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The Efficiency of CAC Stock Price Forecasts : a Survey Based Perspective

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Résumé
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Dans cet article, nous nous proposons d'analyser les problèmes relatifs à l'anticipation des cours boursiers en utilisant les réponses à une enquête qualitative sur l'indice général CAC. Nous examinons la rationalité des anticipations et le type de mécanisme qui caractérise le mieux les anticipations des agents. Nous trouvons, entre autres, que les anticipations sont non rationnelles et sont moins précises que des anticipations purement aléatoires.

The Efficiency of CAC Stock Price Forecasts

A Survey Based Perspective

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Dans cet article, nous nous proposons d'analyser les problèmes relatifs à l'anticipation des cours boursiers en utilisant les réponses à une enquête qualitative sur l'indice général CAC. Nous examinons la rationalité des anticipations et le type de mécanisme qui caractérise le mieux les anticipations des agents. Nous trouvons, entre autres, que les anticipations sont non rationnelles et sont moins précises que des anticipations purement aléatoires.

INTRODUCTION

In this paper we propose using a new survey data base constructed by a French survey agency, *Recherche économique et sociale*, on a number of leading financial institutions in France on how they expect the CAC General stock price index to move. In particular, we use this data to test for informational efficiency - in terms of unbiasedness and error orthogonality - and also to test for the type of expectational mechanism that best characterises the evolution of agents' expectations. The usefulness of survey data in an econometric investigation of the efficiency of financial markets is that it gives insight into how such markets operate, without the need to impose auxiliary assumptions like rationality. Indeed, the availability of survey data allows a researcher to directly test the rationality of expectations.

The outline of the remainder of this paper is as follows. In the next Section we present a brief overview of our testing methodology. Our data set and econometric results are presented in Section 3. The paper closes with a concluding Section.

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TESTING METHODOLOGY

A financial market is said to be informationally efficient if all available information is discounted into the current asset price. From our perspective, if our forecasts of the stock price are determined in an efficient market they should obey two properties : they should be unbiased predictors of the actual price and their implied forecast error should be orthogonal to the conditioning information set. These properties may be summarised with reference to regression equations (1) and (2) :

$$\Delta p_{t+k} = \rho + \delta \Delta p^e_{t+k} + \varphi_{t+k} \quad (1)$$

$$p^e_{t+k} - p_{t+k} = \Phi_0 + \Phi_1 X_t + \varsigma_{t+k} \quad (2)$$

where p denotes the (logarithm) of the stock price, the superscript e denotes an expectation, Δ is the first difference operator and X_t is the period t information set available to agents at the time their forecasts were formed[1]. Assuming we have access to agents' expectations (an assumption we return to below), and if agents form optimal forecasts of the future stock price, then in equation (1) ρ should should equal zero and δ should equal 1 (the unbiasedness property) and, furthermore, the ϕ coefficients in (2) should jointly equal zero (the error orthogonality property). In the presence of non-overlapping data the error terms in equations (1) and (2) should be serially uncorrelated.

For many years, data on agents' expectations of stock prices has been non-existent. Thus for many researchers the unavailability of a direct measure of p^e_{t+k} has necessitated the use of a proxy measure. This proxy has often been taken to be the actual stock price and researchers have assumed that any change in price has arisen because of the arrival of 'news' between t and $t + k$. Hence instead of estimating equation (1), the assumption that agents are rational processors of information has been invoked, where :

$$\Delta p^e_{t+k} = \Delta p_{t+k} + \nu_{t+k} \quad (3)$$

and ν_{t+k} is a white noise k step ahead forecasting error orthogonal to the actual change in stock price, and Δp_{t+k} is approximately equal to stock returns[2]. If one further assumes that equilibrium stock prices are constant, then it follows that the logarithmic change in the stock price equals a drift term plus a random error term :

$$\Delta p_{t+k} = \alpha + \varphi_{t+k} \quad (4)$$

The efficiency of the stock market is often argued to be reflected in such random price movements. Indeed the early literature on stock market efficiency

1. Thus all expectations are conditioned on period t information and in the current context this relates to the end of each month.

2. That is, dividend unadjusted returns.

concentrated on tests of the random walk model (see Fama [1976]) and could not reject it as a model of stock price behaviour. However, as is now well known randomness of price movement is neither necessary nor sufficient for an efficient market (for example, the presence of non-constant equilibrium returns could easily result in non-random price movement, but this would not necessarily be in conflict with the efficient markets hypothesis EMH). For proponents of the EMH this is, perhaps, just as well since a number of researchers (*see, inter alia*, Fama and French, [1988], Poterba and Summers, [1988], Lo and MacKinlay, [1988], and MacDonald and Power [1991]) have demonstrated that stock prices often contain substantial mean-reverting properties. The big advantage of survey based data is that one can test stock market efficiency without imposing any of the dubious auxilliary assumptions necessary to test the random walk model.

The availability of survey data on agents expectations also facilitates testing the type of expectations mechanism which best characterises the evolution of agents expectations. Assume, for example, that the expected stock price is a weighted average of the current stock price and some other element, x_t :

$$p^e_{t+k} = \tau x_t + (1-\tau)\, p_t \qquad (5)$$

If the weighting factor, τ, equals zero then (5) describes static expectations, so popular in the early open economy macrœconomics literature (see Mundell, [1961], and Fleming [1961]). In what follows we take the case of static expectations as a null hypothesis and consider different versions of (5). In particular, we consider three alternative expectational mechanisms: adaptive (where, $x_t = p^e_t$) extrapolative (where $x_t = p_{t-1}$), and regressive (where $x_t = \bar{p}_t$)[1].

EMPIRICAL EVIDENCE

The survey data base used in this study was constructed by the French-based survey agency firm : *Recherche économique et sociale (RES)*. The agency surveyed a representative sample of financial market operators - banks, assurance companies and foreign exchange dealers - on a regular basis between October 1984 and June 1987. In particular, RES asked survey participants the following question : *« For the following month what are your expectations of French share prices ? »*[2]. From the information received, a global response was cons-

1. The different equations which arise from these substitutions are noted in Table 4, which is discussed in the next Section.

2. The question related specifically to the general CAC index and was asked in the last week of each month. RES did not specify the number of agents involved in the study. The actual price data used in this study are month end to month end.

tructed as a weighted average of the responses from each of the financial sectors[1]. In this paper we examine the disaggergate and gobal responses.

In Figures 1 to 4 the expectations series for the different forecast categories are presented along with the logarithmic change of the CAC index. While all the series appear to follow a similar pattern the expectations series seem to display more volatility than the actual CAC series. Within the expectations group, the assurance series exhibits relatively volatile behaviour with expectations fluctuating within broader bands than the other series. What is particularly striking is that all the survey participants failed to forecast the rapid decline in the rate of change in prices occurring in 86 :3 and 87 :1. The 1986 overestimation appears to be the result of a particularly bullish market in mid-March of that year : the bullishness appears to reflect market opinion on an expected fall in French interest rates and an expectation of positive corporate earnings results (Financial Times 26/3/1986). The January 1987 forecast error, however, dœs not seem to reflect any important 'news' story and hence may be the result of market dynamics. We now turn to a more formal analysis of the data contained in Figures 1 to 4.

In Table 1a we report cœfficient estimates and results from estimating equation 1 - the unbiasedness test - for the different classifications. These estimates indicate evidence of significantly negative constants for all regressions, with the exception of foreign exchange forecasters. Point estimates of the expectation variable are in every regression insignificantly different from zero and, not surprisingly, the computed F test convincingly rejects the joint hypothesis that $\alpha = 0$ and $\beta = 1$. Although ARCH tests indicate that no residual heteroscedasticity is present, and hence standard errors are consistent, the model is poorly specified with the overall fit convincingly rejected : the DW statistic indicates the presence of autocorrelation and, with the exception of foreign exchange forecasts, the R^2 is zero[2].

We next estimated versions of the orthogonality equation 2, defining the information set to consist of own lagged forecast errors (a weak orthogonality test) and, alternatively, lagged forecast errors from other markets (a semi-strong form orthogonality test). These results are reported in Table 1b for the four sectors. For all the expectations series, the computed F statistic allows us to con-

1. Since this question is qualitative in nature, a method has to be used to obtain a quantitative time series. In this paper we follow the methodology used in Knobl, [1974], Carlson and Parkin [1975], and Batchelor, [1981]. This methodology has not gone uncriticised - see, for example, Batchelor [1986]. An anonymous referee has suggested that it would have been preferable had the question been framed directly in a quantitative manner, such as « Today the CAC is equal to X, what do you expect its value at the last trading session of the following month ». Although we are inclined to agree with this remark, there is not a comparable direct quantitative measure available for our sample period.

2. We also estimated the unbiasedness equations with dummy variables included to model the two dramatic forecast errors indictated in figures 1 to 4 (i.e. for periods 1986 : 3 and 1987 : 1) ; however, although the explanatory power of the equations improved dramatically the null hypothesis of unbiasedness was still rejected in all cases.

Fig. 1. *CAC change – Global*

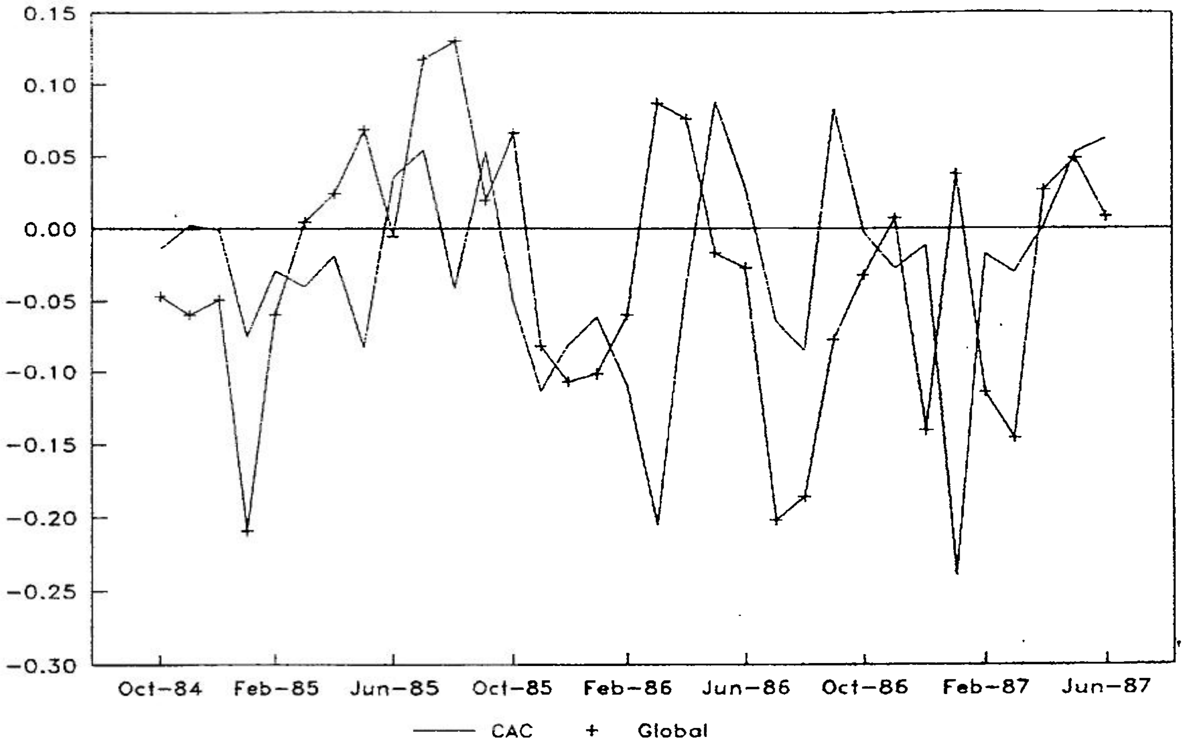

Fig. 2. *CAC change – Bank*

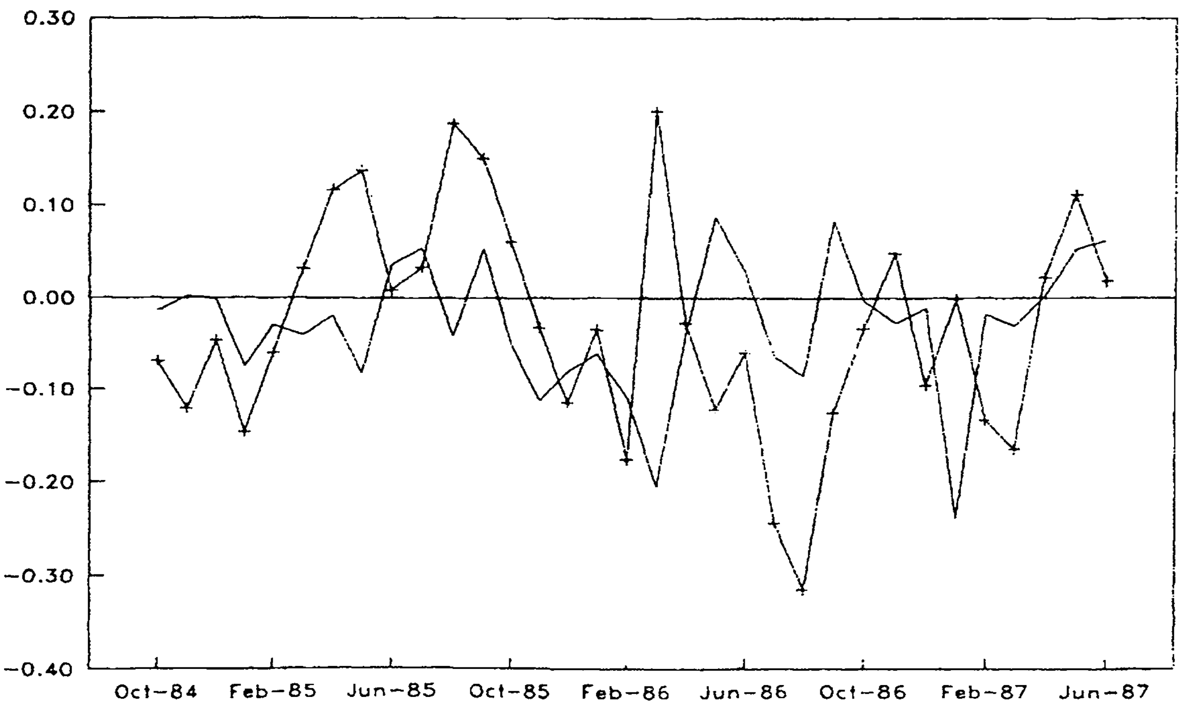

Fig. 3. *CAC change – Assur*

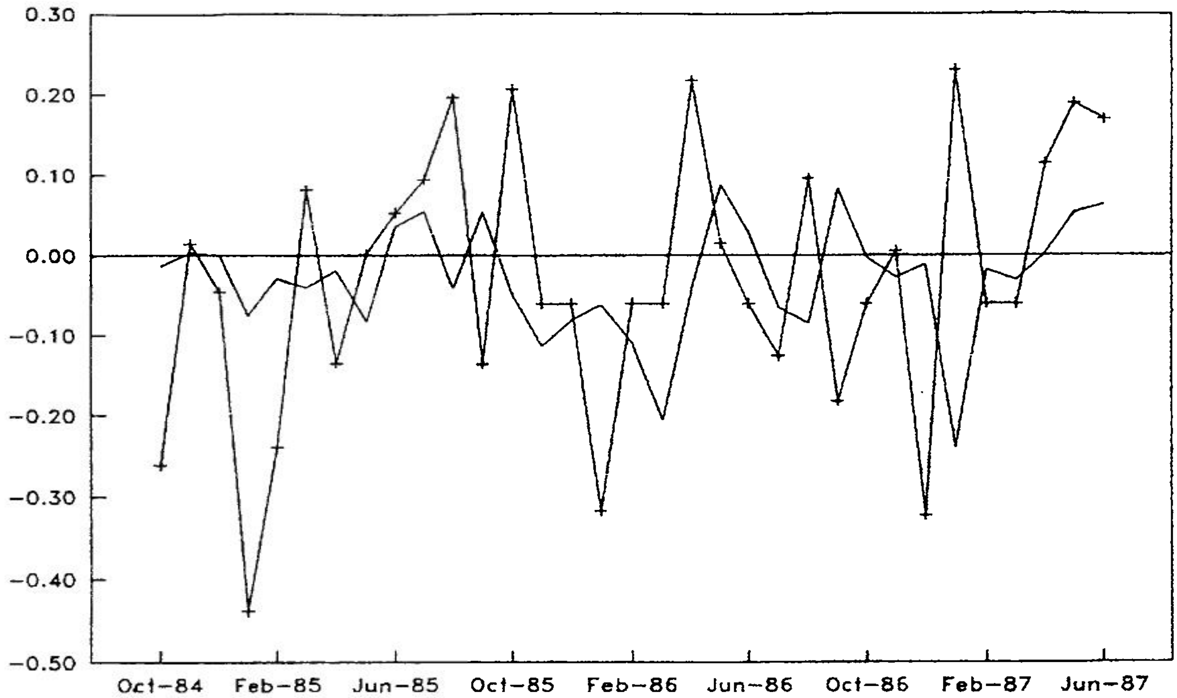

Fig. 4. *CAC change – Forex*

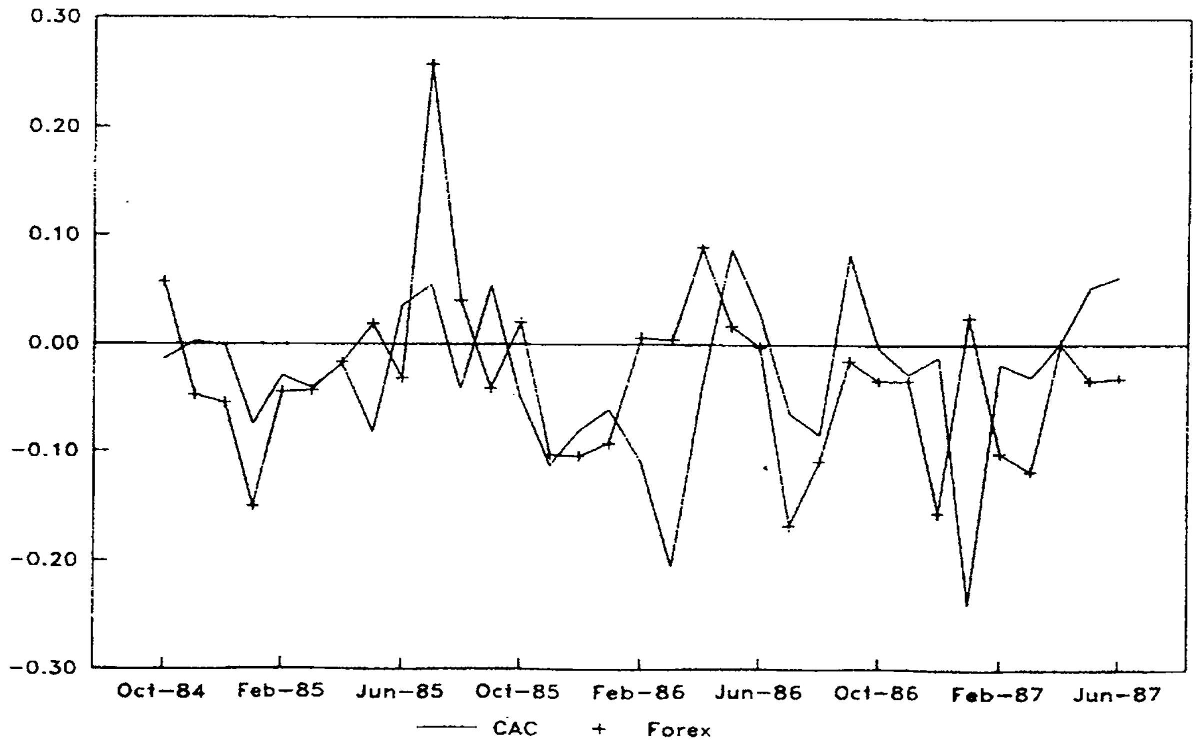

Table 1. *Unbiasedness and Orthogonality Tests*[1]

a. Unbiasedness Tests

	α	β	R^2	DW	$F_{(2,31)}$	Arch (4)
Global	– 0.028 (0.013)	0.049 (0.146)	0.00	1.64	21.009 (0.000)	1.023 (0.906)
	– 0.029 (0.013)	– 0.007 (0.108)	0.00	1.59	43.053 (0.000)	1.207 (0.876)
Assur	– 0.029 (0.013)	– 0.009 (0.078)	0.00	1.57	83.260 (0.000)	1.223 (0.874)
Forex	– 0.025 (0.014)	(0.145) (0.159)			14.313 (0.000)	0.783 (0.941)

1. The dependent variable is the change in the logarithm of the CAC index ; X denotes the expectations series ; R^2 is the coefficient of determination ; DW is the Durbin Watson test statistic for first order autocorrelation ; the F(.) is the computed F statistic with (.) degrees of freedom testing the joint hypothesis $\alpha = 0$; $\beta = 1$; Arch (4) is a test of Autoregressive Conditional Heteroscedasticity for up to 4 lags ; figures in parenthesis under the Arch statistics and computed F statistics are marginal significance levels and those below the coefficient estimates are standard errors. The sample period is from October 1984 to June 1987. Estimation is by OLS.

b. Orthogonality Tests

	F^1	F^2	F^3
Global	0.393 (0.849)		1.618 (0.170)
Bank	0.332 (0.888)	0.963 (0.457)	1.136 (0.374)
Assur	0.370 (0.863)	0.831 (0.539)	0.725 (0.652)
Forex	0.309	0.414	1.845

1. F^1 is the computed F statistic for testing the joint hypothesis that the sum of four own lagged forecast errors, plus a constant, jointly equals zero ;

F^2 is an F test which jointly tests the significance of two own lagged forecast errors, two lagged Global forecast errors and the constant ;

F^3 is an F test for testing the joint significant of two lagged forecast errors, two lagged forecast errors from each of the other sectors (apart form the Global) and the constant ; figures in parenthesis are marginal significance levels. See the text for a further discussion. Estimation is by OLS.

vincingly accept the null hypothesis of weak- and semi-strong form efficiency. It would appear that all the one-step-ahead forecast errors are uncorrelated with past own forecast errors and forecast errors from other sectors. However, in examining the regression results from these equations we noted that an occasional lagged forecast error differed significantly from zero. (For example, the period t-1 assurance forecast error proved significant at the 5 per cent level in the bank and foreign exchange sector equations and the t-2 Bank forecast error was marginally significant in the foreign exchange sector.)

As an alternative way of gauging the randomness of the different forecast errors, we estimated runs tests for the different sectors. Since such tests are non-parametric they may offer a more discerning way of detecting violations of orthogonality in the presence of non-normal errors. Although by definition our expectations series are normally distributed, it is now widely accepted that stock price data often violate normality. Since our forecast errors utilise the actual stock price data, we thought it worthwhile to use this test as a check on our orthogonality results. A runs test indicates the presence of trends and reversals in the series, with trends causing fewer runs than expected and reversals producing more runs than expected. These tests are reported in table 2. For all agents' forecast errors we cannot reject the hypothesis that the observed and expected number of runs are similar, the significance level in every case being above 5 %. This result appears to confirm the results from the orthogonality tests discussed above that agents use available information efficiently.

Table 2. *Runs Tests* [1]

	Observed	Expected	Significance
Global	15	16.76	0.515
Bank	15	17.12	0.515
Assur	18	17.36	0.820
Forex	12	15.67	0.143

1. Runs is a two sided runs test which tests for randomness of the order of the forecast errors. Figures below 'observed' are the number of consecutive observations found to be < or > *k*, where *k* is the mean of the forecast errors ; figures below 'expected' are the number of runs that would be expected conditioned on the number of observations above and below *k* ; figures below 'significance' are significance levels and measure the probability of attaining the expected number of runs.

In table 3 we report statistics on the performance of the forecasting agencies. In particular, we compare the forecasting performance of all expectation series to that of a naive random walk model by computing the Root Mean Square Error (RMSE) for each sectors' expectation series and for the CAC series. Our evidence suggests that agents did not out-perform a naive random walk model over the period under consideration : in every case the RMSE of the sectoral expectation series was greater than that of expecting no change in the CAC series.

Table 3. *Forecasting Performance : Expectations v Random Walk* [1]

	Global	Bank	Assur	Forex	ΔCAC
RMSE	0.110	0.139	0.181	0.089	0.078

1. RMSE denotes the Root Mean Square Error of the series.

In an attempt to classify the type of expectational mechanism which govern agents' behaviour, we also estimated versions of equation 5 noted in the previous Section. The results are reported in table 4[1]. While we could not accept the significance of estimated cœfficients from any of the expectation series at conventional significance levels, point estimates suggest that the assurance sector may have regressive expectations while bank and foreign exchange sectors may extrapolate past changes into the future, but with an elasticity of expectations with respect to changes in the CAC which is less than unity. Overall, the implication is that if speculators act on the basis of these expectations then such expectations may be considered to have a stabilising effect on CAC prices.

Tableau 4. *Expectational Mechanisms* [1]

	Extrapolative	Regressive	Adaptive
	$\Delta p^e_{t+k} = -\chi(p_t - p_{t-1})$	$\Delta p^e_{t+k} = \varphi(\bar{p}_t - p_t)$	$\Delta p^e_{t+k} = \gamma(p^e_t - p_t)$
Global	0.191 (0.226)	-0.267 (0.044)	-0.094 (0.067)
Bank	0.288 (0.305)	-0.075 (0.059)	-0.103 (0.062)
Assur	0.293 (0.413)	0.103 (0.079)	-0.169 (0.134)
Forex	0.138 (0.202)	-0.026 (0.036)	-0.077 (0.076)

1. The equations at the top of each column are the reparameterised versions of equation 5, where x is substituted out for various measures of the price series (see text for further details). Numbers not in parenthesis are the estimated values of the parameters χ, φ and γ. Numbers in parenthesis denote standard errors.

CONCLUDING COMMENTS

This paper has utilised a unique data base on French financial sector expectations of movements in the general CAC index. Our evidence overwhelmingly suggests that agents hold biased expectations, although once account is taken of two particular outliers, the bias is less pronounced. While orthogonality and runs test accept forecast errors are random, this result cannot be considered conclusive : for both bank and foreign exchange sectors we found some evi-

1. In implementing the regressive expectations equation we assumed that the equilibrium stock price was constant over our sample period (this is a common assumption in the empirical implementation of such equations).

dence of inefficient use of information in past forecast errors. The forecasting performance of agencies also appears to be poor. We found no evidence of any sector being able to out-perform a naive random walk forecasting model. Tests to classify expectations mechanisms indicate that we are unable to reject our null hypothesis that agents hold static expectations. Note that on the basis of our finding that agents cannot outperform a random walk, they would produce better forecasts by giving more weight to the current stock price. Future work on this unique data base will look to analysing further the rationality of the major French financial sectors.

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