

Análisis y Predicción del Precio de Activos Financieros

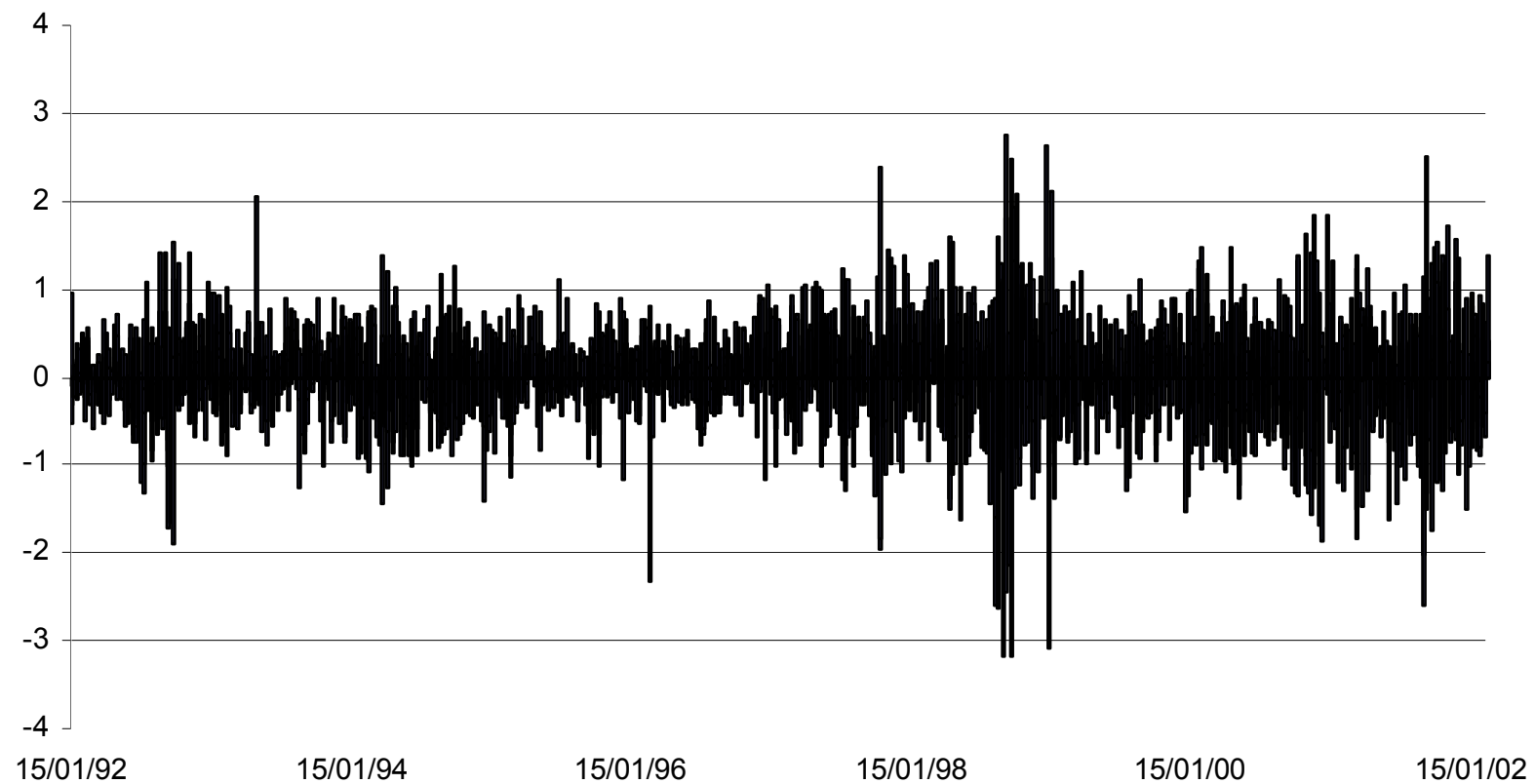
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¿Son predecibles los precios de los activos financieros?

$$f(P_{t+i} / F_t) \begin{cases} m_{t+i} = E_t(P_{t+i}) \\ W_{t+i/t} = E_t(P_{t+i} - m_{t+i})(P_{t+i} - m_{t+i})^{-1} \end{cases}$$

- Hipótesis de eficiencia de mercado
- Teoría de la gestión de carteras

Rentabilidad diaria IBEX-35 (15/01/92 al 28/02/02)



Rasgos de las series financieras

- Media constante con escasa estructura dinámica
- Series leptocúrticas con colas pesadas
- Heterocedasticidad
- Agrupamiento en la volatilidad
- Long-Memory en la volatilidad
- Cambios de régimen en la volatilidad
- Efecto apalancamiento

Modelización de series financieras

Modelo AR: $Y_t = c + a_1 Y_{t-1} + L + a_p Y_{t-p} + e_t$

$$e_t^2 = g + q_1 e_{t-1}^2 + L + q_m e_{t-m}^2 + w_t$$

$$e_t = \sqrt{h_t} J_t, \text{ con } E(J_t) = 0, \text{Var}(J_t) = 1$$

ARCH(m)
(Engle, 1982)

$$\text{y } h_t = g + q_1 e_{t-1}^2 + L + q_m e_{t-m}^2$$

GARCH(p,m)

$$e_t = \sqrt{h_t} J_t, \text{ con } E(J_t) = 0, \text{Var}(J_t) = 1$$

(Bollerslev, 1986)

$$\text{y } h_t = k + f_1 h_{t-1} + L + f_p h_{t-p} + q_1 e_{t-1}^2 + L + q_m e_{t-m}^2$$

❖ Recogen la heterocedasticidad y el peso en las colas

Modelización de series financieras

$$\log h_t = k + f_1 \log h_{t-1} + L + f_p \log h_{t-p} + q_1 (|J_{t-1}| - E |J_{t-1}| + XJ_{t-1}) + L$$

c

EGARCH(p,m)
(Nelson, 1991)

$$\log h_t = k + \frac{q_1 + q_2 L + L + q_m L^{m-1}}{1 - f_1 L - L - f_p L^p} g(J_{t-1})$$

$$g(J_t) = (|J_t| - E |J_t| + XJ_t)$$

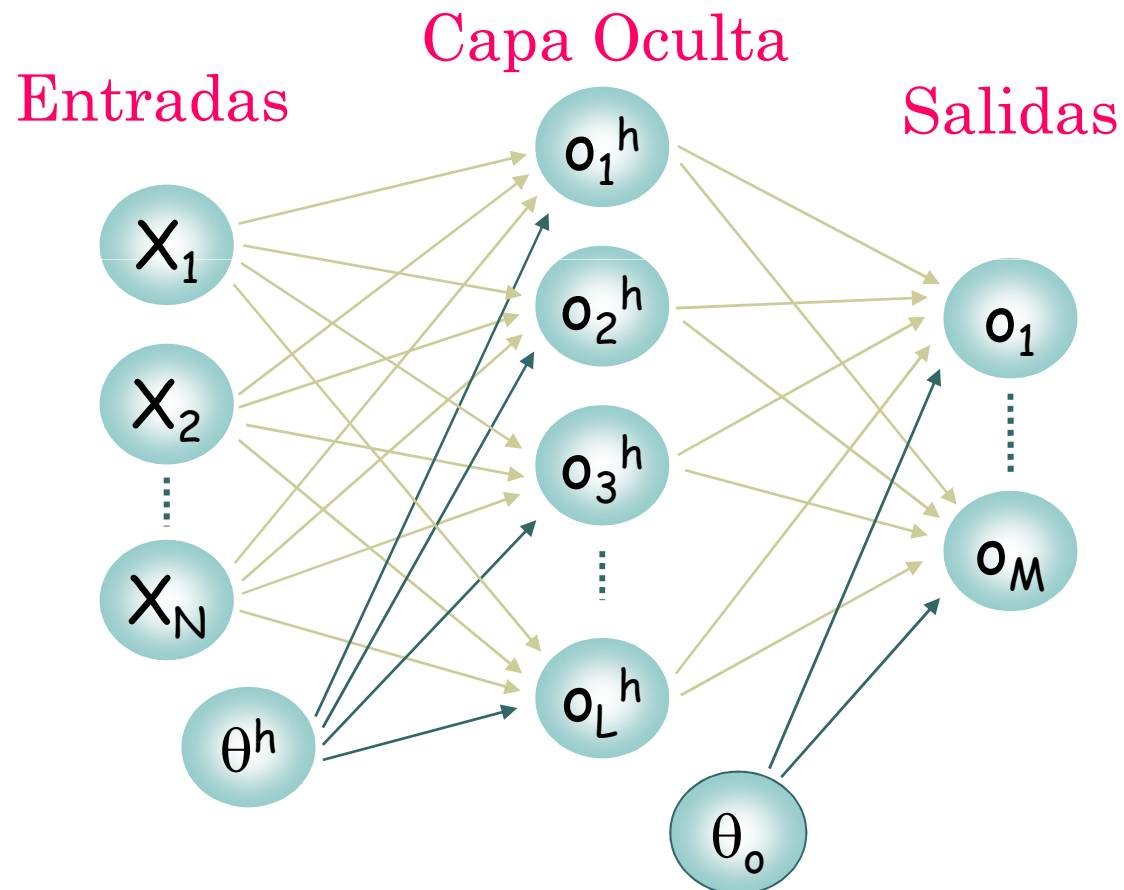
❖ Recoge el apalancamiento

FIEGARCH(p,d,m)
(Bailie, Bollerslev, Mikelsen, 1996)

$$(1 - F(L))(1 - L)^d \log h_t = k + Q(L)g(J_t)$$

❖ Recoge Long-Memory

Topología de una red neuronal



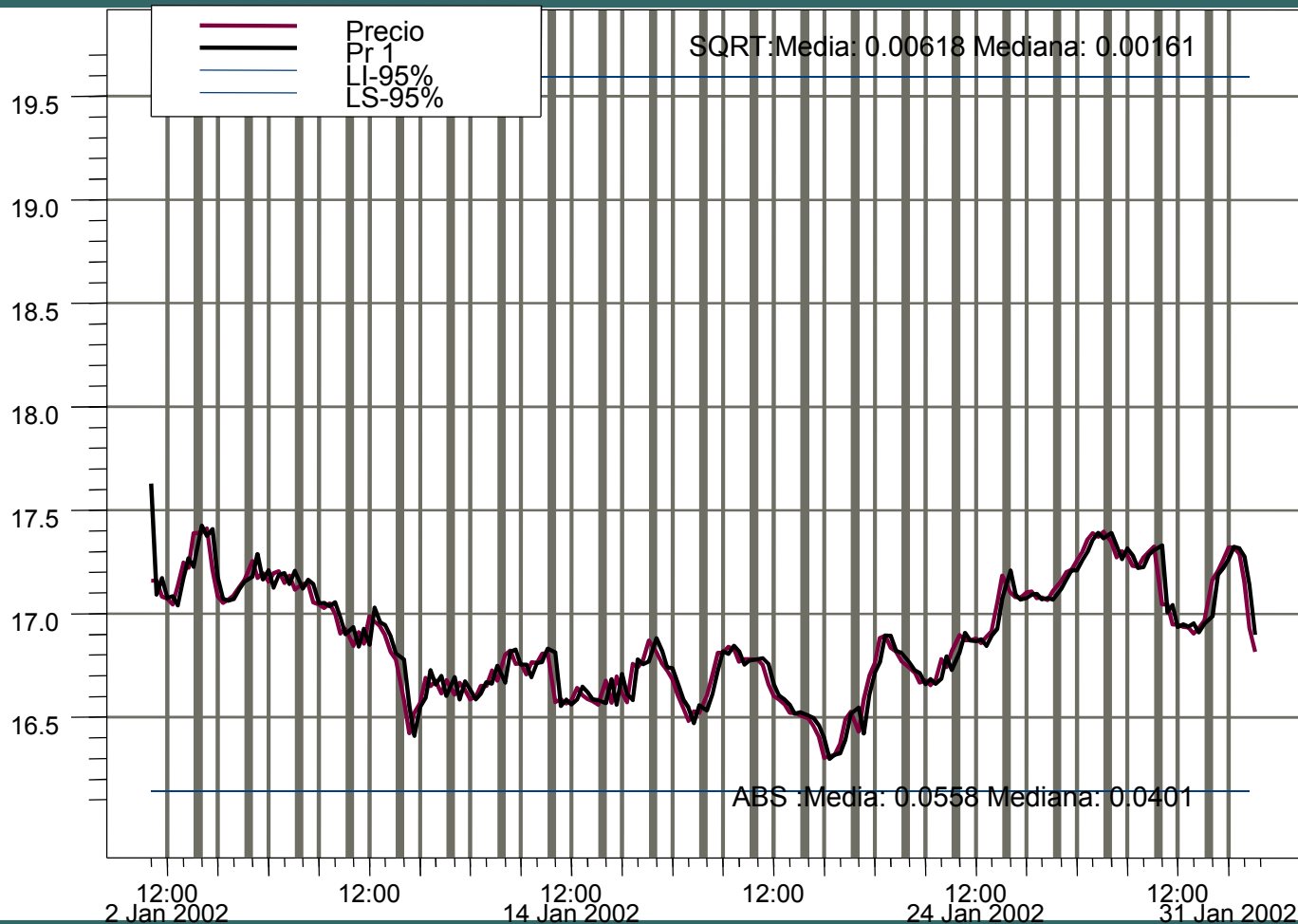
Salidas red neuronal

Dado $\mathbf{X} = (X_1, \dots, X_N)$

$$o_k^o = \theta_k^o + \sum_{j=1}^L \omega_{jk}^o f_j \left(\theta_j^h + \sum_{i=1}^N \omega_{ji}^h X_i \right)$$

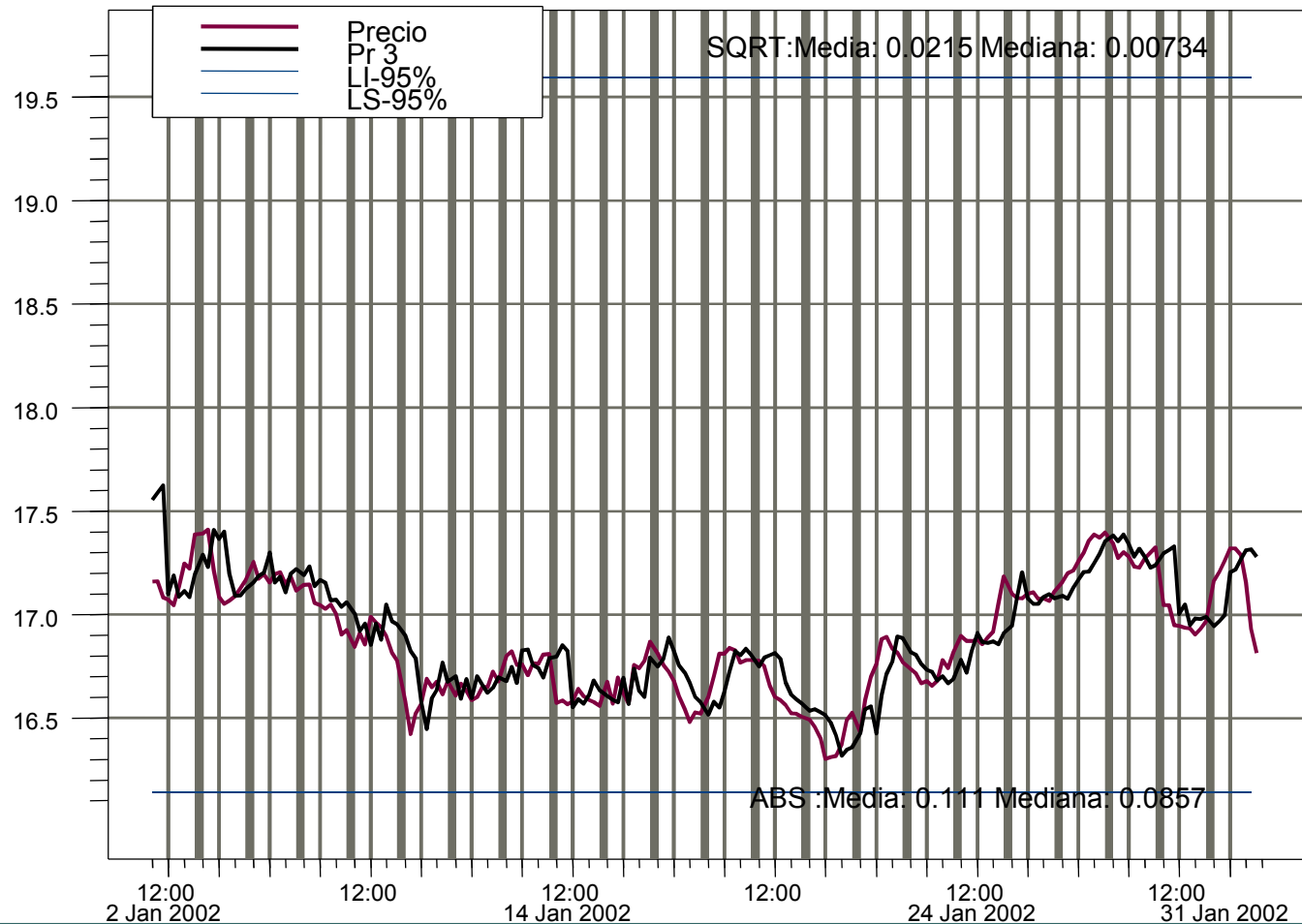
$$k = 1, \dots, M$$

AR(27) – 1 hora



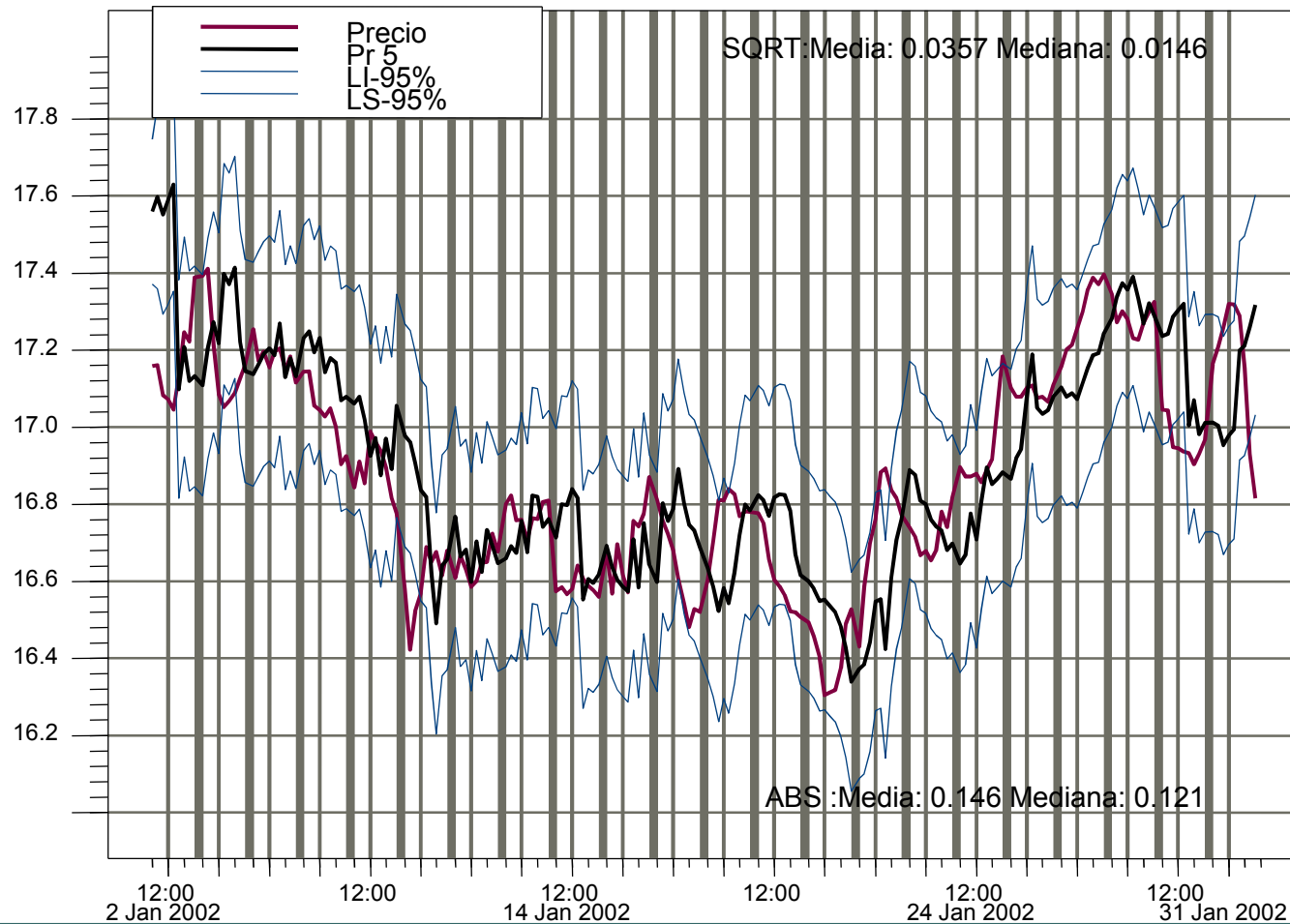
Pred: 1 Cobertura: 0.9949 Long.media: 3.451

AR(27) – 3 horas



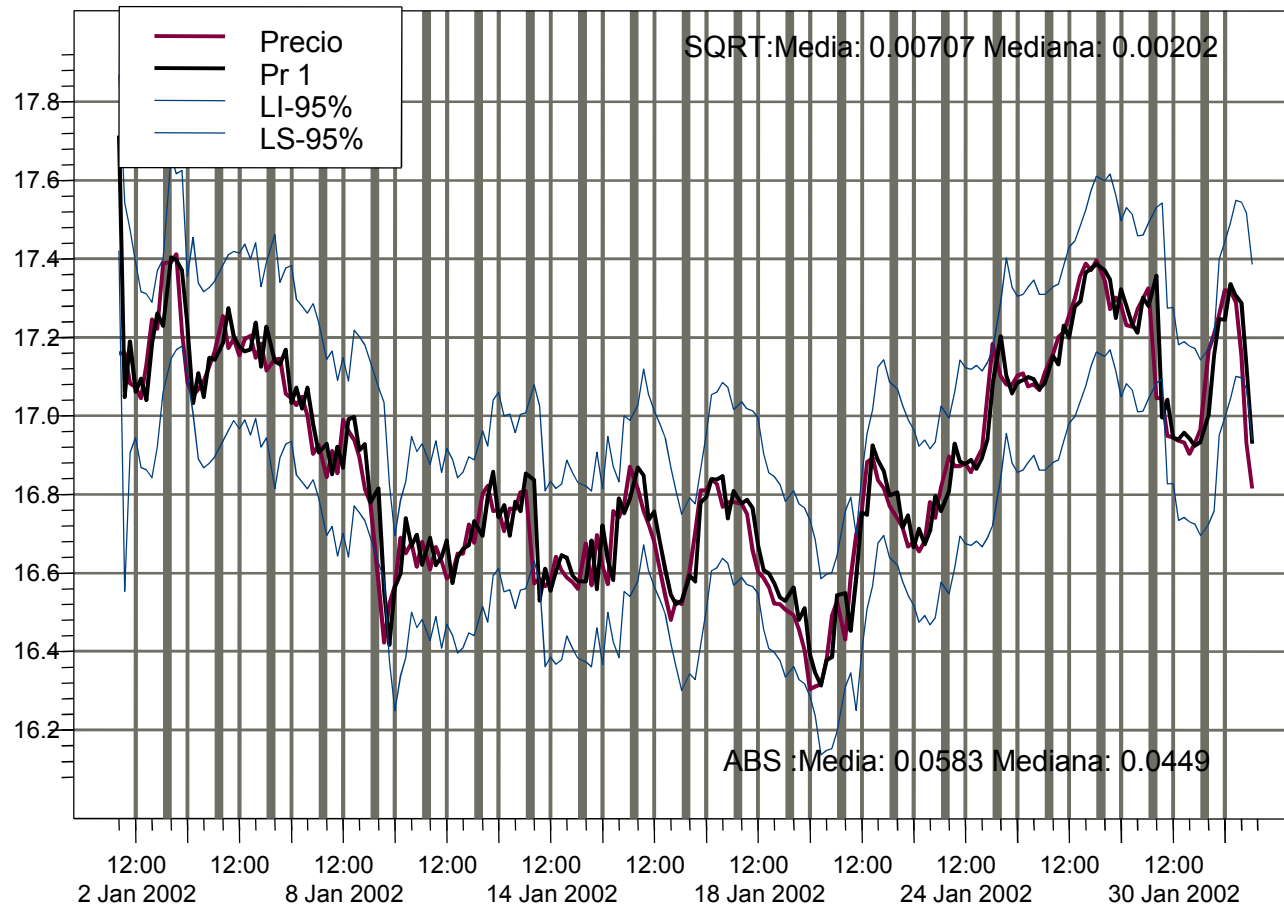
Pred: 3 Cobertura: 0.9949 Long.media: 3.451

AR(27) – 5 horas



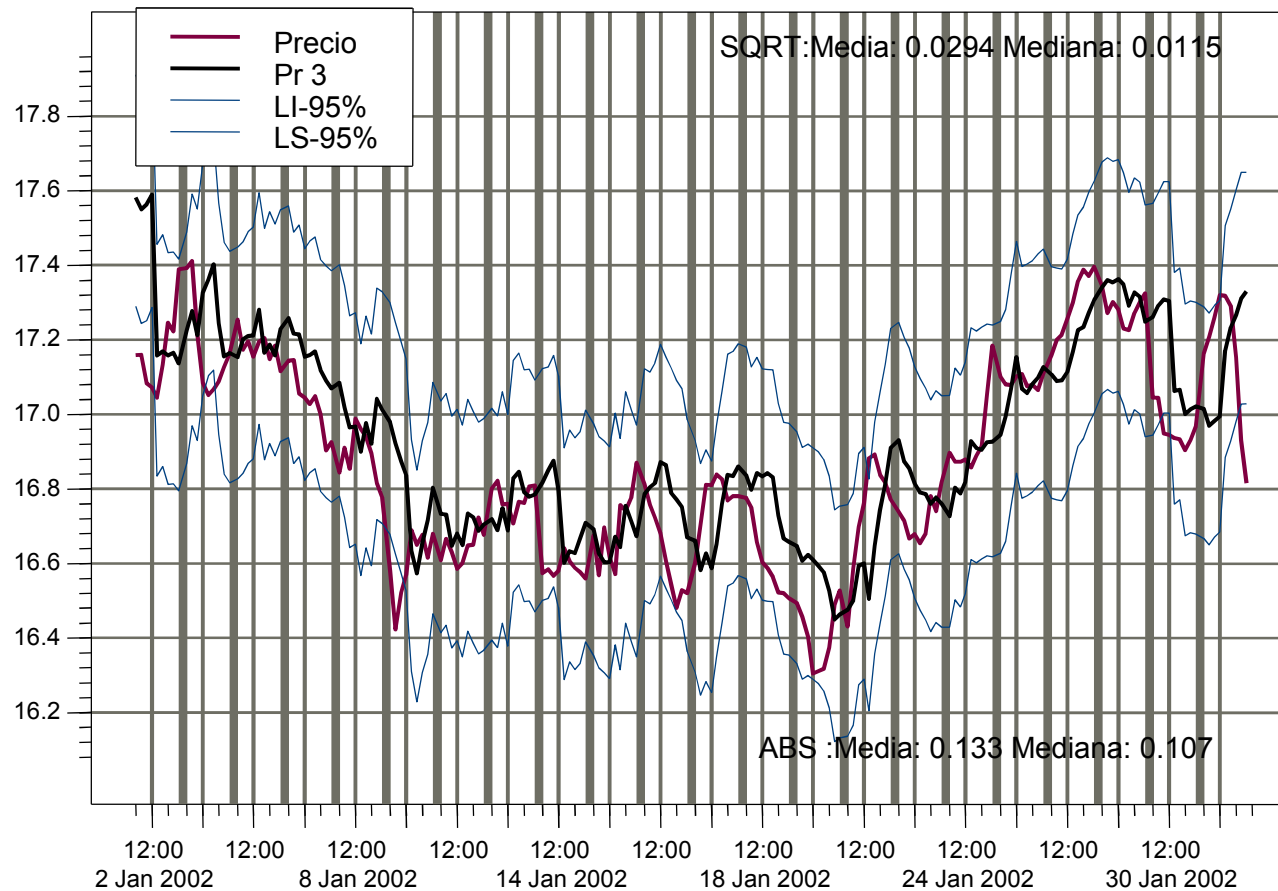
Pred: 5 Cobertura: 0.8788 Long.media: 0.568

AR(27), GARCH(0,27) – 1 hora



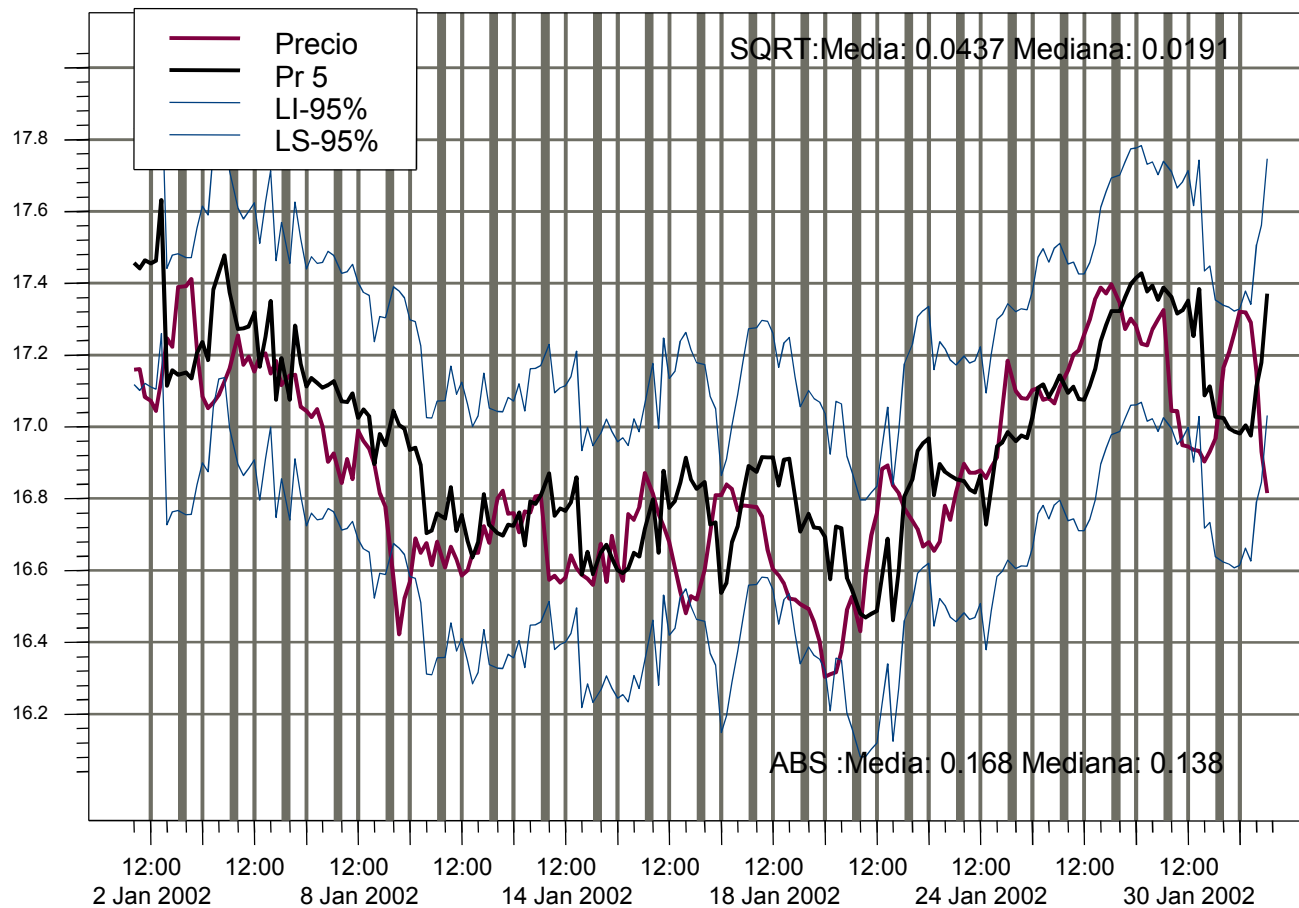
Pred: 1 Cobertura: 0.9394 Long.media: 0.4507

AR(27), GARCH(0,27) – 3 horas



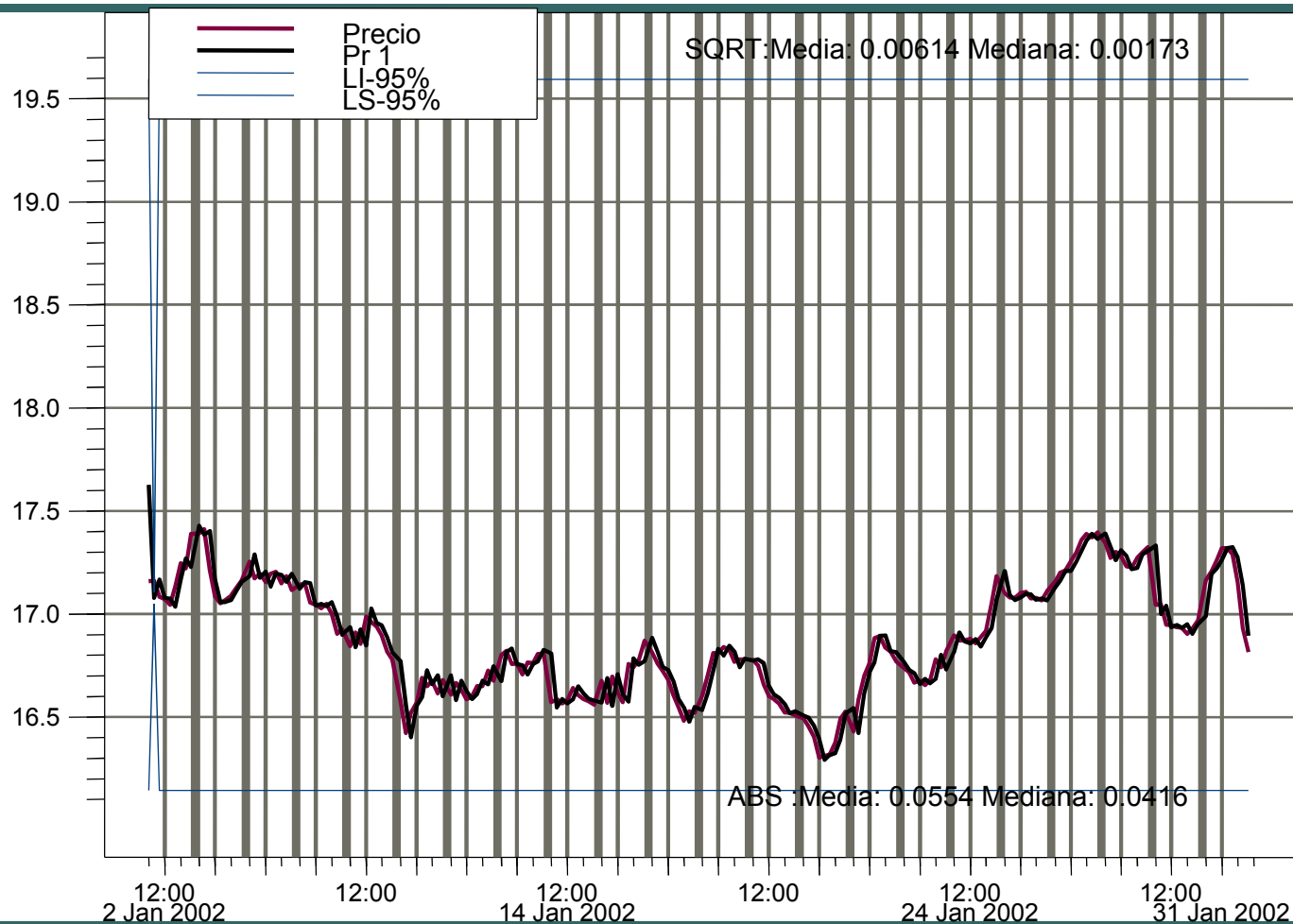
Pred: 3 Cobertura: 0.9242 Long.media: 0.6215

AR(27), GARCH(0,27) – 5 horas



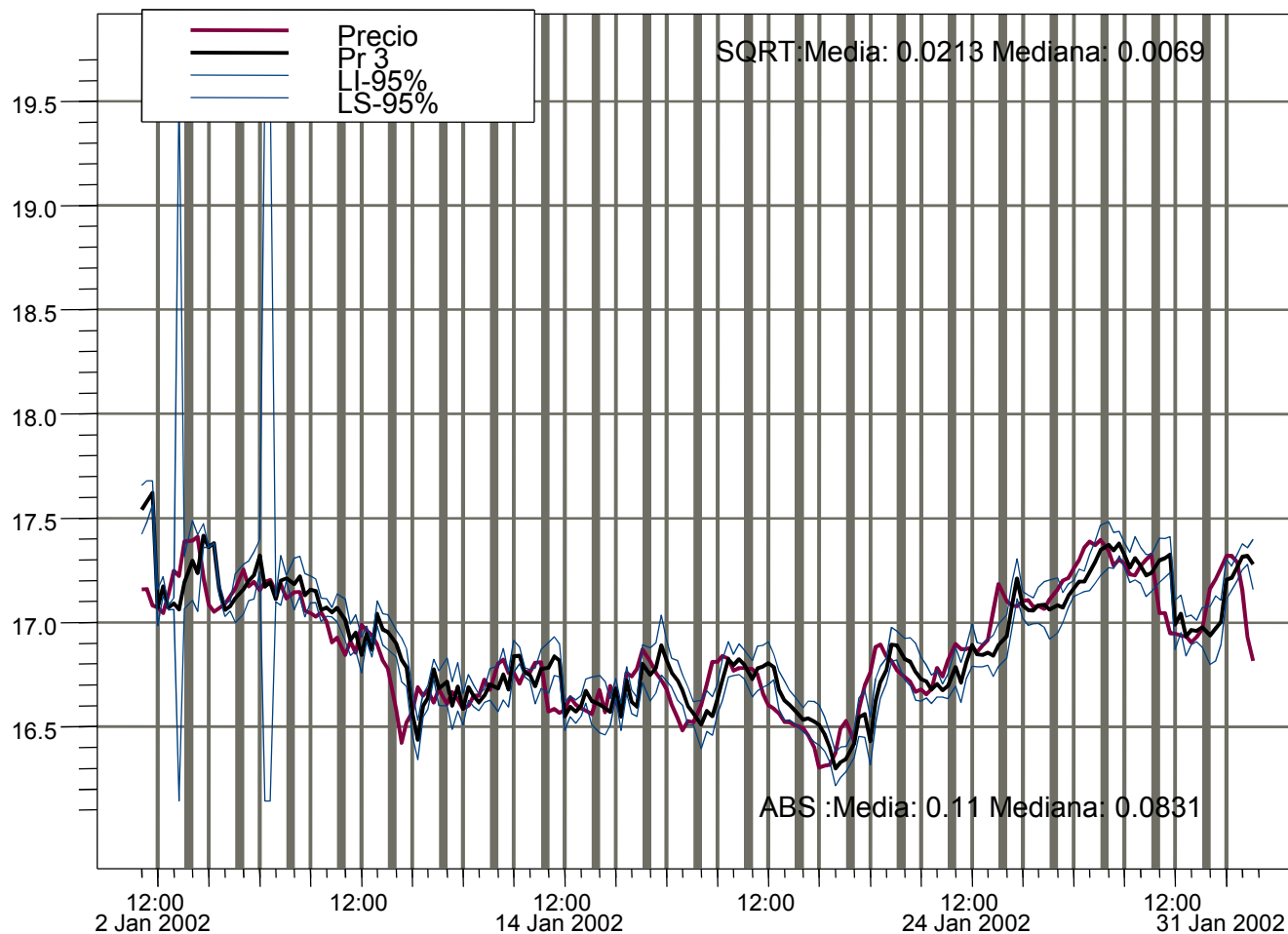
Pred: 5 Cobertura: 0.9091 Long.media: 0.7148

AR(27), FIEGARCH(0,d,27) – 1 hora



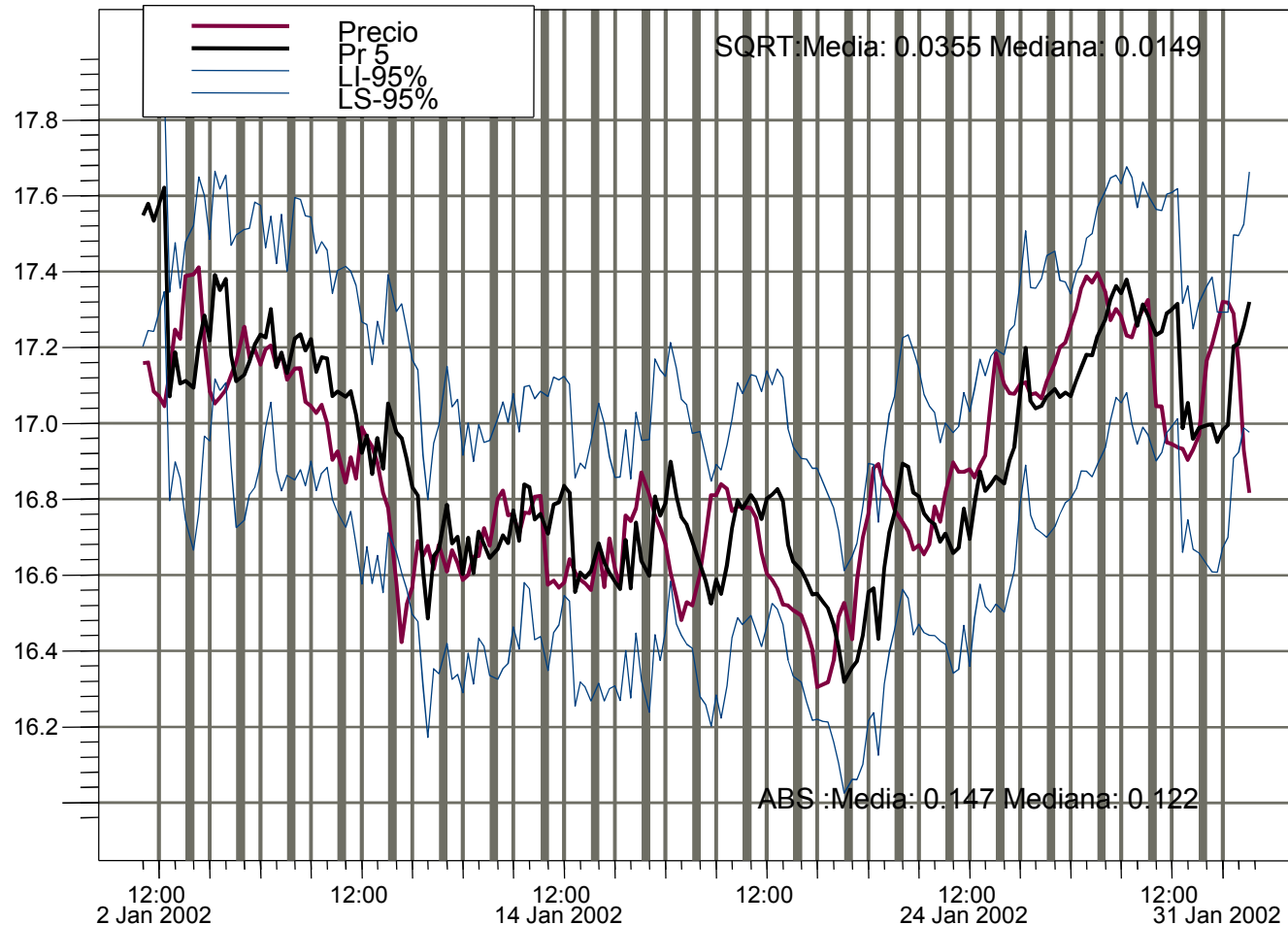
Pred: 1 Cobertura: 0.9949 Long.media: 3.434

AR(27), FIEGARCH(0,d,27) – 3 horas



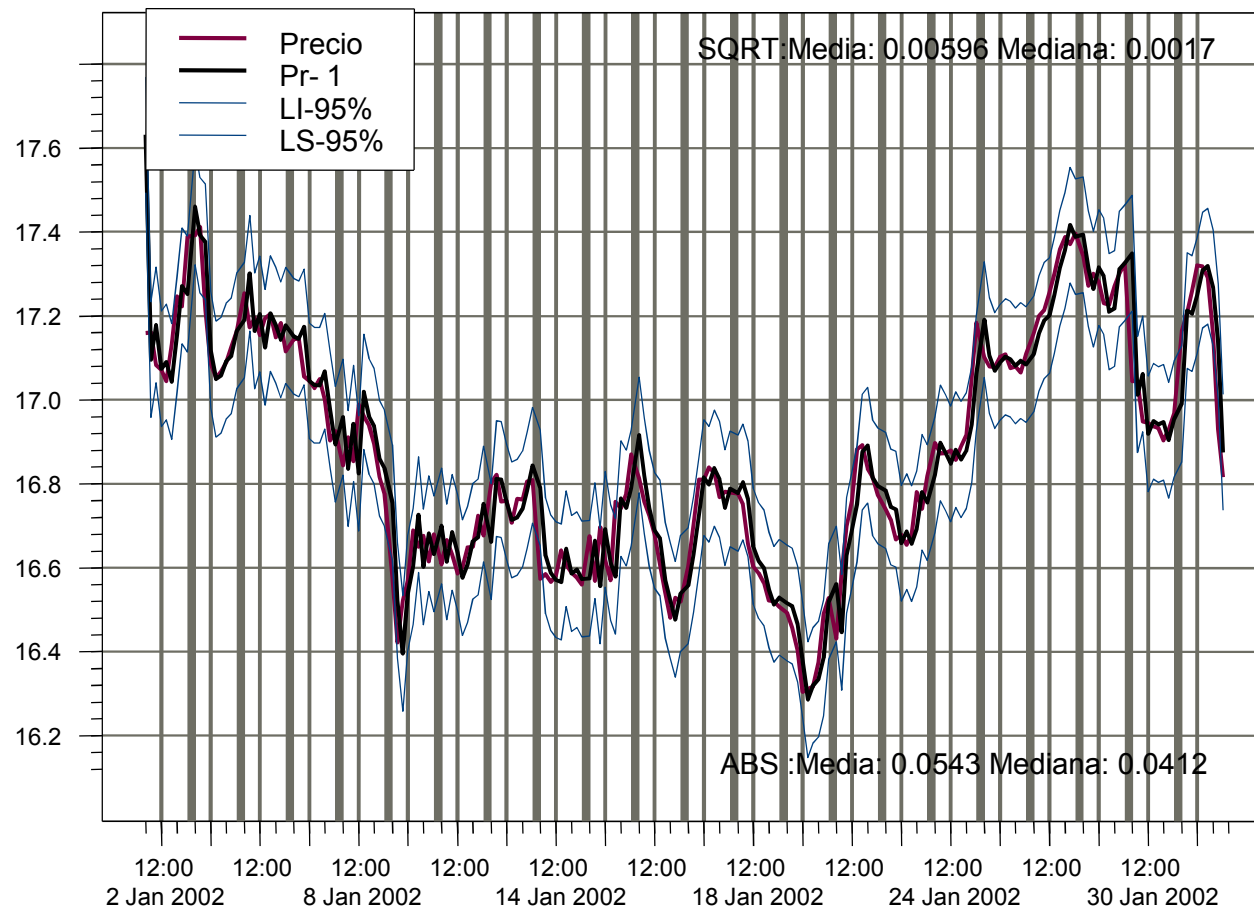
Pred: 3 Cobertura: 0.4697 Long.media: 0.2122

AR(27), FIEGARCH(0,d,27) – 5 horas



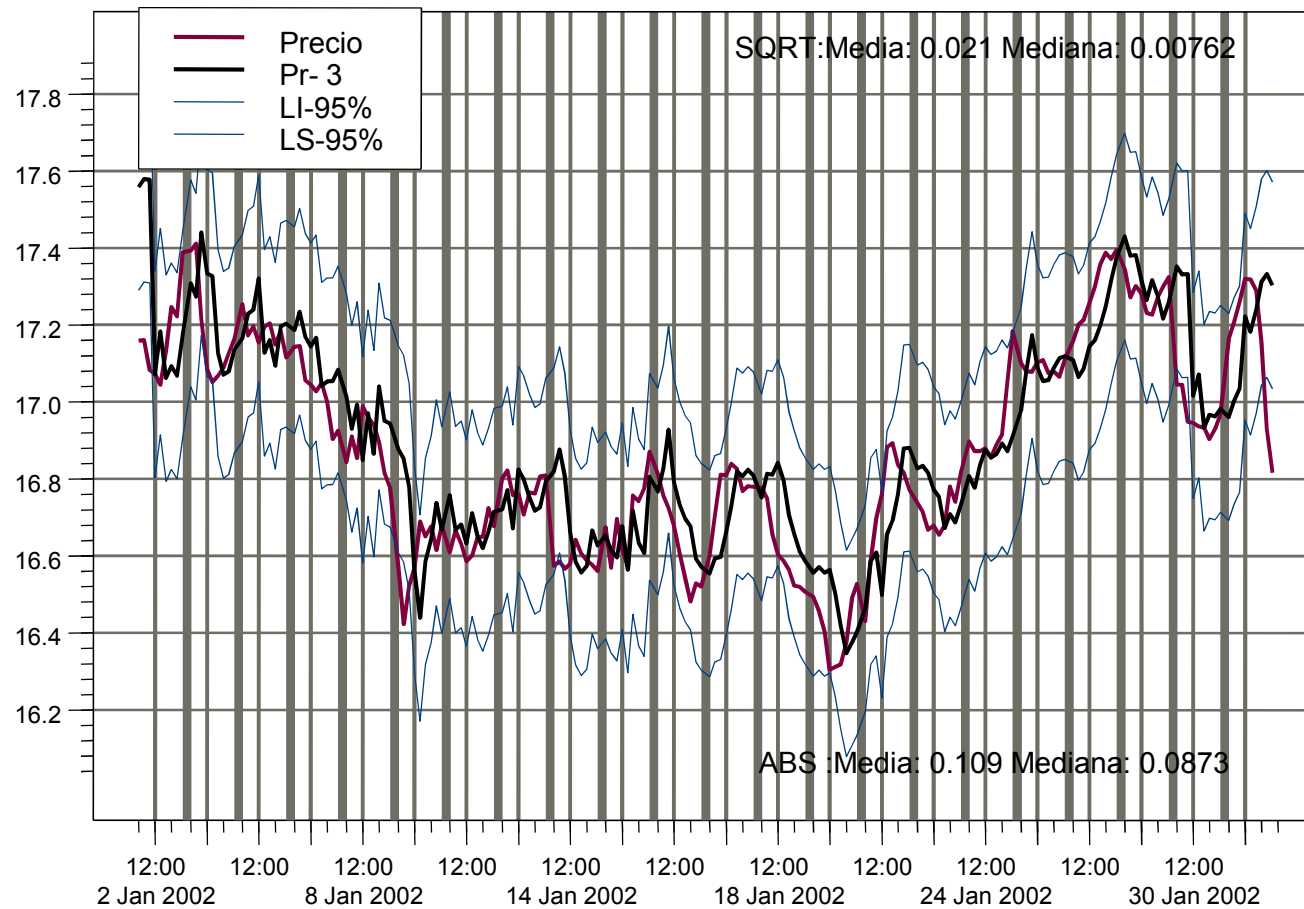
Pred: 5 Cobertura: 0.904 Long.media: 0.6341

Red Neuronal 3 nodos – 1 hora



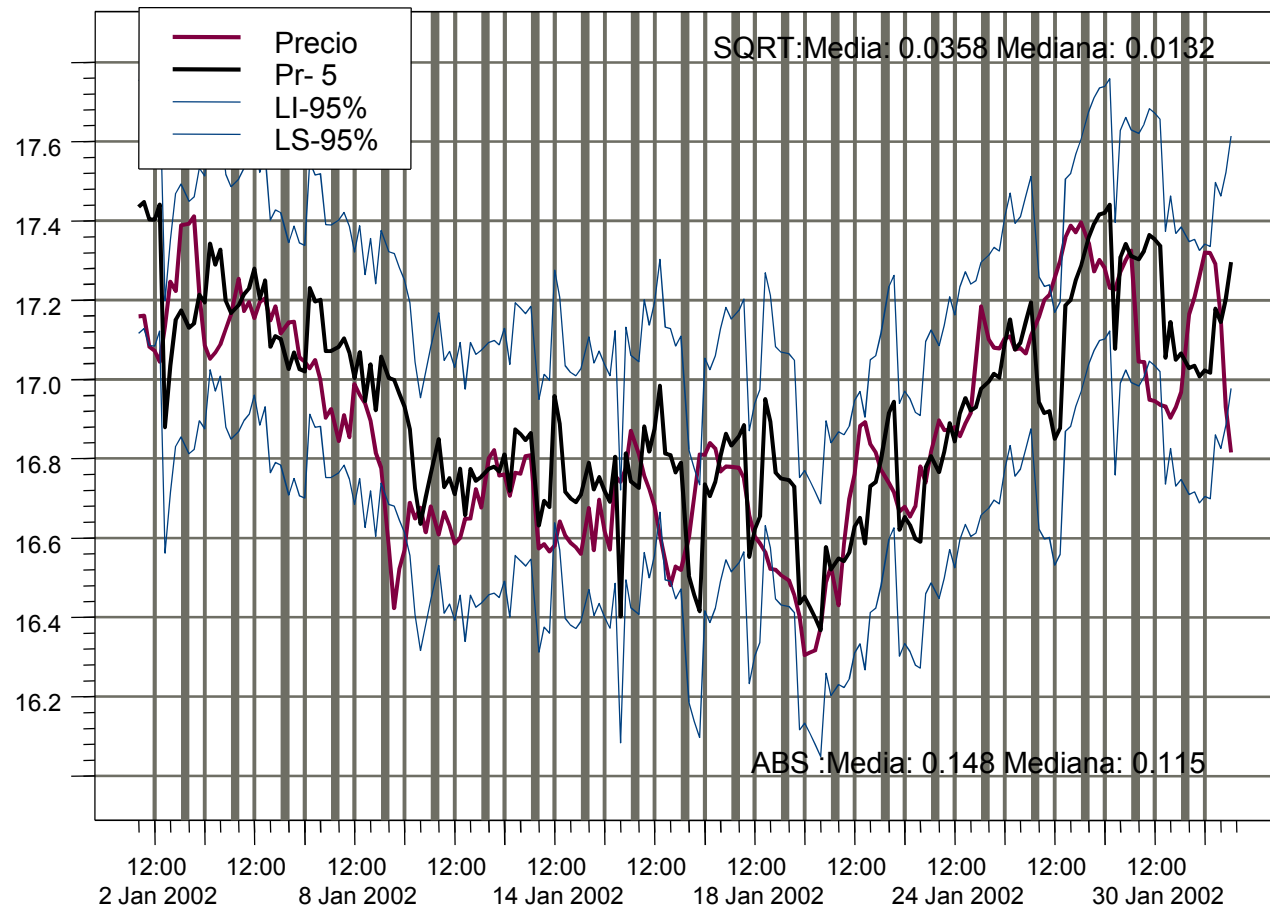
Pred: 1 Cobertura: 0.9394 Long.media: 0.2702

Red Neuronal 3 nodos – 3 horas



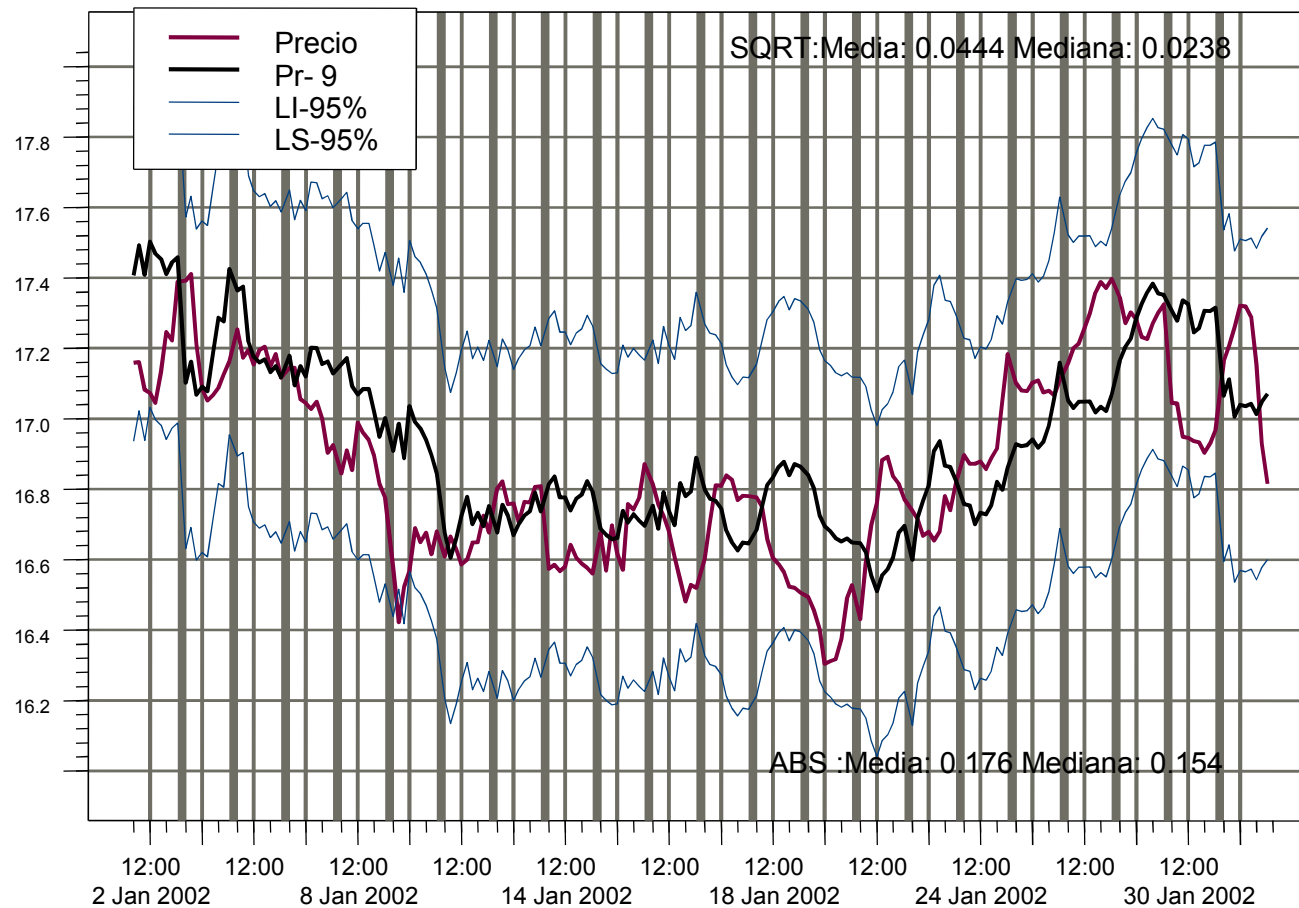
Pred: 3 Cobertura: 0.9343 Long.media: 0.5259

Red Neuronal 3 nodos – 5 horas



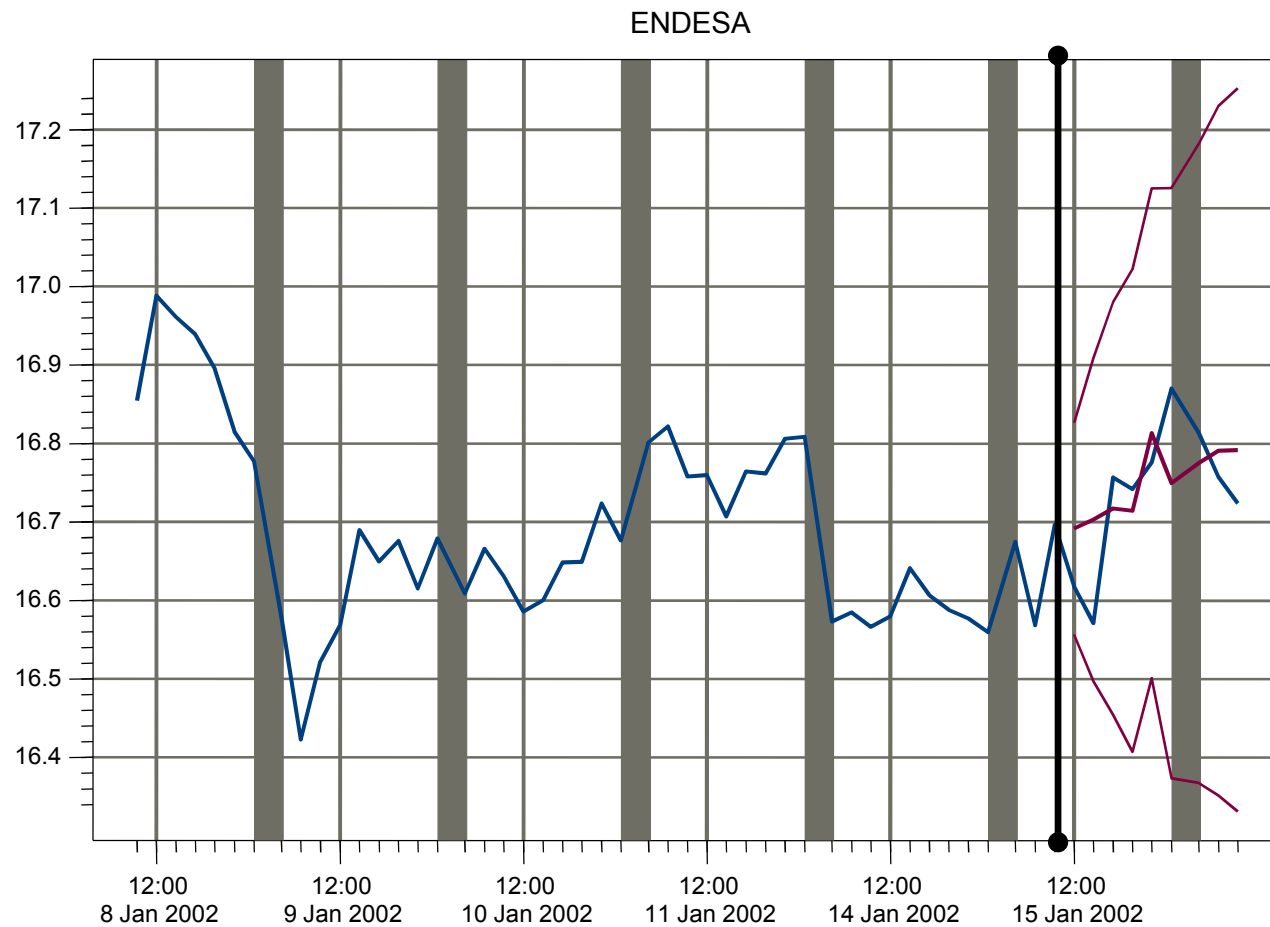
Pred: 5 Cobertura: 0.899 Long.media: 0.6244

Red Neuronal 3 nodos – 9 horas



Pred: 9 Cobertura: 0.9949 Long.media: 0.9219

Precio ENDESA – Predicción 15/01/2002 11:00



Comparación modelos – 1 hora

	Error cuadrático	Error absoluto	Cobertura 95%	Longitud	$\frac{Cob}{Long Cob - 95\% }$
AR(27)	0.00618	0.0558	0.9949	3.451	0.0642
AR(27), GARCH(0,27)	0.00707	0.0583	0.9394	0.4507	1.9663
AR(27), FIEGARCH(0,d,27)	0.00614	0.0554	0.9949	3.434	0.0645
RN 3 nodos	0.00596	0.0543	0.9394	0.2702	3.2799
RN 9 nodos, +covariable + Garch	0.00636	0.0566	0.9545	0.2992	7.0893

Comparación modelos – 3 horas

	Error cuadrático	Error absoluto	Cobertura 95%	Longitud	$\frac{Cob}{Long Cob - 95\% }$
AR(27)	0.0215	0.111	0.9949	3.451	0.0642
AR(27), GARCH(0,27)	0.0294	0.133	0.9242	0.6215	0.5764
AR(27), FIEGARCH(0,d,27)	0.0213	0.110	0.4697	0.2122	0.0461
RN 3 nodos	0.0210	0.109	0.9343	0.5259	1.1316
RN 9 nodos, +covariable + Garch	0.0216	0.112	0.9343	0.5459	1.0901

Comparación modelos – 5 horas

	Error cuadrático	Error absoluto	Cobertura 95%	Longitud	$\frac{Cob}{Long Cob - 95\% }$
AR(27)	0.0357	0.146	0.8788	0.568	0.2173
AR(27), GARCH(0,27)	0.0437	0.168	0.9091	0.7148	0.3110
AR(27), FIEGARCH(0,d,27)	0.0355	0.147	0.9040	0.6341	0.3099
RN 3 nodos	0.0358	0.148	0.8990	0.6244	0.2823
RN 9 nodos, +covariable + Garch	0.0439	0.160	0.9141	0.7853	0.3242