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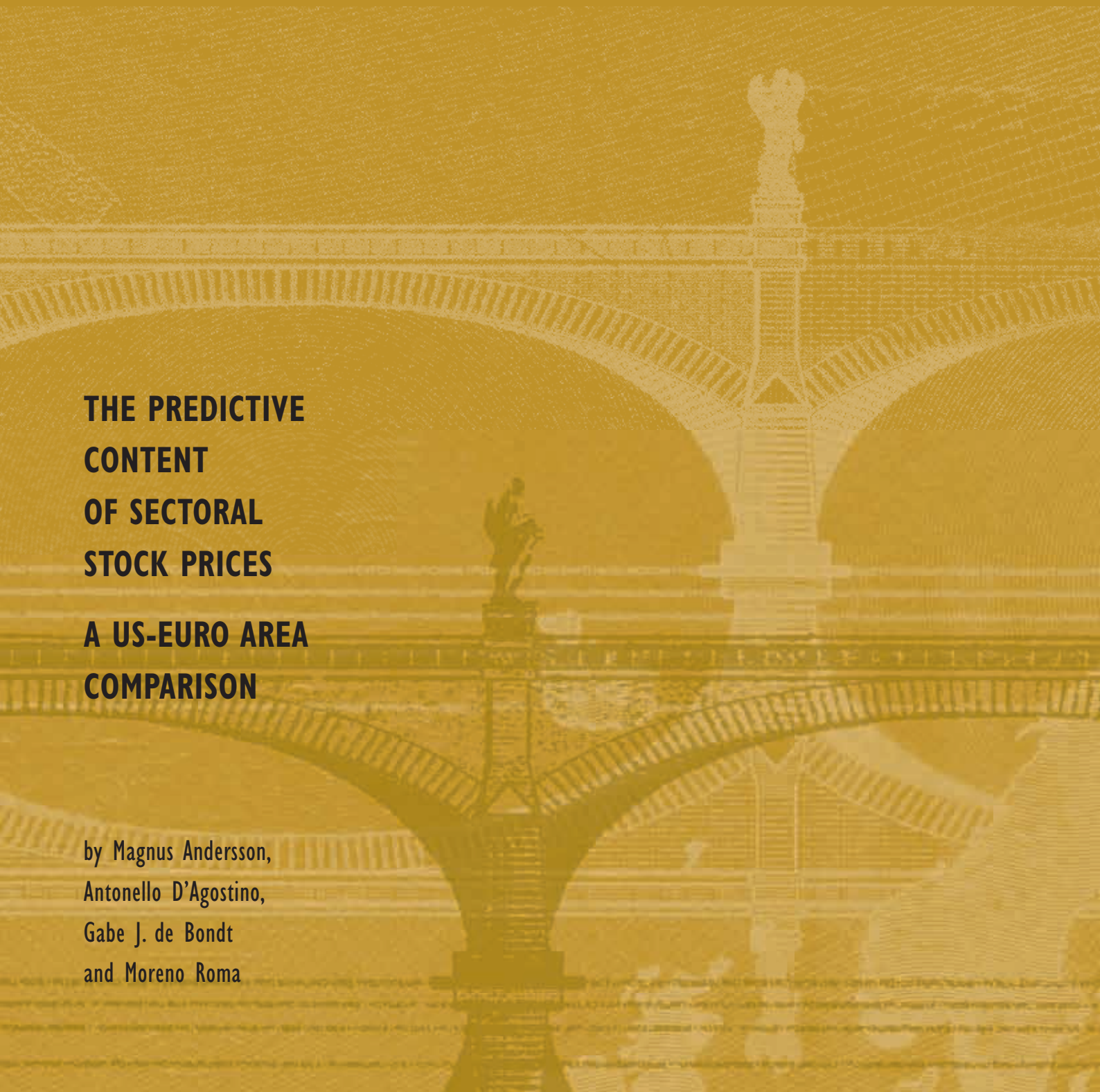

THE PREDICTIVE CONTENT OF SECTORAL STOCK PRICES

A US-EURO AREA COMPARISON

by Magnus Andersson,
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Abstract

This paper examines the out-of-sample forecast performance of sectoral stock market indicators for real GDP, private consumption and investment growth up to 4 quarters ahead in the US and the euro area. Our findings are that the predictive content of sectoral stock market indicators: i) is potentially strong, particularly for the financial sector, and is stronger than that of financial spreads; ii) varies over time, with a substantial improvement after 1999 for the euro area; iii) is stronger for investment than for private consumption; and iv) is stronger in the euro area than in the United States.

JEL classification: C53; E37; G12

Keywords: forecasting real GDP, consumption and investment; sectoral stock prices; stock market valuation metrics; US; Euro Area

Non-technical summary

This paper examines if stock prices and stock market valuation metrics can help to predict real GDP, private consumption and investment growth up to 4 quarters ahead by performing an out-of-sample forecast exercise over the period 1985 to 2009 for the US and the euro area. This paper contributes to the literature in a number of ways. First, we assess from a sectoral perspective not only stock price returns, but also two valuation metrics - dividend yields and price/earnings ratios. The second novelty is that we examine to what extent the predictive content of financial asset prices and valuation metrics differs across the Atlantics. Third, we focus not only on forecasting aggregate real GDP growth, but also the main GDP components - private consumption and investment.

The basic intuition behind the empirical investigation carried out is that the price of a share should reflect the sum of current and expected dividends discounted by an appropriate discount factor. Dividends are usually paid out as a fraction of firms' earnings which in turn should be positively related to overall demand. Thus, holding the discount factor constant, higher stock prices are likely to reflect upward revisions of future economic activity, as seen through the eyes of investors. Stock prices also play an active role for the economy through various transmission channels: wealth, confidence, cost of capital, Tobin's Q, and risk taking and compensation.

Our main findings are fourfold. First, we show that certain sectoral stock market indicators contain strong predictive power. Regardless of the out-of-sample periods we find a strong predictive performance of the financial sector, in particular for the US financial services stock return and the euro area bank dividend yield. This result can be explained by a pro-cyclical financial system. We show that the predictive content embedded in sectoral stock price indicators is better than those of term and corporate bond spreads. This notwithstanding, it is challenging to practically select in real time among several sectoral indicators the best performing. Second, we show that the predictive power of sectoral stock returns and valuation metrics varies over time. For the euro area we find a substantial improvement in the forecast performance after 1999. It appears that the introduction of the monetary union has helped to sharpen the linkages between stock market indicators and aggregate economic activity. Third, we find that sectoral stock prices are better at predicting cyclical investment than consumption. Fourth, we find that the predictive content of sectoral stock market

indicators is stronger in the euro area than in the US. This finding is consistent with earlier presented evidence that the output pattern is predominantly shaped by investment in the euro area and by consumption in the US.

Finally, results from alternative forecast models show that the predictive content for US consumption can be further improved by considering sectoral stock market indicators vis-à-vis those of the less cyclical utilities sector and for US and euro area consumption as well as investment by considering not the observed stock price index, but an estimate of the fair value of the index based on fundamentals – earnings, risk-free interest rate and an equity risk premium.

1. Introduction

The 2008-2009 financial and economic crisis brought to the fore the need for better understanding the link between the financial sector and the real economy. Although this link has been analysed before the outbreak of the crisis (see, among others, Ang and Piazzesi, 2003 and the studies cited there), it attracted after the crisis considerable attention. For example, Espinoza et al. (2009) document whether a wide set of financial indicators helps in improving forecasting aggregate economic activity. They conclude that the forecast improvement by adding financial indicators is tiny for the US and even less prominent for the euro area. Against this background, this paper examines from a sectoral perspective the predictive content of one specific financial market segment, i.e. the stock market, for real GDP, private consumption and investment growth up to 4 quarters ahead from a sectoral perspective. We apply for US and euro area sectoral stock price indices and valuation metrics an out-of-sample forecast exercise over the period 1985 to 2009.

Despite the fact of a vast empirical literature about the predictive content of stock prices for economic activity, there is no convincing conclusion. Schwert (1990) argues that one century of US data indicate that stock prices do contain useful information about the future economic growth. A recent US study by Hatzius et al. (2010) shows that the total stock market index is the best predictor among five single financial variables. Stock and Watson (2003) conclude from their literature review and empirical analysis that some asset prices, including stock prices, predict output growth in some countries during some periods. Others argue that there has been a break in this relation and find that the predictive power of stock prices have declined from the mid 1980s and onwards for a number of G7-countries (Binswanger, 2001). A possible explanation for this loss of predictive content might relate to extended periods of stock market overvaluations. Indeed, stock prices can rise beyond (or fall below) their fundamental or intrinsic value if they are (temporarily) driven by non-fundamental factors. De Bondt (2009) analyses therefore not the predictive content of the observed stock prices, but of their three key fundamental determinants: earnings, risk-free interest rate and a proxy for the equity risk premium. He concludes that stock price fundamentals still contain information about future economic growth in industrial countries.

Most studies have been concentrated on the information content of broad stock market indices. Very recently, a few authors have argued that this approach can be extended further since certain sectors within the aggregate indices potentially may be more informative about the future business cycle. Applied to US data, Browne and Doran (2005) examine sectoral stock prices relative to the utilities sector, with the latter sector a priori assumed to be the less cyclical sector. They find that a number of industry sector ratios show strong and consistent informational properties for industrial production growth, notably for a 3-month horizon. Similarly, Andersson and D'Agostino (2008) analyse for the euro area the predictive content of sectoral stock prices and argue in favour of a strong predictive content since the introduction of the euro in 1999.

This paper contributes to the literature in a number of ways. First, we assess from a sectoral perspective not only stock price returns, but also two valuation metrics - dividend yields and price/earnings (P/E) ratios. Both valuation metrics are not only affected by stock price developments, but also by quarterly movements in earnings and dividends, which show a less pronounced cycle as stock prices but still more than nominal GDP.[1] The second novelty is the examination to what extent the predictive content of financial asset prices and valuation metrics differs across the Atlantics. Third, studies so far in this strand of the literature have focused on forecasting aggregate real GDP growth. This study examines in addition to the GDP aggregate the forecast performance of private consumption and investment. This approach is appealing given that the time series properties of the two series differ (private consumption being a comparatively smooth variable while investment is more cyclical). Moreover, Angeloni et al. (2003) show that consumption is the main driver of output changes in the US, whereas the euro area output pattern is mainly driven by investment.

Our main results are the following. First, we show that certain sectoral stock market data contain strong predictive power. Regardless of the out-of-sample periods we find a strong predictive performance of the financial sector, in particular of the return on US real estate,

1 For example, the average quarter-on-quarter growth rates in earnings and dividends of the US total stock market over our sample period amount to 2.5%, respectively, 2.2%, with a standard deviation of 4.5, respectively, 2.4 percentage points. This compares to an average quarterly growth rate in the US stock price index and nominal GDP of 2.8%, respectively, 1.6% and a standard deviation of 8.7, respectivley, 1.0% percentage points.

bank or financial services stocks and the euro area bank or insurance dividend yields. This finding can be explained by a pro-cyclical financial system. We show that the forecast performance using sectoral stock market data is potentially better than those of the total stock market and of the term and corporate bond spreads. Our second finding is that the predictive power of stock prices and valuation metrics varies over time. For the euro area we find a substantial improvement in the forecast performance after 1999. It appears that the introduction of the monetary union has helped to sharpen the linkages between the stock market and the real economy. Third, we find that sectoral stock prices are better at predicting the cyclical investment component of GDP than consumption. Fourth, sectoral stock market indicators are more informative about future economic activity in the euro area than in the US. This finding can be explained by the fact that the output pattern is predominantly shaped by investment in the euro area and by consumption in the US.

We further analyse the predictive content of sectoral stock price indicators by considering two alternative forecast models. One forecast model examines the stock market indicators relative to the utilities sectors, following the approach by Browne and Doran (2005). An additional alternative model considers long-run fair or fundamental stock market indicators following the approach of de Bondt (2011). The first alternative forecast model shows an improved predictive performance for US consumption and the second one for US and euro area consumption as well as investment. The fundamental-based forecast model shows, more consistently than the basic forecast model, that the strongest predictive content is embedded in the euro area bank dividend yield and in the US financial services stock returns.

The structure of the rest of the paper is as follows. Sections 2 and 3 briefly describe the theoretical background and the data and methodology applied. Sections 4 and 5 present the empirical results for the basic and the two alternative forecast models, respectively. Section 6 concludes.

2. Theoretical background

In order to understand why asset prices may contain expectations about future economic activity it is instructive to recall the present value model. Applied to the equity markets, the

price of a share should, in theory, reflect the sum of current and expected dividends discounted by an appropriate discount factor. Dividends are usually paid out as a fraction of firms' earnings which in turn should be positively related to overall demand. Thus, holding the discount factor as constant, higher stock prices are likely to reflect upward revisions of future economic activity, as seen through the eyes of investors.

Also stock market valuation metrics may contain useful information about future economic growth. Two of the most standard yardsticks are P/E ratios and dividend yields. A popular argument for their widespread use is that they tend to revert to their long-run mean. This price ratio stationarity can be theoretically related to economic mean reversion in profitability (Giannetti and Viale, 2011) and profitability, in turn, is mirroring the economic conditions. Similarly, Coakley and Fuertes (2006) show that valuation ratios do mean revert and that stock prices reflect fundamentals in the long run, but market sentiment can play an important transitory role. For instance, high stock market valuation, as reflected in a high P/E ratio or low dividend yield, may signal an optimistic view about firms' expected earnings capacity and thus be informative about future economic activity.

Stock prices also play an active role for the economy through various monetary transmission channels (Ammer et al., 2010). For instance, higher stock prices provide an extra stimulus for households and firms that own directly or indirectly, for example via pension funds, shares via positive wealth effects. For a recent literature survey on wealth effects, see Paiella (2009) and Davis (2010). Even if one does not own shares, the stock market is seen as a general measure for the state of the economy through which stock prices affect the real economy via a confidence channel (Jansen and Nahuis, 2003). An increase in stock prices provides a stimulus to the confidence of households and firms and to the uncertainty they have about their future economic situation. Investment also benefits from higher stock prices via lower capital costs. Higher stock prices for listed firms lowers the cost of funding via issuance of new stocks. This financing channel is particularly important during periods when other financing sources may be constrained. The cost channel through which stock prices might affect output (via investment) is also often referred to as Tobin's "q" (for a recent literature survey see Davis, 2010). Tobin's q is the ratio of the market value of firms to replacement cost (i.e. the cost of rebuilding a corporation from scratch). A high Tobin's q values encourage companies to invest more in capital because they are "worth" more than the price they paid

for them. Another mechanism, through which stock prices affect the availability and costs of credit, is that higher stock prices improve the financial position of households and firms. This improvement allows households and firms to borrow easier and cheaper. This mechanism is known as a balance sheet channel. Finally, the equity risk premium provides insight in the degree of risk aversion in the economy, which, in turn can affect the real economy (De Paoli and Zabczyk, 2011). This channel works through risk taking and risk compensation and received a lot of attention in the past years (Rajan, 2006, Borio and Zhu, 2008, Dubecq et al., 2009, Gambacorta, 2009, Altunbas et al., 2010).

3. Methodology

3.1. Data

The dependent variables consist of quarterly growth rates of gross domestic product, private consumption and investment for the US and the euro area covering the sample period 1973Q1 to 2009Q4. The explanatory variables are stock price index (in terms of returns, R), P/E ratio and dividend yield (DY). We consider in total 19 sectors. Table 1 reports the weight of each sector in the index as of 2009. The two most important sectors were in 2009 in the US healthcare and technology and in the euro area utilities and banks.

Besides the above discussed stock market indicators at the total market and sector level, we also include in the forecast exercise standard asset price indicators such as the term spread (TS) and a corporate bond spread (CBS). The term spread is defined as the spread between the ten-year government bond yield and the three-month money market rate. The US corporate bond spread is calculated as the difference between Moody's Baa yield and the ten-year government bond yield. For the euro area it is defined as the spread between the BBB-rated non-financial corporate bond yield and the AAA-rated government yield since 1999 (and before the spread between the Global Financial Data German corporate bond yield and the German ten-year benchmark government bond yield).

Table 1 Data overview: Sectoral weights in the overall index

	Weights (in 2009)	
Stock prices	US	Euro area
Total market		
Sectors		
- Oil & Gas	12.2	7.5
- Chemicals	1.6	3.8
- Basic Resource	1.1	2.0
- Construction & Materials	0.8	4.2
- Industrial Goods & Services	11.4	8.7
- Auto & Parts	0.4	4.8
- Food & Beverages	4.6	4.3
- Personal & Household goods	5.5	4.3
- Health care	13.8	4.1
- Retail	7.3	3.2
- Media	2.8	2.9
- Travel and leisure	1.8	1.6
- Telecom	3.3	7.5
- Utilities	4.4	14.5
- Banks	6.1	11.6
- Insurance	4.7	6.4
- Real estate	1.7	2.1
- Financial Services	3.7	2.9
- Technology	12.9	3.6

* The valuation indicators are decomposed identically to the stock market breakdown.

All in all 20 stock price indicators, 40 valuation indicators, the term spread and the corporate bond spread are tested

Source: Datastream.

3.2. Basic Forecast model

The basic forecast model is in line with Andersson and D'Agostino (2008). The purpose of the out-of-sample exercise is to evaluate if various asset prices and valuation indicators can help to improve forecasts of broad macro economic variables (real GDP growth, consumption and investment) up to four quarters ahead. The evaluation criteria is based on the mean square forecast errors (MSFE) making use of a standard autoregressive set-up as a benchmark. In more detail, the following forecasting model is employed:

$$Y_{t+h}^{h} = \alpha^{h} + \sum_{i=0}^{q_1} \beta_i^{h} Y_{t-i} + \sum_{i=0}^{q_2} \gamma_i^{h} X_{t-i} + u_{t+h}^{h} \qquad (1)$$

where X_t is the candidate predictor (i.e. the stock price return or valuation metric), $h = 1, 2, 3, 4$ is the forecasting horizon, u_{t+h}^{h} u_{t+h} the error term and q_1 and q_2 are the lag lengths. To test the out-of-sample forecasting ability of a given candidate predictor, a *restricted* model

benchmark that excludes the candidate predictor ($X_{t,}$) from *eq.(1)*[2] is estimated for a fixed lag length. The equation is estimated on a restricted sub-sample called estimation window and for a given horizon *h.* The estimated coefficients are then used to forecast the growth rate of the dependent variable *h*-steps outside the estimation window. Next, the estimation window is updated one observation, the parameters are re-estimated on the new sub-sample and the *h*-step ahead forecast is computed for the first observation outside the new estimation window. The procedure is then iterated until the end of the sample. The forecast exercise is conducted over two out-of-sample windows, the first covering 1985Q1 – 2009Q4 and the second covering 1999Q1 – 2009Q4.

The forecasts of Y_{t+h}^{h} Y_{t+h} are labelled as $\hat{Y}_{t+h,r}^{h}$ $\hat{Y}_{t+h,r}$ are used to compute the *h*-step ahead mean squared forecast error (*MSFE*), for the restricted model, defined as:

$$MSFE_{h,r} = \frac{1}{T_2 - T_1} \sum_{t=T_1+h}^{T_2} \left(Y_{t+h}^{h} - \hat{Y}_{t+h,r}^{h} \right)^2 \qquad (2)$$

where *r* refers to the restricted model. The *MSFE* is a measure of the forecast accuracy computed between T_1+h to T_2 which is defined as the out-of-sample forecasting period.

After the benchmark autoregressive models have been determined separately for the dependent variables (real GDP growth, consumption and investment) and forecast horizons, we examine the predictive power of the financial market indicators. The indicators are added one by one in eq. (1) (i.e. the benchmark specification) and the out-of-sample forecast simulation exercise is conducted similarly to the way done for the benchmark model. The forecasts of the *unrestricted* model equation are labelled $\overline{Y}_{t+h,u}^{h}$ and are used to compute the *h*-step ahead mean squared forecast error ($MSFE_{h,u}$) for the unrestricted model.

To facilitate comparisons between various indicators, the results are given in terms of the relative MSFE statistics, defined as:

$$relative\, MSFE = \frac{MSFE_{h,u}}{MSFE_{h,r}}$$

The intuition is that a relative MSFE below one indicates that the inclusion of the stock market indicator improves the forecast precision of the benchmark model.

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[2] *The restriction* $\gamma_0 = \ldots \gamma_{q2} = 0$ is imposed.

4. Empirical Results

4.1. Out-of-sample predictions

We test the predictive content of 62 indicators[3] for the euro area and the US. The forecast exercise is conducted for real GDP, investment and consumption over four forecast horizons which yields 744 (62*3*4) relative MSFE statistics for each economy. For presentation purposes tables 2 and 3 summarize and comment on the main conclusions.[4]

Table 2 displays the 48 best predicting indicators for the dependent variables across the four forecast horizons, applied on both post-1985 as well as the post-1999 out-of-sample periods (similar results are obtained based on relative absolute forecast errors). The table also shows the percentage of the indicators tested that outperform the benchmark autoregressive model. The following conclusions emerge.

• Sectoral stock market information turns out useful to predict real GDP, consumption and investment up to four quarters ahead. Only in one out of the 48 cases the best sectoral forecast model performs worse than the autoregressive benchmark model as indicated by a relative MSFE above one. In general between 50-80% of the euro area models and between 10-50% of the US models have a lower relative MSFE than the benchmark models (see column "(%) indicators beating the benchmark"). This notwithstanding, it is challenging to practically select in real time among several sectoral indicators the best performing. The strongest predictive content is embedded in the financial sector. For the US the return on real estate, bank or financial services stocks and for the euro area the bank or insurance dividend yields.

• A comparison of the two out-of-sample periods shows consistently better predictions for the post-1999 period compared to the post-1985 both in the euro area and the US. This is signalled by both a lower relative MSFE of the best model and a larger percentage of models outperforming the benchmark in the more recent period. This improvement is notably strong for the euro area and confirms the finding of Andersson and D'Agostino (2008).

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[3] Returns, P/E and dividend yields for the total market as well as 19 sectors and the term and corporate bond spreads (see Table 1).

[4] The detailed results for the relative MSFE compared to our benchmark model are available upon request.

• The predictions for investment are generally better than those for consumption. The only exception is for the post-1999 out-of-sample period for the euro area.

• A US - euro area comparison reveals that euro area stock market indicators are more informative about domestic macro economic performance compared to the predictive content of US stock market indicators.

Table 2 Best out-of-sample performing indicators

		Post-1985			Post 1999		
Euro Area	**h**	**Best indicator**	**Relative MSFE**	**(%) indicators beating benchmark**	**Best indicator**	**Relative MSFE**	**(%) indicators beating benchmark**
GDP	1	Banks DY	0.73	59%	Banks DY	0.39	87%
GDP	2	Banks DY	0.74	59%	Banks DY	0.58	78%
GDP	3	Banks DY	0.75	57%	Banks DY	0.67	73%
GDP	4	Banks DY	0.74	52%	Banks DY	0.69	60%
C	1	Insurance DY	0.85	49%	Insurance DY	0.53	65%
C	2	Insurance DY	0.80	46%	Insurance DY	0.47	56%
C	3	Insurance DY	0.77	49%	Insurance DY	0.44	52%
C	4	Insurance P/E	0.75	46%	Insurance DY	0.47	54%
I	1	Banks DY	0.79	75%	Banks DY	0.50	70%
I	2	Banks DY	0.75	73%	Banks DY	0.63	59%
I	3	Banks DY	0.75	71%	Real Estate R	0.71	52%
I	4	Banks DY	0.75	70%	Real Estate R	0.67	49%
US	**h**	**Best indicator**	**Relative MSFE**	**(%) indicators beating benchmark**	**Best indicator**	**Relative MSFE**	**(%) indicators beating benchmark**
GDP	1	Real estate R	0.93	17%	Ind g & s / Media R	0.85	40%
GDP	2	Real estate R	0.84	27%	Media R	0.79	37%
GDP	3	Real estate R	0.83	27%	Fin Serv R	0.81	37%
GDP	4	Real estate R	0.86	24%	Bamks R	0.83	35%
C	1	-	1.02	0%	Oil & gas DY	0.97	5%
C	2	Travel & Leisure R	0.93	11%	Banks R	0.90	27%
C	3	Media R	0.94	10%	Banks R	0.90	25%
C	4	Media R	0.95	11%	Banks R	0.92	27%
I	1	Media R	0.84	43%	Fin Serv R	0.69	60%
I	2	Media R	0.88	35%	Fin Serv R	0.76	59%
I	3	Media R	0.91	30%	Fin Serv R	0.83	46%
I	4	Banks/Media	0.93	13%	Banks R	0.83	49%

Note: GDP, C and I refer to Gross Domestic Product, Consumption and Investment. h is the forecast horizon in quarters. The "Relative MSFE" column refers to the best performing indicators' MSFE relative to the autoregressive benchmark model. R, DY and P/E represent stock price returns, Dividend Yield and Price-earnings ratio respectively. A number below one indicates that the sectoral forecast model outperforms the benchmark model. "(%) indicators beating benchmark" indicates the percentage of the indicators outperforming the benchmark model.

Our findings can be explained by several economic factors.

First, not all economic sectors behave equally to changes in (expected) business activity and thus the predictive content of sectoral stock market developments might differ. Total aggregated stock market developments might and do mask striking differences across sectors, thereby blurring the potential predictive content embedded in sectoral stock prices. Among other explanations, the comparatively strong predictive content of the financial sector can be explained by a pro-cyclical financial system (see, among many others, Borio et al. 2001, Goodhart, 2010, Nikolov 2010). Pro-cyclicality can emerge when banks hold an insufficient capital buffer and are forced to reduce their assets in downturns. This could be due to reduce leverage or as a reaction to the lower value of collaterals, also known as a financial accelerator phenomenon. This mechanism is pro-cyclical given that asset prices tend to be positively correlated with the business cycle. Moreover, credit can be tightened in downturns and eased in booms more than would be justified by the state of the business cycle or by changes in the credit worthiness of borrowers. The financial system tend to be prone to have a more lax assessment of risk in good times than in bad ones influenced by the economy's general environment, the procyclicality of the cash flow of borrowers as well as of the value of collaterals. In addition, financial intermediaries may also intermediate the pro-cyclicality of other markets in so far as they depend on the funding they obtain and that is much scarcer in bad times. Such scarcity of funds (either equity or borrowing) will result in a diminished capacity to lend. This can be exacerbated by regulation and accounting standards (Panetta et al. 2009). Bonuses linked to business growth in favourable years and to business retrenchment in bad ones might be more pronounced in the financial sector leading managers to take excessive risks and focus on short-term performances.

Second, the improvement in predictive content for the post-1999 period compared to post-1985 is probably related to an increasing economic importance of the stock market. This view is supported by some empirical studies that have shown that a developed and liquid stock market can be beneficial for long-run economic growth and, in some instances, be a useful indicator to predict future economic growth (see for example Demirgüç-Kunt and Levine (1996), Levine and Zervos (1998) and Beck and Levine (2002)). Stock market capitalisation has increased from 25% of GDP end-1984 to 123% of GDP end-1998 in the US and from 6% of GDP end-1984 to 55% of GDP end-1998 in the euro area. Although stock market capitalisation in terms of GDP was in 1998 more than twice as high in the US than in the euro area, the increase in stock market capitalisation was more impressive in the euro

area than in the US (almost ten times higher in the euro area compared to five times in the US). Moreover, for the euro area, where the improvement in forecast performance is the strongest, the integration of equity markets has increased considerably since 1999 driven by the elimination of exchange rate volatility and reduced uncertainty in the process of monetary unification (see Fratzscher, 2002). It is possible that the introduction of the monetary union has helped to sharpen the linkages between stock market indicators and macro economic fundamentals at the euro area level. In such an environment of deeper financial integration of euro area equity markets it became more common for investors to focus on diversification across sectors rather than across euro area countries. In fact, around the start of Stage Three of EMU the asset management industry generally moved from top-down country-based equity allocation strategies to top-down global sector-based equity allocation strategies. Even if the empirical evidence is not fully conclusive and results depend on the sample period considered, Moerman (2008) documents that for the euro area in the period 1995-2002 diversification over industries yielded more efficient portfolios than diversification over countries.

Third, the good performance of investment compared to consumption is probably explained by the fact that investment is cyclical in its nature and the autoregressive benchmark model is therefore hard to beat for the comparatively stable private consumption.

Fourth, sectoral stock prices are more informative to predict GDP in the euro area than in the US as indicated by a larger fraction of models outperforming the euro area benchmark compared to the US. This finding, together with our result of a stronger forecast performance of investment than for consumption, is consistent with Angeloni et al. (2003) who show that the output pattern is predominantly investment driven in the euro area and consumption driven in the US. Another factor explaining this finding could relate to the higher weight of financial stocks in terms of total market capitalisation in the euro area than in the US.

4.2. Forecast performance relative to bond market indicators

Although not entirely conclusive, the earlier strand of this literature has broadly concluded that financial indicators extracted from the bond market are more reliable than other financial indicators when it comes to predicting business fluctuations. The question then arises how well the stock market indicators and their sectoral decomposition considered here

perform in comparison with bond market indicators. Empirical research has suggested the term spread (usually defined as the difference between ten-year government bond yields and three-month treasury bill rate) and the corporate bond spreads (usually defined as the difference between the yields offered on long-term corporate debt and government bond yields with similar maturity) are particularly informative.[5] There are well founded theoretical reasons why these bond-market based spreads should contain useful information about future economic activity. The term spread has historically tended to flatten or even invert ahead of an upcoming recession as market participants expect monetary policy to become less accommodative and price long-term yields accordingly. Similarly the corporate bond spread is a proxy for the premium on firms' external financing and their default risk. During economic recessions firms are more prone to default and investors may signal this in advance by demanding higher premia to invest in firms' debt.

Against this background, Table 3 provides the forecast performance in terms of relative MSFE for the best sectoral basic forecast model and the total stock market indicator (in each case for the return, P/E ratio and DY) as well ad the forecast performance of models based on financial spreads (term and corporate bond spread). All results are reported for the post-1985 and post-1999 samples. Three main results emerge.

- The best sectoral basic forecast model outperforms in all cases the forecasts based on the aggregate stock market indicators and also the financial spreads, stressing the potential usefulness to have a detailed look at sectoral stock market developments. This is also confirmed by Hong et al. (2007) showing that sectoral information is able to lead and predict the overall market and also has predictive power in forecasting future economic activity.
- Among the aggregate stock market indicators, the stock market return predicts generally the best for the US (even if the relative MSFE is quite large) while the aggregate dividend yield performs better in the case of the euro area.
- A common feature for both the US and the euro area is a poor predictive performance of the P/E ratio compared to those of the return and the dividend yield, at both the total market and the sectoral level.

[5] For a recent survey about the term spread, see Wheelock and Wohar (2009) and for the usefulness of the corporate bond spread, see de Bondt (2004) and Mody and Taylor (2004).

Table 3 Forecast performance of the best basic sectoral forecast models, total stock market and financial spreads models

		Post-1985								Post-1999							
Euro Area	**h**																
		Best sector			**Total stock market**			**Financial spreads**		**Best sector**			**Total stock market**			**Financial spreads**	
		Returns	P/E	DY	Returns	P/E	DY	TS	CBS	Returns	P/E	DY	Returns	P/E	DY	TS	CBS
GDP	1	0.86	0.95	0.73	0.91	1.03	0.88	0.99	0.83	0.66	0.89	0.39	0.66	0.93	0.60	1.04	0.65
GDP	2	0.88	0.94	0.74	0.93	1.04	0.87	0.99	0.79	0.75	0.93	0.58	0.75	0.95	0.70	1.00	0.70
GDP	3	0.88	0.96	0.75	0.95	1.01	0.86	1.00	0.79	0.79	0.92	0.67	0.79	0.97	0.77	0.96	0.72
GDP	4	0.87	0.98	0.74	0.93	0.99	0.85	1.01	0.80	0.79	0.90	0.69	0.79	0.99	0.80	0.93	0.72
C	1	0.94	0.93	0.85	0.96	1.00	0.98	0.98	1.02	0.77	0.76	0.53	0.78	0.95	0.97	0.97	1.07
C	2	0.92	0.85	0.80	0.94	1.00	0.98	0.95	0.90	0.82	0.69	0.47	0.82	0.98	1.01	0.97	0.72
C	3	0.88	0.80	0.77	0.91	1.00	0.99	0.94	0.84	0.76	0.65	0.44	0.79	1.00	1.03	0.98	0.60
C	4	0.89	0.75	0.78	0.92	1.02	1.01	0.94	0.82	0.80	0.62	0.47	0.82	1.04	1.05	0.99	0.58
I	1	0.95	0.88	0.79	0.98	0.93	0.86	0.93	0.96	0.85	0.88	0.50	0.88	0.95	0.92	0.93	0.98
I	2	0.90	0.85	0.75	0.96	0.89	0.82	0.88	0.88	0.77	0.88	0.63	0.88	1.01	0.98	0.86	0.83
I	3	0.85	0.83	0.75	0.95	0.89	0.81	0.84	0.86	0.71	0.89	0.74	0.86	1.07	1.02	0.82	0.81
I	4	0.81	0.84	0.75	0.96	0.93	0.84	0.82	0.86	0.67	0.91	0.80	0.86	1.13	1.07	0.80	0.78

		Post-1985								Post-1999							
US	**h**																
		Best sector			**Total stock market**			**Financial spreads**		**Best sector**			**Total stock market**			**Financial spreads**	
		Returns	P/E	DY	Returns	P/E	DY	TS	CBS	Returns	P/E	DY	Returns	P/E	DY	TS	CBS
GDP	1	0.93	1.02	0.93	1.03	1.22	1.03	1.27	1.14	0.85	1.00	0.87	0.86	1.21	0.93	1.20	0.98
GDP	2	0.84	1.03	0.90	0.94	1.36	0.99	1.45	1.23	0.79	1.01	0.79	0.81	1.22	0.91	1.32	1.16
GDP	3	0.83	1.03	0.94	0.91	1.28	0.98	1.40	1.29	0.81	1.02	0.83	0.84	1.19	0.94	1.27	1.28
GDP	4	0.86	1.03	0.98	0.94	1.29	1.02	1.41	1.36	0.83	1.01	0.88	0.89	1.16	0.99	1.23	1.37
C	1	1.02	1.07	1.03	1.24	1.45	1.11	1.26	1.25	0.99	0.97	0.97	1.19	1.21	1.03	1.48	1.22
C	2	0.93	1.04	0.98	1.08	1.42	1.03	1.37	1.31	0.90	1.00	0.95	1.00	1.26	0.97	1.45	1.32
C	3	0.94	1.01	0.98	1.03	1.30	1.07	1.36	1.36	0.90	1.03	0.93	0.98	1.23	1.00	1.37	1.35
C	4	0.95	1.05	1.04	1.02	1.33	1.09	1.30	1.36	0.92	1.04	0.94	0.98	1.18	1.01	1.29	1.36
I	1	0.84	1.01	0.88	0.86	1.09	0.92	1.17	0.92	0.69	1.00	0.83	0.71	1.00	0.86	1.17	0.69
I	2	0.88	1.01	0.92	0.95	1.28	0.97	1.20	1.17	0.76	0.99	0.87	0.78	1.09	0.89	1.15	1.03
I	3	0.91	1.00	0.93	0.98	1.31	1.00	1.19	1.26	0.83	0.99	0.93	0.86	1.16	0.97	1.11	1.18
I	4	0.93	1.02	0.97	0.99	1.38	1.04	1.17	1.34	0.83	0.97	0.93	0.87	1.22	0.99	1.07	1.26

Note: GDP, C and I refer to Gross Domestic Product, Consumption and Investment. h is the forecast horizon in quarters. The numbers refer to the relative MSFE over the respective out-of-sample period of each selected forecast model relative to the autoregressive benchmark model. A number below one indicates that a selected forecast model outperforms the alternative one. R, DY, P/E, TS and CBS represent stock price returns, Dividend Yield, Price-earnings ratio, Term spread and Corporate Bond Spread respectively.

5. Alternative forecast models

This section analyses whether the forecast performance can be further improved by considering two alternative models: measurement versus utilities and estimating a fundamental-based stock price index (see Appendix A and B for a discussion). The intuition of the first approach is to consider the excess return or valuation metric of a given sector above the benchmark return or valuation metric of the utility sector (likely to be a comparatively a-cyclical sector) in order to gauge a cyclical indicator which should track the economic cycle. The second approach uses an estimate of the fair value of the stock price

index, rather than the actual stock price index level, based on fundamental variables (earnings, risk free rate and equity risk premium).

Tables 4 and 5 summarise the out-of-sample forecast exercise by focusing on the best predicting sectoral stock market indicators according to the measurement versus utilities and based on fundamentals, respectively. The results are as follows.

• The model based on measurement versus utilities shows compared to the basic forecast model only an improved forecast performance for US consumption, with retail (post-1985 period) and telecom (post-1999 period) as informative sectors. In general, however, there are no forecast gains compared to the basic forecast model and they are small compared to the benchmark model (most numbers are below but close to one).

Table 4 The best out-of-sample performing sectors applying the alternative measurement versus utilities (see Appendix A)

Euro Area	h	Alternative forecast model: measurement versus utilities					
		Relative MSFE	Best sector	Indicator	Relative MSFE	Best sector	Indicator
		Post-1985			Post-1999		
GDP	1	0.97	Const. & mat. / Total	DY	0.94	Total	DY
GDP	2	0.97	Constr. & mat. / Media	R/DY	0.97	Constr. & mat. / Retail	P/E - R
GDP	3	0.97	Constr. & mat. / Media	R/DY	0.96	Retail	P/E
GDP	4	0.96	Constr. & mat. / Leisure	R/DY	0.94	Retail	P/E
C	1	0.93	Constr. & mat.	DY	0.77	Banks	DY
C	2	0.88	Insurance	P/E	0.73	Banks / Insurance	P/E - DY
C	3	0.84	Insurance	P/E	0.70	Insurance	P/E
C	4	0.80	Insurance	P/E	0.66	Insurance	P/E
I	1	0.96	Media	DY	0.98	-	-
I	2	0.94	Media	DY	0.98	Healthcare / Food & bev.	R
I	3	0.93	Media	DY	0.98	Const. & mat.	R
I	4	0.94	Media	DY	0.97	Financial services	R

United States	h	Alternative forecast model: measurement versus utilities					
		Relative MSFE	Best sector	Indicator	Relative MSFE	Best sector	Indicator
		Post-1985			Post-1999		
GDP	1	0.97	Telecom	DY	0.93	Telecom	DY
GDP	2	0.95	Telecom	DY	0.90	Telecom	DY
GDP	3	0.95	Auto & parts / Fin. serv.	R/DY	0.90	Telecom	DY
GDP	4	0.94	Auto & parts	DY	0.86	Telecom	DY
C	1	**0.97**	Retail	P/E	**0.88**	Telecom	DY
C	2	0.95	Retail	P/E	**0.82**	Telecom	DY
C	3	**0.93**	Retail	P/E	**0.77**	Telecom	DY
C	4	**0.91**	Retail	P/E	**0.76**	Telecom	DY
I	1	0.93	Financial services	R	0.86	Financial services	R
I	2	0.92	Financial services	R	0.88	Financial services	R
I	3	0.93	Financial services	R	0.89	Financial services	R
I	4	**0.92**	Financial services	R	0.85	Auto & parts	DY

Note: GDP, C and I refer to Gross Domestic Product, Consumption and Investment. h is the forecast horizon in quarters. The "Relative MSFE" column refers to the best performing indicators' MSFE relative to the autoregressive benchmark model. R, DY and P/E represent stock price returns, Dividend Yield and Price-earnings ratio respectively. A number below one indicates that the sectoral forecast model outperforms the benchmark model, in bold that the forecast performance of the alternative forecast model is at least as good as that of the basic forecast model as presented in Table 2.

• The alternative forecast model focusing on the fundamental part of the sectoral stock price index shows generally an improved forecast performance compared to the basic forecast model, in particular for private consumption and investment for the longer forecast horizons. This finding is consistent with de Bondt (2011) who argues that equity wealth effects on euro area consumption are fundamental-driven. This result suggests that also other stock price channels work more through changes in the fundamental component of stock prices rather than the remaining non-fundamental or bubble component. For the euro area the best predictive content is embedded in the bank dividend yield and for the US in the financial services stock returns, confirming our earlier finding that the financial sector is particularly informative.

Table 5 The best out-of-sample performing sectors applying the fundamental-based model (see Appendix B)

Euro Area	h	Alternative forecast model: fundamentals					
		Relative MSFE	Best sector	Indicator	Relative MSFE	Best sector	Indicator
		Post-1985			Post-1999		
GDP	1	0.73	Banks	DY	0.54	Banks	DY
GDP	2	**0.70**	Banks	DY	0.60	Banks	DY
GDP	3	**0.66**	Banks	DY	**0.59**	Banks	DY
GDP	4	**0.60**	Banks	DY	**0.53**	Banks	DY
C	1	0.86	Banks	DY	**0.40**	Banks	DY
C	2	**0.75**	Banks	DY	**0.31**	Banks	DY
C	3	**0.62**	Banks	DY	**0.24**	Banks	DY
C	4	**0.58**	Banks	DY	**0.23**	Banks	DY
I	1	**0.77**	Banks	DY	0.63	Banks	DY
I	2	**0.68**	Banks	DY	0.68	Banks	DY
I	3	**0.61**	Banks	DY	**0.63**	Banks	DY
I	4	**0.56**	Banks	DY	**0.55**	Banks	DY

United States	h	Alternative forecast model: fundamentals					
		Minimum	Best sector	Indicator	Minimum	Best sector	Indicator
		Post-1985			Post-1999		
GDP	1	0.93	Financial services	R	0.85	Financial services	R
GDP	2	0.91	Financial services	R	0.86	Financial services	R
GDP	3	0.91	Financial services	R	0.87	Financial services	R
GDP	4	0.93	Total market	R	0.90	Total market	R
C	1	**0.96**	Banks	R	**0.65**	Financial services	R
C	2	**0.89**	Financial services	R	**0.63**	Financial services	R
C	3	**0.89**	Financial services	R	**0.70**	Financial services	R
C	4	**0.94**	Total market	R	**0.80**	Automotive	P/E
I	1	0.91	Financial services	R	0.79	Financial services	R
I	2	**0.87**	Financial services	R	0.77	Financial services	R
I	3	**0.87**	Financial services	R	**0.80**	Financial services	R
I	4	**0.90**	Total market	R	**0.83**	Total market	R

Note: see the note to Table 4.

6. Conclusions

This study examines the predictive content of sectoral stock market data for real GDP, consumption and investment up to four quarters ahead in the US and the euro area. Our out-of-sample exercise for the periods 1985-2009 and 1999-2009 confirms the mixed evidence found in the literature for the information content of the total stock market. Sometimes the total stock price return predicts on average better than the autoregressive benchmark model and many times not. Among the total stock market indicators considered, the dividend yield predicts the best, for the US even consistently better as the term and corporate bond spreads.

Further and substantial forecast improvement can, however, be achieved by taking a close look at sectoral stock price developments. We show that the predictive content as embedded at the sectoral level is significantly stronger as in the total market as well as compared to information entailed in financial spreads (term and corporate bond spreads). Among the best predicting sectors are financial-related sectors, in the US especially the return on financial services stocks and in the euro area the bank dividend yield. We also show that it is typically easier to predict investment by sectoral stock prices than consumption and that the sectoral information embedded in the stock market is more informative for future economic activity in the euro area than in the U S. A likely explanation is the fact that the output pattern in the euro area is more investment driven and in the US more shaped by consumption. Moreover, we show that the forecast performance for US consumption can be improved by considering the sectoral stock market indicators vis-à-vis those of the utilities sector. Even further forecast improvements for US and euro area consumption as well as investment are reported by out-of-sample exercises based on our second alternative forecast model, which focuses on the fundamental part of the sectoral stock price index.

Our main finding that the stock market at sectoral level does have a strong predictive content for real GDP, consumption and investment stresses the need for analysts and policy makers to monitor closely and examine in depth sectoral stock price developments, in particular those in financial-related sectors. The selection of the best performing sectoral stock market indicator among all potential ones is, however, a challenge in real-time practice.

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Appendix

Alternative Forecast models

A. Measurement relative to the utilities sector

The first alternative forecast model considers the difference between the respective sector stock price indicator and the same indicator for utilities, following Browne and Doran (2005).

The latter examine the predictive content of US sectoral stock prices relative to those of utilities instead of the sector stock returns as done in our basic forecast model. They analyse thus the predictive content from the excess return of a sector above the benchmark return on utilities. The logic behind it is that the return from sectors whose profits are likely to be pro-cyclical relative to the stock price of a sector whose profits are likely to be a-cyclical should be a good forecast of the cycle itself. Moreover, the methodology of Browne and Doran (2005) is based on the evidence of differences in the relative performance of sectors at different stages of the business cycle (see Beber et al., 2010). Browne and Doran take utilities as a benchmark on the assumption that profitability in this sector, and hence stock prices of utilities, is less likely to be affected by the business cycle. For example, households tend to retrench on non-essential expenditures (e.g. spending on luxury goods and leisure) when the economy slows down, but tend to maintain their expenditures on essentials such as electricity, gas, water and garbage disposal, i.e. utilities.

B. Fundamental–based stock price

The second alternative forecast model considers not the raw stock price index, but only the fair value of the stock price index based on fundamentals. Our proxies of the unobservable fair fundamental stock price are based on long-run estimates of a modified version of the dynamic present value model by Campbell and Shiller (1988). Sharpe (2002) reformulated the original dividend-price ratio model into an earnings-price ratio model, by breaking the log dividends per share into the sum of log earnings per share and the dividend payout ratio. This is typically done because dividend payments are, in contrast to earnings, sensitive to the dividend payout, share buyback and tax policies. More formally:

$$e_t - p_t = -\frac{\kappa}{1-\rho} + E_t\left\{\sum_{j=0}^{\infty}\rho^j r_{t+j} - \sum_{j=0}^{\infty}\rho^j \Delta e_{t+j} - (1-\rho)\sum_{j=0}^{\infty}\rho^j (d_{t+j} - e_{t+j})\right\} \qquad \text{(A.1)}$$

where e_t-p_t denotes the log earnings-price ratio at time t, κ is a parameter of linearization, ρ is a constant less than unity, which can be thought as a discount factor, $E_t\{.\}$ is the expectation based on the information set available at time t, r_{t+j} denotes log stock return during period $t+j$, Δe_{t+j} refers to earnings growth in $t+j$, and d_{t+j}-e_{t+j} denotes log of the payout ratio (dividends / earnings) in $t+j$. Moreover, we model the expected equity return $E_t\{r_{t+j}\}$ as a sum of the return of a risk-free asset (rf_{t+j}) and a time-varying equity risk premium (rp_{t+j}). Finally, we assume a constant dividend pay-out ratio (d_{t+j}-e_{t+j}).

In this framework, stock prices depend one-to-one to earnings and upon unobservable variables such as the expected future growth in earnings and a time-varying discount factor, typically split into a risk-free rate and a proxy for the equity risk premium. In our empirical implementation we relate stock prices to an observed earnings measure reflecting the earnings power, because expected earnings are well-known to be biased. Due to the uncertainty about which observed earnings measure to use, we do not assume a priori a one-to-one earnings elasticity. The estimated general version of the long-run stock price relation reads then as follows:

$$p_t = \alpha + \beta_1 e_t + \beta_2 rf_t + \beta_3 rp_t + \varepsilon_t \qquad \text{(A.2)}$$

where p_t denotes log of real stock prices at time t, e log of real earnings, r_f real risk-free interest rate, rp equity risk premium and ε the residual. We expect the parameter β_1 to be close to one and parameters β_2 and β_3 to be negative, given they reflect the negative impact from the discount rate on stock prices, divided into the negative effects from the safe asset return and from the premium on risky equity. In our empirical implementation, we examine the current (twelve-month trailing) reported earnings. For the discount factor we examine the risk-free rate, captured by the ten-year government bond yield, and the one-month lagged five-year moving average of the earnings yield premium, approximating the long-run fair level of the equity risk premium as proposed by de Bondt (2008). The equation is estimated with two-stage least squares, because the stock price determinants are measured with error. The instruments used are four lags of the independent variables. The fundamental forecast model equals the basic forecast model, except that the estimated long-run fair value of the stock price index based on Eq. (A.2), p^f, instead of the observed actual stock price index, p, is used for the respective stock market indicators (return, P/E ratio and dividend yield).