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Stock prices and macroeconomic factors: Some European evidence

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ABSTRACT

This paper analyses the dependence of stock prices on macroeconomic variables in the three largest European economies: France, Germany and the United Kingdom. In recent decades, industrial production and long-term interest rates have been important significant variables accounting for approximately one half of annual movements in stock prices. Both factors seem to be equally important, but a closer examination reveals that the weight of these factors has clearly moved from interest rates to production. This evidence is common to all three of these European countries and is in sharp contrast with the results for the US.

1. Introduction

Just as the market value of a company depends heavily on its current economic situation and future perspectives, the value of all the companies listed on the stock market of a given country will depend on the global economic situation and future perspectives in that country. This implies that changes in stock prices will be related to economic changes occurring or being anticipated by the market. Empirical facts seem to support this view; international stock markets have generally evolved in close relationship with domestic economies. Nevertheless, there are exceptions to this general rule. A conspicuous example was the October 1987 crash that affected virtually all world markets and most of the companies in those markets, but was not linked to clearly identifiable economic factors. The marked movements that have taken place recently have heightened the interest in the relationships between stock markets and economic performance.

To analyze this issue, measures of both stock prices and economic activity are needed. Stock prices can be measured accurately and instantaneously through stock price indexes. Measurement of economic activity is much more complex, and several economic variables should be used: production, employment, prices, interest rates, or exchange rates, to mention only a few. Stock prices will maintain a close and well-defined relationship with some of these variables, but the relationship with other variables will be less clear-cut. A typical example of the first type of relationship would be that between stock prices in developed countries and the price of oil. International stock markets were clearly and dramatically affected by oil shocks in the seventies. Conversely, the relationship between some economic variables, such as employment, and stock prices is much more complex or ambiguous. An increase in employment, as a reflection of improving economic conditions, might be expected to be associated with stock price increases. However, the contrary may also happen; an employment increase may generate associated increases in inflation or interest rates and,

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subsequently, lower stock prices. An explanation for this paradox would entail the consideration of more complex relationships and models, such as non-linear or state-dependent models (see, for example, McQueen & Roley, 1993 or Boyd, Jagannathan, & Hu, 2001).

Given the importance of this topic linking finance and macroeconomics, numerous theoretical models have tackled the question of the relationship between stock prices and several economic variables. The APT model is probably the most frequently used. In this framework, financial returns are explained through different unknown but identifiable factors with various studies proposing several possible macroeconomic factors. In parallel, many other studies take a present value model as a starting point, where stock prices are the present value of expected future dividends,

$$P_t = \sum_{i=1}^{\infty} \frac{1}{(1+\rho)^i} E(d_{t+i}|\Omega_t) \qquad (1)$$

where P_t is the price of a stock in t, ρ is the discount rate, d_t is the dividend paid in t, and Ω_t is the set of available information in t. If we bear in mind that ρ includes a risk premium, the preceding equation contains the three primary factors, highlighted by Boyd et al. (2001), which shape stock prices: the evolution of future dividends, the risk-free discount rate and the risk premium.

Of course, future dividends are unknown, and the discount rate is not observable. Due to their hypothetical relationship with stock prices, when using this present value model, the two most-used macroeconomic variables have been production and interest rates, as representative of the first two primary factors. Changes in production would cause changes of the same sign in stock prices through expected future dividends. On the contrary, there would be an opposite stock price reaction to changes in interest rates. Increases in interest rates would imply higher discount rates and, therefore, lower stock prices. In addition, there could well exist relationships between interest rates and production; increases in interest rates may cause decreases in investment and, thus, in future production. Hence, interest rates may affect stock prices in two different ways: i) directly, through changes in discount rates; ii) indirectly, through changes in future production. Both effects have the same sign and, subsequently, stock prices will decrease in response to rising interest rates, and conversely they will rise in response to declining interest rates.

In the light of these hypothetical connections, this paper aims to explore the links between stock prices and these two macroeconomic variables, production and interest rates, in the three main European economies: France, Germany and the United Kingdom. Additionally, it compares the results obtained for these European countries with the empirical evidence for the United States. Over the last few decades, abundant empirical literature has tried to quantify these relationships, particularly with regards the US market, but the results are not consistent. While some researchers do not find any clear and significant relationship between macroeconomic factors and equity returns (see, for example, Chan, Karcesky, & Lakonishok, 1998; Flannery & Protopapadakis, 2002, or Maio & Philip, 2015), other researchers find definite relationships. Fischer and Merton (1984) pointed out that stock returns forecast future production. Fama (1981, 1990), using annual data, shows that real stock returns hold a strong relationship with production growth rates. Schwert (1990) confirms these results with data from a whole century, 1889–1988. Ang and Bekaert (2007) find that the most robust predictive variable for future excess returns is the short rate. Finally, Humpe and Macmillan (2009) find that US stock prices are influenced positively by industrial production and negatively by long-term interest rates.

In sharp contrast with the research for the US market, the studies for Europe have been much sparser. Wasserfallen (1989), when analyzing the response of European stock markets to unexpected components of several economic variables, finds very weak relationships. Canova and De Nicolo (1995) find significant relationships between stock returns and growth rates in industrial production. Peiró (1996) shows that stock returns depend positively on future variations in industrial production and negatively on current changes in interest rates. Nasseh and Strauss (2000) also find significant responses of stock prices in six European countries to innovations in industrial production and interest rates. Rapach, Wohar, and Rangvid (2005) find that interest rates are the most consistent and reliable predictors of stock returns in several European countries. Barro and Ursúa (2009) show that stock-market crashes in several countries, including some in Europe, have substantial predictive power for depressions. Jareño and Navarro (2010) confirm a negative relationship between Spanish stock returns and movements in interest rates with a very high degree of significance (see also Fernandez-Perez, Fernández Rodríguez, & Sosvilla-Rivero, 2014). Recently, Kuosmanen, Nabulsi, and Vataja (2015) address the predictive association between financial markets and the real economy in four Nordic countries; they find that the relationship between financial variables and economic activity is stronger in Finland and Sweden than in Denmark and Norway. In addition to the scarcity of studies on the relationships between macroeconomic factors and equity prices in European markets, the evolution of these possible relationships over time and the relative importance of the different economic factors have not been addressed at all. An interesting exception is Binswanger (2004), which provides evidence suggesting a breakdown in the early 1980s in the relationship between real stock returns and growth rates of economic activity.

To cast some light on all these questions, the rest of the paper is organized as follows. Section 2 presents the data used from the three largest European economies: France, Germany and the UK. Section 3 examines the relationships in these countries between stock returns, production and interest rates, paying special attention to their dynamics over time and to the relative importance of these variables. Finally, Section 4 summarizes the main results and conclusions.

2. Data

To analyze the relationship between macroeconomic activity and stock markets in France, Germany and the United Kingdom, production, prices and interest rates will be used. With regard to production, industrial production was used in preference to GDP as it maintained a more definite relationship with stock returns. This is certainly due to the fact that GDP is a very broad variable with

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Table 1
Unit root tests.

	France	Germany	UK	US
log (*SP*)	−1.264	−0.512	−1.439	−0.510
log (*IP*)	−1.083	0.365	−0.735	0.180
IR	−1.066	−0.614	−0.465	−0.833
Δ log (*SP*)	−6.324***	−5.038***	−6.372***	−5.506***
Δ log (*IP*)	−5.625***	−6.034***	−5.353***	−4.543***
Δ *IR*	−4.989***	−5.314***	−4.773***	−2.532**

The entries are the Dickey–Fuller GLS detrended test statistics. log (*SP*) is the log of real stock prices, log (*IP*) is the log of industrial production, and *IR* is the real long-term interest rate. The sample period is 1969–2013.
** denotes significance at the 5% level.
*** denotes significance at the 1% level.

possible counter-cyclical components. Analogously, long-term interest rates were more closely associated with stock prices than short-term rates. Consequently, annual data for industrial production, consumer prices and long-term interest rates were obtained from *International Financial Statistics*, International Monetary Fund, for the period 1969 to 2013. To measure stock prices, the following indexes have been used: CAC Industrial Index and later the CAC 40 for France, Commerzbank and later the DAX 30 for Germany, and FT30 and later the FTSE 100 for the UK. In addition, for purposes of comparison with the US, the same macroeconomic variables were used together with the SP 500 index.

Unit root tests (see Table 1) clearly confirm that these series (or their logarithms) are not stationary, but that their first differences are stationary. Therefore, first differences of the logarithms of production and price indexes were used to obtain the growth rates of industrial production and inflation rates. Real interest rates were obtained by subtracting the inflation rates from the long-term interest rates, and the first differences of these real interest rates were then taken. Finally, nominal stock returns were computed as logarithmic differences in stock price indexes. Inflation rates corresponding to the same year were subtracted from these nominal returns, thus yielding real returns. Table 2 shows some descriptive statistics for these series: real stock index returns, Δ log (*SP*) (*R* in what follows), growth rates of industrial production (Δ log (*IP*)), and changes in real long-term interest rates (Δ *IR*).

3. Results

Production and interest rates have probably been the macroeconomic variables most closely related to stock price indexes. Accordingly, it would be interesting to examine whether these variables maintain a long-term relationship in the three European countries under study. Multivariate cointegration tests do not allow the rejection of the null of zero cointegrating relationships.[1] Consequently, a simple, clear long-term relationship is not found. Establishing clear long-term relationships could require the inclusion of other macroeconomic variables, the consideration of structural breaks or the use of non-linear cointegration techniques. Such practices, however, would be somewhat risky with low sample sizes.

Given this uncertain long-term relationship between stock prices and macroeconomic variables, short-term connections will be analyzed instead. As previously stated in Section 1, production and interest rates are the two most-used variables when studying macroeconomic determinants of stock returns. Therefore, real stock returns will be regressed on a constant and different leads and lags of growth rates in industrial production and changes in long-term interest rates,

$$R_t = \alpha + \beta_i \sum_{i=m_1}^{n_1} \Delta \log\left(IP_{t+i}\right) + \gamma_i \sum_{i=m_2}^{n_2} \Delta IR_{t+i} + u_t \tag{2}$$

where R_t denotes real stock return in period t in a certain country, and IP_t and IR_t denote industrial production and real long-term interest rate, respectively, in the same country and in the same period. The values for m_1, n_1, m_2 and n_2 were selected according to automatic criteria, such as Akaike or Schwarz statistics. These model selection criteria clearly indicated a choice of $m_1 = n_1 = 1$ and $m_2 = n_2 = 0$, for the three countries. The results of these regressions for the period 1969–2012 are shown in Table 3.[2] Several points are worth noting: i) when m_1, n_1, m_2 and n_2 are negative, that is, when annual real returns are regressed on several (combinations of) lags of annual changes in production and in interest rates, the results are insignificant. The conclusion is then clear: these economic variables do not allow anticipation of the evolution of stock markets. This result is hardly surprising. Under efficient markets one would not expect past changes in production and interest rates to affect current returns; ii) though these European economies and their capital markets, due to their integration, cannot be considered completely independent of each other, it is very surprising to see that the dynamic structure of the selected models is the same for the three European countries. In all three countries the selection criteria lead to the choice of $m_1 = n_1 = 1$, and $m_2 = n_2 = 0$; iii) while the effects of interest rate increments on stock returns are contemporaneous and take place in the same year, stock returns are affected by variations in industrial production that will take place in the following year. In other words, stock markets anticipate movements in production a year in advance; iv) excluding the

[1] Only France presents conflicting results in the different cointegration tests.
[2] Though the sample period is 1969–2013, the following annual regressions are run for the period 1969–2012, as there is one regressor dated $t + 1$.

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Table 2
Descriptive statistics.

		France	Germany	UK	US
R	Mean	0.015	0.034	0.002	0.022
	Std. Dev.	0.252	0.241	0.237	0.180
$\Delta \log(IP)$	Mean	0.009	0.019	0.007	0.022
	Std. Dev.	0.047	0.050	0.034	0.043
ΔIR	Mean	−0.110	−0.109	−0.113	−0.073
	Std. Dev.	1.090	0.882	1.076	1.007

Sample means and standard deviations for real stock index returns (R), growth rates of industrial production ($\Delta \log(IP)$), and changes in real long-term interest rates (ΔIR). The sample period is 1969–2013.

intercepts, the estimators have the expected sign, in agreement with different valuations models (for example, the present value model); v) excluding the intercepts, the regressors are always clearly significant with P-values lower than 1%, the only exception being industrial production in the UK, whose P-value is 1.7%; vi) these two macroeconomic variables explain a large proportion (about one half) of the annual variations in real stock returns, according to the coefficients of determination of these regressions; vii) finally, it is interesting to note that this evidence for the European countries is in sharp contrast with the US, where the interest rate is not significant at all.

While all these results are clear and definite with annual data, it would be interesting to delimit the dynamic relationship more precisely. Therefore, quarterly and monthly data of the same variables were used, this time with the variable industrial production seasonally adjusted, and analogous regressions were estimated. These estimations are disappointing, as they do not allow a clear perception of the dynamics of the relationships. This is especially true with regard to the relationship between production and returns. On a monthly basis, virtually all the influence of future production on current returns occurs with a delay of between one and about twelve months. In other words, stock markets seem to anticipate future movements in production up to twelve months ahead. However, as the influence of future production on current returns is distributed over several months, from a statistical perspective the results are much poorer than with annual data (basically, lower t-ratios and lower adjusted coefficients of determination). Table 4 compares the results obtained from monthly data with those obtained from annual data for the four countries. As expected, with monthly data, almost all the estimates are positive, but only a few of them are significant and, furthermore, the goodness-of-fit is much lower than with annual data. Similar results are obtained with quarterly data. The dispersion of the influence over several quarters yields poor statistical results. This phenomenon was previously pointed out by Fama (1990) and could explain why many authors obtain weaker results when using quarterly or monthly data. Given these problems, the objective of more precisely delimiting the timing of the relationships is ruled out, and the entire subsequent analysis will be performed using annual data.

The evidence reported in Table 3 shows that both industrial production and interest rates are important factors in the movements of stock prices. Nevertheless, these results do not allow a comparison of the relative importance of these variables, as their measurement units are different. To perform the comparison of the effects of both factors on stock returns, the variables will be standardized and the following regression will then be carried out for each country,

$$R_t = \alpha^* + \beta^* \Delta^* \log(IP_{t+1}) + \gamma^* \Delta^* IR_t + u_t^* \quad (3)$$

where

$$\Delta^* \log(IP_t) = \frac{\Delta \log(IP_t) - \overline{\Delta \log(IP)}}{S_{\Delta \log(IP)}} \quad (4)$$

Table 3
Regressions of annual stock returns.

	France	Germany	UK	US
Intercept	−0.016	−0.021	−0.028	−0.046
	(0.029)	(0.028)	(0.022)	(0.022)
	[−0.552]	[−0.749]	[−1.302]	[−2.147]**
$\Delta \log(IP_{t+1})$	2.374	2.298	2.092	2.941
	(0.708)	(0.413)	(0.840)	(0.435)
	[3.354]***	[5.558]***	[2.492]**	[6.756]***
ΔIR_t	−0.107	−0.110	−0.119	−0.011
	(0.028)	(0.031)	(0.039)	(0.016)
	[−3.781]***	[−3.580]***	[−3.010]***	[−0.686]
R^2	0.497	0.449	0.500	0.530

Results of the regressions $R_t = \alpha + \beta \Delta \log(IP_{t+1}) + \gamma \Delta IR_t + u_t$, where R is the real stock return, IP is the industrial production and IR is the real long-term interest rate. Values in parentheses are Newey–West robust standard errors, and values in brackets are t-statistics. The sample period is 1969–2012.

** denotes significance at the 5% level.

*** denotes significance at the 1% level.

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Table 4
Annual and monthly regressions of real stock returns on future industrial production.

	France	Germany	UK	US
Annual regressions				
Intercept	−0.011	−0.015	−0.022	−0.047
	(0.036)	(0.032)	(0.034)	(0.021)
	[−0.295]	[−0.465]	[−0.659]	[−2.239]**
$\Delta \log(IP_{t+1})$	3.135	2.704	3.550	3.019
	(0.606)	(0.331)	(1.086)	(0.369)
	[5.173]***	[8.169]***	[3.271]***	[8.190]***
R^2	0.301	0.290	0.253	0.526
Monthly regressions				
Intercept	−0.001	−0.001	−0.001	−0.004
	(0.003)	(0.003)	(0.003)	(0.002)
	[−0.520]	[−0.238]	[−0.575]	[−1.851]*
$\Delta \log(IP_{t+1})$	0.380	0.216	0.088	−0.414
	(0.226)	(0.154)	(0.196)	(0.306)
	[1.677]*	[1.404]	[0.447]	[−1.354]
$\Delta \log(IP_{t+2})$	0.294	0.248	−0.253	0.133
	(0.261)	(0.164)	(0.237)	(0.362)
	[1.127]	[1.515]	[−1.066]	[0.369]
$\Delta \log(IP_{t+3})$	0.221	0.315	0.085	1.317
	(0.248)	(0.161)	(0.219)	(0.351)
	[0.893]	[1.952]*	[0.388]	[3.751]***
$\Delta \log(IP_{t+4})$	0.099	0.231	0.216	0.418
	(0.216)	(0.158)	(0.230)	(0.330)
	[0.457]	[1.462]	[0.941]	[1.269]
$\Delta \log(IP_{t+5})$	0.365	0.128	0.015	0.100
	(0.194)	(0.142)	(0.212)	(0.361)
	[1.881]*	[0.908]	[0.071]	[0.278]
$\Delta \log(IP_{t+6})$	0.298	0.309	0.078	0.448
	(0.262)	(0.141)	(0.169)	(0.299)
	[1.134]	[2.192]**	[0.461]	[1.498]
$\Delta \log(IP_{t+7})$	0.038	0.033	0.282	0.006
	(0.251)	(0.150)	(0.166)	(0.265)
	[0.152]	[0.223]	[1.696]*	[0.022]
$\Delta \log(IP_{t+8})$	0.113	0.111	0.462	0.056
	(0.226)	(0.144)	(0.198)	(0.281)
	[0.502]	[0.769]	[2.334]**	[0.200]
$\Delta \log(IP_{t+9})$	0.289	0.185	0.502	0.059
	(0.227)	(0.155)	(0.217)	(0.256)
	[1.270]	[1.196]	[2.313]**	[0.230]
$\Delta \log(IP_{t+10})$	0.577	0.177	0.179	0.355
	(0.184)	(0.146)	(0.170)	(0.282)
	[3.139]***	[1.216]	[1.057]	[1.257]
$\Delta \log(IP_{t+11})$	0.281	0.031	0.454	0.355
	(0.225)	(0.141)	(0.156)	(0.280)
	[1.245]	[0.221]	[2.913]***	[1.268]
$\Delta \log(IP_{t+12})$	−0.052	0.179	0.559	0.036
	(0.187)	(0.169)	(0.189)	(0.303)
	[−0.278]	[1.060]	[2.951]***	[0.120]
R^2	0.042	0.039	0.062	0.100

Results of the annual and monthly regressions of real stock returns against an intercept and one lead (annual regressions) or twelve leads (monthly regressions) of changes in industrial production. Values in parentheses are Newey–West robust standard errors, and values in brackets are *t*-statistics. The sample periods are 1969–2012 and 1969:01–2012:12.

* denotes significance at the 10% level.
** denotes significance at the 5% level.
*** denotes significance at the 1% level.

$$\Delta^* IR_t = \frac{\Delta IR_t - \overline{\Delta IR}}{S_{\Delta IR}} \tag{5}$$

with $\overline{\Delta \log(IP)}$ and $\overline{\Delta IR}$ being the sample means of the growth rates in industrial production and of the variations in real long-term interest rates, respectively, and $S_{\Delta \log(IP)}$ and $S_{\Delta IR}$ their sample standard deviations, respectively. β^* and γ^* measure the impact of a typical shock (one standard deviation) in the growth rates in industrial production and in the variations of long-term interest rates, respectively, on real index returns. Table 5 shows the results of these regressions. Evidently, with regard to the slope coefficients, the *t*-statistics, or their *P*-values, are exactly the same as in the preceding regressions. As the variables are now standardized, β^* and γ^* can be compared to see whether the effects of industrial production differ in magnitude from those of the interest rates.

Table 5
Regressions of real stock returns with standardized variables.

	France	Germany	UK	US
Intercept	0.018	0.035	−0.001	0.018
	(0.029)	(0.027)	(0.018)	(0.019)
	[0.620]	[1.305]	[−0.053]	[0.928]
$\Delta^*\ log\ (IP_{t+1})$	0.109	0.114	0.070	0.124
	(0.033)	(0.021)	(0.028)	(0.018)
	[3.354]***	[5.558]***	[2.492]**	[6.756]***
$\Delta^*\ IR_t$	−0.115	−0.096	−0.126	−0.011
	(0.030)	(0.027)	(0.042)	(0.016)
	[−3.781]***	[−3.580]***	[−3.010]***	[−0.686]
R^2	0.497	0.449	0.500	0.530

Results of the regressions $R_t = \alpha^* + \beta^*\Delta^*\ \log(IP_{t+1}) + \gamma^*\Delta^* IR_t + u_t^*$, where the regressors have been standardized according to (4) and (5). Values in parentheses are Newey–West robust standard errors, and values in brackets are t-statistics. The sample period is 1969–2012.
** denotes significance at the 5% level.
*** denotes significance at the 1% level.

Table 6 displays the results of the test $H_0: \beta^* = -\gamma^*$ against $H_1: \beta^* \neq -\gamma^*$. In none of the three European countries, can the null hypothesis of equal effects be rejected, with the P-values being rather high. Consequently, the hypothesis that a typical variation in the growth rates in industrial production has the same effect on stock returns as a typical variation in the increments of interest rates cannot be rejected. The evidence obtained from almost the last half century, therefore, does not seem to question the equal importance of both factors in the determination of stock returns.

When the whole sample period is considered, the preceding evidence suggests that both macroeconomic variables move European stock markets and, furthermore, that they are of the same relative importance. However, the effect of each of the two macroeconomic variables on stock returns could be different over the sample period, and the relative importance of these two factors could have changed over the last half century. It could be that, underlying the preceding results, in a certain sub-period interest rates have a much greater impact on stock returns than industrial production does (or vice versa) in the determination of stock returns. Certainly, when one examines the relationships in different sub-periods, this is the case: the preceding global results are misleading and are strongly contradicted by the results obtained for different sub-periods. Thus, let us split the sample period of 44 years into two sub-samples of equal length: 1969–1990 and 1991–2012, each composed of 22 years. Table 7 presents the results of the preceding regressions for these sub-periods. It is very surprising that in France and the United Kingdom, while interest rates are significant exclusively in the first sub-sample, industrial production is significant exclusively in the second sub-period. This evidence is very strong: each of the variables is significant at the 1% level in its corresponding sub-period, and non-significant at the usual levels in the other sub-period. In Germany, the results are practically identical with the only exception being that interest rates are also significant in the second sub-period, but only at the 5% level. On the other hand, it is interesting to note that this is not the case for the US. For that country, industrial production is a very important factor in each sub-period, while interest rates do not affect stock markets in either sub-period. Again, these results are very definite with extremely low P-values for industrial production and high P-values for interest rates.

These results show a drastic change in the factors that move stock markets. However, they have been obtained with one clear limitation. The sub-periods have been deliberately chosen as equal for the three European countries. However, the division into sub-periods could be made differently for each country. Determining the exact date when production replaced interest rates as the macroeconomic motor behind stock prices is a complex task, but it would be interesting to determine the date which 'best splits' the sample period into two sub-periods or regimes, the first with interest rates being the only force behind stock returns and the second with production as the unique factor. Thus, let us consider the following regression,

$$R_t = \alpha_1' D_t + \alpha_2'(1-D_t) + \beta'(1-D_t)\Delta^* \log(IP_{t+1}) + \gamma' D_t \Delta^* IR_t + u_t' \quad (6)$$

where D_t is a dummy variable that is equal to 1 for $t = 1969, 1970, \ldots, N$, and 0 otherwise. Two different regimes are nested in the same model. When the sample period is from 1969 to N, stock returns are regressed on a constant and interest rates. When the sample period is from $N + 1$ to 2012, stock returns are regressed on a constant and production. The model is estimated for the different possible values of N, and the Schwarz model selection criterion (alternative criteria yielded the same results) is used to prescribe a value for N, or, equivalently, a date for the change. The selected models point to the year 1998 for both France and Germany and to 1994 for

Table 6
Tests of equal magnitude effects.

	France	Germany	UK	US
F statistic	0.010	0.261	1.051	15.818
P value	0.920	0.612	0.311	0.000***

Tests of equal magnitude effects of industrial production and interest rates on real stock returns. The null hypothesis is $\beta^* = -\gamma^*$ in the regressions (3). The sample period is 1969–2012.
*** denotes significance at the 1% level.

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Table 7
Regressions of real stock returns with standardized variables for the sub-periods 1969–1990 and 1991–2012.

	France		Germany		UK		US	
	1969–1990	1991–2012	1969–1990	1991–2012	1969–1990	1991–2012	1969–1990	1991–2012
Intercept	0.005	0.026	0.005	0.061	−0.021	0.017	−0.001	0.034
	(0.041)	(0.041)	(0.032)	(0.045)	(0.032)	(0.028)	(0.027)	(0.023)
	[0.133]	[0.636]	[0.159]	[1.369]	[−0.646]	[0.620]	[−0.048]	[1.433]
$\Delta^* \log(IP_{t+1})$	0.044	0.161	0.029	0.161	0.021	0.114	0.099	0.149
	(0.040)	(0.035)	(0.036)	(0.024)	(0.040)	(0.019)	(0.041)	(0.015)
	[1.112]	[4.664]***	[0.801]	[6.829]***	[0.521]	[5.891]***	[2.431]**	[10.106]***
$\Delta^* IR_t$	−0.170	−0.026	−0.126	−0.082	−0.206	−0.020	−0.025	−0.009
	0.050	(0.023)	(0.038)	(0.036)	(0.067)	(0.020)	(0.029)	(0.022)
	[−3.411]***	[−1.127]	[−3.322]***	[−2.307]**	[−3.087]***	[−0.983]	[−0.865]	[−0.410]
R^2	0.502	0.562	0.406	0.524	0.557	0.565	0.480	0.612

Results of the regressions $R_t = \alpha^* + \beta^* \Delta^* \log(IP_{t+1}) + \gamma^* \Delta^* IR_t + u_t^*$, where the regressors have been standardized according to (4) and (5), for the 1969–1990 and 1991–2012 sub-periods. Values in parentheses are Newey–West robust standard errors, and values in brackets are t-statistics.
** denotes significance at the 5% level.
*** denotes significance at the 1% level.

the UK. Table 8 shows the results with these sub-periods; they point even more clearly to a radical change in the factors that have moved these European stock markets. These results are especially remarkable for the UK where, besides the fact that interest rates change from significant to non-significant, industrial production changes from non-significant to significant with a high t-ratio equal to 10.9 — an outstanding value in a stationary time series.

Nevertheless, though the splitting of the sample period into two sub-periods may be an interesting exercise, the replacement of interest rates by production could undoubtedly have occurred progressively and not abruptly. To gain an insight into the evolution of these factors, the statistic $\widehat{\beta^*}/(\widehat{\beta^*} + |\widehat{\gamma^*}|)$ has been computed for moving regressions with sample sizes of twenty years: 1969–1988, 1970–1989, …, 1993–2012. Though this statistic does not take into account the standard errors of the estimates, it provides a rough measure of the proportion of variability in stock returns due to both production and interest rates that is attributable exclusively to production. This statistic ranges between values of zero and one. A value close to zero indicates that production is of negligible relevance, while a value close to one indicates that it is production alone that is affecting stock returns. As the value approaches one, production attains a higher relative importance with regard to interest rates. As shown in Fig. 1, the three European countries show the same profile with a clear general increase in the prominence of production over time, with low values in the first sub-periods and high values in the last sub-periods. Consequently, it seems reasonable to conclude that expectations of production have gradually gained importance relative to interest rates in the determination of stock returns.

Finally, some reflections on the results reported above are worth highlighting here. Production and interest rates are two macroeconomic factors that clearly affect stock prices. In all cases the estimates have the expected signs: changes in future production positively affect stock prices while changes in interest rates have a negative effect. This is in agreement with many previous contributions that have examined different stock markets. This article, however, draws attention to two interesting points that have not been addressed in previous literature. Firstly, the European countries behave in a fairly similar way, but present clear differences with the US. Secondly, over time there is a clear change in the relative importance of these two factors in the European countries, with production becoming a much more important factor at the expense of interest rates. Given these noteworthy features, further research should extend the analysis to other countries.

Table 8
Regressions of real stock returns with standardized variables for different sub-periods.

	France		Germany		UK	
	1969–1998	1999–2012	1969–1998	1999–2012	1969–1994	1995–2012
Intercept	0.031	−0.016	0.041	0.012	−0.011	0.021
	(0.032)	(0.055)	(0.028)	(0.060)	(0.028)	(0.032)
	[0.986]	[−0.289]	[1.468]	[0.196]	[−0.395]	[0.648]
$\Delta^* \log(IP_{t+1})$	0.050	0.195	0.042	0.192	0.027	0.133
	(0.019)	(0.032)	(0.023)	(0.032)	(0.034)	(0.012)
	[2.699]**	[6.047]***	[1.869]*	[6.000]***	[0.796]	[10.919]***
$\Delta^* IR_t$	−0.157	−0.001	−0.125	−0.043	−0.184	−0.003
	0.038	(0.026)	(0.029)	(0.052)	(0.054)	(0.018)
	[−4.176]***	[−0.055]	[−4.392]***	[−0.826]	[−3.404]***	[−0.155]
R^2	0.546	0.601	0.456	0.519	0.549	0.656

Results of the regressions $R_t = \alpha^* + \beta^* \Delta^* \log(IP_{t+1}) + \gamma^* \Delta^* IR_t + u_t^*$, where the regressors have been standardized according to (4) and (5), for different sub-periods. The sub-periods have been chosen with the Schwarz model selection criterion.
* denotes significance at the 10% level.
** denotes significance at the 5% level.
*** denotes significance at the 1% level.

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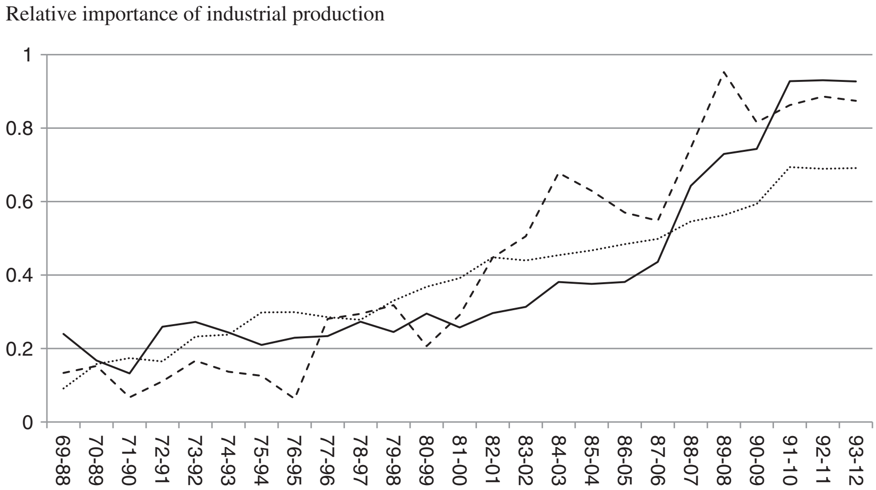

Fig. 1. Relative importance of industrial production. Evolution of the statistic $\widehat{\beta^*}/(\widehat{\beta^*}+|\widehat{\gamma^*}|)$ in the regressions $R_t = \alpha^* + \beta^*\Delta^* \log(IP_{t+1}) + \gamma^*\Delta^* IR_t + u_t^*$, for France (continuous line), Germany (dotted line) and UK (dashed line), with moving samples of twenty years: 1969–1988, 1970–1989, …, 1993–2012.

4. Conclusions

Research on the relationships between macroeconomic activity and stock prices has been very sparse in European countries. This paper has addressed this subject in relation to France, Germany and the United Kingdom, and the evidence reported above suggests the following main conclusions:

i. Movements in production and interest rates clearly determine stock returns in the three countries under consideration.
ii. Stock prices anticipate movements in production one year in advance but move simultaneously with interest rates. Future changes in industrial production and current changes in long-term interest rates account for approximately one half of stock returns.
iii. When taking the entire 1969–2012 period into account, both variables seem to have the same relative importance in the determination of stock returns. However, over different time periods there are clear differences; in the first years interest rates were the main, if not the only factor, but in recent years this variable is of less importance and future production has become the key factor.
iv. All this evidence is surprisingly similar for the three European countries, but differs noticeably from the results obtained for the US, where production seems to be the only factor behind stock returns over the whole period.

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