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# ECONOMIC FUNDAMENTALS AND STOCK MARKET VALUATION: A CAPE-BASED APPROACH

by Maria Ludovica Drudi* and Federico Calogero Nucera*

**Abstract**

This paper estimates a fair-value model, based on macroeconomic fundamentals, of the Shiller Cyclically Adjusted Price-to-Earnings (CAPE) ratio. By performing a multi-country analysis, we find that CAPE – a widely used metric for stock market valuations – is, in general, positively related to economic growth and negatively related to the real long-term interest rate and to measures of economic volatility computed using industrial production and inflation data. Empirical evidence arising from predictive regressions of real stock market returns indicates that deviations of CAPE from its estimated fair value are negatively related to future stock returns. A prediction model based on these deviations outperforms, in many cases, a model based on the CAPE levels both in sample and out of sample.

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# 1 Introduction

"***...Making judgments about the appropriate level of stock prices is a difficult and often humbling endeavor.***", Lansing (2017)[1]

For the United States, in the course of 2021, the Shiller Cyclically-Adjusted Price-to-Earnings ($CAPE$) ratio has reached levels not seen since the *dotcom* bubble of early 2000s. The $CAPE$ ratio or, simply, $CAPE$ is a metric widely used by investors to assess if stock market valuations are high or low relative to the past and if a price correction is at the horizon. $CAPE$ owns its success to its computational simplicity (it is just a refined version of the standard price to earnings ratio) and, most importantly, to its ability to predict stock market returns over the long horizon (e.g., 10 years). The exceptionally high levels of $CAPE$ observed for United States during 2021 were particularly surprising if compared with their historical norm and considering the effects of the Covid-19 shock, thereby raising the question whether the underlying economic conditions justified the observed stock market valuations.[2] For other countries, stock market valuations measured by $CAPE$ were more in line with their long-run averages. However, also for them, market observers wondered whether a correction was at the horizon as $CAPE$, in general, exceeded its pre-pandemic level at the end of June 2021.

Motivated by these considerations, this paper develops a *fair-value* model of $CAPE$ based on macroeconomic fundamentals and performs a cross-country empirical analysis assessing if stock market valuations are in line with the resulting benchmark. The former, in particular, is obtained by estimating a simple linear regression model that relates $CAPE$ to macroeconomic explanatory variables. We select these variables following economic theory, according to which the real interest rate, the economic growth, and the economic uncertainty should explain most of the variation of the stock market. Our variables' selection is coherent with a Gordon Growth model in which the real interest rate is used to discount cash flows, cash flows increase over time at the same growth rate of the overall economy, and economic uncertainty is the main determinant of investors' risk aversion. In defining the output of the estimation as a *fair-value*, we are well aware that fair-value models are imperfect by nature and often criticized, as stock prices can diverge from fundamentals for extended periods. Despite this limitation, we believe that an approach based on fundamentals, and in particular on macroeconomic variables, can provide policymakers that use $CAPE$ to evaluate stock market mis-pricing with a more informative benchmark than simply using the long-term average of $CAPE$ itself, as it

[1]We are indebted for comments or useful conversations to Kevin Lansing, Marcello Pericoli, Marco Taboga, seminar participants at the Bank of Italy and two anonymous referees. We thank Alessandro Montino for outstanding research assistance.

[2]The strong performance of technological stocks has certainly contributed to the quick recovery of $CAPE$ during the first phase of the pandemic. However, following the easing of the Covid-related containment measures, the performance of other sectors (e.g., financials and energy) at the center of the so-called *reflation trade* may have contributed to further increase $CAPE$.

is customarily done.

While we follow a standard approach in the choice of the measures for the real interest rate and the economic growth, we choose to model economic uncertainty with two measures of macroeconomic volatility that are not usually taken into account when assessing stock market valuations, i.e., the volatility of economic growth and the volatility of inflation.[3] The pandemic economic landscape has, in fact, inspired the following considerations. First, after a shock (e.g., the Covid-19 shock), the road to economic recovery can take different paths. Output can be promptly restored (so-called "V" recovery), for instance thanks to specific fiscal and monetary policy measures, but it can also fluctuate for some time, despite the efforts of policymakers (so-called "W" recovery). A "W" type of economic recovery can extend for prolonged periods the negative impact of the initial shock on the stock market and on investors' risk aversion. By inserting the volatility of economic growth in the specification of our fair-value model, we want to assess how stock market valuations relate to the dynamic - rather than the level - of economic growth. Second, inflation has recently surged after years of stability around very low values. Following the Covid-19 shock, base effects and supply-chain bottlenecks have contributed to a sharp rise of the inflation rate in most advanced economies. However, there was a widespread agreement that this increment in inflation was to a great extent the consequence of temporary effects (see, for instance, Powell, 2021, Lagarde, 2021), although more persistent than originally expected. Since the existing literature has mostly focused on the relationship between expected or realized inflation and stock returns[4], little is known about how stock market valuations are affected by inflation volatility.

Although with some caveats that will be examined in detail in the following sections of the paper, the estimation of our fair-value model of stock market valuations provides the following results that in general hold for all the countries taken into account. First, higher real interest rates are associated with lower valuations, as they correlate negatively with $CAPE$. Second, as expected, periods of sustained economic growth are associated with high valuations as they correlate positively with $CAPE$. Finally, macroeconomic volatility coincides with periods of decreasing valuations as both volatility of economic growth and volatility of inflation correlate negatively with $CAPE$.

We conclude our empirical analysis by appraising whether the fair-value model can be used to improve the forecast of future stock returns. We estimate four rival predictive models, the first based on $CAPE$, the second based on the deviations of $CAPE$ from its fair-value, the third based on the excess $CAPE$ (Shiller, 2015) and the last based on the 10-year moving average

[3]The analysis performed in this paper is based on *realized* measures of macroeconomic volatility. In future research, it would be interesting to test the robustness of our results by focusing on *forward-looking* measures.

[4]A notable exception is represented by Pindyck (1984) that investigates the role of inflation volatility as a potential determinant of the strong decline experienced by the New York Stock Exchange Index between 1965 and 1981.

of $CAPE$. Since the forecasting performance of $CAPE$ is known to be good for long-term returns (Campbell and Shiller 1998), but poor when predicting short-term returns, the aim of this exercise is to evaluate whether deviations from the fair-value model provides a better guidance than $CAPE$ - and the other competing models based on $CAPE$ - about subsequent stock returns measured over short-time horizons (e.g., from 1 month to 36 months).

Although forecasting short-term stock market returns remains a very difficult task, the results of the estimation of the predictive regressions show that, in sample, there are cases in which the model based on deviations actually outperforms the rivals over the shortest horizons. In particular, for the United States and Italy, we find that the r-squared (i.e., the regression fit) of the model based on $CAPE$ deviations is higher for horizons ranging from 1 month to 12 months and from 12 months to 24 months, respectively. For the United Kingdom and France, instead, the model based on $CAPE$, in general, delivers a better fit for all the horizons taken into account. For Germany the opposite holds true, as the model based on deviations performs always better than the rival models.

Then, following Davis et al. (2018), Waser (2021) and encouraged by the partial success in sample, we also test the predictive ability of the model based on the deviations of $CAPE$ from its fair-value in an out-of-sample framework. In this set-up, the benchmark rival model is the historical average of stock returns since it is considered by the literature as a difficult benchmark to outperform (Goyal and Welch 2003, Welch and Goyal 2008, Neely et al. 2014). In our horse race, we also include $CAPE$ and the excess $CAPE$ (Shiller, 2015). The result of the out-of-sample forecasting analysis can be summarized as follows. For the United States, we find that the out-of-sample r-squared (oos r-squared) and the mean-squared-forecast-error (MSFE) of the model based on $CAPE$ deviations are, respectively, the highest and the lowest when predicting returns 6- and 12-month ahead. This implies that, at these horizons, the model based on deviations performs better than the other models, historical average included. We find a similar evidence for France and for Germany (for horizons ranging from 6- to 24-month ahead and from 6- to 36-month ahead, respectively); for the United Kingdom and Italy the model based on deviations fails to outperform the historical average for all the horizons considered, although sometimes it performs better than $CAPE$ or excess $CAPE$.

Our paper contributes to the extensive literature about stock market valuations and the predictability of stock returns. This literature includes both academic articles and papers written by practitioners working in the financial industry. Since the literature focusing on this topic is vast, we only mention the works that inspired our paper the most. Our work relates to the strand of the literature that links stock market valuations (or the equity risk premium) to the economic environment and economic uncertainty. In particular, we refer the interested reader to Lettau et al. (2007), Binder et al. (2010), Daly et al. (2010), and, specifically for

$CAPE$, to the works by Lansing (2004), Lansing (2017), Arnott et al. (2017), Davis et al. (2018), Lansing (2020) and Waser (2021). In particular, Lansing (2004) pioneer the use of a simple regression model based on a small group of macroeconomic explanatory variables to account for $CAPE$ fluctuations for the United States. Arnott et al. (2017) estimate a fair-value model of $CAPE$ and find, in general, a good explanatory power, but not as good as in Lansing (2017) and in Lansing (2020). Moreover, they find evidence that the disappointing predicting power of $CAPE$ for short-term returns can be enhanced by using a model based on deviations of $CAPE$ from its estimated fair-value. In a similar vein, Davis et al. (2018) propose a CAPE regression methodology that combines $CAPE$ mean reversion with the current and expected future conditions in the macroeconomy; Waser (2021) estimates a fair-value model for $CAPE$ based on economic variables and tests its out-of-sample forecasting ability. Summing up, the papers that are closer to ours are Arnott et al. (2017), Davis et al. (2018) and Waser (2021). Relative to these papers, our work provides a twofold contribution; first, it specifically investigates how $CAPE$ relates to the volatility of inflation which is a variable that can be addressed by monetary policies[5]; second, it estimates the fair-value model of $CAPE$ (and test its in-sample and out-of-sample predictive ability) for a wide set of European countries (UK, Germany, France, Italy), while Arnott et al. (2017), Davis et al. (2018) and Waser (2021) focus mainly on the United States.[6]

The remaining part of the paper is organized as follows. Section 2 introduces the empirical methodology and provides details about the construction of the variables used for the estimation of the fair-value model. Section 3 provides information about the dataset, while Section 4 provides an explanation of the main results of the econometric analysis. Section 5 describes some robustness checks concerning our empirical analysis, while Section 6 concludes.

# 2 Empirical Methodology

The first step of our empirical analysis is the estimation of a fair-value model of stock market valuations. The model provides a benchmark that can be used to assess whether economic fundamentals provide some justifications for the observed value of $CAPE$. As anticipated, $CAPE$ is a widely-used metric by investors to evaluate whether the stock market is over/undervalued and, most importantly, it is proven to be a reliable predictor of long-term returns. Following the original approach in Campbell and Shiller (1988) and in Campbell and Shiller (1998), we compute $CAPE$ as the ratio between the current real price of the stock market index and a

[5]Specifically, Arnott et al. (2017) consider the real government bond yield and the inflation rate; Davis et al. (2018) add to these variables the realized S&P 500 price volatility and the realized volatility of changes in the real bond; Waser (2021), in addition to the real bond yield and inflation, consider the moving averages of gross domestic product (GDP) growth and earnings growth plus the volatility of GDP growth.

[6]Arnott et al. (2017) also extend its analysis to a set of developed countries, but only at the aggregate level.

ten-year average of its earnings. Earnings are also adjusted for inflation and, as a consequence, $CAPE$ is based on real variables only. Following Shiller (2015), we measure the real interest rate ($Yield_R$) as the 10-year government bond yield minus the average actual inflation rate over the preceding ten years (i.e., a proxy for expected inflation). Afterwards, we measure economic growth as the 5-year moving average of the annual industrial production growth ($\overline{IP}_G$). Finally, we use two measures for macroeconomic volatility. The first is the volatility of the annual industrial production growth ($Vol_{IP_G}$), while the second is the volatility of the annual inflation rate ($Vol_{Infl}$). Both measures are computed by using a 3-year rolling-window. Rather than using the same 5-year horizon applied to the growth measure, we prefer to use a shorter horizon for the computation of the volatility measures in order to improve the fit of the model and to capture the more short-term effects of volatility on investors' behaviour. The fair-value model of stock market valuation is defined as the fitted value obtained by estimating via ordinary least squares (OLS) the following regression:

$$log(CAPE_t) = c + \beta_1 Yield_{R,t-3} + \beta_2 \overline{IP}_{G,t-3} + \beta_3 Vol_{IP_G,t-3} + \beta_4 Vol_{Infl,t-3} + \epsilon_t \qquad (1)$$

We base our analysis on monthly observations and we lag the explanatory variables by three months as macroeconomic data are usually released with this lag. In this way, our model can in principle be estimated at the end of each month, with the available data. We are aware that, following this choice, our model is intrinsically backward looking, but we consider as fundamental to avoid any look-ahead bias in the estimation.[7]

Our methodology can be easily applied to stock market sectors by first computing the sector's CAPE and, then, by estimating the same regression as in equation (1). We expect that different sectors would exhibit different regression coefficients and, as a consequence, that the estimated fair-value model would be sector-specific. However, ex-ante, it is not clear whether the deviations of a sector's CAPE from its model-based fair value could provide additional insights with respect to the Relative CAPE indicator which normalizes the CAPE ratio of a sector relative to its own long-term history and therefore enables comparisons of the over- and undervaluation signals of the CAPE ratio across sectors (Bunn and Shiller, 2014).

To complement the analysis, we also estimate predictive regressions of real stock market returns for different predictive horizons $k = 1, 6, 12, 18, 24, 36$ months. The regressions are specified as:

$$r_{t+k} = \alpha + \beta Pred_t + \epsilon_t \qquad (2)$$

where $r_{t+k}$ is the logarithm of the observed stock market real return, annualized, from month $t$ to month $t+k$, and $Pred_t$ is a predictor variable measured at month $t$. In particular, we

[7]Look-ahead bias consists in assuming that fundamental information is available to the researcher at the time of the empirical analysis when, actually, it is not.

consider four predictors, namely: i) $log(CAPE_t)$, i.e., the natural logarithm of $CAPE$; ii) $[log(CAPE_t) - FV_{CAPE,t}]$, i.e., the deviation of $log(CAPE_t)$ from the estimated logarithm of the fair value, $FV_{CAPE,t}$; iii) the excess $CAPE$ (Shiller, 2015), defined as the inverse of $CAPE$ minus the current 10-year real interest rate; iv) the 10-year moving average of $CAPE$ ($10YAV$).

Finally, we test the predictive ability of the model based on the deviations of $log(CAPE)$ from its fair-value in an out-of-sample framework by performing a horse race among competing models. The set of model considered includes also $log(CAPE)$ and the excess $CAPE$. It is worth noting, however, that the benchmark rival model in the out-of-sample context is the historical average of stock returns (Goyal and Welch 2003, Welch and Goyal 2008, Neely et al. 2014). The prediction implied by the historical average is given by $\hat{r}_{t+k} = (1/t)\sum_{s=1}^{t} r_s$. Instead, the out-of-sample forecast of the stock market real return at month $t + k$, based on an individual predictor and data up to month $t$, is given by

$$\hat{r}_{t+k} = \hat{\alpha}_t + \hat{\beta}_t Pred_t \tag{3}$$

where $\hat{\alpha}_t$ and $\hat{\beta}_t$ are the OLS estimates obtained by regressing $[r_s]_{s=k+1}^{t}$ on a constant and $[Pred_s]_{s=1}^{t-k}$. For the United States, we use May 1983 to May 1998 as the initial period for parameters' estimation, while for the European countries we use July 1991 to June 2003. Those periods correspond to about 40 per cent of the available observations for each country. In doing that, we follow the principle according to which out-of-sample tests of predictive ability have better size properties when the subsample on which the forecasts are performed is a relatively large proportion of the available sample. From the first observation following the end of those initial estimation periods until the end of the samples, we recursively estimate the parameters (i.e., $\hat{\alpha}_t$ and $\hat{\beta}_t$) by adding each time an observation to the estimation sample, thereby effectively using an expanding window for their estimation.

Concluding this section is worth to point out that, given the usual poor performance of $CAPE$ as a predictor for short-term stock returns, the aim of this second part of the empirical analysis (i.e., in-sample and out-of-sample prediction) is to ascertain if deviations of $CAPE$ from the fair value implied by macroeconomic variables delivers a better performance. This would also provide further support to the hypothesis that the fair-value model, with all the caveats previously mentioned, provides in the short-run a better anchoring for $CAPE$ than its long-term average.

# 3 Dataset

In this section, we briefly provide some information about the dataset and the macroeconomic variables used for the estimation of the fair-value model. To extend our empirical analysis beyond the United States, we use Refinitiv Eikon Datastream as the unique provider of our data since this allows us to obtain data covering also the United Kingdom, Germany, France and Italy. The advantage of using a unique provider is that it reduces the risk that data discrepancies across countries could affect our results. In the Appendix, for each country, we provide the Refinitiv Eikon identifiers that we use to download the data.

For each country, Table 1 shows descriptive statistics for $CAPE$, $Yield_R$, $\overline{IP}_G$, $Vol_{IP_G}$, and $Vol_{Infl}$. Our sample spans the period from January 1973 to June 2021. However, it is important to notice that the effective temporal size of the sample is shorter as observations are lost in the computation of the variables of interest (for instance, $CAPE$ requires 10 years of earnings to be computed). Moreover, not all the time series necessary for the construction of the dataset are available since January 1973 for all the countries taken into account (for instance, Italian government bond yields are available only starting from March 1991).

For $CAPE$, the mean is arguably the most important statistics as the $CAPE$'s success as a predictor of long-term stock returns relies on its mean-reversion property. Hence, the comparison of the current value of $CAPE$ with its (unconditional) mean has usually provided investors with a valuable signal about the future directionality of the stock market. However, over the last few years, the mean-reversion property of $CAPE$ has been questioned - in particular for the United States - because of the persistent divergence of $CAPE$ from its mean (see, for instance, Arnott et al. 2017). By performing a cross-country comparison, it is evident that the United States stand out for the magnitude of the $CAPE$ mean (and median) relative to the other countries in the sample. Indeed, for the United States, the mean of $CAPE$ is equal to 22.74. This compares with mean values of $CAPE$ that ranges from 17.03 (United Kingdom) to 18.95 (Germany).

Mean values of $Yield_R$ are positive and range from 1.51 per cent (United Kingdom) to 2.18 per cent (Germany). However, $Yield_R$ is currently negative for all the countries considered since policy support related to the pandemic contributes to keep nominal government bond yields at historically low levels. Negative long-term real bond yields should make bonds unattractive for investors and increase their demand for stocks, thereby providing an argument in favor of high stock market valuations.

Mean values of $\overline{IP}_G$ are a synthetic indicator of the economic growth of a country during the period taken into account. In this respect, as expected, the United States show the highest mean value (about 2 per cent) among the countries considered, while Italy exhibits the lowest (0.62 per cent), not very different from the United Kingdom (0.69 per cent) and France (0.82

per cent).

$Vol_{IP_G}$ is a rough measure of economic growth stability, which is a crucial factor in determining the economic health of a country by reducing, for instance, fluctuations in consumption and in the unemployment rate. $Vol_{Infl}$, instead, is a proxy for price stability, which is also very important for economic health as it contributes to reduce consumers' and firms' uncertainty about the price level. The mean values of $Vol_{IP_G}$ and $Vol_{Infl}$ mirror, in part, the difference in the mandate assigned to national central banks. Indeed, the mean of $Vol_{IP_G}$ is lower for the United States and the United Kingdom (3.13 and 2.8 per cent, respectively) than for Germany, France and Italy (3.97, 3.67 and 4.67 per cent, respectively). Viceversa, the mean of $Vol_{Infl}$ is lower for Germany and France (0.74 and 0.81 per cent, respectively) than for the United States (1.11 per cent) and the United Kingdom (1.39 per cent).

For each country, Table 2 show the correlation among the explanatory macroeconomic variables used in the regression that generates the fair value of $CAPE$. Moreover, Table 2 also reports the variance inflator factor (VIF), i.e., a synthetic measure of the strength of multicollinearity among these variables.[8] In general, correlation signs tend to be similar across countries. For instance, real interest rates $Yield_R$ and average economic growth always exhibit a positive correlation. However, there are also few exceptions, i.e., average $\overline{IP}_G$ shows a negative correlation with $Vol_{Infl}$ for all countries but the United Kingdom and Germany. The variables showing the highest (positive) correlation are $Vol_{IP_G}$ and $Vol_{Infl}$, with correlation values ranging from 0.46 (the United Kingdom and Italy) to 0.64 (United States). Only for France $Vol_{IP_G}$ and $Vol_{Infl}$ are mildly negatively correlated (-0.06). All in all, however, the magnitude of the correlation values does not raise strong concerns about multicollinearity. This is confirmed also by the values associated with the VIFs as they are, in general, of small magnitude.

# 4 Results

In this section, we provide the results of our empirical analysis. First, we start by analysing the results arising from the estimation of the fair-value model. Afterwards, we comment the results obtained from the estimation of the predictive regressions.

## 4.1 Estimation of the fair-value model

For each country, Figure 1 plots $CAPE$, its long-term average based on the full-sample (represented by a horizontal line in the figure), and the fair value estimated with equation (1).

[8]For a given variable $X_1$, $VIF$ is computed as $\frac{1}{1-R_1^2}$, where $R_1^2$ is the r-squared of the regression $X_1 = a_0 + a_2X_2 + a_3X_3 + ... + a_kX_k + e$. A high value of $VIF$ (usually $> 5$, corresponding to a $R_1^2 > 0.8$) for $X_1$ indicates that $X_1$ is highly collinear with the other variables ($X_2$, $X_3$,..., $X_k$) considered.

For the United States, the sample period can be approximately divided in three phases. A first phase that terminated at the inception of the 1990s when $CAPE$ was below both its long-term average and its fair value implied by macroeconomic variables. A second phase of overvaluation that culminated with the historically high value for $CAPE$ in March 2000 during the *dotcom* bubble. Finally, a third phase, started after the global financial crisis, in which $CAPE$, in general, has increased over time fluctuating between phases of over/undervaluation as implied by our model. Recently, it can be observed a strong divergence between $CAPE$ and its fair value following the Covid-19 shock experienced in March 2020. This divergence between $CAPE$ and its model-implied fair value could signal a drop in valuations in the near future, although it is not possible to exclude that a further improvement in the economic landscape and in corporate earnings could also contribute to align $CAPE$ and the model-implied fair value without any sizable price correction.

For the United Kingdom, it is possible to note that $CAPE$ has mostly fluctuated around its model-implied fair value over time with the exclusion of the *dotcom* bubble period. Focusing on the last 15 years, it is also worth noting that $CAPE$ was consistently below its long-run average and its economic fair value. The Covid-19 shock has reversed this trend and produced a divergence between $CAPE$ and its fair value similar to that reported for the United States, although of much smaller magnitude. In this respect, it can be concluded that our model hints at a milder price correction for the United Kingdom in the near future.

For Germany, $CAPE$ has also moved around its model-implied fair value over the sample period considered and exhibited signs of overvaluation during the *dotcom* bubble period. These signs of overvaluation reversed - with $CAPE$ constantly below its fair value - at the early 2000s when German economic performance was particularly poor. During the last decade, stock market valuations have been consistent with those implied by the fair-value model. Interestingly, this holds true also for the most recent period that has followed the Covid-19 shock. In other words, according to our model, latest German stock market valuations are mainly supported by the macroeconomic variables taken into account. This is a unique feature characterizing the German stock market and it can be the consequence of a smaller impact of the pandemic on economic fundamentals compared with other countries.[9] Moreover, stock market valuations for Germany are also in line with their long-term mean and this differentiates Germany with respect to the United States, which also performed relatively well during the pandemic.

Similar considerations apply to France with some notable differences. First, the post-2000 undervaluation period was shorter for France than for Germany and quickly reversed to an overvaluation phase that concluded with the global financial crisis. Second, differently from Germany, France recent stock market valuations are not supported by our model as a sizable

[9] In 2020, gross domestic product (GDP) fell by 5% in Germany, while it fell by 10%, 9% and 8%, respectively, in the United Kingdom, Italy and France. GDP fell by about 4% in the United States.

divergence has developed between $CAPE$ and its fair value following the Covid-19 shock. As for the United States, this divergence strengthens the concerns of a price correction in the near future for France.

Finally, for Italy, the fluctuations of $CAPE$ around its fair value show similarities with other countries (in particular during the *dotcom* bubble period), but there are also specific features that are worth pointing out. In particular, during the sovereign-debt crisis, stock market valuations were consistent with a framework characterised by a disappointing economic landscape. Afterwards, starting from 2015, Italian stock market has started a period of sizable undervaluation when analysed through the lenses of our model. This phase has recently terminated following the Covid-19 shock and stock market valuations have shown only a moderate divergence from the economic fair value over the last few months.

For each country, Table 3 shows the estimates of the fair-value regression model expressed in equation (1). Coefficient estimates are, in general, statistically significant and the fit of the regression is good. $R^2$s oscillate from a minimum of 45 per cent (Germany) to a maximum of 60 per cent (Italy). The sign of the estimated coefficients is, in most of the cases, coherent with economic theory.

Starting with the long-term real interest rate, we would expect that a rise in $Yield_R$ has a negative impact on stock valuations for two main reasons. First, long-term real interest rates are used by investors to discount future expected cash flows. A higher discount rate lowers the present value of future cash flows and leads to a lower stock price today. Second, despite having a very different trade-off between risk and return, government bonds are often seen as competing assets with respect to stocks. As a consequence, a raise in government bond yields makes government bonds more attractive relative to stocks and lead to lower stock prices as investors move their allocation from stocks to bonds. Coherently with our expectations, the coefficient associated with $Yield_R$ is negative and statistically significant at the 1 per cent level for the United States, France and Italy, while, on the contrary, it is positive and statistically significant for Germany and positive but not statistically significant for the United Kingdom.

Moving to economic growth, we would expect that an increase in $\overline{IP}_G$ has a positive impact on future expected cash flows and, therefore, lead to higher stock valuations today. Confirming our conjecture, the coefficient associated with $\overline{IP}_G$ is positive and statistically significant at least at the 5 per cent level for all countries, with the exception of Germany that is instead characterized by a negative coefficient for $\overline{IP}_G$.

Finally, we provide few comments about the coefficients associated with our measures of macroeconomic volatility, i.e., the volatility of the industrial production growth and the volatility of the inflation rate. Ex-ante higher volatility of economic growth should lead to lower stock valuations (i.e., it should have a negative coefficient estimate) as economic growth volatility implies uncertainty about future corporate cash flows, thereby increasing the investors' required risk premium. In line with this reasoning, the estimated coefficient of $Vol_{IP_G}$ is negative for all the countries, although it is statistically significant only for the United Kingdom and Germany.

Economic theory offers little guidance, instead, on the impact of the volatility of the inflation rate on stock valuations. Moreover, literature has mainly investigated the role of the level of the inflation rate on valuations rather than of the volatility of inflation (e.g., Arnott et al., 2017). A plausible hypothesis is that a period of volatile inflation may increase investors' risk aversion and discourage them to allocate their wealth in the stock market. This view is supported by the empirical findings by Arnott et al. (2017), according to which rock-bottom levels of inflation have been historically associated with low valuations. An alternative view is that investors consider stocks as an inflation hedge and, if they are uncertain about the inflation rate, they could therefore increase their allocation to stocks driving in turn valuations up. In sum, whether inflation volatility exerts a negative or a positive impact on stock valuation seems an empirical issue. Our empirical analysis provides support for the first hypothesis, as we find that the estimated coefficient of $Vol_{Infl}$ is negative and statistically significant at the standard conventional level for all countries but Germany.

Summing up, our fair-value model suggests that: i) higher long-term interest rates are associated with lower stock market valuations (i.e., lower $CAPE$); ii) higher economic growth is associated with higher valuations (i.e., higher $CAPE$); iii) higher economic volatility measured either as the volatility of industrial production growth or as the volatility of the inflation rate corresponds to regimes of depressed valuations. Interestingly, our analysis also suggests that, for stock investors, inflation volatility is a bigger source of uncertainty than the volatility of economic growth as the estimated coefficients are, in general, greater in magnitude, statistically significant with the theoretically expected sign. In this respect, our analysis offers additional ground for monetary policy about the importance of implementing policies aimed at stabilizing the inflation rate. Before moving to the results of the predictive regression analysis, the case of Germany deserves specific comments. Indeed, we find that, with the exclusion of $Vol_{IP_G}$, coefficient estimates for Germany have opposite signs if compared with other countries. Particularly striking is that $Yield_R$ is associated with a positive coefficient, while $\overline{IP}_G$ with a negative one. A possible explanation could be that, for Germany, periods of high real interest rates have usually corresponded to periods associated with low inflation, in which the central bank had no motivation to raise nominal rates and unintentionally reduce stock market valuations. A similar, but reversed, argument could apply also to economic growth. An overheated economy could have forced the central bank to raise nominal rates to prevent an increase in inflation with the unintended consequence of generating a correction in stock prices. Being positive, the coefficient associated with inflation volatility for Germany also differs from the other countries, but is not statistically significant, thereby suggesting that inflation has actually not been very volatile and has not represented a concern for German investors.

## 4.2 Estimation of the predictive regressions

For each country, Table 4 reports the results arising from the estimation of predictive regressions in equation (2). For each specification, we include in the table the estimates of the predictive coefficient $\beta$ for different forecasting horizons (ranging from 1 month to 36 months), the Newey-West t-statistics ($tstat_{nw}$) that takes into account heteroschedasticity and serial correlation (HAC), the Newey-West t-statistics computed using non-overlapping returns only ($tstat_{no}$) and the regression's r-squared ($R_2$). As stated by Bauer and Hamilton (2017) and by Arnott et al. (2017), predictive regressions estimated in monthly data but with cumulative returns as dependent variable are plagued by the presence of serial correlation in the predictive errors because of overlapping data. This, in turn, generates lower standard errors and higher than usual t-statistics, with the risk for the researcher of erroneously concluding that the predictive coefficients are statistically significant. Although we limit the maximum predictive horizon to 36 months, our results could also be affected by this problem and, for this reason, we also compute $tstat_{no}$. This second group of t-statistics uses standard errors of the estimated coefficients obtained through separate regressions based on non-overlapping data. In this way, it is possible to eliminate any serial correlation from the residuals and get considerably lower t-statistics.

As anticipated in the previous sections, the goal of our predictive regression analysis is to assess whether deviations of $CAPE$ from its estimated fair value are better than $CAPE$ in predicting real stock market returns over the short horizon. If this is the case, we would expect that: i) the predictive coefficient of $[log(CAPE_t) - FV_{CAPE,t}]$ is statistically significant and the associated t-statistics is higher than that associated with $log(CAPE)$ for the short forecasting horizons; ii) the magnitude of the predictive coefficient of $[log(CAPE_t) - FV_{CAPE,t}]$ decreases with the forecasting horizon; iii) $R_2$ is higher for $[log(CAPE_t) - FV_{CAPE,t}]$ for short forecasting horizons.

As a starting point, it is worth noting that for all countries and forecasting horizons, the estimated predictive regression coefficients are negative for both $log(CAPE)$ and $[log(CAPE_t) - FV_{CAPE,t}]$. The negative relationship between $log(CAPE)$ and future returns is well-known in the literature (see, for instance, Bunn and Shiller, 2014; Arnott et al., 2017) and implies that higher valuations today (i.e., high CAPE) are associated with lower stock returns in the future. The finding of a negative relationship between $[log(CAPE_t) - FV_{CAPE,t}]$ and future returns has interesting implications as well, since it means that periods in which $log(CAPE)$ exceeds its fair value are, in general, followed by lower real stock returns.

At the country level, it is possible to observe that, for the United States, the results from the estimation of the predictive regressions confirm the ability of the model specification based on $CAPE$ deviations to predict short-run stock returns better than $CAPE$. In particular, for predictive horizons going from 1 month to 12 months ahead, the estimated coefficients are statistically significant and the $R_2$s are higher than those obtained from the specification based on $CAPE$ only.[10] Moreover, the magnitude of the estimated coefficients is also decreasing across the forecasting horizon, thereby implying that the sensitivity of future subsequent returns to $[log(CAPE_t) - FV_{CAPE,t}]$ weakens as the predictive horizons get longer. For other countries the evidence is mixed. For instance, for Italy, we find a confirmation that, only in a few cases, the model based on $CAPE$ deviations dominates the model based on $CAPE$ levels. In particular, this happens for forecasting horizons ranging from 6 to 24 months, as the goodness of fit of the model based on $CAPE$ deviations is better and predictive coefficients are also, in general, statistically significant. For the United Kingdom and France, the predictive coefficients of the model based on $CAPE$ deviations are, in general, statistically significant, but the goodness of fit is worse than the one of the model based on $CAPE$ alone for all the predictive horizons. Finally, as it was for the estimation of the fair-value model, Germany represents an exception. Indeed, differently from other countries, for Germany we find that the predictive performance of the model based on $CAPE$ deviations is better for all the predictive horizons and for all the metrics of assessment (e.g., magnitude of the coefficients, goodness of fit, etc;) that we consider.

Summing up, the results from the predictive regression analysis provide supporting evidence of a negative relationship between deviations of $CAPE$ from its fair value implied by macroeconomic variables and future stock returns, i.e., when $log(CAPE)$ is above its fair value, future short-term returns are in general lower as $CAPE$ reverts to its estimated fair value. For the United States, Germany and, in a few cases, for Italy, the results from the predictive regressions also show that deviations of $CAPE$ from its estimated fair value are better than $CAPE$ in predicting real stock market returns over the short horizon.

## 4.3 Out-of-sample forecasting

In Table 5, for each country, we show the results of the out-of-sample forecasting analysis. In particular, we focus, for each forecasting horizon $k$, on two statistics of forecasting accuracy, i.e., the mean squared forecast error (MSFE) and the out-of-sample r-squared ($R2_{oss}$). The $R2_{oss}$ measures the proportional reduction in MSFE for the predictive regression forecast relative to the historical average. A positive value implies that the predictive regression forecast

[10]The low $R_2$s obtained for the 1-month horizon should not be interpreted as a failure of the model since short-term returns are notoriously difficult to forecast being dominated by the noisy component (Fama and French, 1988; Arnott et al., 2017)

outperforms the historical average in terms of MSFE, while a negative value indicates the opposite. For the United States, the results indicate that the model based on $CAPE$ deviations outperforms the rival models and the historical average, for the very short forecasting horizons ($k = 1, 6, 12$). Indeed, at these horizons, the mean squared forecast error ($MSFE$) associated with $[CAPE - FV_{CAPE}$ is the lowest, while the $R2_{oss}$ is the highest. For other countries, the results can be summarized as follows. For United Kingdom, the model based on $CAPE$ deviations outperforms rival models for forecasting horizons equal to $k = 18$ and $k = 24$, but it fails to outperform the historical average at these horizons. For the other European countries, we note that the model based on deviations performs very well for Germany and France. Indeed, for Germany, it classifies as the best forecasting model for all the horizons considered with the exception of $k = 36$, while, for France, it performs better than rival models for all the horizons. Conversely, for Italy, the model based on deviations does not outperform the historical average at any horizon (as the $R2_{oss}$ is negative) and outperforms (in terms of a lower MSFE) rival model only for $k = 24$ and $k = 36$. Summing up, with all the caveats that apply when forecasting stock market returns for short time horizons, the out-of-sample analysis confirms that a model based $[CAPE - FV_{CAPE}$ as a predictor delivers promising results.

# 5 Robustness checks

In this section, we briefly describe some robustness checks that we have performed to verify the validity of our findings. The first check concerns the counterintuitive results that we have got from the estimation of the fair-value model for Germany (i.e., $Yield_R$ has a positive coefficient, while $\overline{IP}_G$ has a negative one). The second check regards how results depend on the time-length of the rolling windows used to estimate for $\overline{IP}_G$, $Vol_{IP_G}$ and $Vol_{Infl}$.

## 5.1 Joint estimation of the fair-value model

The counterintuive results obtained from the estimation of the fair-value model for Germany suggests that there might exist specific issues concerning Germany (or another country in our sample) that our econometric methodology does not take into account. For instance, our fair-value model could suffer of an omitted-variable problem that can be relevant in some cases. For this reason, we pool together the data for all countries and perform a joint estimation of the fair-value model of $CAPE$ by using a panel-data regression with country fixed effects. The results are shown in Table A1 in the Appendix and confirm that, once unobserved characteristics at the country level are taken into account, the sign of the estimated coefficients is coherent with economic theory (i.e., negative for $Yield_R$ and positive for $\overline{IP}_G$).

## 5.2 Window selection

The choice of the time-length of the rolling windows used to estimate $\overline{IP}_G$, $Vol_{IP_G}$ and $Vol_{Infl}$ is driven by the following criteria. For $\overline{IP}_G$ (i.e., economic growth), we think that the 5-year horizon adequately captures the economic cycle, by smoothing out short-run fluctuations that should not affect the growth of cash flows/earnings generated by firms. At the same time, the 3-year horizon for $Vol_{IP_G}$ and $Vol_{Infl}$ is more suitable to reflect the short-term effects of volatility that investors face. A longer window would probably blunt these effects, while a shorter window would probably just capture noise that does not produce any reaction from investors. However, existing literature, for instance Waser (2021) and Lettau et al. (2007), usually consider slightly longer rolling windows of 5/10 year length. For this reason, we check how our main results change i) when we consider a 5-year rolling window for all the variables; ii) when we consider a 10-year rolling window for $\overline{IP}_G$ and a 5-year rolling window for all the variables for $Vol_{IP_G}$ and $Vol_{Infl}$; iii ) when we consider a 3-year rolling window for all the variables. Summing up, we find that when using i) and ii) the fit of the fair-value model remains good (it slightly worsens only for Germany). However, the analysis of the in sample predictive regressions show that the predictive ability of the model in deviations ($log(CAPE_t) - FV_{CAPE,t}$) deteriorates for the United States and, only when using ii), also for Germany. For some country (e.g., the United Kingdom) the predictive ability of the model in deviations instead improves with respect to the benchmark used in Section 4. Finally, we find that using iii) affect neither the fit of the fair-value model nor the predictive ability of the model in deviations.

Concluding, this robustness exercise shows that considering a relatively short rolling window is particularly important for the United States, but also that the main results of the empirical analysis can be reproduced, and in some cases also improved, with different rolling windows. This finding suggests that, when used for policy evaluation, it could be optimal to consider specific windows for each country.

# 6 Conclusions

This paper estimates a fair-value model for the Shiller $CAPE$ ratio based on macroeconomic variables. The main contribution of our research is to provide a new benchmark - complementing the use of the long-term average - to assess if the stock market is fairly valued. Indeed, the use of the long-term average as a benchmark value rests on the mean-reverting property of $CAPE$, but this property does not seem to fit reality very well as deviations of $CAPE$ from its average are not rare. Being based on macroeconomic variables, our fair-value approach is more refined and informative than the $CAPE$ long-term average as rational investors should base their decisions on the evolution of economic fundamentals.

Assessing whether stock market valuations are coherent with the underlying economic conditions or whether there are risks of a downward correction is important not only for asset managers, but for policymakers as well. In particular, the insights of this paper can be relevant for monitoring possible vulnerabilities of financial markets and for the conduct of monetary policy. For instance, from the financial stability perspective, a downward stock market correction could increase investors' risk aversion and stimulate a reappraisal of the risks associated with other financial assets such as sovereign and corporate bonds, thereby resulting in tighter financial conditions and impairing economic activity. Moreover, a timely monitoring of stock market valuations relative to the fair values based on economic fundamentals is important in helping to evaluate potential side effects of unconventional monetary policy.

An application of our methodology which compares actual $CAPE$ with its estimated fair value signals a possible stock market overvaluation for the United States and France (based on data at June 2021). Moreover, our empirical analysis shows that, in general, real interest rates and economic growth correlate positively and negatively with stock market valuations, respectively. Industrial production growth volatility and inflation volatility also correlate negatively. This latter finding provides further support for monetary policies that pursue price stability. Finally, we find that deviations of $CAPE$ from its estimated fair value are negatively related to future stock returns and that, in a few cases, a predictive model based on deviations outperforms rival models both in sample and out of sample.

The main advantage of our benchmark is that, despite its simplicity, it remains anchored to economic theory. Moreover, it takes into account that macroeconomic variables are available with lags and, therefore, it can be easily computed at the end of each month. The main limit is that, being based on macroeconomic variables, it is backward looking. This implies that a divergence between $CAPE$ and its fair value does not necessarily indicate that the stock market is overvalued, as it could just be that stock valuations reflect growth in expected earnings. Future research could address this shortcoming by focusing on projections/forecasts of the macroeconomic variables considered in the estimation of the fair-value model.

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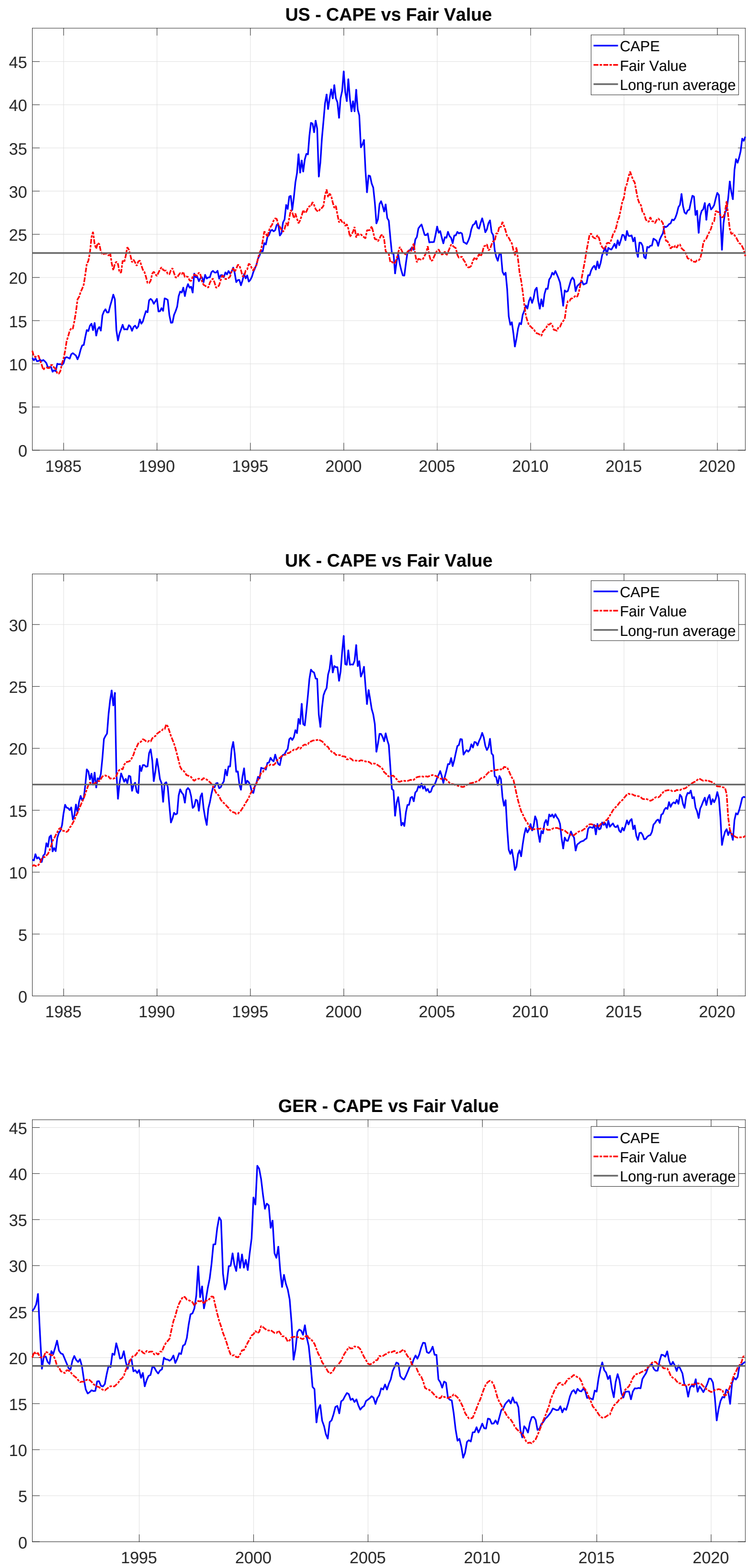
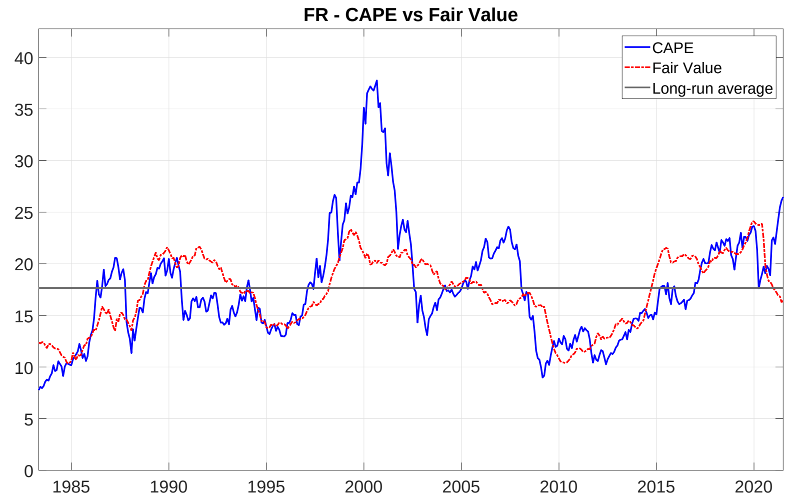
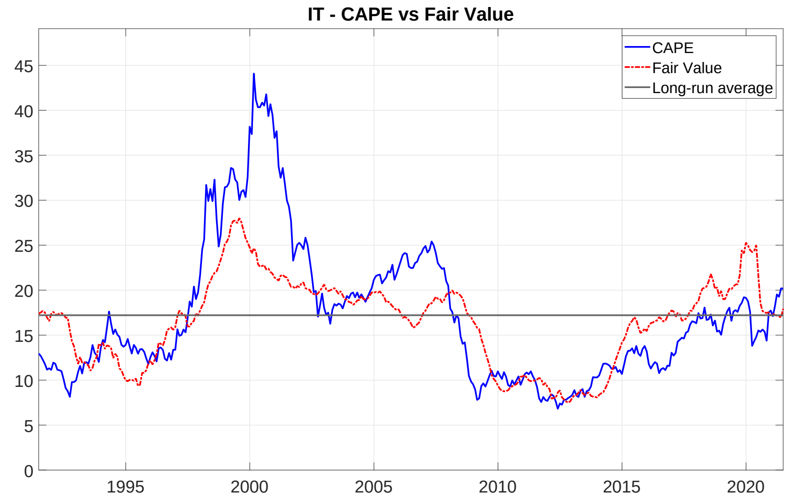
# Figures and tables

Figure 1: CAPE vs Fair Value






For the *United States*, the *United Kingdom*, *Germany*, *France* and *Italy*, the figure shows the Shiller Cyclically-Adjusted Price-to-Earnings (CAPE, straight line) ratio, its long-term average based on the full-sample (horizontal line) and the fitted value (Fair Value, dash-dot line) from the regression model $log(CAPE_t) = c + \beta_1 Yield_{R,t-3} + \beta_2 \overline{IP}_{G,t-3} + \beta_3 Vol_{IP_G,t-3} + \beta_4 Vol_{Infl,t-3} + \epsilon_t$, where $log(CAPE)$ is the natural logarithm of $CAPE$, $Yield_R$ is the real government bond yield, $\overline{IP}_G$ is the the 5-year moving average of the annual industrial production growth, $Vol_{IP_G}$ is the volatility (standard deviation, computed with a 3-year rolling window) of the annual industrial production growth and, finally, $Vol_{Infl}$ is the volatility (standard deviation, computed with a 3-year rolling window) of the annual inflation rate. The sample spans, at monthly frequency, the 04/1983-06/2021 period for the *United States*, the *United Kingdom* and *France*, the 01/1990-06/2021 period for *Germany* and the 06/1991-06/2021 period for *Italy*.

Table 1: Descriptive Statistics

For each country in the sample (the *United States*, the *United Kingdom*, *Germany*, *France*, *Italy*), the table reports descriptive statistics, i.e., mean (*mean*), median (*med*), maximum (*max*), minimum (*min*), value at the last available observation (*last*) and standard deviation (*std*), of the variables used in the empirical analysis. These variables are: the Shiller Cyclically-Adjusted Price-to-Earnings ($CAPE$), the real government bond yield ($Yield_R$), the the 5-year moving average of the annual industrial production growth ($\overline{IP}_G$), the volatility (standard deviation, computed with a 3-year rolling window) of the annual industrial production growth ($Vol_{IP_G}$) and, finally, the volatility (standard deviation, computed with a 3-year rolling window) of the annual inflation ($Vol_{Infl}$). Descriptive statistics are expressed in percentages for $Yield_R$, $\overline{IP}_G$ and $Vol_{IP_G}$ and $Vol_{Infl}$. The last two rows report, for each variable, the date associated with the first (*start*) and the last (*end*) available observation, respectively.

| | $CAPE$ | $Yield_R$ | $\overline{IP}_G$ | $Vol_{IP_G}$ | $Vol_{Infl}$ |
|---|---|---|---|---|---|
| *United States* | | | | | |
| mean | 22.74 | 1.81 | 1.97 | 3.13 | 1.11 |
| med | 22.78 | 1.95 | 1.93 | 2.51 | 0.84 |
| max | 43.86 | 5.77 | 5.5 | 8.43 | 3.49 |
| min | 9.08 | -1.13 | -1.32 | 0.71 | 0.19 |
| last | 36.29 | -0.36 | -0.24 | 6.84 | 1.07 |
| std | 7.46 | 1.41 | 1.75 | 2.01 | 0.74 |
| start | 1/83 | 1/81 | 1/79 | 1/77 | 1/77 |
| end | 6/21 | 6/21 | 6/21 | 6/21 | 6/21 |
| *United Kingdom* | | | | | |
| mean | 17.03 | 1.51 | 0.69 | 2.80 | 1.39 |
| med | 16.40 | 1.89 | 0.45 | 2.20 | 0.83 |
| max | 29.08 | 6.61 | 3.76 | 8.33 | 5.78 |
| min | 10.02 | -2.70 | -2.01 | 0.68 | 0.18 |
| last | 16.03 | -0.92 | -0.37 | 8.33 | 0.59 |
| std | 3.94 | 1.92 | 1.35 | 1.61 | 1.39 |
| start | 1/83 | 1/81 | 1/79 | 1/77 | 1/77 |
| end | 6/21 | 6/21 | 5/21 | 5/21 | 6/21 |
| *Germany* | | | | | |
| mean | 18.95 | 2.18 | 1.27 | 3.97 | 0.74 |
| med | 17.95 | 2.64 | 1.14 | 3.38 | 0.67 |
| max | 40.84 | 6.49 | 3.80 | 12.27 | 1.60 |
| min | 9.12 | -2.03 | -1.88 | 1.23 | 0.29 |
| last | 19.54 | -1.68 | -0.52 | 8.36 | 0.77 |
| std | 5.59 | 2.14 | 1.31 | 2.37 | 0.30 |
| start | 1/83 | 1/81 | 1/79 | 1/77 | 1/77 |
| end | 6/21 | 6/21 | 5/21 | 5/21 | 6/21 |
| *France* | | | | | |
| mean | 17.59 | 1.91 | 0.82 | 3.67 | 0.81 |
| med | 16.92 | 2.15 | 0.71 | 2.86 | 0.56 |
| max | 37.75 | 5.43 | 3.76 | 13.08 | 2.42 |
| min | 6.75 | -1.49 | -2.75 | 1.34 | 0.22 |
| last | 26.46 | -0.79 | -0.12 | 13.08 | 0.66 |
| std | 5.52 | 1.67 | 1.64 | 2.27 | 0.58 |
| start | 1/83 | 1/81 | 1/79 | 1/77 | 1/77 |
| end | 6/21 | 6/21 | 5/21 | 5/21 | 6/21 |
| *Italy* | | | | | |
| mean | 17.55 | 2.16 | 0.67 | 4.67 | 1.22 |
| med | 15.36 | 1.83 | 0.82 | 3.64 | 0.74 |
| max | 45.05 | 8.01 | 5.61 | 17.92 | 4.07 |
| min | 6.82 | -0.44 | -4.52 | 1.57 | 0.18 |
| last | 20.16 | -0.01 | 0.99 | 17.92 | 0.64 |
| std | 7.88 | 1.83 | 1.99 | 2.83 | 1.03 |
| start | 2/86 | 3/91 | 1/79 | 1/77 | 1/77 |
| end | 6/21 | 6/21 | 5/21 | 5/21 | 6/91 |

Table 2: Correlation Matrices

For each country in the sample (the *United States*, the *United Kingdom*, *Germany*, *France*, *Italy*), the table reports the correlation matrix for the economic variables used for the estimation of the empirical model. These variables are: the real government bond yield ($Yield_R$), the 5-year moving average of the annual industrial production growth ($\overline{IP}_G$), the volatility (standard deviation, computed with a 3-year rolling window) of the annual industrial production growth ($Vol_{IP_G}$) and, finally, the volatility (standard deviation, computed with a 3-year rolling window) of the annual inflation rate ($Vol_{Infl}$). The last row of each block reports, for each variable, the variance inflator factor ($VIF$), which is a synthetic measure of the strength of multicollinearity. For a given variable $X_1$, $VIF$ is computed as $\frac{1}{1-R_1^2}$, where $R_1^2$ is the R-square of the regression $X_1 = a_0 + a_2X_2 + a_3X_3 + ... + a_kX_k + e$. A high value of $VIF$ (usually > 5, corresponding to a $R_1^2 > 0.8$) for $X_1$ indicates that $X_1$ is highly collinear with the other variables ($X_2$, $X_3$,..., $X_k$) considered.

| | $Yield_R$ | $\overline{IP}_G$ | $Vol_{IP_G}$ | $Vol_{Infl}$ |
|---|---|---|---|---|
| *United States* | | | | |
| $Yield_R$ | 1.00 | - | - | - |
| $\overline{IP}_G$ | 0.49 | 1.00 | - | - |
| $Vol_{IP_G}$ | -0.14 | -0.56 | 1.00 | - |
| $Vol_{Infl}$ | 0.01 | -0.47 | 0.64 | 1.00 |
| $VIF$ | 1.46 | 2.10 | 1.97 | 1.90 |
| *United Kingdom* | | | | |
| $Yield_R$ | 1.00 | - | - | - |
| $\overline{IP}_G$ | 0.43 | 1.00 | - | - |
| $Vol_{IP_G}$ | -0.32 | -0.32 | 1.00 | - |
| $Vol_{Infl}$ | -0.27 | 0.00 | 0.46 | 1.00 |
| $VIF$ | 1.36 | 1.38 | 1.48 | 1.39 |
| *Germany* | | | | |
| $Yield_R$ | 1.00 | - | - | - |
| $\overline{IP}_G$ | 0.23 | 1.00 | - | - |
| $Vol_{IP_G}$ | -0.11 | -0.25 | 1.00 | - |
| $Vol_{Infl}$ | 0.24 | 0.14 | 0.60 | 1.00 |
| $VIF$ | 1.19 | 1.25 | 2.05 | 2.05 |
| *France* | | | | |
| $Yield_R$ | 1.00 | - | - | - |
| $\overline{IP}_G$ | 0.47 | 1.00 | - | - |
| $Vol_{IP_G}$ | 0.01 | -0.37 | 1.00 | - |
| $Vol_{Infl}$ | -0.20 | -0.36 | -0.06 | 1.00 |
| $VIF$ | 1.34 | 1.79 | 1.27 | 1.20 |
| *Italy* | | | | |
| $Yield_R$ | 1.00 | - | - | - |
| $\overline{IP}_G$ | 0.10 | 1.00 | - | - |
| $Vol_{IP_G}$ | 0.11 | -0.46 | 1.00 | - |
| $Vol_{Infl}$ | -0.10 | -0.20 | 0.46 | 1.00 |
| $VIF$ | 1.07 | 1.30 | 1.62 | 1.30 |

Table 3: Fair-Value Model Estimates

For each country in the sample (the *United States*, the *United Kingdom*, *Germany*, *France*, *Italy*), the table reports the output obtained by estimating via ordinary least squares (OLS) the regression model $log(CAPE_t) = c + \beta_1 Yield_{R,t-3} + \beta_2 \overline{IP}_{G,t-3} + \beta_3 Vol_{IP_G,t-3} + \beta_4 Vol_{Infl,t-3} + \epsilon_t$, where $log(CAPE)$ is the natural logarithm of the Shiller Cyclically-Adjusted Price-to-Earnings ($CAPE$) ratio, $c$ is the constant in the model, $Yield_R$ is the real government bond yield, $\overline{IP}_G$ is the the 5-year moving average of the annual industrial production growth, $Vol_{IP_G}$ is the volatility (standard deviation, computed with a 3-year rolling window) of the annual industrial production growth and, finally, $Vol_{Infl}$ is the volatility (standard deviation, computed with a 3-year rolling window) of the annual inflation rate. The regression output includes the estimated coefficients, the standard errors (in parentheses) of the estimates derived from Newey-West t-statistics adjusted for heteroskedasticity and serial correlation (HAC), and the R-squared ($R_2$). $R_2$s are expressed in percentage. $^{***}$, $^{**}$ and $^{*}$ indicate the 1%, 5% and 10% statistical significance level, respectively. The sample spans, at monthly frequency, the 04/1983-06/2021 period for the *United States*, the *United Kingdom* and *France*, the 01/1990-06/2021 period for *Germany*, and the 06/1991-06/2021 period for *Italy*.

| | *United States* | *United Kingdom* | *Germany* | *France* | *Italy* |
|---|---|---|---|---|---|
| $c$ | 3.43*** | 2.91*** | 3.08*** | 3.06*** | 3.16*** |
| | (0.06) | (0.05) | (0.07) | (0.06) | (0.09) |
| $Yield_R$ | -9.25*** | 1.45 | 3.92*** | -7.89*** | -10.35*** |
| | (1.91) | (0.99) | (0.81) | (1.26) | (1.74) |
| $\overline{IP}_G$ | 5.16** | 6.23*** | -12.10*** | 10.44*** | 13.53*** |
| | (2.42) | (1.34) | (2.16) | (1.82) | (2.01) |
| $Vol_{IP_G}$ | -2.31 | -4.02*** | -5.32*** | -0.96 | -0.57 |
| | (1.91) | (1.32) | (0.91) | (1.12) | (1.00) |
| $Vol_{Infl}$ | -22.50*** | -6.69*** | 19.82 | -16.95*** | -25.16** |
| | (4.57) | (1.96) | (15.37) | (4.09) | (10.29) |
| $R_2$ | 53.16 | 47.61 | 45.54 | 50.98 | 60.13 |

Table 4: Predictive Regression Results

For each country in the sample (the *United States*, the *United Kingdom*, *Germany*, *France*, *Italy*), the table reports the output of predictive regressions of real stock market returns for different predictive horizons $k = 1, 6, 12, 18, 24, 36$ months. The regressions are specified as $r_{t+k} = \alpha + \beta Pred_t + \epsilon_t$, where $r_{t+k}$ is the cumulative log real stock market return from month $t$ to month $t + k$ and $Pred_t$ indicates a predictor variable at month $t$. The predictors taken into account are: $log(CAPE_t)$ i.e., the natural logarithm of the Shiller Cyclically-Adjusted Price-to-Earnings ($CAPE$) ratio; $[log(CAPE_t) - FV_{CAPE,t}]$ i.e., the deviation of $log(CAPE_t)$ from the fair-value model $FV_{CAPE,t}$; $EXCESS\ CAPE$ i.e., the inverse of $CAPE$ minus the 10-year real bond yield; $10YAV$, i.e., the 10-year moving average of $log(CAPE_t)$. For each predictive horizon $k$ and for each specification (i.e., $CAPE$, $CAPE - FV_{CAPE}$, $EXCESS\ CAPE$ and $10YAV$ ), the output includes the estimated coefficient ($\beta$), the Newey-West t-statistics ($tstat_{nw}$) adjusted for heteroskedasticity and serial correlation (HAC), the Newey-West HAC t-statistics computed using non-overlapping cumulative returns only ($tstat_{no}$), and the regression's R-squared ($R_2$, expressed in percentage). The sample spans, at monthly frequency, the 04/1983-06/2021 period for the *United States*, the *United Kingdom* and *France*, the 01/1990-06/2021 period for *Germany*, and the 06/1991-06/2021 period for *Italy*.

| *United States* | $k = 1$ | $k = 6$ | $k = 12$ | $k = 18$ | $k = 24$ | $k = 36$ |
|---|---|---|---|---|---|---|
| $CAPE$ | | | | | | |
| $\beta$ | -0.11 | -0.12 | -0.13 | -0.15 | -0.15 | -0.15 |
| $tstat_{nw}$ | -1.52 | -2.10 | -2.99 | -3.86 | -4.49 | -6.06 |
| $tstat_{no}$ | -1.52 | -1.57 | -1.82 | -2.26 | -2.26 | -3.98 |
| $R_2$ | 0.49 | 3.41 | 8.29 | 14.84 | 20.67 | 30.24 |
| $CAPE - FV_{CAPE}$ | | | | | | |
| $\beta$ | -0.22 | -0.20 | -0.20 | -0.19 | -0.18 | -0.16 |
| $tstat_{nw}$ | -1.76 | -2.28 | -3.39 | -3.50 | -3.45 | -3.78 |
| $tstat_{no}$ | -1.76 | -2.15 | -2.38 | -1.94 | -1.83 | -2.34 |
| $R_2$ | 0.93 | 4.64 | 9.20 | 11.75 | 14.01 | 16.03 |
| $EXCESS\ CAPE$ | | | | | | |
| $\beta$ | 2.28 | 2.10 | 1.90 | 2.02 | 2.04 | 1.92 |
| $tstat_{nw}$ | 1.69 | 2.10 | 2.29 | 2.73 | 2.95 | 3.53 |
| $tstat_{no}$ | 1.69 | 1.50 | 1.27 | 1.39 | 1.34 | 2.66 |
| $R_2$ | 0.71 | 3.62 | 5.70 | 9.42 | 12.46 | 17.23 |
| $10YAV$ | | | | | | |
| $\beta$ | -0.11 | -0.12 | -0.12 | -0.13 | -0.13 | -0.13 |
| $tstat_{nw}$ | -1.46 | -1.83 | -2.50 | -3.25 | -3.89 | -5.34 |
| $tstat_{no}$ | -1.46 | -1.61 | -1.93 | -2.38 | -2.58 | -3.36 |
| $R_2$ | 0.52 | 3.44 | 7.44 | 12.30 | 16.01 | 22.74 |

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| *United Kingdom* | $k = 1$ | $k = 6$ | $k = 12$ | $k = 18$ | $k = 24$ | $k = 36$ |
|---|---|---|---|---|---|---|
| $CAPE$ | | | | | | |
| $\beta$ | -0.27 | -0.27 | -0.25 | -0.24 | -0.23 | -0.21 |
| $tstat_{nw}$ | -2.30 | -3.34 | -4.22 | -4.63 | -4.81 | -5.77 |
| $tstat_{no}$ | -2.30 | -2.74 | -2.57 | -2.35 | -2.71 | -3.23 |
| $R_2$ | 1.26 | 7.43 | 13.25 | 18.73 | 22.88 | 30.40 |
| $CAPE - FV_{CAPE}$ | | | | | | |
| $\beta$ | -0.35 | -0.36 | -0.34 | -0.31 | -0.29 | -0.26 |
| $tstat_{nw}$ | -1.79 | -2.93 | -4.63 | -4.75 | -4.62 | -5.08 |
| $tstat_{no}$ | -1.79 | -3.13 | -3.13 | -2.88 | -2.01 | -1.79 |
| $R_2$ | 1.09 | 6.73 | 12.32 | 15.54 | 18.80 | 24.27 |
| $EXCESS\ CAPE$ | | | | | | |
| $\beta$ | 1.49 | 1.30 | 1.15 | 1.04 | 0.96 | 0.76 |
| $tstat_{nw}$ | 1.91 | 2.14 | 2.30 | 2.29 | 2.33 | 2.04 |
| $tstat_{no}$ | 1.91 | 1.65 | 1.37 | 1.12 | 1.05 | 1.23 |
| $R_2$ | 0.60 | 2.72 | 4.35 | 5.34 | 6.18 | 5.90 |
| $10YAV$ | | | | | | |
| $\beta$ | -0.22 | -0.22 | -0.20 | -0.20 | -0.19 | -0.18 |
| $tstat_{nw}$ | -1.55 | -1.79 | -2.08 | -2.38 | -2.61 | -3.24 |
| $tstat_{no}$ | -1.55 | -1.50 | -1.51 | -1.66 | -2.13 | -4.23 |
| $R_2$ | 0.50 | 2.85 | 5.21 | 7.65 | 9.62 | 13.40 |

| *Germany* | $k = 1$ | $k = 6$ | $k = 12$ | $k = 18$ | $k = 24$ | $k = 36$ |
|---|---|---|---|---|---|---|
| $CAPE$ | | | | | | |
| $\beta$ | -0.22 | -0.25 | -0.25 | -0.25 | -0.24 | -0.23 |
| $tstat_{nw}$ | -1.47 | -2.55 | -3.34 | -3.86 | -4.09 | -5.18 |
| $tstat_{no}$ | -1.47 | -1.76 | -1.87 | -2.19 | -2.87 | -5.45 |
| $R_2$ | 0.90 | 6.24 | 11.89 | 17.65 | 23.07 | 32.28 |
| $CAPE - FV_{CAPE}$ | | | | | | |
| $\beta$ | -0.48 | -0.51 | -0.47 | -0.44 | -0.40 | -0.35 |
| $tstat_{nw}$ | -2.46 | -3.95 | -4.91 | -5.37 | -6.03 | -7.22 |
| $tstat_{no}$ | -2.46 | -3.02 | -3.36 | -3.53 | -3.73 | -4.70 |
| $R_2$ | 2.35 | 13.81 | 24.06 | 30.31 | 34.82 | 43.17 |
| $EXCESS\ CAPE$ | | | | | | |
| $\beta$ | 2.03 | 2.03 | 1.66 | 1.46 | 1.30 | 0.87 |
| $tstat_{nw}$ | 1.85 | 2.72 | 3.01 | 2.95 | 2.74 | 2.08 |
| $tstat_{no}$ | 1.85 | 2.12 | 1.62 | 1.41 | 1.59 | 1.01 |
| $R_2$ | 0.95 | 4.91 | 6.36 | 7.07 | 7.25 | 5.00 |
| $10YAV$ | | | | | | |
| $\beta$ | -0.19 | -0.19 | -0.17 | -0.16 | -0.15 | -0.14 |
| $tstat_{nw}$ | -0.87 | -1.04 | -1.24 | -1.35 | -1.49 | -1.77 |
| $tstat_{no}$ | -0.87 | -0.80 | -0.73 | -0.88 | -0.99 | -1.37 |
| $R_2$ | 0.24 | 1.15 | 1.99 | 2.41 | 2.96 | 3.87 |

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| *France* | $k = 1$ | $k = 6$ | $k = 12$ | $k = 18$ | $k = 24$ | $k = 36$ |
|---|---|---|---|---|---|---|
| $CAPE$ | | | | | | |
| $\beta$ | -0.25 | -0.30 | -0.30 | -0.30 | -0.29 | -0.26 |
| $tstat_{nw}$ | -2.31 | -3.48 | -4.62 | -5.40 | -6.02 | -8.44 |
| $tstat_{no}$ | -2.31 | -2.55 | -3.13 | -3.72 | -4.66 | -5.60 |
| $R_2$ | 1.34 | 9.10 | 18.30 | 27.11 | 34.14 | 45.65 |
| $CAPE - FV_{CAPE}$ | | | | | | |
| $\beta$ | -0.34 | -0.42 | -0.42 | -0.40 | -0.37 | -0.31 |
| $tstat_{nw}$ | -2.19 | -3.77 | -5.38 | -5.63 | -5.40 | -5.44 |
| $tstat_{no}$ | -2.19 | -3.28 | -4.25 | -3.50 | -3.04 | -3.08 |
| $R_2$ | 1.24 | 8.77 | 16.91 | 22.57 | 26.92 | 30.09 |
| $EXCESS\ CAPE$ | | | | | | |
| $\beta$ | 3.60 | 3.56 | 3.11 | 2.82 | 2.60 | 2.16 |
| $tstat_{nw}$ | 2.66 | 3.40 | 3.77 | 3.78 | 3.96 | 4.25 |
| $tstat_{no}$ | 2.66 | 2.61 | 2.50 | 2.47 | 2.07 | 2.25 |
| $R_2$ | 1.79 | 8.57 | 12.49 | 15.03 | 17.87 | 20.41 |
| $10YAV$ | | | | | | |
| $\beta$ | -0.31 | -0.29 | -0.27 | -0.25 | -0.24 | -0.22 |
| $tstat_{nw}$ | -2.23 | -2.48 | -2.84 | -3.17 | -3.77 | -5.31 |
| $tstat_{no}$ | -2.23 | -2.33 | -2.57 | -2.92 | -4.19 | -4.00 |
| $R_2$ | 1.30 | 5.75 | 9.42 | 12.26 | 15.40 | 20.96 |

| *Italy* | $k = 1$ | $k = 6$ | $k = 12$ | $k = 18$ | $k = 24$ | $k = 36$ |
|---|---|---|---|---|---|---|
| $CAPE$ | | | | | | |
| $\beta$ | -0.09 | -0.12 | -0.13 | -0.15 | -0.15 | -0.13 |
| $tstat_{nw}$ | -0.93 | -1.68 | -2.43 | -3.10 | -3.67 | -5.33 |
| $tstat_{no}$ | -0.93 | -1.35 | -1.86 | -2.92 | -3.91 | -3.02 |
| $R_2$ | 0.27 | 2.37 | 5.80 | 10.52 | 14.39 | 19.93 |
| $CAPE - FV_{CAPE}$ | | | | | | |
| $\beta$ | -0.13 | -0.19 | -0.24 | -0.28 | -0.28 | -0.18 |
| $tstat_{nw}$ | -0.78 | -1.69 | -3.15 | -4.39 | -4.75 | -3.35 |
| $tstat_{no}$ | -0.78 | -1.52 | -2.06 | -2.59 | -1.55 | -1.94 |
| $R_2$ | 0.23 | 2.62 | 7.67 | 14.83 | 19.28 | 13.10 |
| $EXCESS\ CAPE$ | | | | | | |
| $\beta$ | 2.52 | 2.55 | 2.19 | 1.91 | 1.56 | 0.86 |
| $tstat_{nw}$ | 1.90 | 2.75 | 2.92 | 2.80 | 2.48 | 1.61 |
| $tstat_{no}$ | 1.90 | 2.18 | 2.13 | 1.89 | 1.51 | 0.95 |
| $R_2$ | 0.83 | 4.62 | 6.42 | 7.18 | 6.46 | 3.32 |
| $10YAV$ | | | | | | |
| $\beta$ | -0.27 | -0.25 | -0.24 | -0.22 | -0.21 | -0.21 |
| $tstat_{nw}$ | -1.68 | -1.87 | -2.13 | -2.39 | -2.75 | -3.47 |
| $tstat_{no}$ | -1.68 | -1.48 | -1.48 | -1.52 | -1.70 | -1.97 |
| $R_2$ | 0.81 | 3.93 | 6.24 | 7.57 | 9.46 | 13.52 |

Table 5: Out-of-sample Forecasting Results

For each country in the sample (the *United States*, the *United Kingdom*, *Germany*, *France*, *Italy*), the table reports the output of out-of-sample forecasting regressions of real stock market returns for different horizons $k = 1, 6, 12, 18, 24, 36$ months. The regressions are specified as $r_{t+k} = \alpha + \beta Pred_t + \epsilon_t$, where $r_{t+k}$ is the cumulative log real stock market return from month $t$ to month $t + k$ and $Pred_t$ indicates a predictor variable at month $t$. For the United States, we use May 1983 to May 1998 as the initial period for parameters' estimation, while for the European countries we use July 1991 to June 2003. From the first observation following the end of those initial estimation periods until the end of the samples, we recursively estimate the parameters (i.e., $\hat{\alpha}_t$ and $\hat{\beta}_t$) by adding each time an observation to the estimation sample, thereby effectively using an expanding window for their estimation. The predictors taken into account are: $log(CAPE_t)$ i.e., the natural logarithm of the Shiller Cyclically-Adjusted Price-to-Earnings ($CAPE$) ratio; $[log(CAPE_t) - FV_{CAPE,t}]$ i.e., the deviation of $log(CAPE_t)$ from the fair-value model $FV_{CAPE,t}$; $EXCESS\ CAPE$ i.e., the inverse of $CAPE$ minus the 10Y real bond yield. For each predictive horizon $k$ and for each specification (i.e., $CAPE$, $CAPE - FV_{CAPE}$, $EXCESS\ CAPE$), the output includes the mean squared forecast error (MSFE) and the out-of-sample r-squared ($R2_{oss}$) that measures the reduction in MSFE for the competing predictor relative to the historical average forecast.

| United States | $CAPE$ | $CAPE - FV_{CAPE}$ | $EXCESS\ CAPE$ |
|---|---|---|---|
| $k = 1$ | | | |
| $R2_{oss}$ | 0.00 | 0.01 | 0.01 |
| $MSFE$ | 19.69 | 19.63 | 19.61 |
| $k = 6$ | | | |
| $R2_{oss}$ | 0.05 | 0.06 | 0.05 |
| $MSFE$ | 3.39 | 3.37 | 3.40 |
| $k = 12$ | | | |
| $R2_{oss}$ | 0.13 | 0.14 | 0.06 |
| $MSFE$ | 1.76 | 1.75 | 1.88 |
| $k = 18$ | | | |
| $R2_{oss}$ | 0.26 | 0.17 | 0.10 |
| $MSFE$ | 1.13 | 1.21 | 1.28 |
| $k = 24$ | | | |
| $R2_{oss}$ | 0.38 | 0.19 | 0.13 |
| $MSFE$ | 0.83 | 0.96 | 1.01 |
| $k = 36$ | | | |
| $R2_{oss}$ | 0.67 | 0.25 | 0.21 |
| $MSFE$ | 0.46 | 0.62 | 0.64 |
| United Kingodm | $CAPE$ | $CAPE - FV_{CAPE}$ | $EXCESS\ CAPE$ |
| k= 1 | | | |
| $R2_{oss}$ | -0.01 | -0.02 | -0.03 |
| MSFE | 15.20 | 15.41 | 15.64 |
| k= 6 | | | |
| $R2_{oss}$ | 0.00 | -0.04 | -0.05 |
| MSFE | 2.78 | 2.91 | 2.92 |
| k= 12 | | | |
| $R2_{oss}$ | -0.03 | -0.03 | -0.07 |
| MSFE | 1.42 | 1.43 | 1.49 |
| k=18 | | | |
| $R2_{oss}$ | -0.10 | -0.08 | -0.09 |
| MSFE | 0.94 | 0.92 | 0.93 |
| k= 24 | | | |
| $R2_{oss}$ | -0.19 | -0.11 | -0.12 |
| MSFE | 0.71 | 0.64 | 0.65 |
| k=36 | | | |
| $R2_{oss}$ | -0.43 | -0.33 | -0.19 |
| MSFE | 0.47 | 0.41 | 0.34 |

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| Germany | $CAPE$ | $CAPE - FV_{CAPE}$ | $EXCESS\ CAPE$ |
|---|---|---|---|
| k= 1 | | | |
| $R2_{oss}$ | 0.01 | 0.03 | -0.01 |
| MSFE | 22.30 | 21.73 | 22.60 |
| k= 6 | | | |
| $R2_{oss}$ | 0.06 | 0.24 | 0.01 |
| MSFE | 3.90 | 3.35 | 4.12 |
| k= 12 | | | |
| $R2_{oss}$ | 0.11 | 0.48 | -0.05 |
| MSFE | 1.80 | 1.35 | 2.11 |
| k=18 | | | |
| $R2_{oss}$ | 0.11 | 0.44 | -0.04 |
| MSFE | 1.15 | 0.89 | 1.34 |
| k= 24 | | | |
| $R2_{oss}$ | 0.08 | 0.28 | -0.05 |
| MSFE | 0.83 | 0.70 | 0.94 |
| k=36 | | | |
| $R2_{oss}$ | -0.23 | -0.20 | -0.20 |
| MSFE | 0.57 | 0.55 | 0.54 |
| France | $CAPE$ | $CAPE - FV_{CAPE}$ | $EXCESS\ CAPE$ |
| k= 1 | | | |
| $R2_{oss}$ | -0.01 | 0.00 | -0.03 |
| MSFE | 21.09 | 20.97 | 21.59 |
| k= 6 | | | |
| $R2_{oss}$ | 0.02 | 0.07 | -0.06 |
| MSFE | 4.16 | 3.97 | 4.49 |
| k= 12 | | | |
| $R2_{oss}$ | 0.05 | 0.23 | -0.15 |
| MSFE | 2.08 | 1.79 | 2.59 |
| k=18 | | | |
| $R2_{oss}$ | 0.05 | 0.39 | -0.25 |
| MSFE | 1.34 | 1.01 | 1.87 |
| k= 24 | | | |
| $R2_{oss}$ | 0.04 | 0.56 | -0.31 |
| MSFE | 0.99 | 0.66 | 1.50 |
| k=36 | | | |
| $R2_{oss}$ | -0.07 | 0.31 | -0.46 |
| MSFE | 0.60 | 0.43 | 1.04 |
| Italy | $CAPE$ | $CAPE - FV_{CAPE}$ | $EXCESS\ CAPE$ |
| k= 1 | | | |
| $R2_{oss}$ | -0.01 | -0.01 | -0.04 |
| MSFE | 30.08 | 30.24 | 31.32 |
| k= 6 | | | |
| $R2_{oss}$ | 0.00 | -0.03 | -0.11 |
| MSFE | 5.89 | 6.09 | 6.65 |
| k= 12 | | | |
| $R2_{oss}$ | 0.00 | -0.04 | -0.18 |
| MSFE | 3.02 | 3.17 | 3.70 |
| k=18 | | | |
| $R2_{oss}$ | -0.04 | -0.09 | -0.26 |
| MSFE | 2.01 | 2.14 | 2.63 |
| k= 24 | | | |
| $R2_{oss}$ | -0.04 | -0.03 | -0.23 |
| MSFE | 1.50 | 1.49 | 1.86 |
| k=36 | | | |
| $R2_{oss}$ | -0.07 | -0.04 | -0.09 |
| MSFE | 0.86 | 0.83 | 0.89 |

# Appendix

Table A1: Fair-value model: Panel Regression

The table reports the output of the estimation of a panel-data regression with country fixed effects in which the dependent variable is $log(CAPE)$, the natural logarithm of the$(CAPE)$ ratio and the explanatory variables are, as in equation 1), $c$, the constant, $Yield_R$, the real government bond yield, $\overline{IP}_G$, the the 5-year moving average of the annual industrial production growth, $Vol_{IP_G}$, the volatility (standard deviation, computed with a 3-year rolling window) of the annual industrial production growth and, finally, $Vol_{Infl}$, the volatility (standard deviation, computed with a 3-year rolling window) of the annual inflation rate. Estimated coefficients ($Coeff.$), robust standard errors ($se$) are reported along with the R-squared ($Within$, $Between$ and $Overall$).

| | $Coeff.$ | $se$ | $R^2$ | |
|---|---|---|---|---|
| $c$ | 3.10 | 0.06 | $Within$ | 0.31 |
| $Yield_R$ | -2.89 | 3.49 | $Between$ | 0.72 |
| $\overline{IP}_G$ | 5.59 | 3.92 | $Overall$ | 0.32 |
| $Vol_{IP_G}$ | -2.93 | 0.69 | | |
| $Vol_{Infl}$ | -15.67 | 4.26 | | |

## Data source

The empirical analysis is based on the following Refinitiv Eikon identifiers:

- **Stock market index (price and earnings)**: TOTMKUS (*United States*), TOTMKUK (*United Kingdom*), TOTMKBD (*Germany*), TOTMKFR (*France*), TOTMKIT (*Italy*);
- **Government bond yield**: USOIR080R (*United States*), UKOIR080R (*United Kingdom*), BDMIR080R (*Germany*), FROIR080R (*France*), ITOIR080R (*Italy*);
- **Industrial production**: USIPTOT(*United States*), UKIPTOT (*United Kingdom*), BDIP7500G (*Germany*), FRIPMAN (*France*), ITIPTOT (*Italy*);
- **Consumer price index**: USCONPRCF(*United States*), UKOCP009F (*United Kingdom*), BDCONPRCF (*Germany*), FROCP00F (*France*), ITCP009F (*Italy*);

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