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Time-Varying Stock Return Predictability: The Eurozone Case

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resumo	abstract

Neste artigo testamos a existência de previsibilidade em onze países da Zona Euro, através de regressões com coeficientes constantes e variáveis. Os resultados obtidos revelam que existem indícios estatísticos de previsibilidade em alguns países. O valor económico dos modelos de previsão é muito maior do que poderia ser inferido, com base nos testes estatísticos. Um investidor, com função de utilidade do tipo média-variância, poderia ter obtido ganhos substanciais na maioria dos países considerados. No geral, os modelos com parâmetros variáveis apresentam um melhor desempenho do que os modelos com coeficientes constantes.

In this paper, we test the existence of predictability in eleven Eurozone stock markets, using both regressions with constant coefficients and with time-varying coefficients. Our results show that there is statistical evidence of predictability in some countries. The economic value of the forecasting models is much stronger than what could be inferred, based on the statistical tests. A mean-variance investor could have obtained substantial utility gains in most countries. Overall, models with time-varying parameters perform slightly better than models with constant coefficients.

JEL Classification: C11; G11; G17

1. Introduction

Despite the fact that there is a voluminous literature that focus on the existence of equity premium predictability, this issue remains unsettled. Most early studies use US data, and assume that there is a stable relation between the predictors and the equity premium. Several researchers have concluded that there is a wide set of macroeconomic and financial variables that predict the US stock market evolution, such as the dividend yield (Lewellen, 2004; Neely et al., 2014), price dividend ratios (Bingsbergen and Koijen, 2010; Campbell and Yogo, 2006), payout yields (Boudoukh et al., 2007), dividend growth ratios (Bingsbergen and Koijen, 2010), price-earnings ratio (Rapach and Wohar, 2006), interest rates (Ang and Bekaert, 2007), the term spread (Rapach and Wohar, 2006), the consumption-wealth ratio (Lettau and Ludvigson, 2001; Hahn and Lee, 2006), the output gap (Cooper and Priestley, 2009), the ratio of shares to GDP (Rangvid, 2006), the stock variance (Guo, 2002) and expected business conditions (Campbell and Diebold, 2009). On the contrary, (Goyal and Welch, 2008) who conducted a very comprehensive study of US equity premium predictability, based on a large set of variables, concluded that predictability was restricted to some specific time periods, and that it had disappeared in the most recent years.

The evidence of instability on the relation between the equity premium and the predictors has lead some researchers to consider models with time-varying parameters. (Pettenuzzo and Timmermann, 2011) searched for breaks in predictive regressions, based on the dividend yield and the short rate, in the US. They concluded that there is strong evidence of breaks, and that they may have a substantial impact on the optimal asset allocation. (Paye and Timmermann, 2006) also tested the existence of breaks in several developed countries, and reached similar results. (Henkel et al., 2011) have used a regime-shifting model to predict the equity premia in the G7 countries. They have shown that parameter estimates are different in the two regimes, and that predictability is substantially higher during recessions than during expansionary periods.

Breaks and regime changes are difficult to estimate in real time, which lead (Dangl and Halling, 2012) to forecast the equity premium, in the US market, through a dynamic linear model, that implies gradual coefficients changes. They considered combinations of univariate and multivariate models, in a Bayesian framework, and showed that their model outperforms the forecasts based on the historical mean equity premium, over a wide range of time periods. (Johannes et al., 2014) proposed a model to estimate the relation between the net payout ratio and the equity premium, in the US, that included both time-varying coefficients and time-varying volatility. They concluded that their model provides statistically and economically significant out-of sample portfolio benefits for a power utility investor.

In this paper we test whether there is out-of-sample time-varying equity premia predictability in eleven Eurozone countries. Our choice is motivated by the fact that research on stock market predictability outside the US is scarcer, addresses essentially the developed countries, and does not consider time-varying predictive coefficients. Besides, the Eurozone countries have experienced substantial economic changes over the period considered in this study (1988 to 2012), which renders this set of countries particularly suitable for testing time-varying equity premia predictability. In the first part of the sample, the interest rates of the Eurozone peripheral countries decreased substantially, and converged towards the German interest rate level. Later, after the recent 2008 financial and sovereign debt crisis, the evolution of interest rates and stock markets was very erratic, specially in the countries that had to request financial assistance. Papers that study predictability outside the US include, among others, (Corte et al., 2010), consumption-wealth ratio, (Harvey, 1991), dividend yield, short-term interest rate and the term spread, (Cutler et al., 1991), short-term interest rate, (Campbell and Hamao, 1992), dividend price ratios and interest rates, (Ang and Bekaert, 2007), dividend yield, short-term interest rate and earnings yield, (Kellard et al., 2010), dividend ratios, (Paye and Timmerman, 2006), dividend yield, interest rates and spreads, and (Henkel et al., 2011), dividend yield and short-term interest rate. To our knowledge, the most comprehensive study on international stock return predictability

was conducted by (Hjalmarsson, 2010), who addressed 24 developed and 16 emerging countries. He concluded that the short-term interest rates and the term spreads are robust predictors of the equity premia in developed countries, and that the dividend price ratios also show some predictive ability, both for emerging and developed countries.

Recently, the Eurozone countries experienced turbulent times, due to the worldwide financial crisis, and also to some country specific sovereign debt problems. Therefore, it is likely that the relation between the equity premium and the predictors has not remained stable throughout this period. We follow (Dangl and Halling, 2012) and assume that the coefficients in the predictive regressions change smoothly. We also considered combinations of univariate and multivariate models, using the dividend yields, short-term interest rates and term spreads as predictive variables, in a Bayesian context. We show that there is some statistical evidence of predictability in some countries but, overall, the results are mixed. On the contrary, the economic value of the predictions, based on the utility gains that could have been obtained by a mean-variance investor, is sizable in most countries.

The rest of this paper is organized as follows. Section 2 describes the methodology used in the estimation of the predictive regressions, and the out-of-sample evaluation measures. Section 3 presents the dataset. Section 4 displays our results, and section 5 presents the main conclusions.

2. Methodology

2.1 The model

Unlike the vast majority of papers that study stock return predictability, we assume that the coefficients that relate the predictors and the equity premium are time-varying. We follow (Dangl and Halling, 2012) and model the changing nature of the predictive coefficients through a dynamic linear model. For each country, we estimate models of the form

$$r_{i,t+1} = X'_{i,t}\beta_{i,t} + v_{i,t+1} \qquad v_i \sim N(0, V_i) \qquad (observation\ equation) \tag{1}$$

$$\beta_{i,t+1} = \beta_{i,t} + \omega_{i,t+1} \qquad \omega_i \sim N(0, W_{i,t}) \qquad (system\ equation) \tag{2}$$

where $r_{i,t+1}$ represents the equity premium over the interval (t,t+1], for country i, $X'_{i,t}$ represents a vector of country i predictors (including a constant), observed at time t, V_i is the observational variance for country i, and W_{it} is the system variance for country i. Note that this model nests the traditional constant coefficient predictive regression, when the system variance is zero.

Even though the assumption that the coefficient vector follows a random walk is theoretical unappealing, because the coefficients may drift to arbitrarily high or low values, (Meese and Rogoff, 1983; Dangl and Halling, 2012) show that this specification outperforms more sophisticated models.

Our choice of the prior distribution follows, once again, (Dangl and Halling, 2012). We consider a diffuse prior centered on the null hypothesis of no predictability. That is, denoting by D_t the information set available at time t, we assume that V_i follows an inverse-gamma distribution, and β_{i0} follows a normal distribution with zero mean and a large variance

$$V_i | D_0 \sim IG\left[\frac{1}{2}, \frac{1}{2}S_{i0}\right] \tag{3}$$

$$\beta_{i0} | D_0, V_i \sim N[0, gS_{i0}(X'_i X_i)^{-1}] \tag{4}$$

where

$$S_{i0} = \frac{1}{N-1} r_i'\big(I - X_i(X_i'X_i)^{-1}X_i'\big)r_i \tag{5}$$

is the ordinary least squares estimate of the variance in the coefficients for country i, and g is a large scaling factor (g=50) that determines the confidence attributed to the null hypothesis of no predictability.

We have chosen a large value for the variance/covariance matrix of β_{i0}, that is, the prior for the coefficients is very uninformative. Therefore, our results are largely insensitive to changes in the prior coefficients mean.

The system variance W_{it} is assumed to be proportional to the variance/covariance matrix of $\beta_{it}|D_{it}$, which implies that the estimation of the coefficient vector loses precision in periods of high system variance. More precisely, we follow (West and Harrisson, 1997) and consider a discount factor δ, where $0 < δ ≤ 1$, which implies that the scaling factor equals $(1- δ)/δ$. Note that the scenario in which δ equals one, corresponds to $W_{it}=0$, i.e. the traditional constant coefficient model.

Given that the prior distribution follows a normal inverse-gamma distribution, it is well known that the posterior parameter distribution is also normal inverse-gamma. We updated the priors, after the arrival of a new observation, using the standard procedure described in (West and Harrison, 1997).

We evaluated the predictions from several types of models, namely:

- Univariate models without time-varying coefficients- The traditional estimation method in which only one variable is included in each predictive regression and time-varying coefficients are not allowed;

- Univariate models with time-varying coefficients- We estimate univariate regressions for all the different values of the discount factor, and then we combine them according to their posterior probability (Bayesian model averaging);

- Bayesian model average without time-varying coefficients- We estimate all the 2^k-1 models (number of possible combinations of the k predictive variables) without time-varying coefficients, and then we combine them according to their posterior probability;

- Bayesian model average with time-varying coefficients- We estimate all the $6(2^k$-1) models (2^k-1 models for each of the 6 possible discount factor value), and then we compute the Bayesian-averaged prediction.

The appendix of (Dangl and Halling, 2012) provides a detailed description of the estimation method and of the Bayesian model combination.

2.2 Out-of-sample performance evaluation

We perform both statistical and economic tests of predictability. We measure the statistical value of the models' predictions through the comparison of the mean-squared prediction error (MSPE) of the models and the MSPE of the forecast based on the historical average. The significance of the differences is tested through the computation of the MSPE-adjusted statistic (Clark and West, 2007). We also calculate the (Pesaran and Timmermann, 1992) sign test, in order to evaluate if the predicted and realized equity premia signs match.

The economic value of the predictions is tested by comparing the utility obtained by a mean-variance investor that chooses his portfolio according to the models predictions, and an investor that bases his asset allocation on the historical equity premium average.

2.2.1 MSPE-adjusted statistic

This test, proposed by (Clark and West, 2007), is an approximately normal modified version of (McCracken, 2007) MSE-F statistic that is used to test the null hypothesis that the unrestricted model forecast MSPE is equal to the restricted model MSPE, against the alternative hypothesis that the former is lower than the later. The most convenient way to implement this test is to compute

$$\hat{f}_{i,t} = \left(r_{i,t} - \hat{r}_{i,t}^m\right)^2 - \left[\left(r_{i,t} - \hat{r}_{i,t}^{mod}\right)^2 - \left(\hat{r}_{i,t}^m - \hat{r}_{i,t}^{mod}\right)^2\right]$$

for all the out-of-sample period, where $\hat{r}_{i,t}^{mod}$ is the equity premium prediction for country i at month t, based on the model, $\hat{r}_{i,t}^m$ is the equity premium prediction for country i at month t, based on the historical mean. The MSPE-adjusted statistic is computed by regressing $\hat{f}_{i,t}$ on a constant, and using the resulting t-statistic for a zero coefficient. Despite the fact that the MSPE-adjusted statistic is not asymptotically normal, (Clark and West, 2007) have shown, using simulations, that the standard normal critical values yield actual sizes close to the nominal size, even when the series are heteroskedastic and correlated. Therefore, the null hypothesis of equal predictive ability is rejected, at the 5% confidence level, if the t-statistic exceeds 1.645 (one-sided test).

2.2.2 Pesaran and Timmerman sign test

The (Pesaran and Timmermann, 1992) nonparametric sign test is designed to evaluate if the forecasts have the same sign as the variable that is being predicted. The test, whose asymptotic distribution in normal, is computed as follows

$$PT = \frac{T^{\frac{1}{2}}(H - F)}{\left[\frac{\hat{\pi}(1 - \hat{\pi})}{\pi(1 - \pi)}\right]^{\frac{1}{2}}}$$

where T is the number of observations in the forecast period, H is the probability of correctly predicting the sign of positive equity premia, F is the probability of incorrectly predicting the sign of negative equity premia, π is the probability that the equity premia are positive, and $\hat{\pi}$ is the probability that the predicted equity premia are positive. The PT test is a one-sided asymptotically normal test.

2.2.3 Utility gains

The previous performance evaluation measures are statistical in nature, and do not necessarily bear a direct relation with the benefits of the equity premium forecast for a real world investor. In order to evaluate the economic value of the predictions, we compute the utility gains for a mean-variance investor, who allocates his wealth between the stock market and the riskless asset, if he based his decisions on the model predictions, instead of relying only on the historical mean.

A mean-variance investor, with coefficient of relative risk aversion γ, who forecast the equity premium using the historical average, will invest a fraction $w_{i,t}^m$ of his wealth in equities, at each month t[1]

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1 Following (Campbell and Thompson, 2008) we constrain the portfolio weight to lie between 0% and 150%.

$$w_{i,t}^m = \frac{1}{\gamma} \frac{\hat{r}_{i,t+1}^m}{\hat{\sigma}_{i,t+1}^2}$$

where $\hat{\sigma}_{i,t+1}^2$ is the rolling window (60 month)estimate of the variance of stock returns. Over the out-of-sample period, the investor from country i obtains an average utility of

$$\hat{v}_i^m = \hat{\mu}_{i,m} - \frac{1}{2}\,\gamma\hat{\sigma}_{i,t+1}^2$$

where $\hat{\mu}_{i,m}$ and $\hat{\sigma}_{i,t+1}^2$ represent the sample average and variance, respectively, over the out-of-sample period, for the portfolio formed using only information about the historical mean of the equity premium.

The optimal portfolio weight and the average utility, for a country i investor that bases his investment decisions on the predictive model, will be

$$w_{i,t}^{mod} = \frac{1}{\gamma} \frac{\hat{r}_{i,t+1}^{mod}}{\hat{\sigma}_{i,t+1}^2}$$

$$\hat{v}_i^{mod} = \hat{\mu}_{i,mod} - \frac{1}{2}\,\gamma\hat{\sigma}_{i,t+1}^2$$

where $\hat{\mu}_{i,mod}$ and $\hat{\sigma}_{i,t+1}^2$ represent the sample average and variance , respectively, over the out-of-sample period, for the portfolio formed using the model.

The net average benefit per month obtained by the investor will be

$$\Delta U_i = \hat{v}_i^{mod} - \hat{v}_i^m$$

and can be interpreted as the average monthly fee that an investor from country i would be willing to pay to have access to the model predictions.

3. Empirical results

Our dataset comprises monthly data on eleven Eurozone countries - Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherland, Portugal and Spain - from January 1988 to December 2012. The data source is DATASTREAM.

The dependent variable, for each country, is the equity premium, that is, the difference between the log total return on the stock market (MSCI country index in local currency) and the short-term interest rate.

The predictive variables that we used include:

- Dividend yield (Div) - Dividend yields, over the last 12 months, are computed from the MSCI total return index and MSCI price index, using the method described in (Campbell and Viceira, 1999);

- Short-term interest rate (Stir) - Three month money market rate[2];

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2 Due to data availability, we used the 3 month treasury bill rate for Greece and Italy. The data for Greece begins in September 1992.

- Term spread (Spr) - Difference between the ten year government bond yield and the short-term interest rate.

In the remainder of this section, we analyse the performance of the predictive models. First, we present the results of the statistical tests of predictive ability. Then, we focus on the economic evaluation of the models' predictions. We present the average annualized utility gains, for each country, and for the average of all the countries. Finally, we show that there is a positive correlation between the economic and statistical measures of performance evaluation.

Table 1 displays the differences in the MPSE's (multiplied by 100) between the models' predictions and the benchmark, based on the historical mean. Overall, the evidence is mixed- approximately 28% of all the predictions are significant at the 5% level. The univariate model based on term spread, without time-varying coefficients, displays the best performance (6 significant MSPE's differences), followed by the short-term interest rate model with time-varying coefficients and the Bayesian model average with time-varying coefficients (5 significant MSPE's differences). In a country level analysis the best results are achieved for Belgium (6 significant MSPE's differences), followed by the Netherlands (5 significant MSPE's differences). Predictability seems to be almost absent in the southern countries that were most affected by the recent sovereign debt crisis (Greece, Portugal, Spain and Italy).

Table 1 – MSPE differences								
	Div	Stir	Spr	Div-tv	Stir-tv	Spr-tv	BMA	BMA-tv
AUT	-0.0068	0.0026	0.0027*	-0.0114	0.0212*	0.0164*	-0.0032	0.009*
BEL	0.0027	0.0023*	0.0103*	-0.0097	0.0212*	0.0171*	0.0097*	0.0086*
FIN	-0.0053	-0.0094	0.0078*	-0.0134	-0.0043	-0.0013	-0.0071	-0.0498
FR	-0.0007	0.0005	0.0035*	-0.0019	0.0036*	0.0044*	0.0012	0.002*
GER	-0.0004	0.0008	0.0044*	-0.0052	0.0019	0.0034	0.0014	-0.0011
GRE	0.0087	0.0002	-0.0127	0.0025	0.0063	-0.033	-0.0084	-0.0227
NE	0.002	-0.0014	0.0038*	0.0003	0.0043*	0.0041*	0.0042*	0.0067*
IR	0.0105*	0.0001	0.0007	0.0029*	0.02*	0.0001	0.009*	0.0119*
IT	-0.0012	-0.0023	-0.0114	-0.0035	-0.002	-0.0069	-0.0088	-0.0062
PT	0.0011*	-0.0064	-0.0052	-0.0005	-0.0016	-0.0049	-0.002	-0.0026
SP	-0.0016	-0.0044	-0.001	-0.0039	-0.0052	-0.0046	-0.0034	-0.0062

Notes: This table displays the difference (multiplied by 100) between predictive models MSPE's and the benchmark (historical mean) MSPE's, in the eleven countries (AUT- Austria, BEL- Belgium, FIN- Finland, FR- France, GER- Germany, GRE- Greece, NE- Netherlands, IR- Ireland, IT- Italy, PT- Portugal and SP- Spain). The Bayesian model average with (without) time-varying coefficients is represented by BMA-tv (BMA).
* significant at the 5% level, according to the MSPE-adjusted test.

Table 2 displays the Pesaran and Timmermann test results. Most of the test values are positive, which indicates that the models have some ability to forecast the sign of the equity premium. Approximately 20% of the test values are significant at the 5% level. Curiously, Greece presents the best results, despite the fact that it presented poor predictive MSPE's. Time-varying models perform slightly better. In particular, all the test values for the Bayesian model average with time-varying coefficients are positive. The model based on the interest rate spread, with time-varying coefficients exhibits the best performance, with four significant test results, and only one negative value. The short-term interest rate model and the bayesian model average with constant coefficients are the worst performers, with only one significant test result.

Table 2 - Pesaran and Timmerman sign test

	Div	Stir	Spr	Div-tv	Stir-tv	Spr-tv	BMA	BMA-tv
AUT	0.35	-0.05	0.7	0.26	1.21	0.54	0.66	1.08
BEL	1.67	1.2	1.56	1.78*	1.36	0.87	0.63	0.84
FIN	1.75*	0	0.62	0.37	0.22	0.32	1.1	0.28
FR	-0.07	0	2.33*	1.3	2.32*	2.5*	1.49	1.42
GER	0.21	0	1.95*	-0.38	1.23	0.16	0.99	1.06
GRE	3.37*	1.8*	1.39	3.4*	2.26*	2.05*	1.37	1.82*
NE	1.05	1.08	2.62*	0.84	1.86*	-0.21	1.04	1.04
IR	1.1	-0.64	-1.61	1.27	-0.05	0.61	0.77	0.76
IT	-1.23	-0.66	-1.48	-0.82	0.63	0.53	-0.61	0.99
PT	2.43*	0	0.76	2.85*	1.98*	1.31	2.55*	1.96*
SP	0.26	0	1.14	0.79	1.35	1.13	-0.22	0.66

Notes: This table presents the value of the Pesaran and Timmerman sign test, for each model, in the eleven countries (AUT-Austria, BEL- Belgium, FIN- Finland, FR- France, GER- Germany, GRE- Greece, NE- Netherlands, IR- Ireland, IT- Italy, PT-Portugal and SP- Spain). The Bayesian model average with (without) time-varying coefficients is represented by BMA-tv *(BMA)*.
* significant at the 5% level.

Table 3 - Utility gains

	Div	Stir	Spr	Div-tv	Stir-tv	Spr-tv	BMA	BMA-tv
AUT	4.13%	4.24%	0.56%	3.57%	10.31%	7.13%	4.07%	9.15%
BEL	9.07%	5.65%	10.46%	9.44%	14.93%	11.54%	11.85%	14.61%
FIN	0.65%	-5.59%	3.94%	3.44%	-1.47%	3.52%	2.17%	-0.33%
FR	2.3%	1.95%	7.11%	5.28%	8.42%	8.6%	4.74%	7.61%
GER	1.02%	1.57%	5.43%	1.02%	5.4%	6.28%	3.23%	3.44%
GRE	2.71%	-0.28%	-3.13%	3.12%	-3.02%	-9.1%	-0.42%	-4.12%
NE	6.15%	-0.87%	7.04%	8.39%	9.04%	8.57%	10.13%	9.45%
IR	7.47%	0.81%	1.77%	6.51%	-1.07%	-1.72%	6.42%	1.41%
IT	-1.3%	-1.46%	-7.21%	-0.18%	0.12%	-3.77%	-6.39%	-2.79%
PT	1.48%	-6.14%	-3.29%	1.31%	-1.86%	-2.69%	1%	-0.66%
SP	0.5%	-2.83%	1.07%	1.74%	0.58%	-0.04%	-0.04%	1.16%
Av.	3.11%	-0.29%	2.16%	3.97%	3.76%	2.57%	3.34%	3.53%

Notes: This table displays the annualized utility gains, for each model, in the eleven countries (AUT- Austria, BEL- Belgium, FIN-Finland, FR- France, GER- Germany, GRE- Greece, NE- Netherlands, IR- Ireland, IT- Italy, PT- Portugal and SP- Spain). The last line presents the average utility gains for each model. The Bayesian model average with (without) time-varying coefficients is represented by BMA-tv (BMA).

Table 3 presents the results of the economic evaluation of the models' forecasts. In the vast majority of the cases, the utility gains are positive. The average utility gains are positive for all the models, except for the model based on the short-term interest rate with constant coefficients. The

utility gains are largest in Belgium, while the southern European countries affected by the sovereign debt crisis exhibit the worst performance. Overall, the models with time-varying coefficients tend to outperform the models with constant coefficients, especially in the models based on the short-term interest rate. The model based on the short-term interest rate, with constant coefficients, is the only one that has a negative average utility gain.

Table 4 – Correlation between statistical and economic performance measures				
	MSPE/ΔU		PT/ΔU	
	Lin. Cor.	Rank Cor.	Lin. Cor.	Rank Cor.
AUT	0.86	0.81	0.8	0.5
BEL	0.64	0.46	-0.32	-0.53
FIN	0.19	0.24	0.34	0.55
FR	0.66	0.64	0.84	0.63
GER	0.65	0.67	0.4	0.45
GRE	0.81	0.71	0.46	0.31
NE	0.78	0.71	0.17	0.07
IR	-0.13	0.23	0.13	0.64
IT	0.93	0.88	0.25	0.19
PT	0.69	0.76	0.69	0.62
SP	-0.07	-0.1	0.42	0.62

Note: This table displays the linear correlation coefficients (Lin. Cor.) and the rank correlation coefficients (Rank Cor.) for the eleven countries (AUT- Austria, BEL- Belgium, FIN- Finland, FR- France, GER- Germany, GRE- Greece, NE- Netherlands, IR- Ireland, IT- Italy, PT- Portugal and SP- Spain).

Our results reveal that, although there is not an overwhelming statistical evidence of predictive ability, the economic performance of the models is, generally, very good. In order to test if the economic and statistical measures of performance are related, we follow (Cenesizoglu and Timmermann, 2012) and compute the linear correlation and the rank correlation between these measures. Table 4 presents the results.

Most coefficients of correlation are positive and considerable, in particular the correlation coefficients between the MSPE's differences and the utility gains are quite high. Therefore, our results corroborate the evidence presented by (Cenesizoglu and Timmermann, 2012), which reveals that there is a positive relation between the statistical and economic performance measures.

4. Conclusions

In this paper we have shown that the statistical evidence of predictability is mixed- it is stronger in the core Eurozone countries than in the peripherical southern ones, that have been affected by recent sovereign debt crisis. Models with time-varying coefficients could not capture the recent instability in these countries. On the contrary, the economic gains that could have been obtained by a mean-variance investor are considerable. Models with time-varying coefficients generally outperform constant coefficients models, based on this criterion, particularly in the case of the models based on the short-term interest rate. We have also shown that there is a strong correlation between the statistical and economic performance measures.

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