Predicting GDP Growth with Stock and Bond Markets: Do They Contain Different Information?

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Abstract

This paper examines the ability of bond and stock markets to predict subsequent GDP growth over a range of horizons for twelve international countries. The results, using linear, probit, time- and regime-varying in-sample regressions and out-of-sample forecasting, confirm the view that both financial markets exhibit predictive power for future output growth. Moreover, there is notable variation within the strength of the predictive relation, for example, predictive power increases during the financial crisis period. Results suggest that while the term structure arguably exhibits stronger predictive power, both series contain distinct predictive information. Notably, predictive power emanating from the stock return series appears stronger over shorter (up to four-quarter) time horizons, while the term structure series exhibits more consistent predictive power over a range of horizons. Considering different regimes, we observe that the bond market exhibits greater predictive power for a flatter yield curve and lower stock prices relative to fundamentals, while the stock market exhibits greater predictive power for a steeper yield curve and higher relative stock prices. This suggests that the two financial markets exhibit different information content for future output growth. This view is further supported by forecast results whereby a model that includes both financial series outperforms a model that only includes one. Forecast encompassing tests further support the view that stock returns contain additional information over that presented by the term structure alone.

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1. Introduction.

Financial markets are a window on to the future movements of the macroeconomy. Changes in the behaviour of financial asset returns reflect varying degrees of investor confidence in future economic conditions. An expectation of a future improvement in the economy will see a rise in current stock prices and market interest rates. Investors wish to hold the stocks of companies who they believe will see future earnings rise. Equally, long-term interest rates will rise as households and firms increase spending for consumption and investment purposes. Such relations, indicating a direction of causality from movements in financial markets to movements in economic aggregates, are well grounded in economic theory.[1] That bond and stock markets can predict future output growth has a long history in empirical research (e.g., Harvey 1989, 1991; Estrella and Hardouvelis, 1991; Estrella and Mishkin, 1998) and is reviewed in the work of Stock and Watson (2003) and Wheelock and Wohar (2009). However, empirical evidence in support of the positive effect noted above is mixed. Notably, Stock and Watson (2003) highlight the mixed nature of the results, varying over countries and time. In the light of the conflicting evidence, this paper reassesses the empirical evidence but with emphasis on both time- and regime-variation and out-of-sample forecast power. Thus, seeking to understand whether the information content from the two financial markets occurs over different phases such that they do contain unique information.

The recent past has seen interest rates affected by both quantitative easing, which is targeted at influencing long-rates, and very low policy rates, which will influence short-rates. Equally, stock prices have experienced large swings through the late 1990s and 2000s with the dotcom bubble, crash and recovery before the financial crisis crash and recovery. This raises the question of whether any predictive power from financial markets to output growth continues to exist. Chinn and Kucko (2015) argue that predictive power is enhanced with

[1] See for example, the discussion in Morck et al (1990).

increased economic volatility, while Kuosmanen and Vataja (2018) argue that forecast power is linked to turbulent economic conditions. Hence, this paper seeks to examine whether the mixed nature of the existing empirical evidence for the term structure of interest rates or stock returns to predict future output growth arises from time-, or other forms of, variation. Financial markets can act in an important leading indicator role for subsequent economic activity. Thus, the ability of the movements in financial asset returns to predict recessions or periods of economic stress can signal the need for policy-makers to act accordingly and thus the results here carry important implications.

The term structure of interest rates between long and short dated government debt indicates the difference between the rate of return on real investments that dominates the long term yield and the current policy rate that dominates short term yields. Thus, the slope of the term structure represents investor views on how current policy will affect future economic activity. A steepening of the yield curve will indicate that investors expect future output growth and inflation to rise, while a flat or negative slope is synonymous with recessionary expectations. Evidence in favour of the term structure providing predictive content for future output growth is provided by Estrella and Hardouvelis (1991), Harvey (1997), Estrella and Mishkin (1998) and Lange (2018) and this includes both predictive regressions for output growth and indicator regressions for recessionary periods.

Stock returns represent movements in investor expectations of the discounted stream of future earnings. Where investors expect subsequent economic activity to increase, this will result in higher expected earnings and a lower expected discount rate (risk premium). Thus, a rise in current returns can signal a future economic expansion. Early evidence (e.g., Fischer and Merton, 1984; Fama, 1990; Schwert, 1990) often find support for a causal relation running from stock returns to output growth. However, mixed evidence is reported, for example, Stock and Watson (1990) and Binswanger (2000) both suggest the potential for the predictive relation to breakdown. Notwithstanding this, Mauro (2003) and Henry et al (2004) provide further supportive evidence.

Movements in stocks returns and the term structure thus both depend on investor expectations of future economic performance. However, the nature of the two instruments differs. Bonds are a claim on a nominal income stream and thus their movements depend on changes to inflationary expectations. Furthermore, bonds exhibit a mechanical response to changes in interest rates. Low inflationary expectations (and thus, lower expected economic growth) are likely to be consistent with a narrowing of the gap between short- and long-interest rates as investors purchase longer-dated bonds and sell shorter ones. In contrast, stocks represent a claim on a real income stream, with movements dependent on expectations of future real cash flows and risk. This, however, gives rise to the potential that changes in stock returns could have a confounding effect in respect of predicting future economic growth. Higher expected growth will lead to higher cash flow, while lower expected growth will lead to a higher risk premium and both lead to higher (expected) stock returns. Moreover, the risk premium component may respond differently to changes in interest rates depending on the current market situation. For example, a fall in interest rates during a period of economic stress will lead to a rise in bond prices but could lead to a fall in stock prices as the interest rate fall signals worsening economic conditions (for example, Gregoriou et al. (2009) argue that the stock market response to falling interest rates changed with the financial crisis). Given these differences, several authors examine the relative predictive power of stocks and bonds for future output growth

This paper thus seeks to consider whether stock returns and the term structure of interest rates has predictive power for output growth across a range of international markets.[2] We are

[2] We focus on stock returns and the term structure of interest rates as we are interested in the role of investor expectations. We could also include the change in the short-term rate (e.g., Kuosmanen and Vataja, 2018) but this is dominated by policy considerations rather than investor behaviour. Equally, we could consider the VIX (e.g., Bekaert and Hoerova, 2014), which does capture investor expectations regarding stock market conditions.

notably interested in whether stock returns and / or the term structure provide predictive power, and by extension which provides stronger evidence of predictive power. However, perhaps more importantly, we are interested in whether financial markets provide greater predictive power over different market and economic phases. Thus, whether there is variation across these two variables in the strength of their respective predictive power and under what conditions they provide better explanatory power for future economic performance. Such information will aid the use of bond and stock market information as leading indicators. Harvey (1989) indicates that the term structure provides stronger predictive power, while the review in Stock and Watson (2003) suggests little predictive power arising from stock returns. However, Kuosmanen et al (2015) and Kuosmanen and Vataja (2018) argue that the joint predictive power of financial variables is greater than their individual power.[3]

Therefore, in this paper, we consider the predictive ability of the term structure and stock returns both individually and jointly for output growth over a range of subsequent horizons. Here, we consider both standard linear predictive and indicator based probit regressions. This will allow us to add to the weight of the evidence as to whether joint predictability exists or whether one of the two financial variables is preferred. The existing literature also highlights time-variation in the strength of financial market predictive power for subsequent output growth. We consider this through both Bai and Perron (1998, 2003a,b) break point tests and rolling and recursive (fixed and expanding window) regressions. However, we are equally interested in whether predictive power varies with market and economic regimes of behaviour. Thus, we identify periods where the interest rate spread, stock prices and economic growth are high and low (relative to their recent history) and examine whether predictive ability varies over these different regimes. While, the preceding analysis is

However, there is insufficient data, in terms of time and market coverage to include this variable in the current study.

[3] Estrella and Mishkin (1998) argue that stock returns contribute to predictive power over short horizons but the term structure individually is preferred over longer horizons.

conducted using in-sample estimation, we further examine the out-of-sample predictive content of bond and stock markets for output growth. Again, by considering both individual and joint forecast power, we can examine whether one market dominates or whether they both contain helpful information.

In preview of the results, we provide confirmatory evidence that both stock and bond markets exhibit predictive power for subsequent output growth. As with the existing research, evidence suggests the term structure arguably exhibits stronger predictive power than stock returns, but both are significant for the majority of the markets. Further, we also report evidence of time-variation and support the emerging view that predictability increases in more turbulent economic times, with greater predictability during the financial crisis period. Our results also provide new insight and indicate a distinction in the information content of the two financial series as they exhibit differences in their predictive ability. The stock return series exhibits stronger predictive power over shorter output growth horizons, notably up to the four-quarter horizon. In contrast, the term structure series exhibits more consistent predictive power over the range of horizons considered. We also observe a difference when separating the financial market series into regimes according to whether the term structure and dividend-price ratio are above or below their recent historical averages. The results reveal that the term structure exhibits greater predictive power for a flatter (below average) yield curve and lower stock prices (above average dividend-price ratio), while stock return exhibits the opposite pattern, with greater predictive power for a steeper yield curve and a higher relative stock price. This suggests that the two financial markets exhibit different information content for future output growth, which depends on whether markets imply stronger or weaker expected future economic conditions. The view that the two markets contain different information is further supported by forecast results that show forecasts obtained from a regression model that includes both financial series outperforms a model that only includes one. Further, forecast encompassing tests, support the view that stock returns contain additional forecast information over that presented by the term structure. It is hoped that these results, particularly, the new results that point to the different information content for future output arising from the two markets will be of interest to market participant, policy-makers and those engaged in modelling the relation between financial and real markets.

2. Literature Review.

As indicated in the Introduction, separate strands of research have developed examining the predictive power for subsequent output growth of the term structure and stock returns, while some work considers their joint ability. Moreover, methodologically, there are developments that consider standard predictive regressions, probit indicator regressions as well as work that introduces time-variation into the analysis. The underlying logic behind the potential for predictive power of both bond and stock markets is broadly similar. Movements in the term structure and stock returns reveal market expectations for future economic conditions. For the bond market, a narrowing of the term spread indicates higher short-term rates that are dominated by policy considerations, while investors will demand longer-term bonds, reducing this yield. Movements in stock returns depend upon investors changing perceptions of future cash flows (dividends) and risk, with expectations of lower future payoffs or higher risk leading to a fall in current returns.

Dating back to Fisher (1907), it is argued that movements in interest rates reflect investors expectations of the future economic outlook. Investors fearful of a future recession will hold long-term bonds and sell short-term bonds. Thus, the price of long-term bonds rises, while the price of short-term bonds falls with the yields on each bond type moving in the opposite direction, leading to a flattening of the term structure. Thus, a flat, or even inverted, term structure is an indicator of poor future economic conditions. Further, during a period of economic expansion, policy authorities will seek to increase the short-rate (thus, closing the gap with the long-rate) to prevent higher inflation, at a given point the higher short rates will discourage consumption and investment, leading to a subsequent downturn.

Support for the view that the term structure provides predictive power for subsequent economic activity has been provided by several authors. Harvey (1988) reports positive predictive power of the term structure for US consumption growth, while Estrella and Hardouvelis (1991) do likewise for consumption but also output and investment growth. Bernanke and Blinder (1992) and Hamilton and Kim (2002) also support predictive power of the term structure for US GDP growth. Supportive evidence for a wider set of markets is provided by Plosser and Rouwenhorst (1994), Estrella and Mishkin (1997) and Ahrens (2002). Hvozdenska (2015) focuses on Scandinavian countries and reports evidence in favour of the term structure as a predictor of output, while Lange (2018) does likewise for Canada. Several researchers, including Lange (2018) but also Deuker (1997) and Estrella and Mishkin (1998) extend the analysis beyond predictive regressions and consider the ability of the term structure to predict recession, for which they find support. Notwithstanding this research and a wider view that the term structure is indeed a good predictor of future output growth,[4] there is some dissenting evidence. For example, Ang et al (2006) and Rudebusch et al (2007) provide contrary evidence in which the predictive coefficient is not statistically significant and may even be of the incorrect sign. In addition, several researchers argue that the strength of predictability has declined. Notably, Haubrich and Dombrosky (1996) argue that the predictive power of the term structure weakens during the 1980s and 1990s respectively. Feroli (2004) argues that the strength of term structure predictive power varies with the behaviour of the monetary policy authorities. Specifically, linking predictive power with how strongly monetary

[4] For example, an article in 'The Economist' in 2018 (Volume 428, No. 9102, p59) takes the view that such predictability is widely acknowledged.

policy targets inflation and the output gap compared to interest rate smoothing.

According to the present value model for stock prices, movements in prices depend upon changes in expected future cash flows (dividends) and risk (discount rate). Therefore, as investor perceptions of future economic conditions change, so will stock returns, leading to a predictive relation for future output growth. Evidence in support of a predictive relation dates back to Fama (1981, 1990), Fischer and Merton (1984), Kaul (1987) and Schwert (1990). More recent supportive evidence for the ability of the stock market to predict output growth is provided by Mauro (2003), Henry et al (2004), McMillan and Wohar (2012), Croux and Reusens (2013) and Tsagkanos and Siriopoulos (2015).

As with the literature on the predictive ability of the term structure, equally, there is evidence against the stock markets role in predicting future economic conditions. Barro (1990) examines the ability of the stock market to predict recessions, and while reporting supportive evidence of this ability, Barro also reports the tendency for the stock market to overpredict recessions.[5] Stock and Watson (1990) and Binswanger (2000) both argue that the nature of the relation between stock returns and output growth varies over time, with Binswanger suggesting that the relation has broken down. The weaker predictive relation arising from stock returns is argued to occur due to the confounding reasons for an increase in stock returns that has differing implications for subsequent output. Following the Campbell and Shiller (1988) present value model of stock prices, an increase in stock returns arises due to an increase in expected future cash flows or an increase in expected future risk. However, these two channels for stock return movement have different implications for economic conditions. A rise in stock returns due to an increase in expected future cash flow, suggests an improving economy, while a rise in stock returns due to an increase in expected future risk, suggests a weakening economy. Thus, a rise

[5] This tendency is noted in the oft-quoted remark of Paul Samuelson that 'stock markets have predicted nine of the last five recessions' (Samuelson, 1966).

in stock returns could equally predict higher and lower output growth.

The above strands of literature examine the ability of either the term structure or stock returns to predict output growth. A further line of work considers the comparative ability of the two variables. Within this research, the term structure finds favour over stock returns in exhibiting greater predictive ability. Harvey (1989) argues that term structure can predict over thirty percent of the movement in US output growth, while stock returns predict less than five percent and indeed, has no predictive power in certain time periods. Likewise, Stock and Watson (1990) for the US and Hu (1993) for the G7, argue that the term structure exhibits superior predictive ability for subsequent economic activity. Kuosmanen and Vataja (2018) examine the G7 markets and argue that the predictive ability of the term structure and stock returns is time-varying and has re-emerged during the 2000s. Moreover, they link predictability to unsettled economic conditions, a view also espoused by Chinn and Kucko (2015). Kuosmanen and Vataja (2018) note that while the term structure typically performs better than stock returns on an individual basis, better predictive power is obtained by including both variables.

Taking the sum of the evidence, the broad view is that the term structure of interest rates provides stronger predictive power for subsequent output growth compared to stock returns. Notably, the weight of evidence in favour of predictive power arising from the term structure is greater than that for stock returns, for which there is greater evidence of mixed results. Notwithstanding this, there is evidence that both predictive relations are time-varying and some evidence in favour of a more recent role for stock returns. This, therefore, raises several important questions. Notably, whether the term structure of interest rates retains its predictive power in the era of ultra-low short rates and quantitative easing and whether there is a role for stock returns in predicting output growth.

3. Empirical Method.

We consider the basic predictive regression to examine whether financial markets have any explanatory power for subsequent movements in output growth. This equation is given as:

(1) $$\Delta y_{t+h} = \alpha + \beta x_t + \rho \Delta y_{t-h} + \varepsilon_{t+h}$$

where Δy_t refers to the change in GDP (y_t) measured over the time horizon h, x_t refers to the financial variable (either stock returns or the term structure) and ε_t is a white noise error term. We also include a corresponding autoregressive term for output growth measured over the same time horizon as for future output growth. In applying equation (1), we consider several variants. We consider a range of horizons from h=1 (one quarter) to h=8 (two years), including both overlapping and non-overlapping horizons. We also include the term structure and stock returns both individually and jointly.

Having examined the predictive regression above for the full sample period for our data, we then consider the potential for time-variation within the nature of the predictive relation. This includes the use of the Bai and Perron (1998, 2003a,b) multiple breakpoint test in the parameter values. The Bai-Perron test is well-known and so to briefly state, the test sequentially examines the parameter values for breaks, starting from the null hypothesis of no breaks versus a single break using a F-test approach. We allow for up to five breaks in each regression and use a trimming value of 15%, this means that at least 15% of the observations must lie between each break. In addition, we consider rolling and recursive regressions for equation (1). For the rolling, fixed window, regressions we use a window size of ten years. Thus, we estimate equation (1) over the first ten years of our sample, then as we add an additional observation to the end of the sample, we drop the first observation. For the recursive, expanding window, regressions, we use the same initial sample (ten years) but do not drop an observation as we add a new one. These two approaches will allow an examination of whether the parameter values in equation (1) exhibit any noticeable shift in value over the full sample period. To further examine variation in the nature of the results, we consider equation (1) according to different economic and market periods. Specifically, we estimated equation (1) across periods characterised by a steep or flat term structure, by high or low stock prices relative to a measure of fundamentals and by rising and falling output. Hence, across these different approaches, we can consider whether predictability arising from the bond or stock markets differs across time or regimes of behaviour.

As noted in the discussion above, a key element in considering whether financial markets have predictive power for output growth is not just the ability to predict the value of growth but also whether recessionary periods can be predicted. To consider this issue, we estimate a probit regression version of equation (1). Here, the dependent variable is defined as an indicator [0,1] variable according to whether subsequent output is in an expansionary or contractionary regime. Thus, we estimate the equation:

$$I(\Delta y_{t+h}) = \alpha + \beta x_t + \rho \Delta y_{t-h} + u_{t+h} \qquad (2)$$

where $I(\Delta y_{t+h})$ is the indicator variable for expansionary and contractionary regimes, x_t is again the financial variables (which are included individually and jointly) and u_t is the random error term. In the analysis below, we define a contractionary period as having negative growth over different subsequent horizons and an expansionary period covers all other periods.

In a final approach to examine the ability of financial variables to predict output growth, we conduct an out-of-sample forecasting exercise. To conduct the forecasts, we use the recursive modelling approached outlined about and obtain one-period ahead forecasts at each recursion. Specifically, where the in-sample period is $t=1,\ldots,\tau$, we then obtain the forecast for $\tau+1$. The end of the sample period is then rolled forward with the model estimated over the in-sample period of $t=1,\ldots,\tau+1$, with the forecast obtained for $\tau+2$. This process continues until the end of the sample. We conduct the forecasts for both one- and four-quarter ahead periods. Forecasts are obtained for the term structure and stock returns both individually and jointly and are benchmarked against an autoregressive model of order one for output growth. To evaluate the forecasts, we consider two related approaches. First, we use the Mincer-Zarnowitz regression where realised output growth is regressed on forecasted output growth as such:

(3) $$\Delta y_{t+h} = \mu + \gamma \, \Delta y_{t+h,f} + v_{t+h}$$

where $\Delta y_{t+h,f}$ denotes the forecast series and v_t is an error term. The forecast model that produces the highest R-squared value is deemed to be the preferred model as it can explain a greater proportion of the realised series. Second, we extend this approach to consider the forecast encompassing test (Fair and Shiller, 1989; Clements and Harvey, 2009). Here, equation (3) is expanded to include competing models, with one regarded as a baseline model. The forecast encompassing test is given by:

(4) $$\Delta y_{t+h} = \mu + \gamma \, \Delta y_{t+h,f1} + \delta \, \Delta y_{t+h,f2} + \zeta_{t+h}$$

where the baseline and alternative forecasts are denoted *f1* and *f2* respectively. In this approach, the baseline forecast is said to encompass the alternative model forecast if δ is statistically insignificant. However, if δ is positive and statistically significant then the alternative model contains information beneficial for forecasting that is not captured by the baseline model.

4. Data and Empirical Results.

4.1. Data

We obtain GDP, stock price and term structure (10-year Treasury Bond minus 3-month Treasury bill) data for the markets of Australia, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, South Africa, Switzerland, the UK and the US. The data is obtained from DataStream and the choice of markets is largely determined by data availability. The sample period is from the start of 1973 to the end of 2017. However, this differs for some markets, but we allow for different starting dates to maintain the largest available data set. Table 1 presents a small set of summary statistics as well as the respective sample periods.

From Table 1, we can that quarterly growth is highest for Australia, the US and Canada and lowest for Italy and Japan (albeit the sample periods are not equal). We observe negative skewness across all countries except for Australia and Denmark, while all markets exhibit excess kurtosis of varying degrees. Higher stock returns are seen for Denmark and South Africa, while (again) Italy and Japan have the lowest values. All series exhibit a high standard deviation relative to returns, negative skewness (except the UK) and excess kurtosis. For the term structure, the spread is largest for the US and Italy and smallest for Australia and Canada. Negative skewness is reported for all markets, except Italy and the Netherlands, while kurtosis is mixed across the markets being both above and below three.

4.2 In-Sample Predictive Regressions

Table 2 presents the results of the predictive regression for GDP growth measured over horizons of one-, two-, four-, six- and eight-quarters using the term structure variable for our twelve international markets. We can consider these results both by country and by time horizon, while an overall impression from the results reveals a large amount of statistical significance.[6] We can also observe that for all markets and horizons there is a positive predictive relation between the term structure and subsequent GDP growth, with the exception of Italy for the longest two horizons and Japan across all horizons, albeit that in each case these coefficients are not statistically significant. The positive relation is consistent with the view that a steepening of the term structure points to stronger future economic conditions and a flat or inverted term structure is an indicator of a future downturn.

Considering the individual markets and using a significance level of up to 10%, we can

[6] In examining statistical significance, we adjust the standard errors for heteroscedasticity and autocorrelation using the Newey-West method, as is common within the literature. However, as we consider overlapping data within the regression models, we also implement the Hansen and Hodrick (1980) correction as a robustness check. The results remain broadly consistent and so discussion focuses on the more usual Newey-West approach. Notwithstanding this, a further alternative is to use a bootstrap e.g., Rapach et al. (2005).

see that the term structure has significant predictive power for output growth over all measured horizons for Australia, Canada (all at the 5% significance level), France, Germany (although most at the 10% significance level), South Africa (all at the 5% significance level), Switzerland (all at the 5% significance level), the UK and the US. We also present the results for a fixed effects panel regression, which also supports a predictive relation at all horizons. In contrast, for Denmark, there is only a significant predictive relation for the one-quarter horizon, while for Italy and Japan there is no evidence of a significant predictive relation across any horizon. Considering the results by horizon, at the one quarter horizon, five (out of twelve) markets exhibit a 5% significant predictive relation, while four markets exhibit a positive and 10% significant relation. Across the longer time horizons, we see greater evidence of predictability, with seven (two), nine, eight (one) and seven (two) markets exhibiting 5% (10%) significant predictability at the two-, four-, six- and eight- quarters respectively. Arguably, the greatest amount of statistical significance is at the four-quarter (one-year horizon).

Table 3 presents the same set of results but using stock returns as the predictor variable. As with the term structure results, looking at the totality of the results, we can see a large amount of statistical significance, albeit with some differences compared to the term structure results. We can also observe that all the coefficients are positive, which supports the view that higher stock returns are synonymous with stronger future economic growth. Examining the results across the individual markets, and again up to the 10% significance level, we can see that stock returns have predictive power at all GDP growth horizons for Australia, France and the US and at four of the five horizons for Canada, Germany, Japan and the UK. Of notable contrast to the term structure results, we observe significant predictive power of stock returns for the output growth for Italy and Japan but more limited predictive power for Switzerland. Examining the results by time horizon, there is greater predictive power for the two-, four- and six-quarter horizons (with either eight or nine markets significant at the 5% level) compared to the one- and eight-quarter periods (with six and four market significant at the 5% level respectively).

In comparing the results between the bond and stock market predictors for output growth, we see similarities in the two sets of results. Both the term structure and stock returns exhibit a high degree of predictive power and exhibit a positive predictive relation. We can also observe some difference whereby stock returns exhibit stronger predictive power for Germany, Italy and Japan, while the term structure exhibits more predictive power for the Netherlands, South Africa and Switzerland. To provide a more direct comparison between the predictive ability of the bond and stock markets, we estimate the predictive regression jointly using three alternative approaches. First, we repeat the above exercises, estimating predictive regressions over time horizons of one-, two-, four-, six- and eight-quarters. Second, we reconsider predictability over subsequent horizons but without using multiple overlapping periods. That is, we consider one-quarter predictive power between time periods *t+1* to *t+2* and then likewise between time periods *t+2* to *t+3, t+3* to *t+4*, *t+4* to *t+5*, *t+5* to *t+6*, and *t+7* to *t+8*. Third, we resample the data to both a semi-annual and annual frequency and again examine the predictive power of the bond and stock markets for output growth.

Table 4 presents the predictive regressions for subsequent output growth over a range of horizons including stock returns and the term structure jointly. We consider the nature of these results across all the markets for each predictive horizon and in doing so note a pattern in the nature of the predictive relations. For the shorter horizons, up to one year, both stock returns and the term structure exhibit a similar degree of predictive power. In predicting one-quarter ahead GDP growth, both financial series have significant predictive power at the 5% level for six markets, although the term structure is additionally significant at the 10% level for a further three series. When predicting GDP growth two-quarters ahead, stock returns are significant at the 5% level for six markets (and one at the 10% level), while the term structure is significant at the 5% level for seven markets (and two at the 10% level). When looking at four quarters ahead GDP growth, stock returns are significant predictors for seven markets at the 5% level (and two at the 10% level), with the term structure 5% significant for eight markets (and a further market at the 10% level). Thus, the bond market variable exhibits slightly more predictive power for output growth than the stock market variable up to the one-year horizon but broadly equivalent. Beyond that, the term structure exhibits noticeably greater predictive power, with eight and seven markets significant at the 5% level over the eighteen month and two-year horizons respectively. In contrast, only two and three markets show a significant predictive relation with the stock market variable. Across markets and the five prediction time horizons, stock returns exhibit 5% predictive power for at least three horizons for Australia, Canada, Denmark, France, Germany the UK and the US, while the term structure provides predictive power over at least three horizons for Australia, Canada, France, the Netherlands, South Africa, Switzerland, the UK and the US. Thus, the bond market appears to exhibit a greater degree of predictive power than stock returns, but nonetheless, stock returns do exhibit some predictive power for subsequent output growth.

We can further consider this by examining the adjusted R-squared values reported in Tables 2-4. In examining these values, we are interested both in which regression model achieves the highest adjusted R-squared and whether individually stocks or bonds provide greater explanatory power. Including the panel regressions, there are three sets of 65 comparable regressions, for 45 of these regressions the joint term structure and stock return predictive model achieves the highest adjusted R-squared value. Stock returns achieve the highest R-squared values eleven times (on one occasion this is a joint highest value). These results are almost uniquely for the Italian and Japanese results. The term structure achieves the highest adjusted R-squared value eleven times (again this includes a joint highest value). These results are primarily found for the Dutch and South African markets, but also occasionally for the longer predictive horizon for other markets. In comparing the individual term structure and stock return regressions, we can see that the term structure model produces a higher adjusted R-squared value 46 out of 65 times, while the stock return model achieves the highest R-squared 18 times (with one tied value). These results reveal that while the term structure typically outperforms stock returns in terms of predictive power for subsequent output growth, in the majority of cases a model that includes both variables performs the best.

Table 5 presents the results of predicting quarterly output growth over different future horizons. The distinction between the ability of stock returns and the term structure to forecast future output growth observed in the last table, becomes more apparent in this table. Taking the results as a whole, we can observe a greater degree of predictive power arising from the bond market compared to the stock market, albeit that the stock market does provide some predictive power. When predicting between subsequent quarter *t+1* to *t+2*, stock market returns exhibit predictive power for three markets at the 5% level, while the bond market does so for seven markets. When predicting between subsequent quarter *t+2* to *t+3*, those respective figures are two for stock markets returns and six for the term structure. The term structure also provides noticeable predictive power over horizons *t+3* to *t+4* and *t+4* to *t+5* with five and six markets respectively at the 5% level. For stock returns and the remaining horizons for the term structure there is less evidence of predictive power, with no more than two markets significant at the 5% level. These results continue to support the view that the bond market provides greater predictive power than the stock market, but that the latter market does provide some predictive power.

The results in Table 6 again, continue this theme. Here, we resample the data at the semi-annual and annual frequencies and repeat the joint estimation of equation (1). At the semi-annual frequency, we see that the term structure has 5% significant predictive power for seven markets, while stock returns do likewise for four markets. At the annual frequency, those respective values are three for stock market returns and five for the term structure. Of note, the term structure provides predictive power across both frequencies for Canada, France, Switzerland, the UK and the US and across just one frequency for Australia and South Africa (semi-annual). Stock returns only exhibit predictive power across both frequencies for the UK, are significant at the semi-annual frequency for Canada, Denmark and the US and at the annual frequency for Australia and Germany.

The results in this sub-section provide several key points. Across the different sets of results, we observe evidence that both stock returns and the term structure provide statistically significant predictive power for subsequent output growth. The totality of the evidence suggests that the bond market provides a greater amount of predictive power, covering more markets and time horizons. Nonetheless, the stock market does provide significant evidence of predictability, including for markets that the term structure does not provide predictive power. Further, the stock market appears to exhibit greater predictive power for more near-term economic growth. For example, when jointly modelling stock and bond returns in the predictive regression, stock returns are able to predict approximately double the markets up to the one-year horizon as it does after the one-year horizon. In contrast, the term structure exhibits more consistent predictive power across all the GDP growth horizons.

4.3. Time and Regime Variation

The above results present evidence on the ability of stock returns and the term structure to predict subsequent movements in GDP growth over the full sample of available data. The time period under examination, starting varyingly from 1973, is one characterised by several events that may affect the stability of the results. This includes both financial events, such as the stock market crash in 1987, the dotcom bubble and the financial crisis starting in 2007, as well as recessions identified by the NBER (for the US) and the IMF (globally) during the early 1980s, 1990s, 2000s as well as the later 2000s. Thus, we consider whether any breaks exist within the above predictive relation either across time (i.e., breaks in the coefficient values) or according to given market or economic regimes (i.e., during periods of rising or falling markets, interest rate cycles or economic growth).

Tables 7 and 8 present the respective results of the Bai and Perron structural break tests of equation (1) for subsequent one- and four-quarter GDP growth. We can compare the nature of these results with those reported in Table 4 for the full sample, where we can observe greater predictability over the full sample at the four-quarter compared to the one-quarter horizon. Examining the results in Table 7, we can see that a single break is the most common result across the markets considered. Exceptions to this include, no breaks for France, Germany, Italy and the UK and three breaks for the Netherlands and Switzerland. The results in Table 8 for the presence of breaks in the subsequent four-quarter GDP growth predictive regressions indicate evidence of one break for five markets, two breaks for four markets, three breaks for one market and no breaks for two markets. Thus, evidence of more breaks for the longer horizon regressions. In terms of the break dates, we can observe a clustering of dates in the early to mid 1980s, the early 1990s, the late 1990s to early 2000s and the late 2000s. These dates roughly correspond to global recessions in the identified 1980s and 1990s period, the dotcom bubble in the late 1990s and its burst in the early 2000s and the financial crisis and accompanying global recession starting in 2007.

Examining the results where breaks do occur, we can see a mixed picture in which predictability disappears and reappears across different markets. For example, in Table 7, for stock returns, we have evidence of predictability both before and after the break point (in Australia), evidence where predictability disappears after the break (in Canada) and evidence where predictability appears after the break (in Denmark). Overall, across both Tables 7 and 8, there is evidence that predictability changes across the identified break points, but there is no convincing evidence that predictability disappears. In Table 7, excluding the no break markets, four markets exhibit a significant predictive relation arising from stock returns before the first break (Australia, Canada, Japan and the US). After the break point(s), we do see some evidence of predictability weakening, for example, the predictive strength declines to the 10% significance level for Japan and the US. But equally, we find stronger evidence of predictability after the break point for markets including Denmark, the Netherlands and Switzerland. A similar picture emerges for the term structure variable, where five markets (excluding no break markets) exhibit a significant predictive relation before a break and four markets after a break (with two markets exhibiting a weaker 10% significance). In Table 8, two and seven markets demonstrate stock return and term structure predictability before the first break, with four and five markets exhibiting predictability after the first break. For markets that exhibit a second or third break, there is some evidence of term structure but not stock return predictability. Of note, the second break point is typically associated with the financial crisis period.

To compliment the break point tests, we report in Figure 1 the 10-year rolling, fixed window, coefficient estimates of equation (1) where we include both financial variables jointly.[7] While the break point tests examine for a discrete shift in the parameter values, the rolling regressions present a more dynamic picture.[8] In examining the graphs we can observe several common features across some of the markets. Notably, there are several parallels in the behaviour of the coefficients for Australia, Canada, the UK and the US (and to a lesser extent, Denmark). For each of these markets, we see both the stock return and term structure series exhibiting a positive coefficient of reasonable magnitude from the beginning of the sample period. However, during the dotcom bubble period, the predictive coefficients decline and

[7] We only present the rolling figures, but the equivalent recursive ones are available upon request. The rolling window values are inevitably more variable, but the nature of this exercise is indicative rather than precise in seeking to understand how the strength of predictability changes.

[8] We also examine the rolling and recursive marginal significance tests and they are available upon request. Again, the nature of this exercise is more indicative of behaviour rather than looking at precise statistical significance.

approach zero (and indeed may become marginally negative) during the crash period following the bubble. Subsequently, the coefficients increase at the beginning of the financial crisis period and again take a larger coefficient value indicating predictive power (except for the term structure in Australia). For France, Germany, Italy, the Netherlands, South Africa and Switzerland, we see that the term structure coefficient remains positive and of a reasonable magnitude throughout their respective sample periods (with the exception of Germany), although it shows a noticeable increase in value with the onset of the financial crisis period. In contrast, for these markets, the stock return coefficient is close to zero throughout the sample period. Although for each of these markets we notice a small increase in the stock return coefficient value around the financial crisis period. For Japan, we can observe that neither the bond nor stock market exhibits a sizeable predictive coefficient for the full sample period, except for the term structure from the financial crisis period onwards.

Overall, the results from the above exercises support time-variation in the predictive power of the stock and bond markets for output growth. Notably, we observe periods where predictability exists, declines and rises. For the markets of Australia, Canada, the UK and the US, we observe predictability arising from both markets through the 1980s and 1990s until the beginning of the dotcom bubble upon which predictability declines and arguably disappears with the resulting crash. This indicates that financial markets became disconnected with the real economy. Over the same time period for the remaining markets, there is evidence of bond market but not stock market predictability. However, of notable pertinence, we see a rise in the predictive ability of both markets for output growth from the time of the financial crisis. This supports the view expressed by Chinn and Kucko (2015) and Kuosmanen and Vataja (2018) that predictability is enhanced in a crisis periods and may provide useful to policy-makers.

While the above analysis examines time-varying predictability, we also consider whether predictability varies across regimes of behaviour. Therefore, we re-estimate equation

(1), including both financial variables, for four-quarter ahead GDP growth across regimes dependent on whether the current value of the term structure, the dividend/price ratio and GDP growth are above or below a three-year moving average.[9] Thus, we are identifying regimes where the interest rate spread, the stock market and economic conditions are in an up or down phase and asking whether predictability for output growth varies according to these regimes. The results of these approaches are reported in Table 9.

A larger term structure spread is an indicator of a growing economy. Long-term interest rates rise as households and firms increase their levels of consumption and investment and investors recognise the potential for future inflation. In contrast, when the term structure spread narrows, this is an indicator of high policy rates and an expectation of a downturn. Across the two regimes of above and below the three-year term structure moving average we can see a distinction in the predictive ability of the two financial markets. When the term structure is above its average, stock returns exhibit greater predictive power for subsequent GDP growth compared to when the term structure is below its average. In the former regime, four markets are significant at the 5% level (and another four at the 10% level) compared to only one (and one) in the latter regime. In contrast, for the term structure itself, there is substantially more predictive power when the term structure is below average, with ten markets indicating statistical significance at the 5% level compared to two (and one at the 10% level) when the term structure is above average. This pattern is repeated for the regimes relating to stock market conditions. A high dividend/price ratio indicates low stock prices relative to fundamentals and that investors are concerned about market and economic risk. In this regime, we observe that the term structure exhibits noticeable predictive power, with eight markets significant at the 5% level (and a further market significant at the 10% level). However, there is very little

[9] The dividend/price ratio is a measure of stock market valuations based on the dividend discount model of stock prices. We also consider the price/earnings ratio, which is an alternative but similar measure. For a discussion of these measures, see Campbell and Shiller (1988).

evidence of stock return predictability, with only one market significant at the 10% level. In contrast, when stock prices are high relative to dividends, then stock returns exhibit greater predictive power, with six markets significant at the 5% level (and one at the 10% level), while the term structure exhibits less predictive power, with only three markets significant at the 5% level. The results for output growth regimes continue to support the view that term structure predictability is greater when economic conditions are weaker. When GDP growth is below its three-year moving average, the term structure exhibits predictive power for nine markets at the 5% level (with a further market significant at the 10% level). However, when GDP growth is above its average, then the term structure only predicts subsequent GDP growth for two markets at the 5% level. For stock returns, predictability appears broadly equal across the two regimes, with two markets significant at the 5% level in the above average regime and three in the below average regime (with two in each regime significant at the 10% level).

The results examining predictability across regimes of behaviour present an interesting set of conclusions. Notably, there exists a dichotomy between predictability arising across bond and stock market according to rising and falling interest rate spread and stock prices. When the bond spread and stock prices are rising, and signalling stronger economic conditions, stock returns exhibit greater predictive ability. However, when the interest rate spread narrows and when stock prices are falling, indicative of weaker economic conditions, the term structure variable exhibits greater predictive power than stock returns. Thus, when financial markets are predicting stronger economic conditions, stock returns provided greater predictive power, while, when financial markets are predicting weaker economic conditions, the term structure provides greater predictive power. Moreover, when economic conditions are themselves weak, the term structure continues to provide predictive power for future growth, although the evidence for stock returns is more limited. When economic conditions are strong, neither financial market exhibits noticeable predictive power across our markets. From a policy perspective, during periods of stronger economic conditions, higher stock returns predict a continuing strengthening, which could lead to higher subsequent inflation. Equally, during weaker economic conditions, policy makers should look at the term structure as an indictor of subsequent output growth.

4.4 Probit Regressions

The above analyses examine the predictive ability for GDP growth. However, a related line of work considers the ability of financial markets to predict the probability of the economy experiencing an economic expansion or contraction. Tables 10 and 11 present the estimated results of equation (2) for a range of future economic conditions. We construct four different indicator variables as the dependent variable. In Table 10, we construct a dummy that equals one if the next periods output growth is positive and zero if it is negative. We also construct a second dummy variable that equals one if the next two quarters exhibit positive economic growth and zero otherwise. Thus, these two sets of regressions are examining whether the immediately succeeding levels of output growth will be positive or negative. In Table 11, we repeat the same exercise but differ in the time period concerning the construction of the dummy variable. We construct a dummy that equals one if output growth over the period $t+3$ to $t+4$ is positive and a second if output growth over the period $t+2$ to $t+4$ is positive and, in both cases, otherwise zero. Thus, we are introducing a time lead that may be of greater relevance to policy-makers who may seek to take corrective action. As with the original set of regressions, we include the term structure and stock returns both individually and jointly.

In Table 10, we can see that the term structure variable is statistically significant (up to the 10% level) for six and nine markets at the one-quarter and two-quarter horizons respectively regardless of whether the variable is included individually or jointly. Moreover, the positive coefficient throughout (except for some results for Italy and Japan) supports the view that a steeper term structure indicates a future expansion. Regarding stock returns, there is a lower number of significant markets, with seven and six at the one-quarter and two-quarter horizons respectively (including up to the 10% significance level). Again, the coefficient is positive supporting the view that higher current stock returns signal a future economic expansion. In comparing the model performance arising from the two financial variables, we consider the McFadden R-squared value and note that for one-quarter output growth it is generally higher for the stock return regression compared to the term structure regression, while for two-quarter output growth it is generally higher for the term structure. However, across all markets and models, the R-squared is higher in eleven of the twelve markets for the joint regression.

Table 11 presents the probit estimation results when seeking to predict expansionary and contractionary behaviour further into the future. Here, a different picture emerges in comparison to Table 10, with the term structure variable noticeably superior as a predictor of future economic conditions. Across the time horizon *t+3* to *t+4* the term structure provides significant predictive power for eight series (all at the 5% significance level), while stock returns are only significant for one market. At the *t+2* to *t+4* horizon, the results are similar, with the term structure significant for eight markets and stock return for one (for both predictive series there is some additional significance at the 10% level).

Overall, the results of the probit regressions point to the view that both the term structure and stock returns exhibit significant predictive power for subsequent economic expansion and contraction periods. However, the term structure appears to exhibit a greater degree of significant predictive power and this discrepancy increases as we seek to predict further into the future. Nonetheless, stock returns do contribute to overall predictive power.

4.5. Forecasting

All the above results are based upon in-sample estimation. However, a key test of predictability is to consider the out-of-sample forecast performance. Using the recursive estimation approach with an initial 10-year in-sample period we conduct a series of one-step ahead forecasts for both one-quarter and four-quarter output growth using equation (1). We estimate a purely autoregressive (AR) model as a baseline as well as stock returns and the term structure both individually and jointly. Table 12 presents the (Mincer and Zarnowitz) R-squared results of equation (3), while Table 13 presents the (forecast encompassing) coefficient results of equation (4).

Examining the R-squared values in Table 12, we can see that for the one-quarter output growth forecasts, the joint stock return and term structure model achieves the highest R-squared for eight of the twelve markets. Of the remaining four markets, the joint model achieves the second highest R-squared twice and ranks third and fourth once each. Stock returns and the term structure solely achieve the highest R-squared once each and are also joint highest once, while the AR model is highest once. In terms of the poorest performing forecast models, the AR model achieves the lowest R-squared value five times and the second lowest four times. The stock return only model achieves the second lowest six times but is never the lowest, while the term structure only model is lowest and second lowest three times each respectively. As noted, the joint model ranks lowest and second lowest once each.

Turning to the results for forecasting four-quarters ahead, an even stronger picture emerges in favour of the ability of the joint stock and bond markets model. This joint model achieves the highest R-squared value for ten of the twelve markets. Moreover, for seven markets, the ranking of highest to lowest R-squared is from the joint model, to the term structure only model, the stock return only model and then the autoregressive model. For two further markets, the same ranking occurs except that the stock return and AR model positions are reversed, while for one market the stock return and term structure model positions are reversed. For one market (Denmark), the stock return model ranks highest and the joint forecast model second, while for one market (Japan), the AR model ranks highest. Notably, the AR model, with the above noted exception, achieves the lowest R-squared (eight markets) or second lowest (three markets).

Overall, these results support the view that jointly including stock returns and the term structure is preferred when forecasting. Across the twelve markets and both the one-quarter and four-quarter forecasts for output growth, the joint model is preferred eighteen times, which is 75% of the forecasts. In comparing stock returns with the term structure, the stock return forecasts tend to be preferred for the one-quarter forecasts, while the term structure is preferred for the four-quarter forecasts. With very few exceptions, the financial variables outperform the baseline autoregressive model.

Table 13 presents the results of the encompassing tests. First, we report results using the AR forecasts as the baseline model and the stock return and term structure forecasts, alternately, as the competing forecasts. Second, we consider the term structure forecasts as the baseline and the stock return forecasts as the alternate. The results are reported for both one-quarter and four-quarter GDP growth forecasts. Using the AR model as the baseline and stock return forecasts as the alternative, we can see that for one-quarter output growth forecasts, the alternative model contains additional forecast information for five markets at the 5% significance level (and a further two at the 10% level). For the four-quarter GDP growth forecasts, the stock return forecasts contain information additional to that captured by the AR model for four markets at the 5% level (and five at the 10% level). Replacing the stock return forecasts with the term structure forecasts, we can see that there is additional forecast power for three markets at the 5% significance level (two at the 10% level) for one-quarter GDP growth forecasts. The equivalent figures for the four-quarter output growth forecasts are six markets at the 5% level (and one at the 10% level). When using the term structure forecasts as the baseline model, the alternative stock return forecasts have additional power for six markets at the 5% level (one at the 10% level) for one-quarter output growth forecasts and for five markets at the 5% level for four-quarter output growth forecasts.

The results from the forecast encompassing tests suggest that stock returns have additional explanatory power over both a baseline AR model for the majority of the markets and a baseline term structure model for approximately half of the markets. When using the AR model as the baseline forecast, the term structure forecasts contain additional information for approximately half of the markets. The purpose of this test is not to suggest a prefer model, but to consider whether there is additional information contained in the forecasts of the alternative model over that already contained within the baseline forecasts. These results support the view that the financial variables do contain additional information that will help improve forecast power for subsequent output growth. Moreover, stock returns do contain information that is not captured by term structure forecasts.

5. Summary and Conclusion.

This paper examines the ability of the stock and bond market to predict subsequent output growth. We use data for twelve international markets, consider a range of horizons over which to predict output growth and utilise alternative in-sample estimation techniques as well as out-of-sample forecasting. Specifically, we estimate the predictive model for output growth over horizons of one-quarter up to eight-quarters and consider both overlapping and non-overlapping periods. We allow for both time and regime variation in the estimated models through rolling and recursive estimation as well as models estimated over periods of rising and falling stock and bond markets and output growth. Probit estimation is used to examine the ability of financial markets to predict expansionary and contractionary regimes, while a forecasting exercise considers the ability of different forecast to explain output growth and whether they contain unique information.

While the current state of the literature could be regarded as mixed, there is a broader consensus in favour of the view that the bond market provides greater predictive power than the stock market for future output growth. We present results that show both markets, individually, exhibit predictive power, but in support of the existing literature, when we consider joint estimation, there is greater support for the term structure, although positive evidence for stock returns in providing predictive power remains. Further results equally support existing work by presenting evidence of time-variation within the predictive relation. Moreover, we support emerging evidence that predictability is heightened during more turbulent economic periods. Notably, we find an increase in predictive power from the start of the financial crisis period.

In addition to confirming these (more) established results, we present a series of newer results that will enhance our knowledge of the links between financial and real markets. Across the range of in-sample linear and probit regressions and out-of-sample forecasts, there is notable evidence that suggests stock returns provide better predictive power over shorter output growth horizons. For example, the joint regression results in Table 4 show that stock return predictability declines noticeably after the one-year horizon. Equally, the probit results show substantially greater stock return predictability up to the two-quarter horizon than after, while the one-quarter out-of-sample forecast power is greater than that for the four-quarter horizon. Results that consider regimes of market and economic behaviour reveal an interesting distinction between the stock and bond markets. There is greater evidence of stock return predictability when the term structure is above its recent historical average and equally when the stock price is high relative to fundamentals (dividends). In contrast, the bond market shows greater predictive power when the slope of the term structure is below its recent average and when stock prices are low relative to dividends. There is also greater predictive power emanating from the term structure when economic growth is relatively low, although there is no obvious distinction between high and low growth states for stock returns. Thus, stock returns appear to be a better predictor during market upswings, with a steeper term structure and high stock prices, while the term structure is a better predictor with a flatter term structure and low relative stock prices. In terms of the out-of-sample forecasts, while the term structure forecasts typically outperform the stock return forecasts, the joint term structure and stock return forecasts outperform the individual forecasts. Together with the results from the forecast encompassing tests, this supports the view that stock returns help improve forecasts of subsequent output growth.

Overall, our results support the view that both the bond and stock markets exhibit predictive power for subsequent output growth. Notably, we can observe that stock returns have greater predictive power for nearer horizon growth while the term structure exhibits consistent predictive power across horizons. Stock returns exhibit greater predictive power when markets are rising, while the term structure exhibits greater predictive power when markets are falling. Out-of-sample forecast power is greatest when we include both the bond and stock market variables. These key results should be of interest to market participants, policy-makers and those engaged in modelling the relations between financial and real markets. Notwithstanding the results that are presented here, it is of interest to consider a wider range of, particularly, emerging markets in future work, and to consider whether the nature of the results presented here remains.

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Table 1. Summary Statistics

Country	Smpl Start	GDP Growth				Stock Returns				Term Structure			
		Mean	SD	Skew	Kurt	Mean	SD	Skew	Kurt	Mean	SD	Skew	Kurt
Australia	1973:1	0.753	0.870	0.112	5.045	1.664	9.899	-1.330	7.389	0.108	1.754	-1.593	9.403
Canada	1973:1	0.630	0.744	-0.686	4.126	1.606	7.960	-0.754	4.501	0.694	1.522	-0.781	3.696
Denmark	1991:1	0.397	0.960	0.050	3.401	2.287	9.841	-0.891	3.678	0.791	1.577	-1.898	8.967
France	1973:1	0.487	0.538	-0.782	5.996	1.878	11.124	-0.691	4.528	1.085	1.274	-1.043	4.290
Germany	1991:1	0.340	0.806	-2.230	14.949	1.387	10.855	-1.014	4.714	0.965	1.123	-0.438	2.714
Italy	1996:1	0.131	0.711	-1.175	6.491	0.756	11.636	-0.058	4.284	1.847	1.422	0.481	2.602
Japan	1989:1	0.288	1.000	-1.213	9.153	-0.133	10.858	-0.612	3.375	0.935	0.841	-0.564	3.652
Netherlands	1996:1	0.494	0.693	-1.797	10.815	1.238	11.310	-1.001	4.448	1.346	0.877	0.050	2.745
South Africa	1981:1	0.532	0.795	-0.631	3.725	3.153	11.516	-0.384	5.821	1.243	2.466	-0.074	2.897
Switzerland	1980:1	0.426	0.580	-0.461	4.322	1.806	9.562	-1.358	8.290	0.435	1.403	-1.113	4.152
UK	1973:1	0.501	0.846	-0.525	7.103	1.807	10.104	0.438	9.914	1.004	1.693	-0.121	3.042
US	1973:1	0.649	0.779	-0.414	5.673	1.747	8.322	-0.845	4.499	1.748	1.329	-0.767	3.977

Notes: Entries are for the mean, standard deviation, skewness and kurtosis values. For each series, the sample ends in 2017:4, while the start of the sample differs according to data availability.

Table 2. GDP Predictability - Term Structure

Countries	Quarters Ahead GDP Growth				
	1	2	4	6	8
Australia	0.059* (1.90) {1.95} [0.001]	0.151** (2.45) {2.52} [0.036]	0.268** (2.03) {1.87} [0.070]	0.411** (2.55) {2.15} [0.151]	0.409* (1.80) {1.48} [0.136]
Canada	0.144*** (4.59) {4.24} [0.287]	0.346*** (5.13) {4.62} [0.274]	0.724*** (4.82) {4.51} [0.274]	0.987*** (4.41) {4.01} [0.266]	1.163*** (4.53) {3.76} [0.237]
Denmark	0.138** (2.13) {2.20} [0.030]	0.165 (1.16) {1.18} [0.058]	0.229 (0.72) {0.63} [0.022]	0.148 (0.33) {0.26} [0.003]	0.377 (0.55) {0.44} [0.010]
France	0.078** (2.21) {2.55} [0.295]	0.232*** (2.71) {2.46} [0.377]	0.584*** (3.13) {2.71} [0.235]	0.803*** (2.94) {2.48} [0.178]	0.908*** (2.81) {2.32} [0.139]
Germany	0.162* (1.89) {1.87} [0.123]	0.351* (1.79) {1.56} [0.121]	0.734** (1.96) {1.63} [0.138]	0.694* (1.64) {1.28} [0.229]	0.619* (1.85) {1.51} [0.384]
Italy	0.011 (0.16) {0.14} [0.311]	0.072 (0.38) {0.34} [0.196]	0.089 (0.18) {0.15} [0.004]	-0.145 (-0.2) {-0.2} [-0.024]	-0.321 (-0.4) {-0.3} [-0.018]
Japan	-0.034 (-0.3) {-0.3} [-0.013]	-0.050 (-0.3) {-0.2} [-0.003]	-0.160 (-0.4) {-0.4} [-0.015]	-0.279 (-0.6) {-0.5} [-0.011]	-0.362 (-0.7) {-0.6} [-0.009]
Netherlands	0.165 (1.56) {1.59} [0.305]	0.448* (1.77) {1.62} [0.372]	1.267** (2.42) {2.14} [0.356]	2.110*** (2.86) {2.43} [0.300]	2.265*** (2.64) {2.21} [0.196]
South Africa	0.063*** (2.70) {4.20} [0.294]	0.159*** (3.31) {4.07} [0.255]	0.336*** (3.79) {4.23} [0.137]	0.416*** (3.17) {3.11} [0.109]	0.464** (2.48) {2.18} [0.094]
Switzerland	0.073** (2.44) {3.68} [0.295]	0.214*** (3.08) {6.20} [0.255]	0.535*** (4.22) {5.26} [0.201]	0.783*** (5.33) {5.12} [0.217]	0.988*** (4.49) {3.75} [0.244]
UK	0.075* (1.72) {1.54} [0.039]	0.172** (2.33) {2.15} [0.135]	0.438*** (3.14) {2.87} [0.095]	0.602*** (2.99) {2.53} [0.096]	0.613** (2.23) {1.80} [0.064]
US	0.072* (1.66) {1.66} [0.151]	0.240*** (3.08) {2.63} [0.182]	0.530*** (3.53) {3.25} [0.208]	0.819*** (4.20) {3.96} [0.210]	1.063*** (4.56) {3.91} [0.226]
FE Panel	0.081*** (7.47) [0.120]	0.192*** (8.18) [0.202]	0.420*** (7.53) [0.208]	0.567*** (6.87) [0.225]	0.658*** (6.33) [0.246]
# 5% (10%)	5 (4)	7 (2)	9	8 (1)	7 (2)

Notes: Entries are the coefficient values, and Newey-West *t*-statistics in parenthesis (Hansen-Hodrick *t*-statistics in braces), for the predictive regression in equation (1), where the periods ahead *h=1, 2, 4, 6, 8*. Asterisks denote (Newey-West) statistical significance at the 1% (***), 5% (**) and 10% (*) levels. Numbers in square brackets are Adjusted R-Squared values. The final row is the number of significant relations at the 5% (10%) significance level.

Table 3. GDP Predictability – Stock Returns

Countries	Quarters Ahead GDP Growth				
	1	2	4	6	8
Australia	0.021*** (4.01) {4.88} [0.044]	0.023* (1.94) {2.18} [0.022]	0.059*** (3.13) {3.14} [0.111]	0.042* (1.78) {1.96} [0.073]	0.043** (2.07) {3.11} [0.083]
Canada	0.022** (2.44) {2.34} [0.271]	0.051*** (3.23) {2.90} [0.208]	0.068*** (3.10) {2.78} [0.069]	0.054** (2.10) {2.28} [0.014]	0.044 (1.51) {1.98} [0.002]
Denmark	0.029** (2.57) {2.37} [0.060]	0.042** (2.54) {2.33} [0.109]	0.075*** (2.69) {2.41} [0.113]	0.050* (1.65) {2.09} [0.029]	0.044 (1.26) {1.52} [0.001]
France	0.009*** (2.77) {3.07} [0.274]	0.019** (2.50) {2.39} [0.308]	0.036** (2.43) {2.33} [0.092]	0.034** (2.23) {2.54} [0.031]	0.029* (1.76) {2.25} [0.016]
Germany	0.015** (2.25) {2.24} [0.114]	0.030** (2.25) {2.05} [0.090]	0.049** (2.07) {1.88} [0.051]	0.047** (2.11) {2.13} [0.194]	0.033 (1.62) {2.14} [0.361]
Italy	0.005 (0.91) {0.93} [0.316]	0.017 (1.32) {1.33} [0.211]	0.043* (1.67) {1.52} [0.054]	0.054** (1.99) {1.95} [0.026]	0.054* (1.94) {2.54} [0.008]
Japan	0.012 (1.35) {1.18} [0.033]	0.024** (2.00) {1.93} [0.090]	0.041* (1.90) {1.86} [0.101]	0.055** (2.05) {2.26} [0.148]	0.063*** (2.42) {2.63} [0.184]
Netherlands	0.008 (0.88) {0.87} [0.275]	0.017 (1.11) {1.00} [0.295]	0.049* (1.80) {1.75} [0.209]	0.065** (2.22) {2.43} [0.101]	0.049* (1.68) {2.35} [0.014]
South Africa	0.005 (1.01) {1.19} [0.127]	0.018** (2.09) {2.08} [0.156]	0.033** (2.08) {1.93} [0.051]	0.041** (2.15) {1.86} [0.024]	0.034 (1.55) {1.37} [0.001]
Switzerland	0.006 (1.53) {2.09} [0.274]	0.014 (1.45) {1.58} [0.183]	0.031* (1.68) {1.81} [0.042]	0.036* (1.65) {1.91} [0.011]	0.023 (0.94) {1.16} [0.027]
UK	0.007 (1.28) {1.17} [0.039]	0.026*** (3.15) {2.61} [0.160]	0.040*** (2.63) {2.27} [0.061]	0.062*** (2.99) {2.61} [0.044]	0.051** (2.11) {2.04} [0.020]
US	0.022*** (2.75) {2.69} [0.169]	0.041*** (3.47) {3.12} [0.079]	0.060*** (2.81) {2.56} [0.186]	0.054** (2.11) {2.38} [0.018]	0.056** (1.97) {2.17} [0.011]
FE Panel	0.013*** (6.09) [0.117]	0.026*** (9.61) [0.174]	0.046*** (11.67) [0.136]	0.049*** (15.01) [0.124]	0.045*** (9.91) [0.135]
# 5% (10%)	6	8 (1)	8 (4)	9 (3)	4 (3)

Notes: Entries are the coefficient values, and Newey-West *t*-statistics in parenthesis (Hansen-Hodrick *t*-statistics in braces), for the predictive regression in equation (1), where the periods ahead *h=1, 2, 4, 6, 8*. Asterisks denote (Newey-West) statistical significance at the 1% (***), 5% (**) and 10% (*) levels. Numbers in square brackets are Adjusted R-Squared values. The final row is the number of significant relations at the 5% (10%) significance level.

Table 4. GDP Predictability – Term Structure and Stock Returns

Countries	Quarters Ahead GDP Growth									
	1		2		4		6		8	
	R	TS	R	TS	R	TS	R	TS	R	TS
Australia	0.020*** (4.05)	0.052* (1.76) [0.049]	0.022* (1.90)	0.153*** (2.63) [0.061]	0.057*** (3.31)	0.248** (2.03) [0.168]	0.039* (1.78)	0.403** (2.55) [0.184]	0.041** (1.98)	0.396* (1.76) [0.162]
Canada	0.019** (2.25)	0.119*** (5.85) [0.324]	0.043*** (3.07)	0.317*** (6.12) [0.343]	0.047*** (2.65)	0.672*** (4.79) [0.300]	0.026 (1.04)	0.907*** (3.93) [0.267]	0.013 (0.42)	1.046*** (4.06) [0.239]
Denmark	0.025** (2.36)	0.108** (2.06) [0.080]	0.038** (2.23)	0.114 (0.90) [0.116]	0.070** (2.31)	0.124 (0.42) [0.112]	0.047 (1.35)	0.075 (0.17) [0.021]	0.035 (0.87)	0.333 (0.49) [0.010]
France	0.007*** (2.60)	0.073** (2.16) [0.299]	0.014** (2.39)	0.214*** (2.72) [0.388]	0.022** (1.98)	0.519*** (3.14) [0.253]	0.018 (1.28)	0.665*** (2.67) [0.182]	0.012 (0.69)	0.713** (2.38) [0.135]
Germany	0.013** (2.03)	0.144* (1.74) [0.144]	0.024** (2.12)	0.313* (1.70) [0.152]	0.035** (1.99)	0.665* (1.91) [0.163]	0.034* (1.79)	0.606 (1.49) [0.243]	0.024 (1.15)	0.562* (1.68) [0.386]
Italy	0.005 (0.91)	0.009 (0.13) [0.308]	0.016 (1.41)	0.061 (0.34) [0.205]	0.043* (1.85)	0.051 (0.11) [0.043]	0.055** (2.07)	-0.171 (-0.25) [0.017]	0.057** (2.08)	-0.362 (-0.49) [0.008]
Japan	0.007 (0.74)	-0.047 (-0.45) [-0.016]	0.016 (1.37)	-0.083 (-0.43) [0.002]	0.035 (1.52)	-0.244 (-0.62) [0.006]	0.020 (0.87)	0.324 (-0.64) [-0.014]	0.029 (1.41)	-0.435 (-0.77) [-0.007]
Netherlands	0.004 (0.51)	0.150 (1.49) [0.299]	0.0055 (0.49)	0.427* (1.72) [0.366]	0.020 (1.14)	1.157** (2.20) [0.357]	0.024 (1.09)	1.965** (2.48) [0.299]	0.011 (0.37)	2.205** (2.36) [0.185]
South Africa	0.003 (0.66)	0.062*** (2.61) [0.292]	0.007 (0.75)	0.157*** (3.25) [0.254]	0.021 (1.07)	0.328*** (3.65) [0.143]	0.026 (1.08)	0.405*** (3.05) [0.112]	0.019 (0.65)	0.457** (2.43) [0.091]
Switzerland	0.006 (1.62)	0.073** (2.47) [0.300]	0.014 (1.60)	0.214*** (3.14) [0.265]	0.030* (1.83)	0.532*** (4.41) [0.223]	0.035* (1.89)	0.782*** (5.47) [0.237]	0.032 (1.52)	1.006*** (4.72) [0.253]
UK	0.007 (1.25)	0.068 (1.63) [0.047]	0.027*** (2.99)	0.172** (2.48) [0.191]	0.040** (2.42)	0.424*** (3.16) [0.135]	0.062*** (2.80)	0.596*** (3.11) [0.142]	0.053** (2.11)	0.615 (2.30) [0.089]

US	0.021*** (2.76)	0.099*** (2.58) [0.193]	0.040*** (3.41)	0.292*** (4.71) [0.228]	0.056*** (2.72)	0.624*** (4.89) [0.274]	0.048* (1.81)	0.971*** (5.38) [0.227]	0.050 (1.61)	1.220*** (5.88) [0.237]
FE Panel	0.012*** (5.23)	0.075*** (8.07) [0.141]	0.022*** (7.13)	0.184*** (8.28) [0.219]	0.040*** (9.30)	0.392*** (7.31) [0.219]	0.037*** (7.87)	0.533*** (6.86) [0.222]	0.032*** (6.80)	0.613*** (6.46) [0.239]
# 5% (10%)	6	6 (3)	6 (1)	7 (2)	7 (2)	8 (1)	2 (4)	8	3	7 (2)

Notes: Entries are the coefficient values, and Newey-West *t*-statistics in parenthesis, for the predictive regression in equation (1), where the periods ahead *h=1, 2, 4, 6, 8*. Asterisks denote statistical significance at the 1% (***), 5% (**) and 10% (*) levels. Numbers in square brackets are Adjusted R-Squared values. The final row is the number of significant relations at the 5% (10%) significance level.

Table 5. GDP Predictability – Term Structure and Stock Returns: Alternative Horizons

Countries	t+1→t+2		t+2→t+3		t+3→t+4		t+4→t+5		t+5→t+6		t+7→t+8	
	R	TS	R	TS	R	TS	R	TS	R	TS	R	TS
Australia	0.002 (0.18)	0.105*** (2.63)	0.012 (1.54)	0.054 (1.06)	0.023** (2.26)	0.047 (1.02)	-0.012 (-1.59)	0.107** (2.24)	-0.004 (-0.37)	0.072 (1.46)	-0.003 (-0.51)	0.047 (1.26)
Canada	0.021*** (3.74)	0.183*** (5.38)	0.001 (0.03)	0.183*** (4.13)	-0.001 (-0.19)	0.151** (2.52)	-0.013* (-1.81)	0.143** (2.32)	-0.006 (-0.80)	0.090 (1.52)	-0.003 (-0.53)	0.050 (0.81)
Denmark	0.012 (1.29)	0.037 (0.44)	0.031*** (3.76)	-0.001 (-0.02)	0.001 (0.05)	-0.010 (-0.10)	-0.007 (-0.90)	-0.004 (-0.04)	-0.016 (-1.60)	-0.004 (-0.04)	-0.023*** (-2.78)	0.020 (0.31)
France	0.004 (1.09)	0.116*** (2.71)	0.004 (1.13)	0.128*** (2.78)	0.002 (0.57)	0.124*** (2.71)	-0.001 (-0.01)	0.074 (1.45)	-0.004 (-1.13)	0.041 (0.94)	-0.004 (-1.10)	-0.007 (-0.16)
Germany	0.011* (1.80)	0.150 (1.55)	0.008 (1.12)	0.139 (1.42)	0.001 (0.02)	0.170 (1.63)	0.003 (0.55)	0.135 (1.43)	-0.009 (-1.38)	0.091 (1.02)	-0.005 (-0.69)	0.057 (0.68)
Italy	0.007 (0.93)	0.022 (0.24)	0.012* (1.82)	-0.004 (-0.04)	0.004 (0.55)	-0.030 (-0.30)	0.004 (0.72)	-0.034 (-0.34)	0.003 (0.53)	-0.057 (-0.63)	-0.002 (-0.35)	-0.103 (-1.37)
Japan	0.010 (1.29)	-0.044 (-0.38)	0.012 (1.22)	-0.096 (-0.90)	0.005 (0.60)	-0.042 (-0.42)	0.003 (0.48)	-0.067 (-0.70)	-0.018** (-2.35)	-0.020 (-0.22)	0.006 (0.69)	-0.046 (-0.47)
Netherlands	-0.001 (-0.01)	0.208 (1.59)	0.006 (1.24)	0.219 (1.63)	-0.001 (-0.14)	0.261* (1.86)	-0.003 (-0.55)	0.288** (2.04)	-0.003 (-0.54)	0.213 (1.46)	-0.004 (-0.51)	0.139 (0.91)
South Africa	0.007 (0.88)	0.073*** (2.77)	0.011 (1.40)	0.075** (2.57)	0.001 (0.16)	0.065* (1.95)	0.005 (0.77)	0.050 (1.40)	-0.001 (-0.14)	0.029 (0.79)	-0.001 (-0.10)	0.027 (0.72)
Switzerland	0.006 (0.89)	0.121*** (3.21)	0.007 (1.08)	0.140*** (3.84)	0.001 (0.13)	0.153*** (4.85)	-0.005 (-1.07)	0.160*** (5.35)	0.007* (1.80)	0.144*** (3.70)	-0.003 (-0.70)	0.108 (2.54)
UK	0.020*** (3.24)	0.104** (2.52)	0.014** (2.30)	0.101** (2.42)	-0.003 (-0.51)	0.112*** (2.61)	0.006 (1.40)	0.092** (2.14)	0.013** (2.31)	0.047 (0.95)	-0.004 (-0.58)	0.011 (0.20)
US	0.017*** (3.03)	0.192*** (4.40)	0.008 (1.39)	0.165*** (3.55)	0.001 (0.02)	0.139** (2.29)	-0.003 (-0.30)	0.191*** (3.43)	-0.010* (-1.65)	0.126** (2.26)	0.005 (0.59)	0.095 (1.31)
FE Panel	0.010*** (6.09)	0.105*** (7.69)	0.010*** (6.95)	0.093*** (6.05)	0.004 (1.52)	0.088*** (5.59)	-0.001 (-0.39)	0.087*** (4.88)	-0.003 (-1.04)	0.055*** (4.13)	-0.003** (-2.17)	0.034 (3.05)***
# 5% (10%)	3 (1)	7	2 (1)	6 (1)	1	5 (3)	0 (1)	6	2 (2)	2	1	1

Notes: Entries are the coefficient values, and Newey-West *t*-statistics in parenthesis, for the predictive regression in equation (1), where the periods ahead are given in the first row. Asterisks denote statistical significance at the 1% (***), 5% (**) and 10% (*) levels. The final row is the number of significant relations at the 5% (10%) significance level.

Table 6. GDP Predictability – Term Structure and Stock Returns: Annual and Semi-Annual

Countries	6 months		12 months	
	R	TS	R	TS
Australia	0.008 (0.64)	0.146** (2.45)	0.033*** (2.96)	0.184 (1.54)
Canada	0.030** (2.42)	0.305*** (4.63)	0.023 (1.01)	0.589*** (2.83)
Denmark	0.028** (2.19)	0.149 (0.97)	0.020 (0.90)	0.233 (0.62)
France	0.006 (1.36)	0.221*** (3.17)	0.008 (0.98)	0.380** (2.35)
Germany	0.014 (1.49)	0.297 (1.39)	0.031** (2.36)	0.419 (0.88)
Italy	0.010 (1.16)	0.076 (0.39)	0.025 (1.11)	0.095 (0.19)
Japan	0.015 (1.20)	-0.077 (-0.38)	0.003 (0.23)	0.074 (0.19)
Netherlands	-0.003 (-0.05)	0.469 (1.59)	0.004 (0.51)	0.150 (1.49)
South Africa	0.003 (0.29)	0.131** (2.55)	0.002 (0.07)	0.218* (1.79)
Switzerland	0.009 (0.97)	0.210*** (3.76)	0.013 (0.81)	0.513*** (5.13)
UK	0.024*** (2.85)	0.157** (2.14)	0.031*** (2.56)	0.375*** (2.65)
US	0.022*** (2.74)	0.269*** (3.63)	0.012 (0.63)	0.348*** (3.03)
FE Panel	0.015*** (6.40)	0.133*** (3.88)	0.018*** (5.13)	0.294*** (6.31)
# 5% (10%)	4	7	3	5 (1)

Notes: Entries are the coefficient values, and Newey-West *t*-statistics in parenthesis, for the predictive regression in equation (1). The data is re-sample to semi-annual and annual and predictions are one-period ahead. Asterisks denote statistical significance at the 1% (***), 5% (**) and 10% (*) levels. The final row is the number of significant relations at the 5% (10%) significance level.

Table 7. Bai-Perron Breakpoint Test – One-Period Ahead

Countries	Sub-Sample Periods									
	1		2		3		4		Break Dates (first date of new sample)	
	R	TS	R	TS	R	TS	R	TS		
Australia	0.017** (2.00)	0.069 (1.45)	0.020*** (3.57)	0.053* (1.75)					1981Q2	
Canada	0.025** (2.26)	0.180*** (5.98)	0.014 (1.25)	0.157*** (4.12)					1990Q1	
Denmark	0.004 (0.34)	0.129* (1.86)	0.027*** (3.07)	0.340*** (2.76)					2001Q3	
France	0.007*** (2.60)	0.073** (2.16)							No Break	
Germany	0.013** (2.03)	0.144* (1.74)							No Break	
Italy	0.005 (0.91)	0.009 (0.13)							No Break	
Japan	-0.021*** (-3.38)	-0.606** (-2.46)	0.019* (1.93)	0.162 (1.52)					1993Q3	
Netherlands	-0.005 (-0.73)	0.025 (0.42)	0.012 (1.57)	0.092 (0.82)	0.125** (2.20)	-0.145 (-0.36)	-0.007 (-0.74)	-0.066 (-0.67)	2000Q4; 2005Q1; 2009Q1	
South Africa	0.002 (0.34)	0.055** (2.31)	0.012 (0.75)	0.270*** (6.45)					2008Q3	
Switzerland	0.005 (0.83)	0.103** (2.05)	0.005 (1.25)	0.136*** (3.01)	-0.006 (-0.54)	0.141 (1.04)	0.017** (2.28)	0.175* (1.68)	1990Q1; 2001:Q3; 2009Q1	
UK	0.007 (1.25)	0.068 (1.63)							No Break	
US	0.043** (2.46)	0.179*** (2.65)	0.011* (1.67)	0.011 (0.32)					1985Q3	

Notes: Entries are the coefficient values, and Newey-West *t*-statistics in parenthesis, for the predictive regression in equation (1) with the breakpoints determined by the procedure of Bai and Perron. Asterisks denote statistical significance at the 1% (***), 5% (**) and 10% (*) levels.

Table 8. Bai-Perron Breakpoint Test – Four-Periods Ahead

Countries	Sub-Sample Periods								
	1		2		3		4		Break Dates (first date of new sample)
	R	TS	R	TS	R	TS	R	TS	
Australia	0.099*** (5.00)	0.066 (0.45)	0.033 (1.38)	0.288* (1.67)	0.020 (1.36)	-0.141 (-0.61)			1983Q4; 1999Q4
Canada	0.048* (1.89)	1.014*** (5.56)	0.032 (1.47)	0.732*** (4.55)					1989Q3
Denmark	0.015 (0.32)	0.166 (1.11)	0.043*** (3.47)	1.435*** (3.00)					2000Q4
France	0.002 (0.20)	0.733*** (5.45)	0.026** (2.20)	0.086 (0.58)	0.026* (1.78)	0.976*** (2.79)			1993Q1; 2007Q2
Germany	-0.002 (-0.17)	0.474** (2.01)	0.033* (1.89)	0.213 (0.46)	0.010 (0.49)	2.413*** (3.65)			1999Q3; 2007Q4
Italy	0.002 (0.23)	1.238*** (10.75)	0.033 (1.05)	2.166*** (3.45)	0.022 (1.37)	-1.139*** (-4.86)			2001Q1; 2009Q1
Japan	0.003 (0.14)	0.325 (1.04)	0.068** (2.45)	0.144 (0.32)					1996Q2
Netherlands	0.020 (1.14)	1.157** (2.20)							No Break
South Africa	0.016 (0.71)	0.427*** (3.54)	-0.004 (-0.34)	0.243 (1.53)	0.016 (1.16)	0.385** (2.30)	0.024 (0.91)	0.631*** (4.72)	1992Q3; 2001Q1; 2008Q1
Switzerland	0.023 (1.06)	0.910*** (6.13)	0.029 (1.59)	0.676*** (6.02)					1990Q1
UK	0.040** (2.42)	0.424*** (3.16)							No Break
US	0.093** (1.96)	1.099*** (4.67)	0.033** (2.05)	0.351** (2.20)					1983Q4

Notes: Entries are the coefficient values, and Newey-West *t*-statistics in parenthesis, for the predictive regression in equation (1) with the breakpoints determined by the procedure of Bai and Perron. Asterisks denote statistical significance at the 1% (***), 5% (**) and 10% (*) levels.

Table 9. Regime Specific GDP Predictability

	High / Low Term Structure				High / Low Dividend-Price Ratio				High / Low GDP Growth			
	High		Low		High		Low		High		Low	
	Ret	TS	Ret	TS	Ret	TS	Ret	TS	Ret	TS	Ret	TS
Australia	0.034* (1.84)	0.281 (0.95)	0.037 (1.55)	0.359** (2.11)	0.049* (1.92)	0.623*** (3.39)	0.038** (2.21)	0.071 (0.55)	0.063** (2.09)	0.231 (1.47)	0.054* (1.89)	0.457** (2.44)
Canada	0.077*** (2.94)	0.718* (1.91)	0.014 (0.45)	0.846*** (4.30)	0.026 (0.87)	0.735*** (4.82)	0.071** (2.30)	0.677*** (3.43)	0.037 (1.18)	0.784*** (4.63)	0.087*** (3.30)	0.693*** (4.04)
Denmark	0.045** (2.36)	-0.337 (-0.63)	0.078* (1.82)	0.011 (0.04)	0.036 (1.37)	0.248 (0.93)	0.083** (2.11)	-0.001 (-0.02)	0.040 (1.59)	0.594 (1.49)	0.014 (0.56)	1.388** (2.51)
France	0.020* (1.82)	0.283 (1.21)	0.024 (1.45)	0.612** (2.33)	0.005 (0.35)	0.567*** (2.62)	0.025** (2.01)	0.183 (0.88)	0.016 (0.95)	0.313 (1.46)	0.025* (1.93)	0.578*** (3.22)
Germany	0.029* (1.75)	0.078 (0.29)	0.029 (1.08)	1.375** (2.42)	0.014 (0.65)	1.011** (2.21)	0.027 (1.58)	-0.305 (-0.83)	0.040* (1.88)	0.455 (0.87)	0.005 (0.27)	1.191* (1.77)
Italy	0.039*** (3.41)	-0.942*** (-2.74)	0.052 (1.48)	1.126** (1.97)	0.036 (1.12)	0.393 (0.57)	0.017 (0.83)	-0.527 (-1.35)	0.063 (1.54)	-0.014 (-0.02)	0.044 (1.53)	0.112 (0.21)
Japan	0.018 (0.74)	1.180*** (3.19)	0.047 (1.51)	-0.554 (-1.22)	0.020 (0.71)	-0.384 (-1.00)	0.037 (0.94)	-0.352 (-0.59)	0.017 (0.59)	-0.269 (-0.57)	0.043 (1.55)	-0.290 (-0.83)
Netherlands	0.002 (0.09)	1.105 (1.58)	0.021 (0.69)	1.831*** (2.69)	-0.019 (-0.57)	2.634*** (3.35)	0.050*** (3.22)	0.512 (1.48)	0.060** (2.07)	0.010 (0.02)	0.005 (0.33)	2.133*** (3.74)
South Africa	0.006 (0.40)	0.046 (0.26)	-0.031 (-1.35)	0.403*** (2.81)	0.016 (0.72)	0.311* (1.66)	0.020 (0.94)	0.346*** (3.11)	0.020 (0.96)	0.142 (1.16)	0.010 (0.31)	0.402*** (3.39)
Switzerland	0.003 (0.22)	0.314 (1.21)	0.055 (1.48)	0.589*** (3.77)	0.025 (1.53)	0.701*** (5.90)	0.003 (0.12)	0.297 (1.41)	0.029 (1.26)	0.198 (1.12)	0.023 (1.15)	0.628*** (3.69)
UK	0.036* (1.76)	0.222 (1.05)	0.048 (1.34)	0.466*** (2.98)	0.025 (0.89)	0.691*** (5.12)	0.035* (1.95)	-0.105 (-0.79)	0.015 (0.95)	0.002 (0.01)	0.100** (2.35)	0.610*** (5.55)
US	0.064** (2.10)	0.423 (1.21)	0.049** (2.27)	0.693*** (3.48)	0.047 (1.61)	0.580*** (3.52)	0.064** (2.19)	0.437*** (2.36)	0.066* (1.87)	0.508*** (2.79)	0.048** (2.26)	0.659*** (4.06)
# 5% (10%)	4 (4)	2 (1)	1 (1)	10	0 (1)	8 (1)	6 (1)	3	2 (2)	2	3 (2)	9 (1)

Notes: Entries are the coefficient values, and Newey-West *t*-statistics in parenthesis, for the predictive regression in equation (1). High and low refers to whether the series is above or below a three-year moving average. Asterisks denote statistical significance at the 1% (***), 5% (**) and 10% (*) levels. The final row is the number of significant relations at the 5% (10%) significance level.

Table 10. Probit Regression for Expansion / Contraction Prediction: One- and Two-Periods Ahead

Country	Individual Predictor Regressions				Joint Predictor Regressions			
	TS – 1	TS - 2	Ret – 1	Ret - 2	TS – 1	Ret - 1	TS – 2	Ret - 2
Australia	0.153** (2.43) [0.037]	0.163** (2.14) [0.058]	0.019* (1.71) [0.038]	0.020 (1.55) [0.030]	0.143** (2.18)	0.019* (1.65) [0.073]	0.151* (1.93)	0.018 (1.32) [0.068]
Canada	0.394*** (4.59) [0.264]	0.488*** (4.50) [0.370]	0.053*** (3.04) [0.246]	0.050*** (2.67) [0.244]	0.430*** (4.30)	0.053*** (2.78) [0.390]	0.517*** (4.26)	0.053** (2.44) [0.445]
Denmark	0.246*** (2.72) [0.064]	0.212** (2.48) [0.055]	0.043*** (3.01) [0.074]	0.022 (1.61) [0.023]	0.209** (2.55)	0.037** (2.55) [0.115]	0.198** (2.25)	0.017 (1.20) [0.068]
France	0.296*** (3.04) [0.248]	0.482*** (4.33) [0.361]	0.032*** (2.67) [0.215]	0.039*** (2.99) [0.241]	0.266*** (2.62)	0.027** (2.17) [0.267]	0.488*** (4.05)	0.038** (2.56) [0.410]
Germany	0.222* (1.85) [0.039]	0.300** (2.39) [0.066]	0.029** (2.31) [0.056]	0.041*** (3.06) [0.102]	0.193 (1.58)	0.027** (2.10) [0.077]	0.266** (2.04)	0.038*** (2.81) [0.142]
Italy	0.047 (0.45) [0.133]	-0.050 (-0.48) [0.140]	0.021 (1.42) [0.151]	-0.003 (-0.19) [0.138]	0.034 (0.32)	0.020 (1.39) [0.152]	-0.049 (-0.47)	-0.002 (-0.17) [0.141]
Japan	0.003 (0.02) [0.00]	-0.075 (-0.44) [0.027]	0.011 (1.07) [0.013]	0.022* (1.92) [0.080]	-0.006 (-0.04)	0.006 (0.53) [0.002]	-0.123 (-0.70)	0.020* (1.66) [0.049]
Netherlands	0.248 (1.22) [0.161]	0.344 (1.54) [0.169]	0.016 (0.99) [0.154]	0.021 (1.30) [0.158]	0.202 (0.92)	0.010 (0.55) [0.165]	0.286 (1.21)	0.015 (0.85) [0.178]
South Africa	0.189*** (3.15) [0.243]	0.234*** (3.88) [0.244]	0.010 (1.10) [0.103]	0.014 (1.60) [0.093]	0.193*** (3.15)	-0.004 (-0.36) [0.244]	0.235*** (3.83)	-0.001 (-0.97) [0.244]
Switzerland	0.145* (1.65) [0.251]	0.182** (2.12) [0.145]	0.024* (1.86) [0.256]	0.014 (1.12) [0.121]	0.156* (1.72)	0.026* (1.94) [0.275]	0.185** (2.14)	0.016 (1.17) [0.155]

UK	0.112* (1.76) [0.053]	0.130** (2.01) [0.041]	-0.006 (-0.61) [0.055]	0.029** (2.48) [0.065]	0.108* (1.66)	-0.006 (-0.59) [0.070]	0.169** (2.41)	0.034*** (2.82) [0.098]
US	0.226** (2.54) [0.129]	0.391*** (3.80) [0.224]	0.044*** (2.81) [0.171]	0.041** (2.45) [0.186]	0.227** (2.37)	0.044*** (2.70) [0.215]	0.436*** (3.72)	0.047** (2.49) [0.324]
# 5% (10%)	6 (3)	9	5 (2)	5 (1)	6 (2)	5 (2)	8 (1)	5 (1)

Notes: Entries are the coefficient values and *t*-statistics in parenthesis, for the probit regression in equation (2) for expansion and contraction periods ahead *h=1, 2*. Asterisks denote statistical significance at the 1% (***), 5% (**) and 10% (*) levels. Numbers in square brackets are McFadden R-Squared values. The final row is the number of significant relations at the 5% (10%) significance level.

Table 11. Probit Regression for Expansion / Contraction Prediction: Alternative Horizons

	Individual Predictor Regressions				Joint Predictor Regressions			
	TS – 3-4	TS – 2-4	Ret – 3-4	Ret – 2-4	TS – 3-4	Ret – 3-4	TS – 2-4	Ret – 2-4
Australia	0.197*** (3.04) [0.080]	0.171** (2.37) [0.072]	0.031*** (2.75) [0.066]	0.040*** (3.08) [0.114]	0.192*** (2.76)	0.030** (2.57) [0.121]	0.184** (2.37)	0.041*** (3.07) [0.173]
Canada	0.425*** (5.18) [0.181]	0.621*** (5.46) [0.340]	-0.001 (-0.02) [0.00]	0.012 (0.69) [0.004]	0.450*** (5.10)	-0.010 (-0.57) [0.215]	0.619*** (5.25)	0.009 (0.44) [0.359]
Denmark	0.036 (0.43) [0.002]	0.097 (1.12) [0.012]	0.004 (0.29) [0.001]	0.029* (1.90) [0.034]	0.033 (0.38)	0.003 (0.21) [0.002]	0.066 (0.73)	0.026* (1.71) [0.039]
France	0.331*** (3.68) [0.107]	0.504*** (4.78) [0.233]	0.016 (1.48) [0.017]	0.011 (0.96) [0.009]	0.326*** (3.50)	0.010 (0.88) [0.111]	0.521*** (4.75)	-0.003 (-0.20) [0.241]
Germany	0.184 (1.55) [0.024]	0.247** (2.03) [0.041]	0.001 (0.04) [0.003]	0.007 (0.59) [0.005]	0.189 (1.57)	-0.003 (-0.24) [0.024]	0.242** (1.96)	0.003 (0.22) [0.041]
Italy	-0.036 (-0.35) [0.006]	-0.056 (-0.55) [0.004]	0.009 (0.66) [0.009]	0.022 (1.54) [0.025]	-0.040 (-0.38)	0.009 (0.67) [0.011]	-0.071 (-0.69)	0.023 (1.59) [0.030]
Japan	-0.017 (-0.12) [0.034]	-0.196 (-1.18) [0.011]	0.006 (0.56) [0.006]	0.022* (1.93) [0.035]	-0.026 (-0.18)	0.005 (0.45) [0.035]	-0.248 (-1.45)	0.022* (1.75) [0.036]
Netherlands	0.390** (1.98) [0.076]	0.332* (1.66) [0.052]	0.009 (0.57) [0.027]	0.027* (1.67) [0.050]	0.401* (1.91)	-0.003 (-0.16) [0.076]	0.256 (1.22)	0.020 (1.19) [0.071]
South Africa	0.176*** (3.23) [0.084]	0.225*** (4.05) [0.127]	0.006 (0.71) [0.003]	0.007 (0.85) [0.099]	0.177*** (3.24)	-0.004 (-0.37) [0.085]	0.223*** (4.00)	0.007 (0.71) [0.130]
Switzerland	0.319*** (3.76) [0.100]	0.305*** (3.59) [0.102]	0.014 (1.18) [0.010]	0.012 (0.93) [0.006]	0.322*** (3.77)	0.016 (1.25) [0.110]	0.306*** (3.57)	0.012 (0.88) [0.107]

UK	0.149** (2.37) [0.029]	0.216*** (3.15) [0.058]	-0.003 (-0.33) [0.001]	0.014 (1.25) [0.016]	0.148** (2.34)	-0.003 (-0.31) [0.031]	0.228*** (3.21)	0.019 (1.55) [0.079]
US	0.412*** (4.37) [0.155]	0.586*** (5.30) [0.264]	-0.009 (-0.52) [0.027]	0.010 (0.64) [0.029]	0.414*** (4.20)	-0.015 (-0.79) [0.187]	0.580*** (5.11)	0.010 (0.50) [0.307]
# 5% (10%)	8	8 (1)	1	1 (3)	7 (1)	1	8	1 (2)

Notes: Entries are the coefficient values and *t*-statistics in parenthesis, for the probit regression in equation (2) for expansion and contraction periods ahead *h=1, 2*. Asterisks denote statistical significance at the 1% (***), 5% (**) and 10% (*) levels. Numbers in square brackets are McFadden R-Squared values. The final row is the number of significant relations at the 5% (10%) significance level.

Table 12. Forecast Results: Mincer-Zarnowitz R-Squared

Countries	AR	SR	TS	SR-TS
	One-Period Ahead			
Australia	0.096	0.021	0.014	0.024
Canada	0.210	0.238	0.285	0.307
Denmark	0.013	0.048	0.001	0.061
France	0.295	0.302	0.293	0.309
Germany	0.036	0.073	0.066	0.094
Italy	0.284	0.279	0.279	0.325
Japan	0.034	0.027	0.056	0.040
Netherlands	0.128	0.135	0.140	0.143
South Africa	0.310	0.311	0.311	0.308
Switzerland	0.217	0.221	0.249	0.253
UK	0.019	0.046	0.001	0.001
US	0.120	0.165	0.168	0.181
	Four-Periods Ahead			
Australia	0.004	0.009	0.016	0.031
Canada	0.005	0.059	0.338	0.360
Denmark	0.001	0.084	0.001	0.082
France	0.079	0.087	0.172	0.177
Germany	0.023	0.018	0.082	0.105
Italy	0.016	0.001	0.048	0.079
Japan	0.018	0.001	0.016	0.001
Netherlands	0.022	0.063	0.149	0.162
South Africa	0.001	0.006	0.011	0.017
Switzerland	0.001	0.004	0.137	0.151
UK	0.002	0.024	0.009	0.029
US	0.012	0.081	0.089	0.151

Notes: Entries are the R-squared values from equation (3). For the forecast models, AR refers to an autoregression model of order one, SR is the stock return model, TS is the term structure model and SR-TS is the joint model.

Table 13. Forecast Encompassing Tests

Countries	AR Baseline Model		TS Baseline Model
	SP	TS	SP
	One-Period Ahead		
Australia	0.494 (2.74)	0.293 (0.49)	0.415 (2.20)
Canada	0.622 (1.90)	0.869 (4.42)	0.361 (1.99)
Denmark	1.116 (2.64)	2.570 (2.40)	0.938 (2.04)
France	0.601 (2.30)	0.514 (1.50)	0.594 (3.11)
Germany	1.410 (1.72)	2.234 (1.32)	0.489 (0.91)
Italy	0.123 (0.18)	0.959 (1.81)	0.154 (0.31)
Japan	0.791 (0.42)	-0.857 (-1.49)	2.657 (1.66)
Netherlands	0.814 (0.59)	0.617 (0.59)	0.037 (0.05)
South Africa	0.638 (0.24)	0.530 (1.17)	0.501 (1.25)
Switzerland	0.767 (0.88)	0.944 (2.19)	0.004 (0.01)
UK	1.879 (2.15)	-0.553 (-1.18)	1.650 (3.08)
US	0.402 (2.02)	0.470 (1.90)	0.497 (2.21)
	Four-Periods Ahead		
Australia	0.399 (2.07)	0.924 (2.97)	0.091 (0.37)
Canada	0.713 (2.84)	0.929 (4.70)	0.422 (2.44)
Denmark	1.242 (3.64)	2.675 (1.49)	1.207 (3.37)
France	0.574 (1.60)	0.657 (2.46)	0.630 (2.33)
Germany	1.609 (1.82)	2.143 (1.80)	-0.124 (-0.23)
Italy	0.807 (1.31)	0.613 (2.19)	-0.290 (-0.53)
Japan	1.869 (1.77)	0.217 (0.71)	1.685 (2.11)
Netherlands	1.069 (1.93)	0.768 (1.49)	-0.141 (-0.25)
South Africa	2.363 (1.79)	0.324 (0.90)	0.065 (0.27)
Switzerland	0.847 (1.33)	0.763 (3.37)	-0.216 (-0.77)
UK	0.747 (1.92)	0.230 (0.97)	0.465 (1.54)
US	0.757 (2.09)	0.565 (3.02)	0.663 (2.71)

Notes: Entries are the δ coefficient values and Newey-West *t*-statistics in parenthesis for equation (4). The baseline models are given in the first row, where AR refers to an autoregression model of order one, SR is the stock return model and TS is the term structure model.

Figure 1. Rolling and Recursive Four-Quarter Ahead GDP Growth Predictive Coefficients
Australia