so mismanaged its affairs that it would have to cut its dividends or go bankrupt.[13] By the end of that day, Citigroup shares had dropped 8%, and four days later, Citigroup CEO Chuck Prince resigned. Also, on October 31st, the FOMC lowered the target rate by 25bp to 4.5%. Second, on November 2nd, the Fed approved the Basel II accord. Third, on November 27th, Citigroup raised $7.5 billion from the Abu Dhabi investment authority. Finally, the St. Louis Fed crisis time line notes for November 1st 2007: "Financial market pressures intensify, reflected in diminished liquidity in interbank funding markets."

9.2.2 September 2008

The month of September 2008 was a very turbulent month for financial markets. For example, on September 7th, the Federal Housing Finance Agency (FHFA) placed Fannie Mae and Freddie Mac in government conservatorship, and on September 15th, Lehman Brothers Holdings Incorporated files for Chapter 11 bankruptcy protection. Perhaps surprisingly, growth expectations for the US did not change all that much in September for all maturities. As an illustration, the 1-year yield was -6.2% on September 1st and -6.1% on September 30th, and the volatility of the 1-year equity yield was low. For the

[13] See "The Big Short" by Michael Lewis.

US, most of the drop in short- and long-term expectations occurred in October. Growth expectations in Japan and Europe on the other hand, did substantially drop in September as well as in October. For Europe, between September 1st and September 30th, the 1-year yield dropped from -3.9% to -7.9%, and the 10-year yield dropped from -0.8% to -1.8%. For Japan, the 1-year yield dropped from 5.6% to -4.6% and the 10-year yield dropped from 2.0% to 0%.

9.2.3 October 2008

During the month October the 1-year yield dropped from -6.3% on October 1st to -24.4% on October 30th. Over the same period, the 2-year yield dropped from -3.4% to -16.9%, the 5-year yield dropped from -0.5% to -5.8%, and the 10-year rate dropped from 0% to -1.4%. Several major events happen during this time period. Interestingly we find that the one of the largest drops in the one-year equity yield occurred around the time when former Federal Reserve chairman Alan Greenspan testifies before the House Committee of Government Oversight and Reform.

9.3 Growth expectations and the earthquake in Japan

The earthquake and subsequent tsunami in Japan in mid March of 2011 have had a significant impact on implied growth in Japan for all maturities. Growth rates for all maturities fell each day from Monday 14 to Thursday 17 March, to recover slightly on the joint G-7 intervention on Friday 18. The one-year equity yield dropped from almost 3% to more than -6.6% in the first four days, to rebound to -5% on Friday. Similarly, the 2-year equity yield dropped from 1.4% to -4.7% to settle at -4.2%. Even the 7-year equity yield changed from 0% to -2.3% and eventually settled at -1.8%. This indicates that financial markets expected long-lasting influence on Japanese economy, either due to growth expectations or risk premia. The US and Europe were much less affected by the Japanese situation, which illustrates that financial markets view these events as Japan-specific, rather than having an impact on global growth.

We use the same approach as before to extract the expected growth component from equity yields. Figure 11 displays the term structure of growth expectations in February 2011, while Figure 12 presents the results for April 2011. The growth expectations for Europe are unaltered by the events. During this period, the short-term growth expectations of the US slightly lowered, but the long-term growth expectations are unaffected. It is obviously unclear whether this can be attributed to the crisis in Japan. For Japan, by contrast, we see that the short-term growth expectations are adjusted by almost 5%.

10 Conclusion

We use a new data set on dividend futures with maturities up to 10 years to uncover expected dividend growth rates across three major regions around the world: the US, Europe, and Japan. We use these futures to derive equity yields, analogous to bond yields, and decompose these yields into expected growth rates of dividends and a risk premium component. We find that both risk premia as well as expected growth rates exhibit substantial variation over time. Further, we find that equity yields are important leading indicators of economic growth as measured by GDP growth, consumption growth, and dividend growth, particularly in periods when nominal bond yields are at the zero lower bound. We relate the dynamics of growth expectations to recent events related to the financial crisis and the recent turmoil following the earthquake in Japan.

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Maturity in years	1	2	3	4	5	6	7
S&P500 Index (Oct 2002 - Apr 2011)							
Mean	0.0337	0.0295	0.0288	0.0285	0.0277	0.0267	0.0263
Stdev	0.0964	0.0768	0.0571	0.0468	0.0402	0.0358	0.0329
Median	0.0639	0.0523	0.0417	0.0392	0.0341	0.0298	0.0251
Min	-0.2986	-0.2559	-0.1727	-0.1272	-0.1002	-0.0806	-0.0671
Max	0.1736	0.1385	0.1380	0.1134	0.1073	0.1008	0.0932
DJ Eurostoxx 50 Index (Oct 2002 - Apr 2011)							
Mean	-0.0116	-0.0206	-0.0156	-0.0119	-0.0089	-0.0083	-0.0063
Stdev	0.1435	0.1251	0.0921	0.0716	0.0582	0.0495	0.0424
Median	0.0208	-0.0038	-0.0032	-0.0077	-0.0082	-0.0097	-0.0092
Min	-0.4179	-0.4211	-0.3122	-0.2421	-0.1963	-0.1640	-0.1390
Max	0.2698	0.2120	0.1630	0.1333	0.1150	0.1053	0.0900
Nikkei 225 Index (Jan 2003 - Apr 2010)							
Mean	0.0531	0.0351	0.0303	0.0289	0.0282	0.0271	0.0260
Stdev	0.1780	0.1452	0.1107	0.0901	0.0761	0.0656	0.0570
Median	0.0375	0.0256	0.0184	0.0130	0.0101	0.0091	0.0095
Min	-0.4429	-0.4147	-0.3072	-0.2305	-0.1810	-0.1458	-0.1206
Max	0.3471	0.2545	0.2136	0.1822	0.1610	0.1406	0.1231

Table 1: Summary statistics equity yields

Maturity	n=1	n=2	n=3	n=4	n=5
Right hand side variables					
PC1 nominal bonds	0.3030	0.2995	0.3413	0.3703	0.3768
PC1 + PC2 nominal bonds	0.3163	0.3105	0.3413	0.3728	0.3831
PC1 real bonds	0.0371	0.0372	0.0129	0.0041	0.0012
PC1 + PC2 real bonds	0.0458	0.0442	0.0150	0.0042	0.0013
PC1 + PC2 nominal and PC1 + PC2 real bonds	0.7483	0.7059	0.6585	0.6473	0.6071

Table 2: R^2 values of contemporaneous regressions of equity yields, with maturities n=1,...5 years on principal components of nominal and real bond yields. We use the first two principal We use monthly observations between October 2002 and March 2011.

Correlations

Panel A: Levels

	PC1 Eq	PC2 Eq	PC1 Nom B.	PC2 Nom B.	PC1 Real B.	PC2 Real B.
PC1 Equity	1	0	0.60	-0.05	-0.06	-0.04
PC2 Equity		1	-0.06	-0.36	-0.50	-0.27
PC1 Nom Bonds			1	0	0.59	-0.26
PC2 Nom Bonds				1	0.14	0.86
PC1 Real Bonds					1	0
PC2 Real Bonds						1

Panel B: Innovations

	PC1 Eq	PC2 Eq	PC1 Nom B.	PC2 Nom B.	PC1 Real B.	PC2 Real B.
PC1 Equity	1	-0.05	0.40	-0.23	-0.28	-0.14
PC2 Equity		1	0.03	0.07	-0.30	0.03
PC1 Nom Bonds			1	-0.76	0.28	-0.65
PC2 Nom Bonds				1	-0.31	0.74
PC1 Real Bonds					1	-0.17
PC2 Real Bonds						1

Table 3: Correlations between principal components. The Panel A describes correlations in levels, and Panel B describes the correlation in innovations of a VAR(1) model of all six variables.

Panel A: S&P500

n	β_n	t-statistic	R-squared
1	0.88	22.75	76%
2	1.09	16.33	70%
3	1.40	7.20	60%
4	1.66	4.99	53%
5	1.86	3.85	48%

Panel B: Eurostoxx 50

n	β_n	t-statistic	R-squared
1	0.93	12.39	73%
2	1.01	10.05	69%
3	1.44	11.64	69%
4	1.87	13.19	65%
5	2.29	12.59	62%

Panel C: Nikkei 225

n	β_n	t-statistic	R-squared
1	0.63	9.14	65%
2	0.76	10.95	65%
3	1.03	10.69	64%
4	1.29	9.10	63%
5	1.53	7.90	62%

Table 4: Predictability of dividend growth by equity yields

Panel A: Consumption growth predictability by equity yields

	Estimate	T-statistic	R-squared
5-year	0.16	2.48	18.9%
4-year	0.16	2.86	23.2%
3-year	0.14	3.29	28.6%
2-year	0.12	3.97	36.9%
1-year	0.10	4.24	40.0%

Panel B: Consumption growth predictability by nominal bond yields

	Estimate	T-statistic	R-squared
1-year	0.20	1.18	4.9%
5-year	0.64	2.20	15.2%
5-1-year	-0.01	-0.02	0.0%

Panel C: Consumption growth predictability by real bond yields

2-year	-0.14	-0.49	1.1%
5-year	-0.15	-0.32	0.4%
5-2-year	0.66	1.16	5.8%

Table 5: Predictability of consumption growth by equity yields (Panel A) and bond yields (Panel B).

Panel A: GDP growth predictability by equity yields

	Estimate	T-statistic	R-squared
5-year	0.22	2.41	20.2%
4-year	0.22	3.37	24.6%
3-year	0.19	4.71	29.3%
2-year	0.15	9.20	38.5%
1-year	0.13	9.27	40.4%

Panel B: GDP growth predictability by nominal bond yields

	Estimate	T-statistic	R-squared
1-year	0.19	0.68	2.4%
5-year	0.72	1.61	11.4%
5-1-year	0.167	0.38	0.4%

Panel B: GDP growth predictability by real bond yields

	Estimate	T-statistic	R-squared
2-year	-0.32	-0.96	3.4%
5-year	-0.43	-0.78	1.8%
5-2-year	1.15	1.84	10.4%

Table 6: Predictability of GDP growth by equity yields (Panel A) nominal bond yields (Panel B) and real bond yields (Panel C).

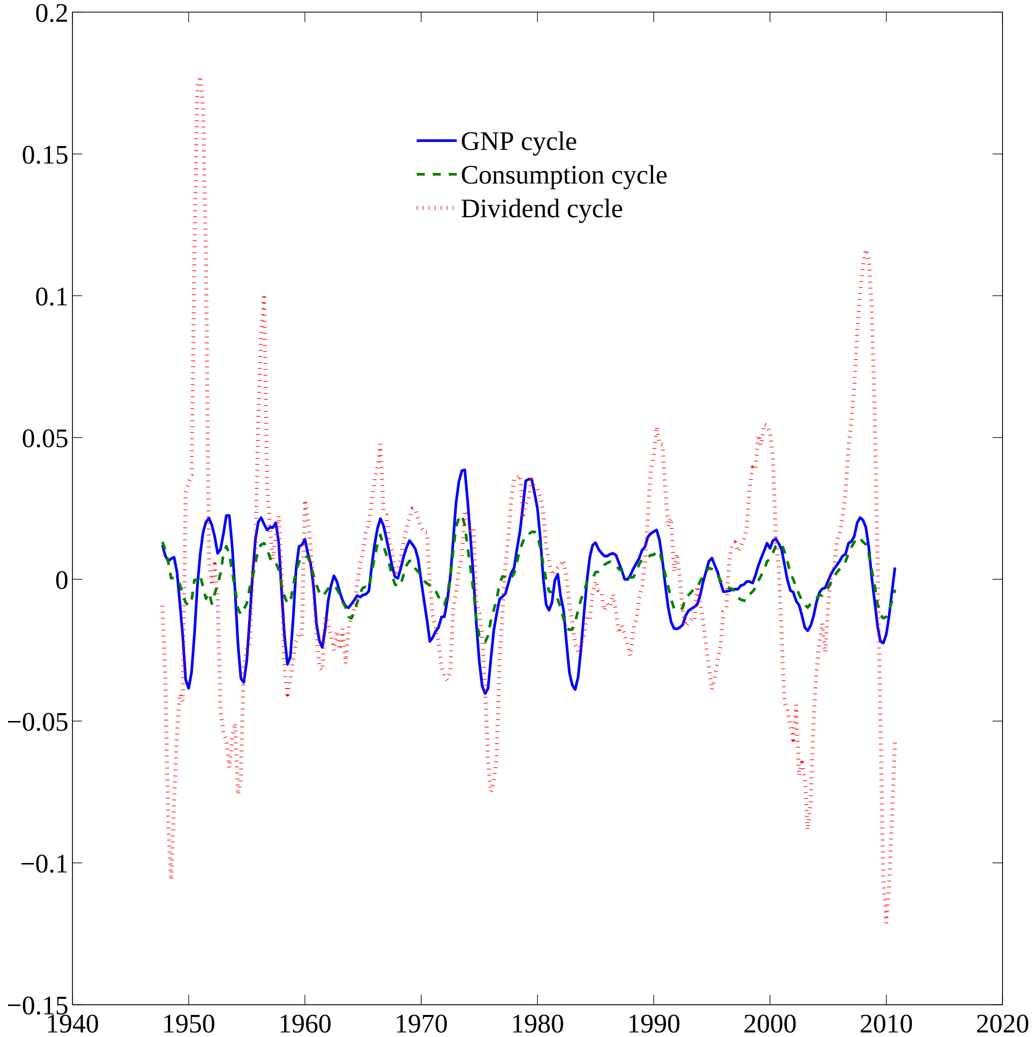

Figure 1: Cyclical components of GNP, consumption, and dividends
The graph displays the cyclical residue of Hodrick-Prescott filtered series for real GNP, real consumption (nondurables and services) and dividends.

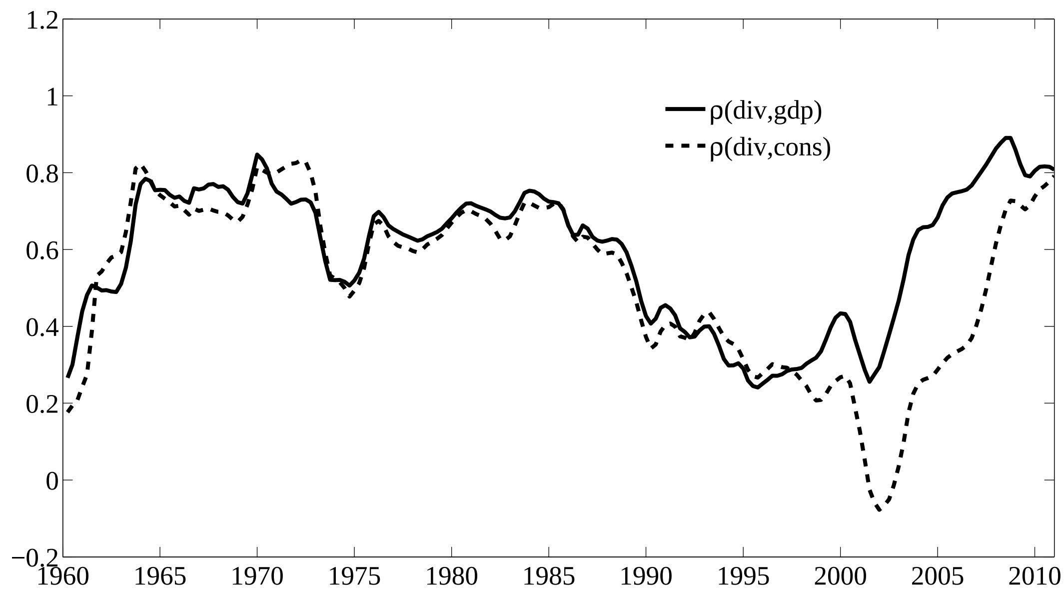

Figure 2: Rolling correlations between the cyclical components of consumption, GNP, and dividends

The graph displays the rolling correlation between the cyclical residue of Hodrick-Prescott filtered series for real GNP, real consumption (nondurables and services) and dividends. We use a 10-year window to construct the correlations.

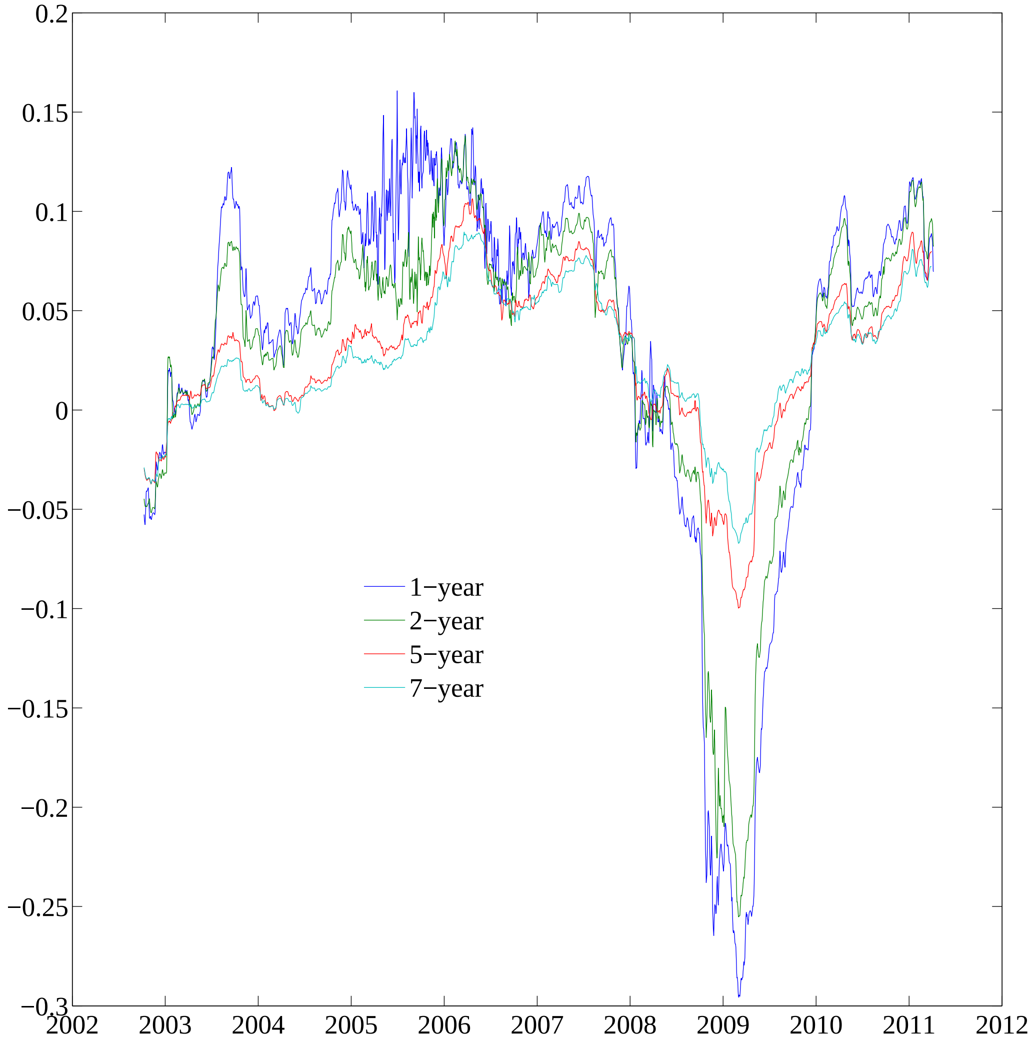

Figure 3: Equity yields: S&P500 Index
The graph displays the equity yields $g^{\star}_{t,n}$ for $n = 1, 2, 5, 7$ years for t varying between October 7th 2002 and April 8th 2011.

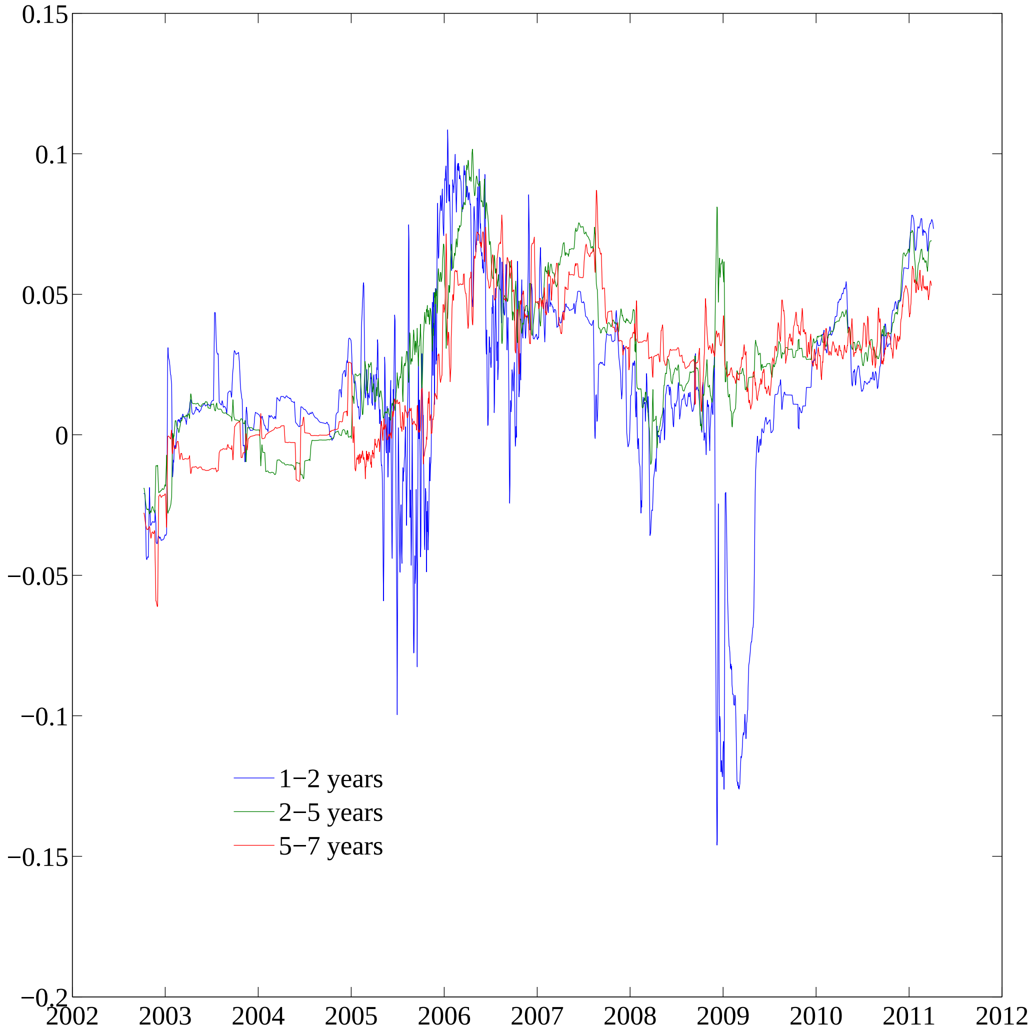

Figure 4: Forward equity yields: S&P500 Index
The graph displays the forward equity yields $f_{t,n1,n2}$ for $n_1 = 1, 2$ and 5 years and $n_2 = 2, 5$ and 7 years.

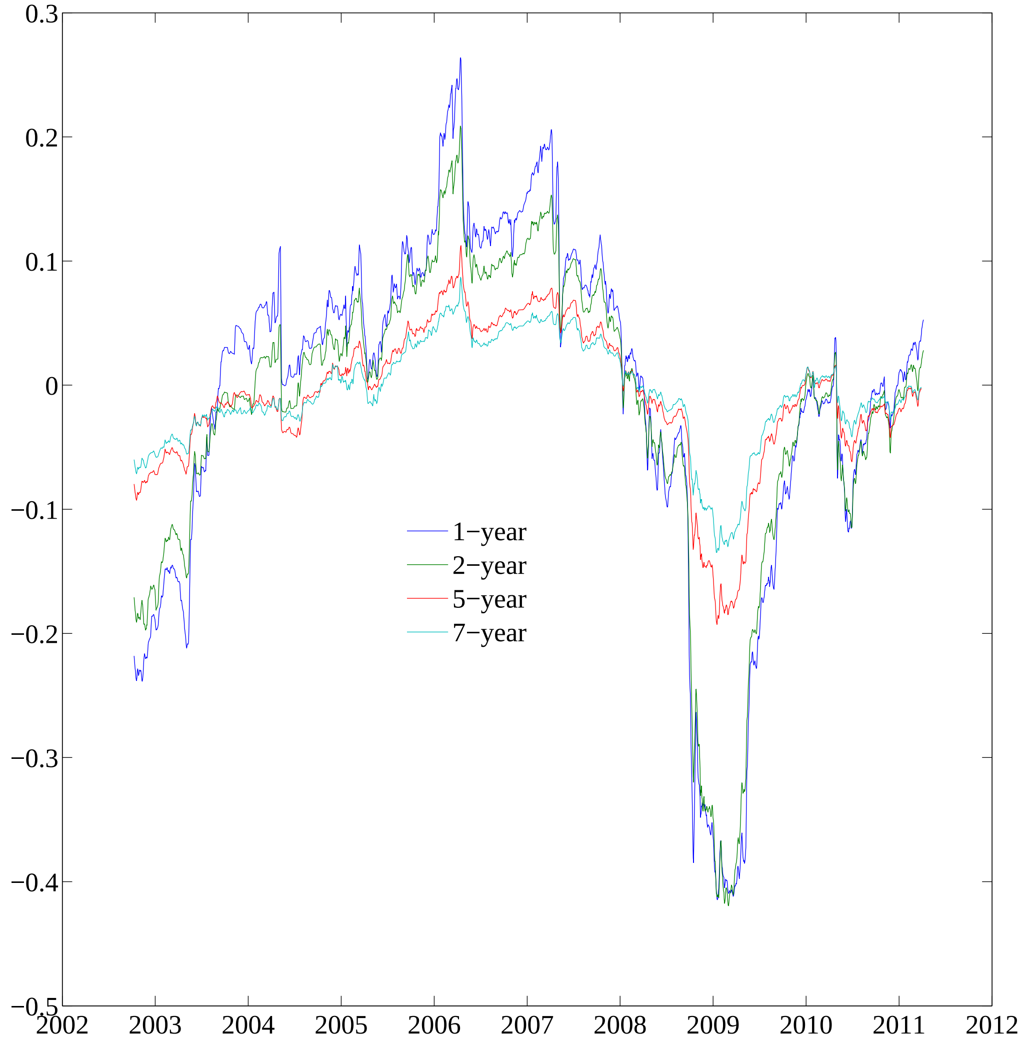

Figure 5: Equity yields: DJ Eurostoxx 50 Index
The graph displays the equity yields $g^{\star}_{t,n}$ for $n = 1, 2, 5$ and 7 years for t varying between October 7th 2002 and April 8th 2011.

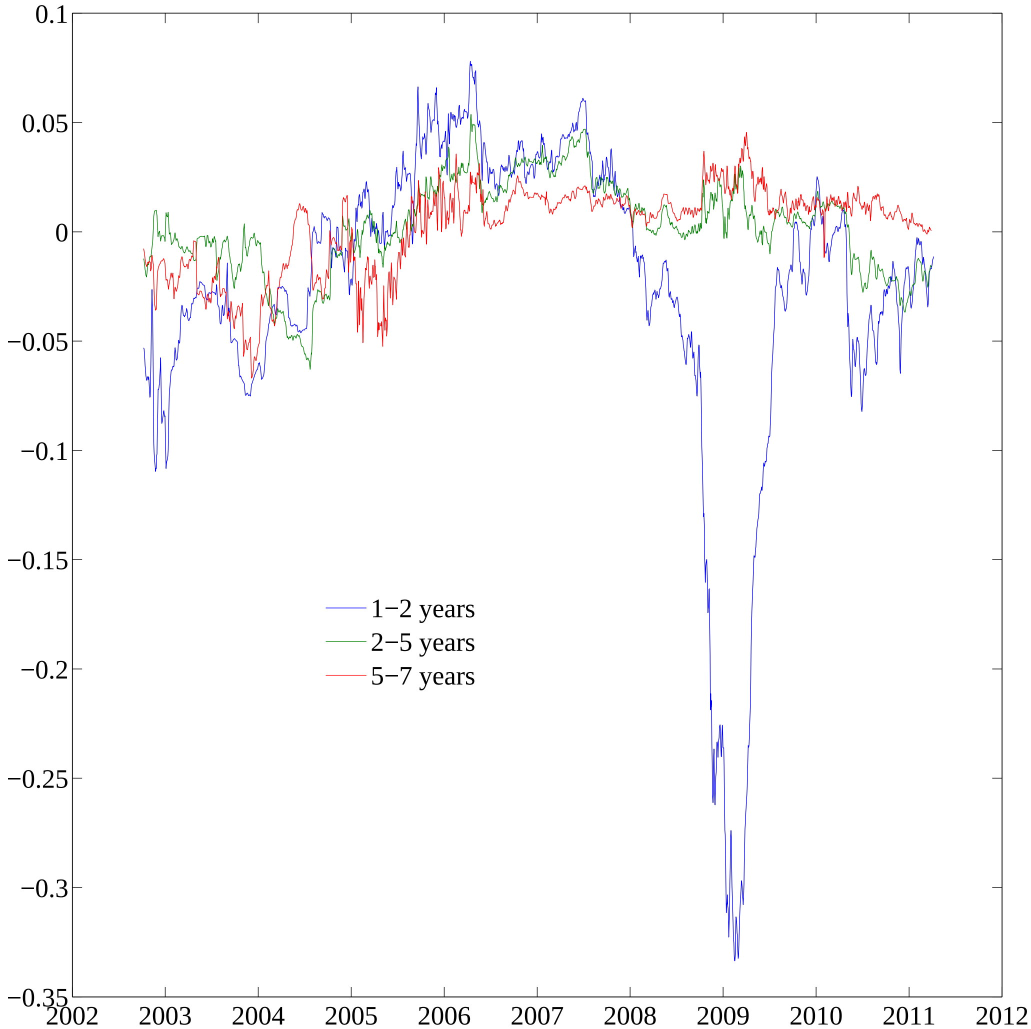

Figure 6: Forward equity yields: DJ Eurostoxx 50 Index
The graph displays the forward equityyields $f_{t,n1,n2}$ for $n_1 = 1, 2$ and 5 years and $n_2 = 2, 5$ and 10 years.

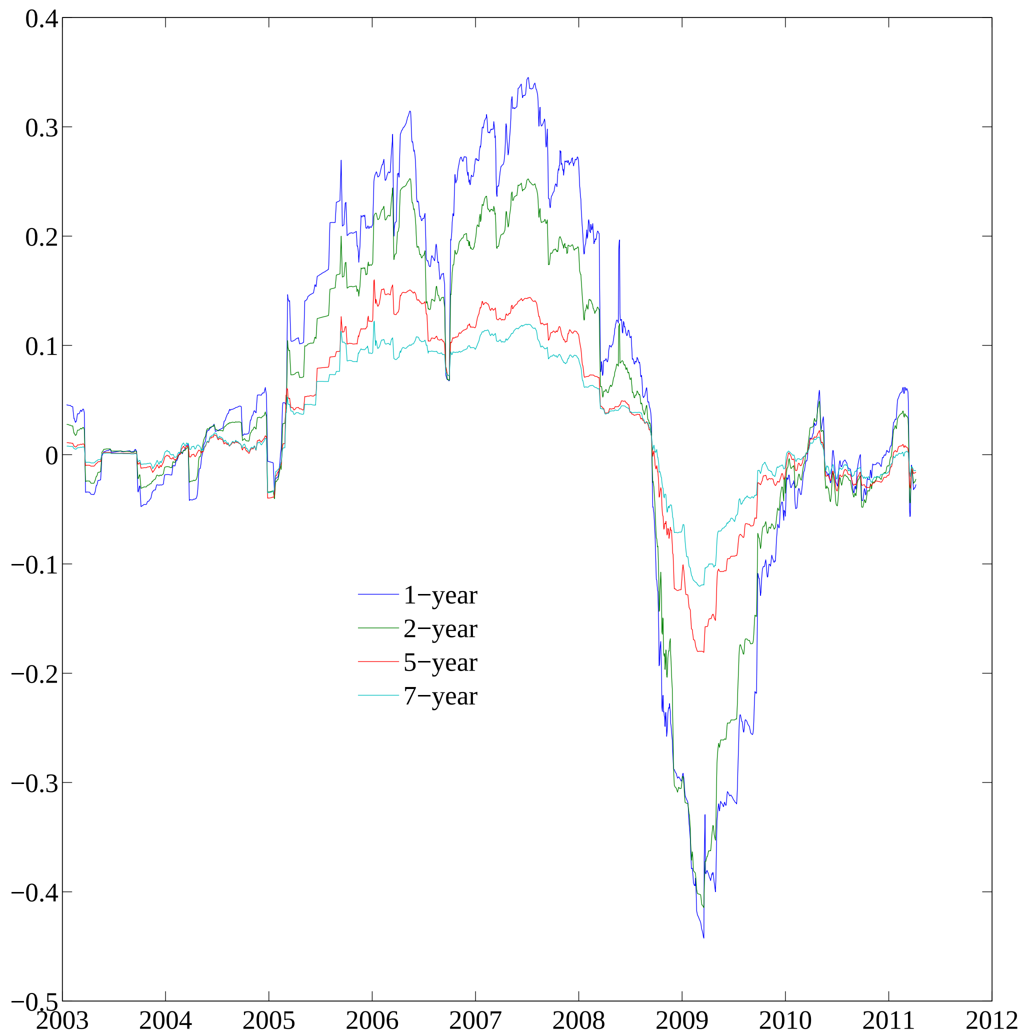

Figure 7: Equity yields: Nikkei 225 Index
The graph displays the equity yields $g^{\star}_{t,n}$ for $n = 1, 2, 5$ and 10 years for t varying between October 7th 2002 and April 8th 2011.

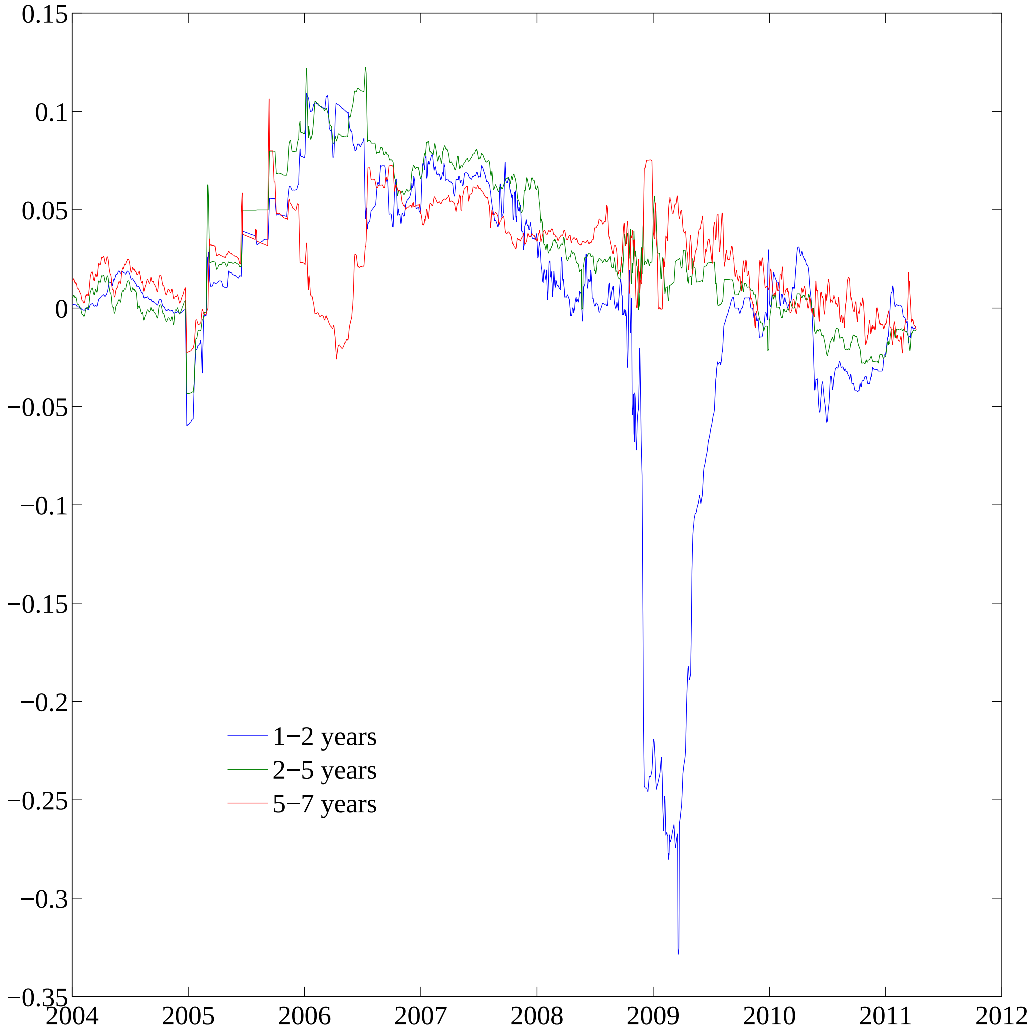

Figure 8: Forward equity yields: Nikkei 225 Index
The graph displays the forward equity yields $f_{t,n1,n2}$ for $n_1 = 1, 2$ and 5 years and $n_2 = 2, 5$ and 10 years.

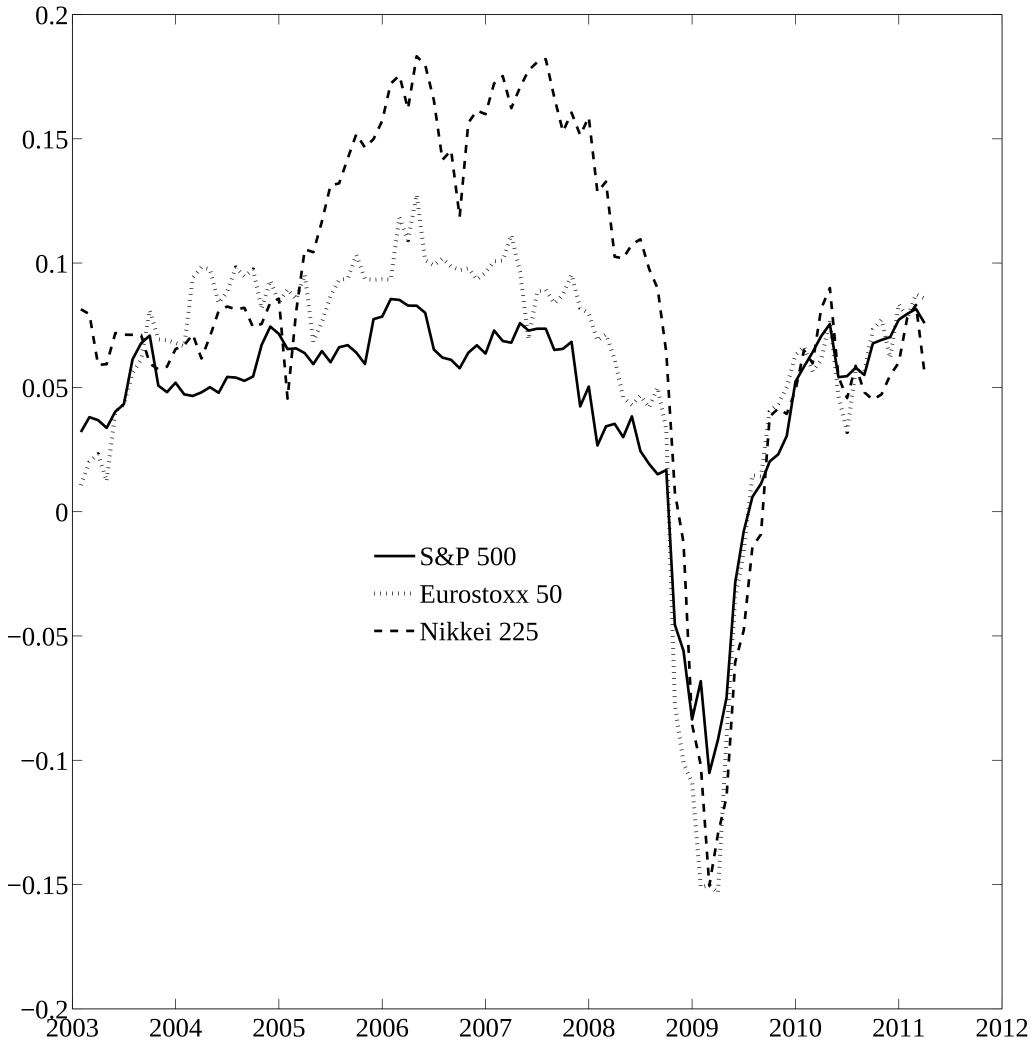

Figure 9: 2-year expected dividend growth across regions
The graph displays the expected growth rate $g_{t,n}$ for $n = 2$ years for t varying between January 14th 2003 and April 8th 2011 for three regions: the US (as represented by the S&P500 Index), Europe (as represented by the DJ Eurostoxx 50 index), and Japan (as represented by the Nikkei 225 index).

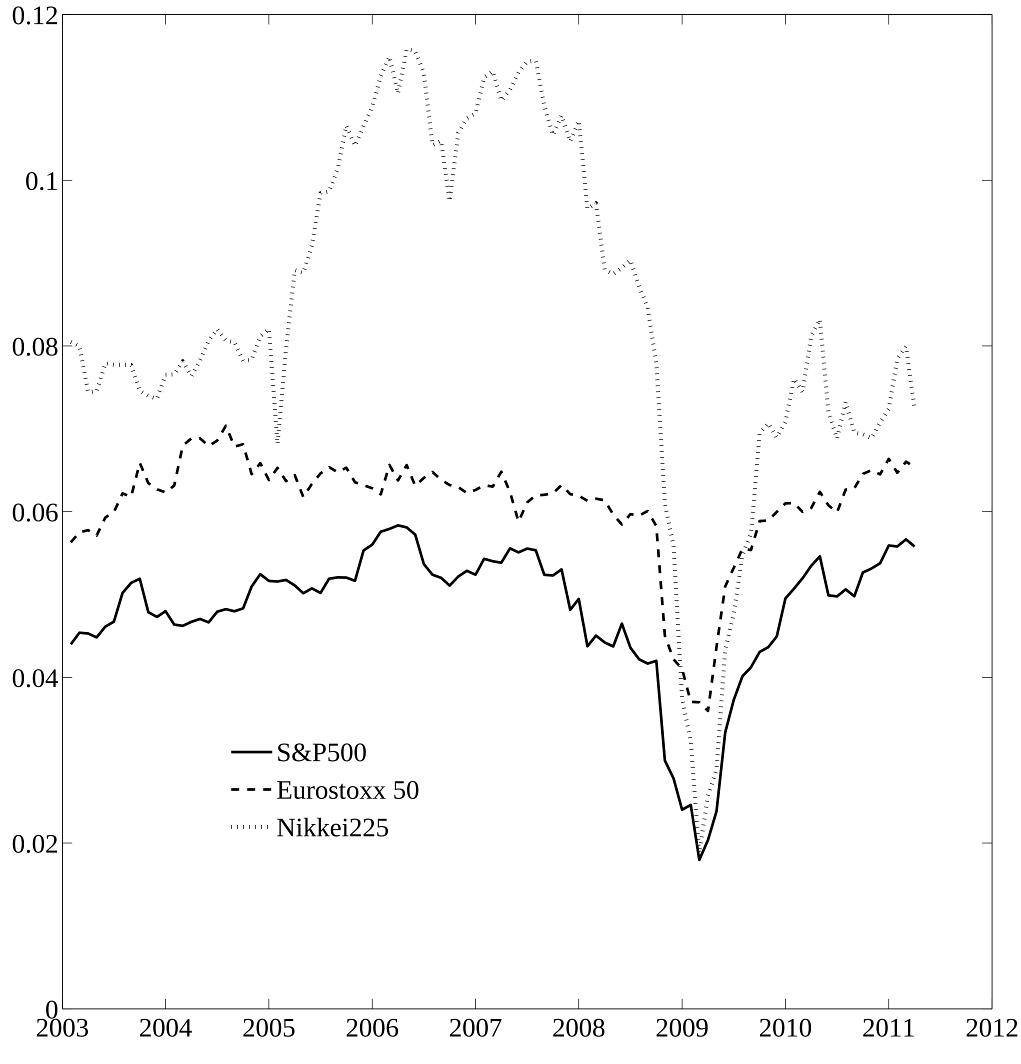

Figure 10: 5-year expected dividend growth across regions
The graph displays the expected growth rate $g_{t,n}$ for $n = 5$ years for t varying between January 14th 2003 and April 8th 2011 for three regions: the US (as represented by the S&P500 Index), Europe (as represented by the DJ Eurostoxx 50 index), and Japan (as represented by the Nikkei 225 index).

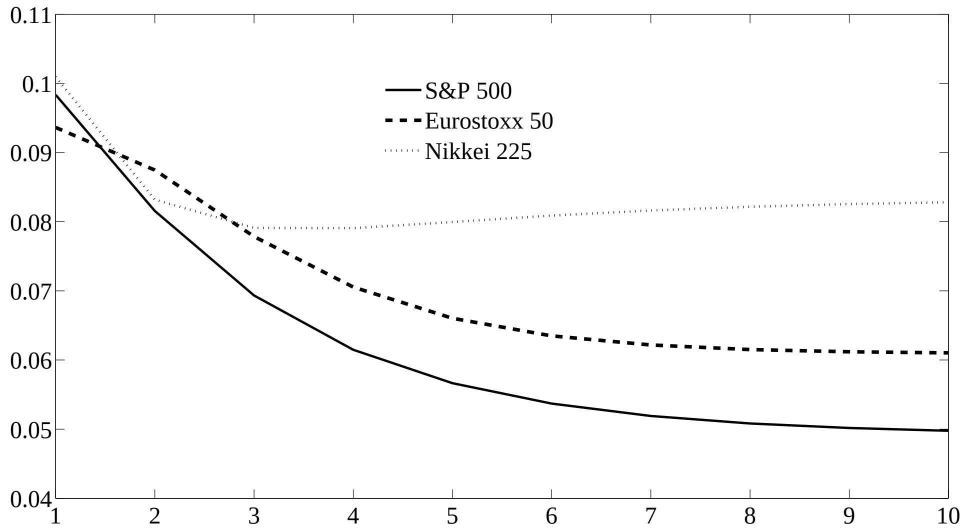

Figure 11: Term structure of expected growth on February 28th 2011
The graph displays the equity yields $g_{t,n}$ for $n = 1, .., 10$ years for t equals February 28th 2011 for three regions: the US (as represented by the S&P500 Index), Europe (as represented by the DJ Eurostoxx 50 index), and Japan (as represented by the Nikkei 225 index).

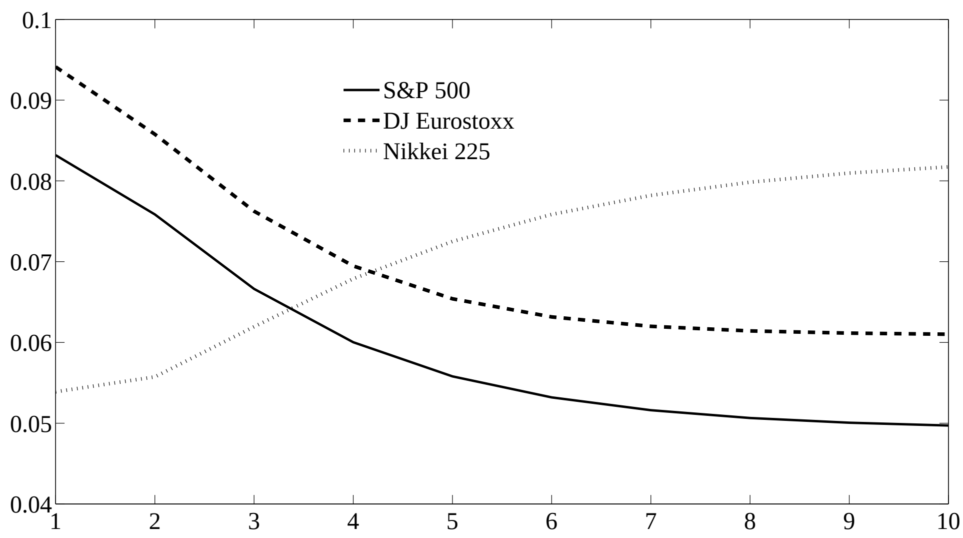

Figure 12: Term structure of expected growth on April 8th 2011
The graph displays the equity yields $g_{t,n}$ for $n = 1, .., 10$ years for t equals April 8th 2011 for three regions: the US (as represented by the S&P500 Index), Europe (as represented by the DJ Eurostoxx 50 index), and Japan (as represented by the Nikkei 225 index).

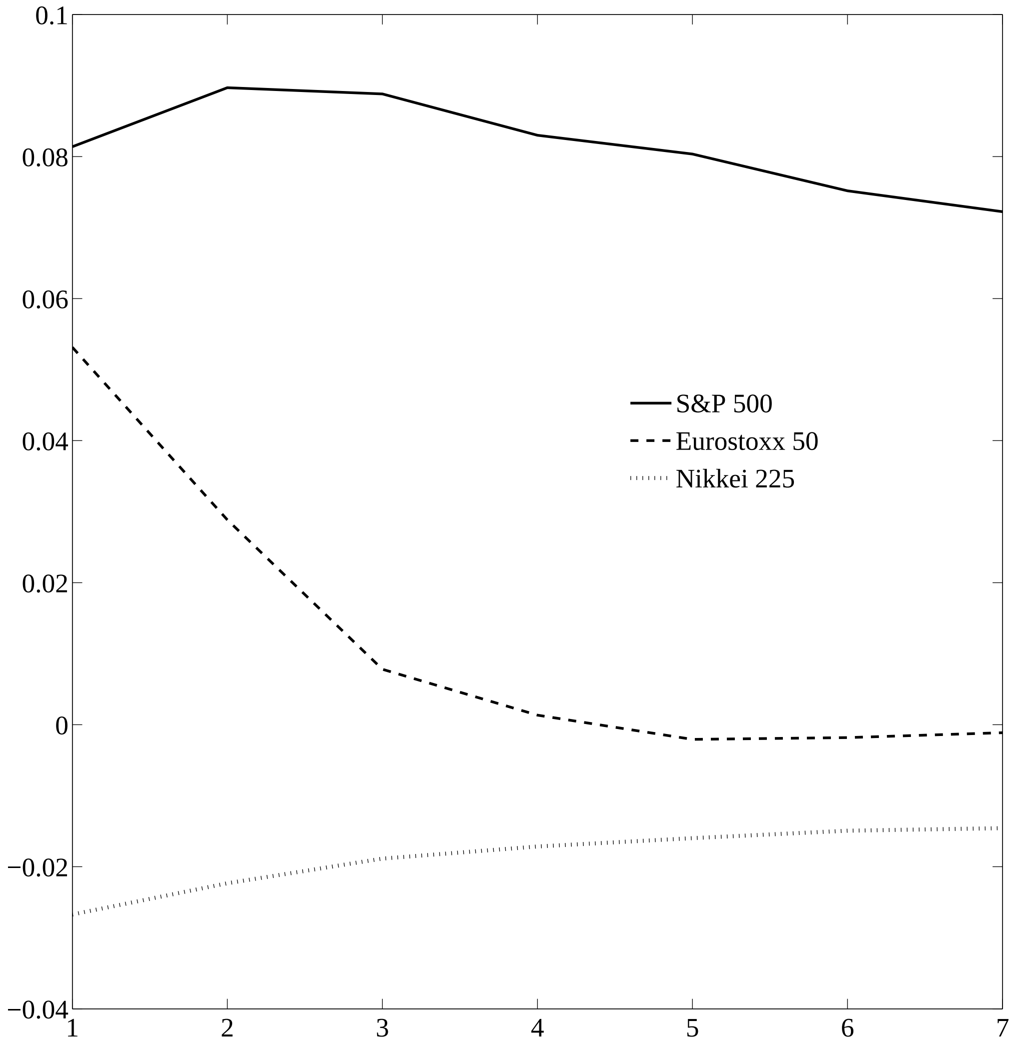

Figure 13: Term structure of equity yields on April 8th 2011
The graph displays the equity yields $g^{\star}_{t,n}$ for $n = 1, .., 10$ years for t equals April 8th 2011 for three regions: the US (as represented by the S&P500 Index), Europe (as represented by the DJ Eurostoxx 50 index), and Japan (as represented by the Nikkei 225 index).

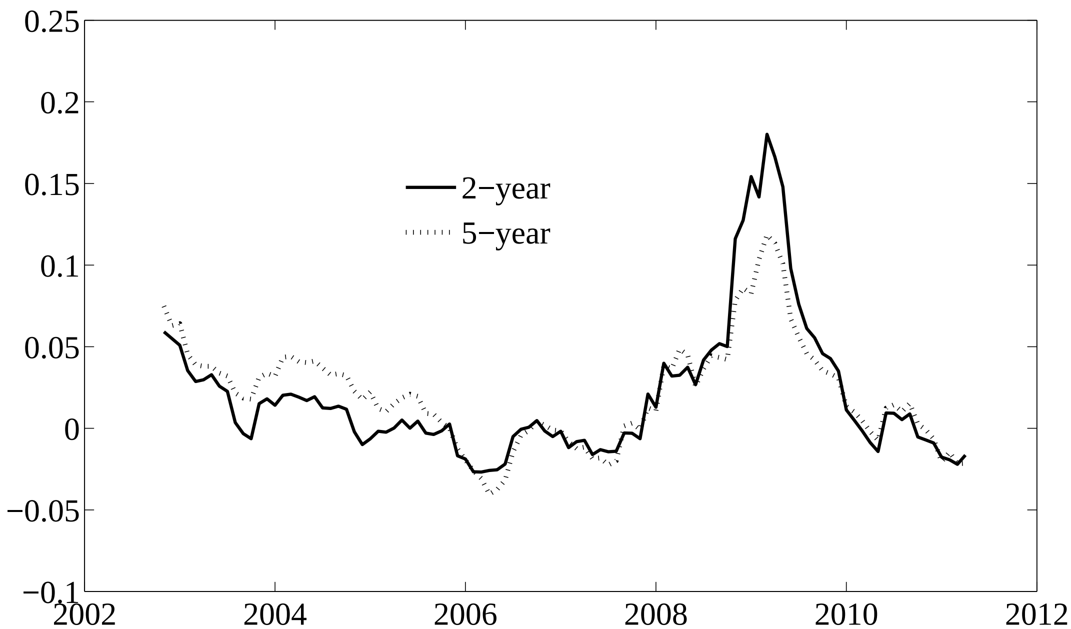

Figure 14: Risk-premium dynamics across maturities
The graph displays the risk premium component for 1-, 2-, and 5-year equity yields for the S&P500 data.

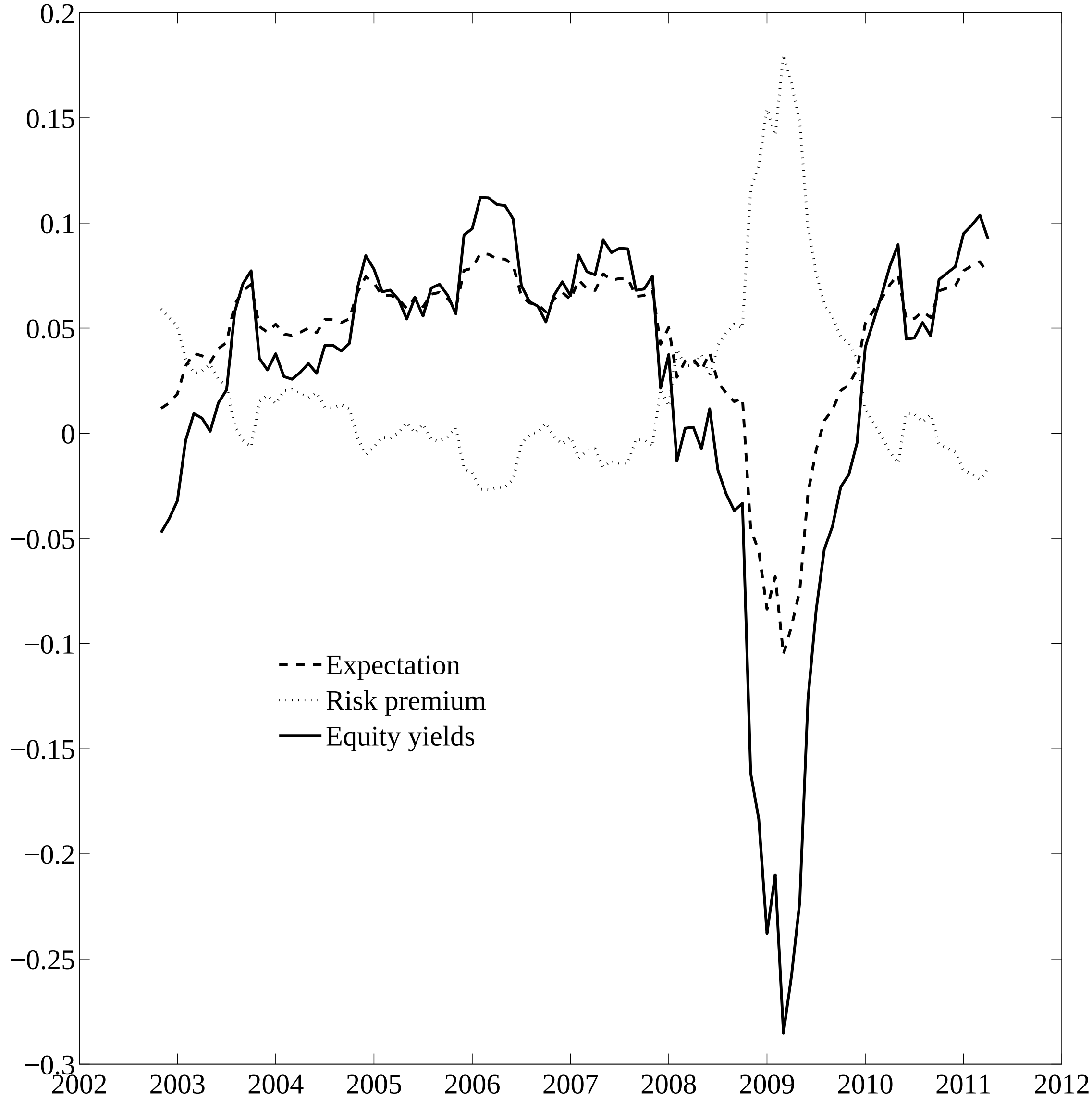

Figure 15: Decomposition of 2-Year Equity Yields
The graph decomposes the 2-year equity yield of the S&P500 index into expected dividend growth and a risk premium component.

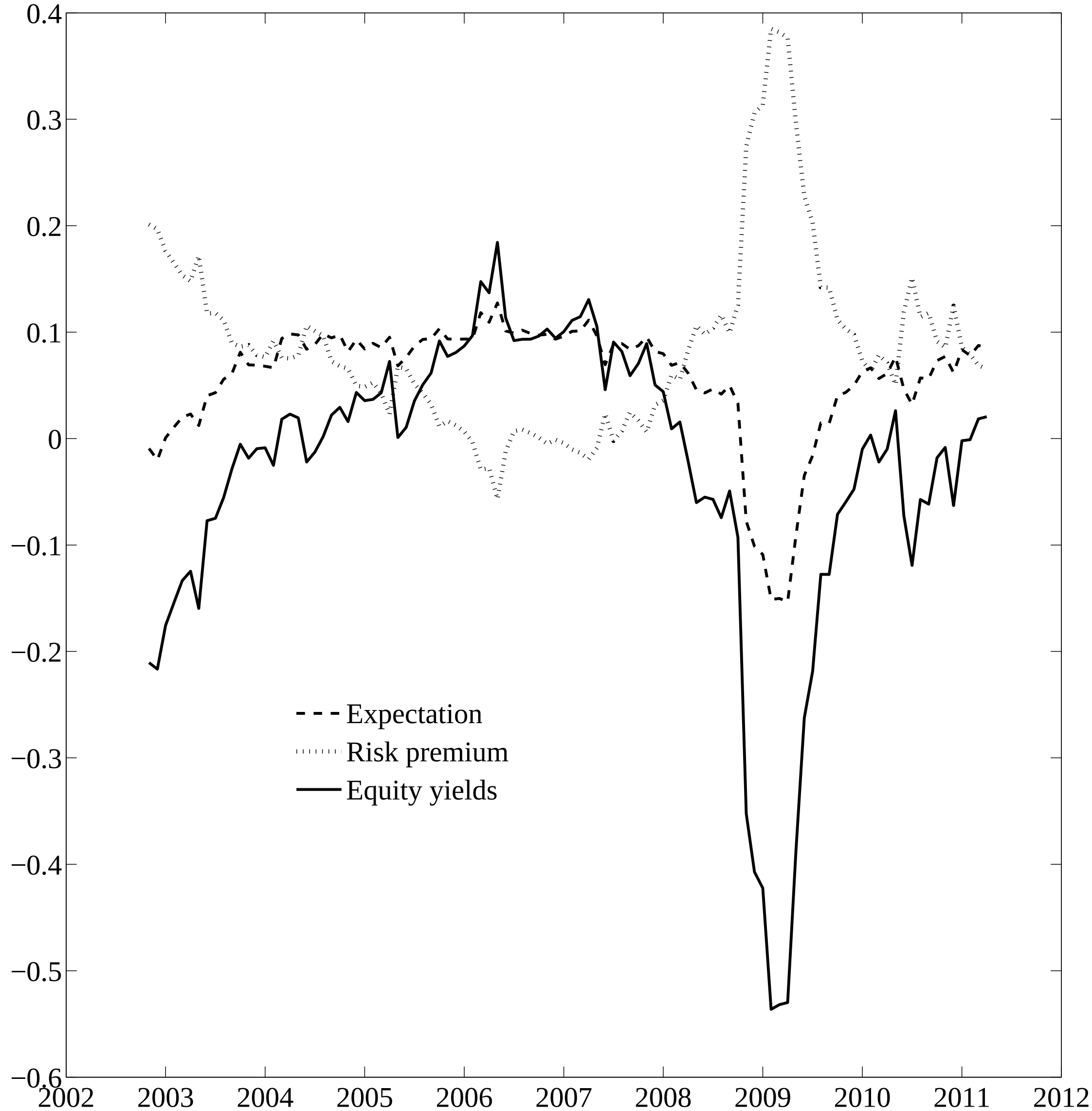

Figure 16: Decomposition of 2-Year Equity Yields
The graph decomposes the 2-year equity yield of the Eurostoxx 50 index into expected dividend growth and a risk premium component.

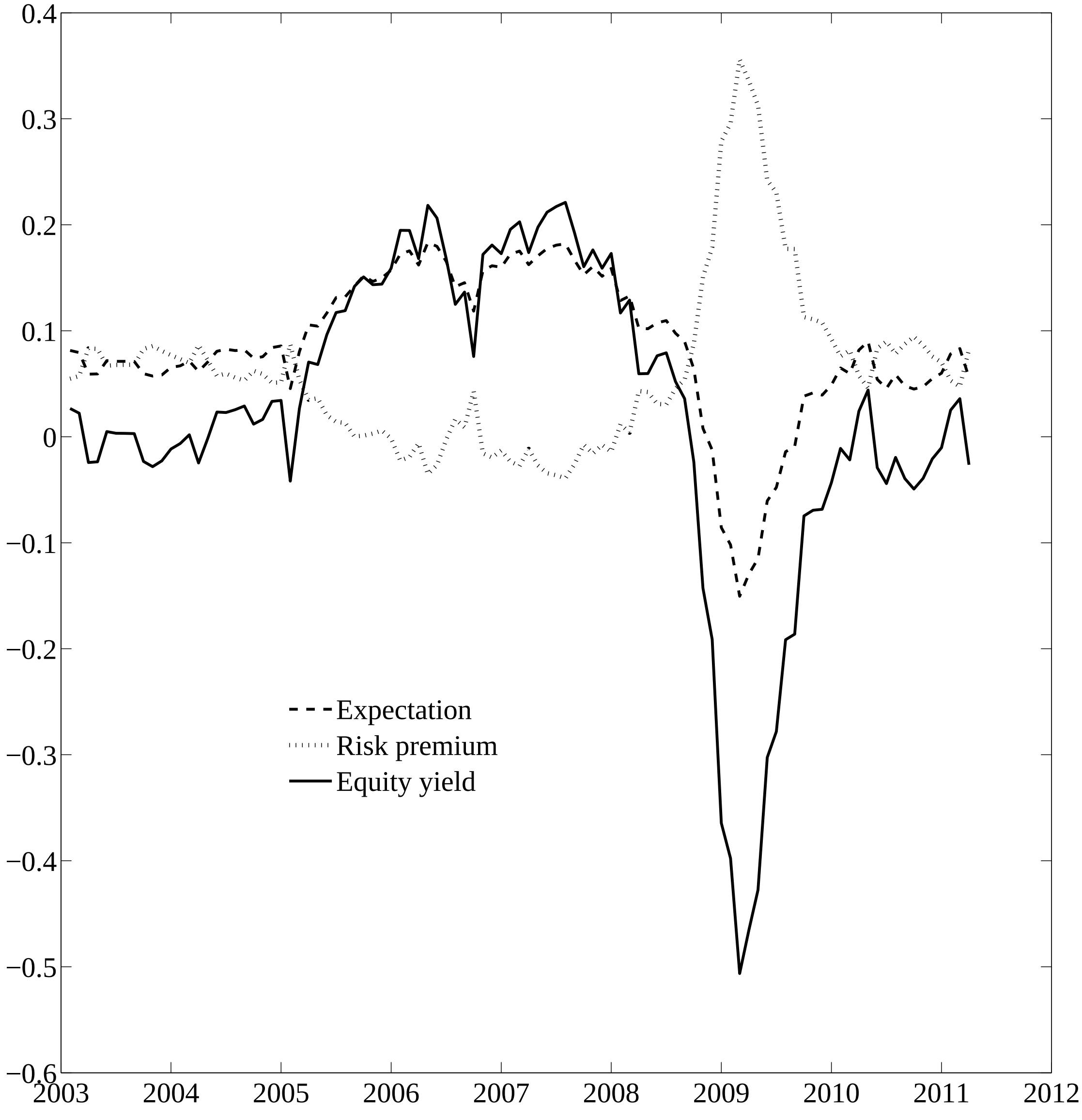

Figure 17: Decomposition of 2-Year Equity Yields
The graph decomposes the 2-year equity yield of the Nikkei index into expected dividend growth and a risk premium component.