¿Qué podemos aprender de los datos acerca de las relaciones económicas?

Alfonso Novales
Universidad Complutense
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Esquema

1. Deficiencias en la aplicación de métodos estadísticos en Economía
2. Significación estadística y precisión
3. Significación estadística y capacidad explicativa/contenido informativo
4. ¿Dónde está la función de potencia?
5. Interpretación de coeficientes individuales en regresiones múltiples: colinealidad, sesgo de variables omitidas
6. Tratamiento de la colinealidad
7. Sugerencias
    - Evitar un excesivo resumen de la información muestral
    - Enfoque alternativo para le contraste de hipótesis conceptuales
    - Cómo evaluar contenido informativo
    - Evaluar restricciones mediante su efecto sobre la cuestión objeto de análisis

- Comentarios aplicables a modelos y métodos sofisticados
- Implicaciones para el modo en que enseñamos Estadística y Econometría

1. Deficiencias debido a la aplicación mecánica de métodos estadísticos en Economía

- Tratándose de una ciencia no experimental
  - Una única muestra (relevancia de la ausencia de sesgo?)
  - Colinealidad (diseño no experimental)
  - Variabilidad paramétrica
- Excesivo resumen de la información muestral en unos pocos estadísticos, a pesar de lo cual, a menudo se leen conclusiones excesivamente enfáticas:
  - "we have *shown* that…."
  - "we have obtained *conclusive evidence* on the relevance of variable X to explain the behavior of variable Y …"
- Pretensión: pronunciarnos sobre la verdad o falsedad de una teoría, en vez de corroborar si los datos son consistentes con una determinada teoría: *falsacionismo vs. corroboración*.
- Insistencia en contrastación de hipótesis paramétricas
- No encontrar evidencia en contra de la hipótesis nula suele interpretarse como haber probado que dicha hipótesis es cierta.

2. Significación estadística y precisión

Algunas aparentes paradojas :

El BCE quiere reducir la inflación un punto porcentual elevando los tipos de interés ¿en cuánto debe hacerlo? ¿basta un alza de 100 puntos básicos o debe ser una elevación superior?

Modelo: $\pi_t = \alpha + \beta r_t + u_t$

H0: β=1 versus: H1: β<1

- **Paradoja 1:** Estimación: β =.65 (.25) No rechazamos H0
- **Paradoja 2:** Estimación: β =.95 (.01) Rechazamos H0
- **Paradoja 3:** Estimación: β =1.45 (.10) No rechazamos H0

- **Paradoja 4:** $volatility_t = 0.487 + 3.275\, inflation_t + u_t$

  $p - value = 0.24$

2. Significación estadística y precisión

$$t = \frac{\hat{\beta} - \beta_0}{DT(\hat{\beta})} = \frac{\hat{\beta} - \beta_0}{\sqrt{\sigma_u^2 / \sum_1^n (x_i - \bar{x})^2}}$$

- Un estadístico *t* es el producto de:
  - Grado de incumplimiento muestral de H0
  - Precisión en la estimación
- En la significación estadística de un coeficiente, la precisión en la estimación juega un papel fundamental
- Un estadístico *t* puede ser reducido porque:
  - ✓ H0 se cumple, aproximadamente, en los datos ⇒ no hay problema, pero examinemos la función de potencia
  - ✓ O porque los coeficientes involucrados en la hipótesis se estiman con precisión reducida (incluso si la hipótesis no se satisface)
- Un estadístico t puede ser elevado incluso si el grado de incumplimiento muestral de H0 es muy reducido
- Abuso del estadístico t-Student

Precisión y t-Student

		Grado de incumplimiento de H0	
		Alto	**Bajo**
Precisión	**Elevada**	**Rechazar H0** **t elevado**	**?** **t?**
	Reducida	**?** **t?**	**No rechazar H0** **t reducido**

Paradojas ?

- **Paradoja 1:** Estimación: β =.65 (.25) No rechazamos H0 (!!!) [reducida precisión]
  - *Cuestión clave: Relación entre precisión en la estimación y potencia en el contraste*
  - *No deberíamos contrastar*

- **Paradoja 2:** Estimación: β =.95 (.01) Rechazamos H0 [“excesiva” precisión?]

- **Paradoja 3:** Estimación: β =1.45 (.10)
  - No rechazamos H0 (!!!) [Solo se cumple una de las 2 condiciones precisas para rechazar]
  - *No tiene sentido contrastar*

Testing the Expectations Hypothesis of the term structure of interest rates: Error tipo II

Future spot interest rate projected on lagged forward rate

Model: $r_t^3 = \alpha + \beta f_{t-3}^{3,6} + u_t, \quad f_t^{3,6} = 2r_t^6 - r_t^3$

H0: β=1 versus: H1: β<1

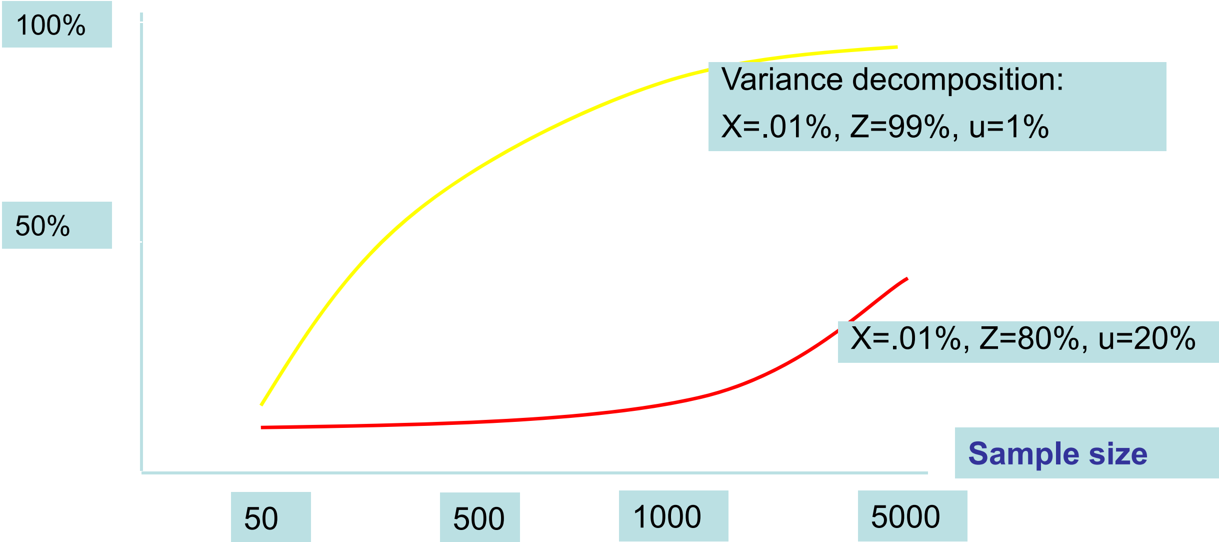
Maturity	Beta	Standard dev.	R2	t stat H0: Beta = 1
1 month	0,96	0,04	0,54	-1,00
3 months	0,93	0,06	0,42	-1,17
6 months	1,10	0,15	0,32	0,67
1 year	1,40	0,24	0,22	1,67
3 years	1,63	0,47	0,15	1,34
5 years	2,40	0,85	0,04	1,65

Test size and sample size: Error tipo I

- Simulation experiment

$$y = \beta_1 x + \beta_2 z + u, \;\; Corr(x,z) = Corr(x,u) = Corr(z,u) = 0$$

- How the frequency of rejection of H0: $\beta_x = 0$ changes with T



3. Una lamentable confusión: significación estadística versus capacidad explicativa o contenido informativo

Consecuencias de una confusión

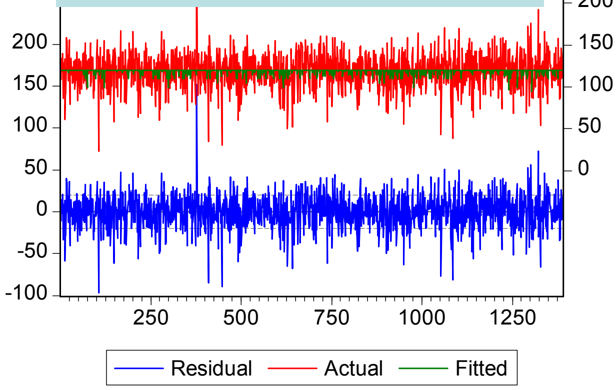
- Errónea identificación de dos conceptos: significación estadística de un coeficiente y capacidad explicativa o contenido informativo de la variable asociada
- El concepto de variable significativa no existe
- Abuso del estadístico t-Student
- Leading to serious fallacies and misinterpretations of estimation results
  - ✓ Qualitatively: X explains Y iff its associated coefficient is statistically different from zero
  - ✓ Quantitatively: explanatory power ⇔ high absolute value of Student's *t*
  - ✓ Sign econometrics
  - ✓ Asterisk econometrics
- Inappropriately comparing *relative* explanatory power
  - ✓ Comparing estimated coeficients: *The more important variable to explain Y is Z.*
  - ✓ Comparing values of *t* - statistics for different variables: *The more significant variable in the estimated model is Z*
  - ✓ Or for the same variable between different subsamples: *Variable X has become more significant after 1998*

It is relatively easy to find evidence contrary to
H0: *lack of statistical significance of β*
with a large sample even though the associated variable has little information content. **Type I error (?).**

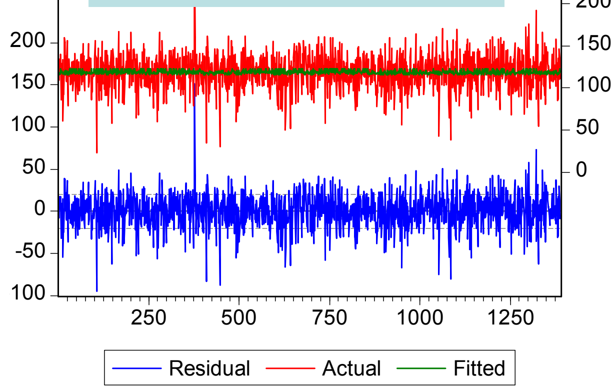
$$t = \frac{\hat{\beta} - \beta_0}{DT(\hat{\beta})} = \frac{\hat{\beta} - \beta_0}{\sqrt{\sigma_u^2 / \sum_{1}^{n} (x_i - \bar{x})^2}}$$

Example (Wooldridge 2003): Explain child birth weight in terms of: cigarettes smoked by the mother per day during pregnancy, family income, education of father and mother, birth order of the child among siblings.

$$Peso = 119{,}77 - \underbrace{0{,}514}_{0{,}090/-5{,}68}\ Cigarrillos$$



$$Peso = 115{,}27 + \underbrace{0{,}118}_{0{,}029/4{,}08}\ Renta$$



Dependent Variable: PESO
Sample: 1 1388 IF EDUCP <> NA AND EDUCM <> NA
Included observations: 1191

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	114.5	3.728	30.71	0.00
CIGS	-0.595	0.110	-5.40	0.00
EDUCP	0.472	0.282	1.67	0.09
EDUCM	-0.370	0.319	-1.15	0.24
FAMINC	0.056	0.036	1.53	0.12
ORDENAC	1.787	0.659	2.71	0.00

R-squared	0.038	Mean dependent var	119.5
Adjusted R-squared	0.034	S.D. dependent var	20.14
S.E. of regression	19.78	Akaike info criterion	8.813

EDUCP: father's education level

EDUCM: mother's education

CIGS: cigarettes/day smoked by mother

FAMINC: family income

ORDENAC: order among siblings

Sample: 1388

Smokers among mothers : 212 (15,2%)

Dependent Variable: PESO
Sample: 1 1388 IF EDUCM<>NA AND EDUCP<>NA
Included observations: 1191

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	117.8	1.21	96.98	0.00
CIGS	-0.632	0.107	-5.87	0.00
ORDENAC	1.763	0.657	2.68	0.00

R-squared	0.032	Mean dependent var	119.52
Adjusted R-squared	0.031	S.D. dependent var	20.14
S.E. of regression	19.82	Akaike info criterion	8.81

Dependent Variable: PESO
Sample: 1 1388
Included observations: 1191
Excluded observations: 197

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	109.0	3.937	27.68	0.00
CIGS	-0.598	0.109	-5.450	0.00
ORDENAC	1.915	0.655	2.923	0.00
RENTA	0.043	0.036	1.183	0.23
EDUCM	-0.328	0.317	-1.033	0.30
EDUCP	0.411	0.281	1.463	0.14
MALE	3.795	1.142	3.321	0.00
WHITE	4.713	1.607	2.931	0.00

R-squared	0.054	Mean dependent var	119.52
Adjusted R-squared	0.048	S.D. dependent var	20.141
S.E. of regression	19.64	Akaike info criterion	8.800

F-statistic: 9.67 , p-value=0

Dependent Variable: PESO
Sample: 1 1388 IF EDUCM<>NA AND EDUCP<>NA
Included observations: 1191

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	111.0	1.942	57.1	0.00
CIGS	-0.627	0.106	-5.87	0.00
ORDENAC	1.913	0.653	2.92	0.00
WHITE	5.364	1.572	3.41	0.00
MALE	3.738	1.141	3.27	0.00

R-squared	0.050	Mean dependent var	119.5298
Adjusted R-squared	0.047	S.D. dependent var	20.14
S.E. of regression	19.66	Akaike info criterion	8.799

¿What kind of information do we really get out of the t - statistic?

Linear correlation coefficients between dependent variable (weight) and residuals from alternative models

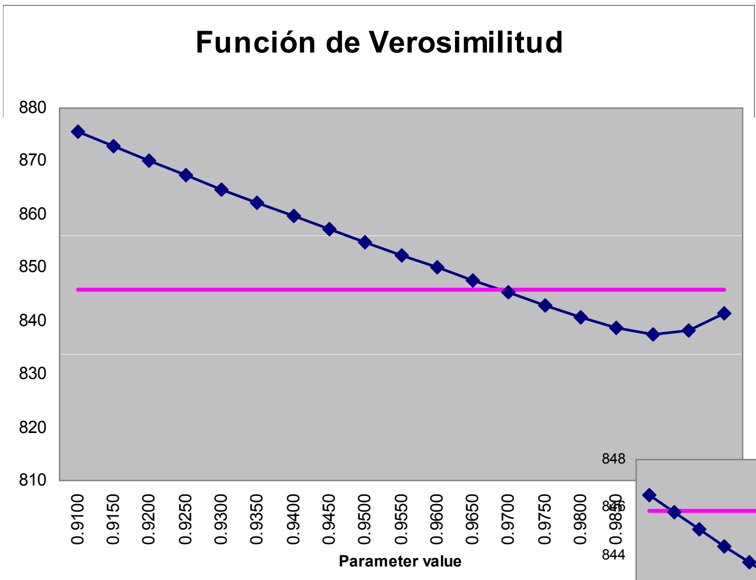
	PESO	R1	R2	R3	R4	R5	R6	R7	R8
PESO	1.0								
PESO_CIGS	0.990	1.0							
PESO_RENTA	0.994	0.987	1.0						
PESO_CIGSRENTA	0.987	0.996	0.992	1.0					
PESO_CIGSEDUCP	0.984	0.998	0.984	0.996	1.0				
PESO_CIGSEDUPM	0.984	0.997	0.983	0.995	0.999	1.0			
PESO_TODAS	0.980	0.993	0.983	0.994	0.995	0.996	1.0		
PESO_TODAS_FIC	0.972	0.985	0.975	0.986	0.987	0.988	0.992	1.0	
PESO_TODAS_NOORD	0.976	0.989	0.978	0.990	0.991	0.991	0.989	0.996	1.0

In spite of which there is sample evidence on the fact that smoking during pregnancy affects child birth weight: *difference in median weights …*

… that boys weight more than girls and white babys weight more than comparable non-white babys

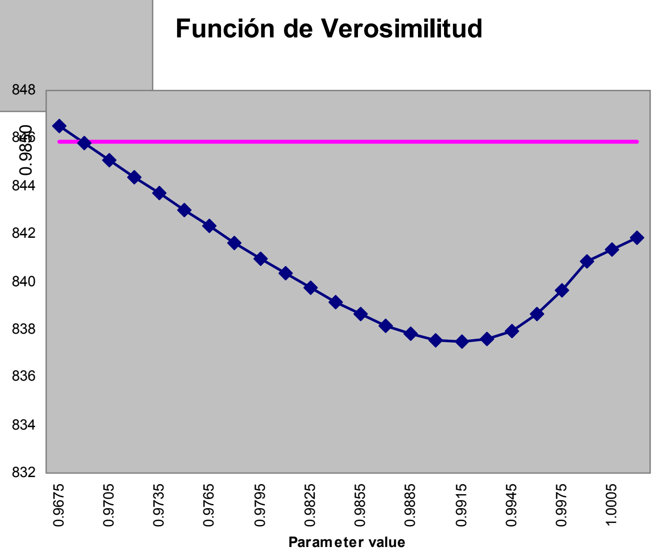
4. Where is the power function?

- Lack of rejection of the null hypothesis is usually identified with having shown that the hypothesis is true,
  - ✓ As a consequence of completely ignoring the power function of the test
  - ✓ And forgetting about the fact that rejecting the null hypothesis requires sample evidence in favor of the alternative hypothesis
  - ✓ Surprisingly low frequency of one-sided tests
- Providing *p* - values is not enough
- And they usually get the wrong interpretation: P [H0 / muestra] versus P [muestra / H0]
- ***Much better*** : graph displaying changes in an appropriate objective function under changes in parameter values: *What is the question? What is the associated loss function?*



Objective: To characterize how the VaR of a portfolio (SP500/TSE) changes with its composition.

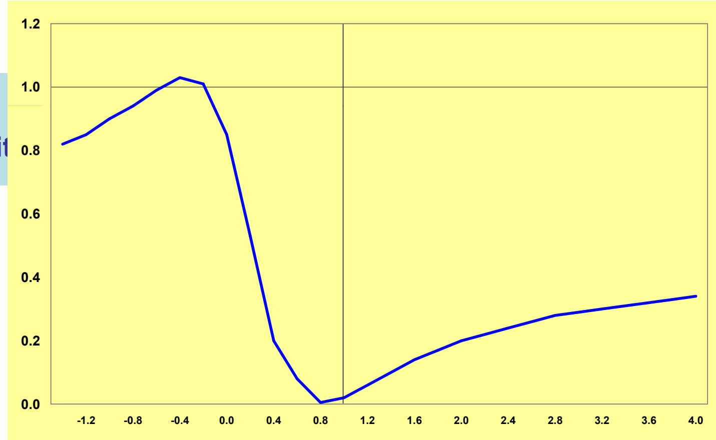
The correlation model depends on a single parameter

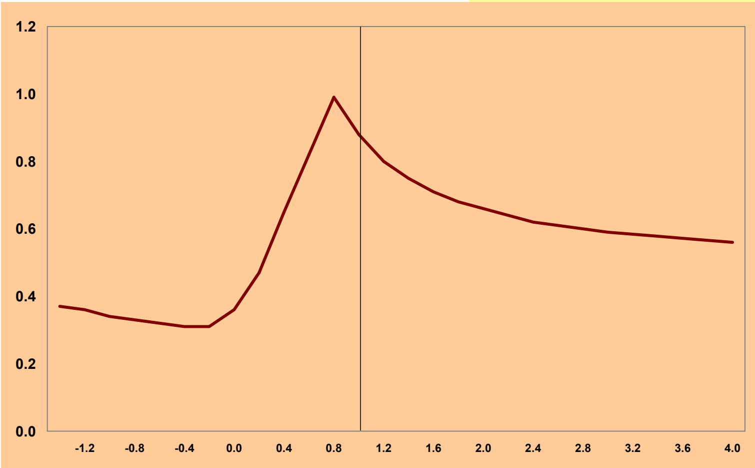


Standard analysis: VaR is a single function of the porfolio weights

Values of LRT statistic
H0: a given income elasticit

Testing for a unit elasticity of income in the demand for money function





p-values for LRT statistic for income elasticity values

5. Interpretación de coeficientes individuales en regresiones múltiples

Main difficulties when interpretating individual *coefficients as* individual *effects*

- Taking proper account of sample variability in explanatory variables
  - ✓ Effect on Y of changes in the value of X from min(X) to Max(X), or from the 10% to the 90% percentile of X (that ignores colinearity, anyway)
  - ✓ $100\beta R(x)/R(y)$ $100\beta DT(x)/DT(y)$

- The explanatory power of X on Y is not an absolute characteristic of the two variables but rather, it is ***conditional*** on the model specification (the explanatory variables already included in the model, besides the sample used, the data frequency, …)

- But we sometimes even compare statistical significance of a given variable across different models !!!

Estrategias de diversificación en las exportaciones manufactureras – REA 2003

	Indice de dispersión geográfica de exportaciones	Empleo <50	Empleo (50,100)	Empleo (100,200)	Empleo >200	Segundas líneas productos	Participación capital extranjero	Ratio importador	Concent. industrial	I+D/Ventas	Publicidad/ /Ventas	Concent. provincial
Medias muestrales												
Media	0,243	0,203	0,349	0,221	0,226	4,375	0,094	0,114	0,185	0,005	0,009	0,175
Beta			0,026	0,057	0,099	0,004	0,047	-0,015	-0,006	0,051	1,302	0,087
			(4,29)	(7,25)	(13,2)	(2,56)	(6,53)	(1,96)	(1,54)	(2,35)	(6,44)	(6,79)
Producto						0,018		-0,002	-0,001	0,000	0,012	0,015
Mínimo	0	0	0	0	0	0	0	0	0,036	0,001	0,001	0,052
Máximo	0,560	1	1	1	1	82	1	0,724	0,810	0,083	0,086	0,745
Producto			0,026	0,057	0,099	0,328	0,047	-0,011	-0,005	0,004	0,111	0,060
Desviaciones típicas												
	0,170					5,480		0,200	0,140	0,010	0,060	0,180
						0,022		-0,003	-0,001	0,001	0,078	0,016

Ejemplo 1: Taking into account sample variation

Positive size effect. ✓

Positive effect from the number of products (✓) and from foreign capital participation (≠).

Negative effect from import coefficient (≠)

No effect from market concentration (✓)

Positive effect from the other two product differentiation variables: Advertising (✓) and R&D expenditures (≠).

Explanatory power/information content are conditional concepts

- We cannot test for the information content or the explanatory power of a given regressor in a multiple regression model.
  - ✓ For that, we would have to use a single regression model approach
  - ✓ In a multiple regression model, we can just test for the amount of information a given variable **adds** to those already included in the model
- Colinearity is central in this evaluation (as it is in the interpretation of individual coefficients)
- Collinearity
  - ✓ Requires some structural interpretation. Cholesky decomposition as an example
  - ✓ What type of questions can we give an answer to?
- Omitted variable bias (Are we getting it right?)

Omitted variable bias

$$\underset{}{Ventas_t} = 247,6 + \underset{(0,545)}{2,204}\, Pub_t - \underset{(0,649)}{1,464}\, P_t$$

$$Ventas_t = 96,0 + \underset{(0,375)}{3,224}\, Pub_t$$

An increase of 6.200 euros in advertising = 1 standard deviation

Corr(Pub,P) = -0,829 $\Rightarrow$ decrease of -0,829 standard deviations in price = 4,327 euros.

Total effect on sales: (6,200)(2,204) + (1,464)(4,327) = 20,0 thousand euros

Single variable model: (3,224) (6,200) = 20,0 thousand euros

- The simple linear regression measures the *global effect* (*direct+indirect*) on Y of a change in either one of the X
  - It is a biased estimation of the *ceteris paribus individual effect (indirect),* which is seldom interesting
  - But it is an unbiased estimate of the global effect, the one on which we are usually interested
- While the multiple regression provides a biased estimation of that global effect, because of collinearity
- What is the question ?

6.Tratamiento de la colinealidad

Dependent Variable: RENTA
Sample: 1 83
Included observations: 58
Excluded observations: 25

T1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.699	0.168	45.74	0.00
OIL	1.130	0.246	4.59	0.00
INTER	-0.434	0.446	-0.97	0.33
PREM	-0.344	0.339	-1.01	0.31
INFLAC	0.032	0.370	0.08	0.93
OVER	-0.143	0.287	-0.49	0.61
DEMOC	0.218	0.180	1.21	0.23
ESTAB	-0.258	0.204	-1.26	0.21
EFICA	0.158	0.308	0.51	0.61
REGULA	0.632	0.207	3.04	0.00
LEYES	0.273	0.235	1.16	0.25
CONTROL	0.353	0.297	1.18	0.24

R-squared	0.674	Mean dependent var	7.577
Adjusted R-squared	0.596	S.D. dependent var	0.896
S.E. of regression	0.569	Akaike info criterion	1.894

Cleaning "non-significant variables" and re-estimating the model

	RES_T1	RES_T4	RES_T5
RES_T1	1.00		
RES_T4	0.949	1.00	
RES_T5	0.768	0.801	1.00

Dependent Variable: RENTA
Sample: 1 83
Included observations: 70
Excluded observations: 13

T4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.652	0.111	68.79	0.00
OIL	1.093	0.204	5.34	0.00
INTER	-0.748	0.338	-2.21	0.03
REGULA	0.717	0.133	5.36	0.00
CONTROL	0.677	0.126	5.34	0.00

R-squared	0.656	Mean dependent var	7.544
Adjusted R-squared	0.635	S.D. dependent var	0.923
S.E. of regression	0.557	Akaike info criterion	1.737

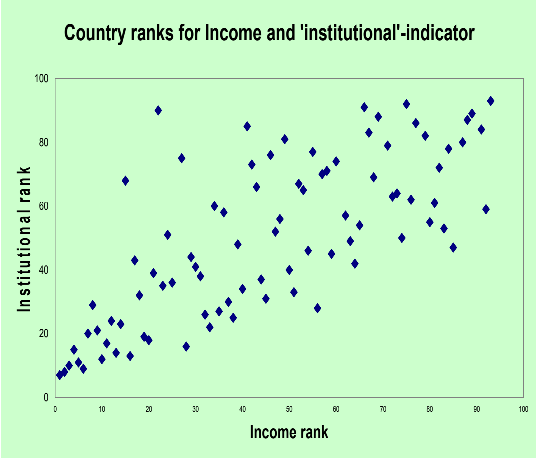
Dependent Variable: RENTA
Sample: 1 83
Included observations: 82
Excluded observations: 1

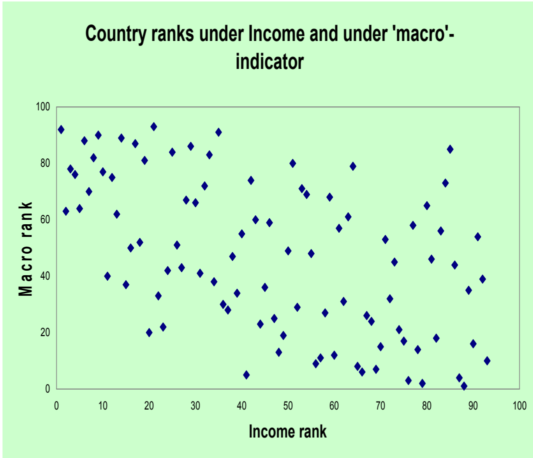
T5

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.376	0.081	90.56	0.00
OIL	0.700	0.233	2.99	0.00
REGULA	0.946	0.116	8.15	0.00

R-squared	0.477	Mean dependent var	7.470
Adjusted R-squared	0.464	S.D. dependent var	0.943
S.E. of regression	0.690	Akaike info criterion	2.133

Factores económicos vs. Factores institucionales como determinantes del crecimiento





Rank corr: .71 (9.2)

Utilizando institutions\macro:
Rank corr: .50 (4.9)

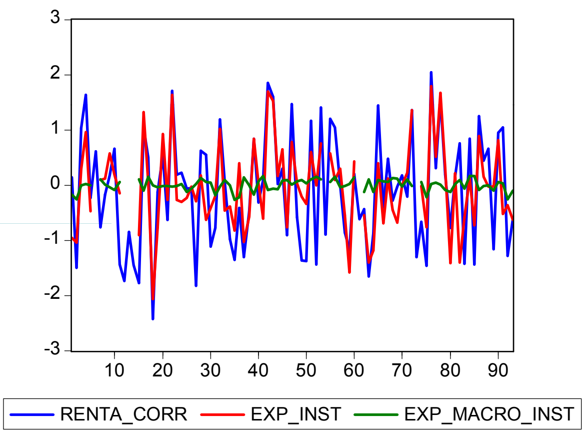
Rank corr: -.51 (-5.7)

Utilizando macro\institutions:
Rank corr: -.11 (-1.0)

Dependent Variable: RENTA. Method: Least Squares
Sample: 1 93. Included observations: 87 Excluded observations: 6

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.734	0.072	108.48	0.00
INSTITUTIONS	1.826	0.166	10.98	0.00
MACRO_INSTITUTIONS	-0.211	0.144	-1.46	0.15

R-squared	0.594	Mean dependent var	7.688
Adjusted R-squared	0.584	S.D. dependent var	1.029
S.E. of regression	0.664	Akaike info criterion	2.052
Sum squared resid	37.018	Schwarz criterion	2.137
Log likelihood	-86.28	F-statistic	61.35
Durbin-Watson stat	2.25	Prob(F-statistic)	0.000

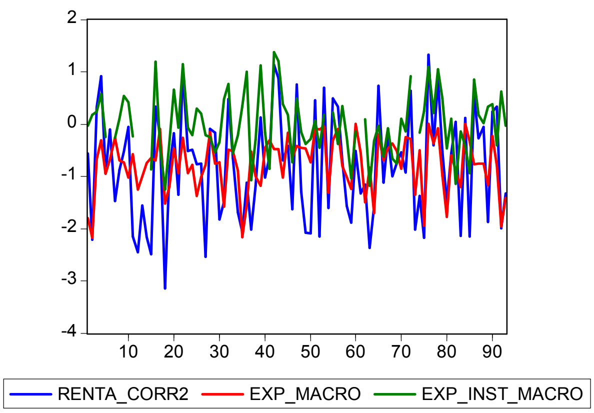


Orthogonalize explanatory variables

Dependent Variable: RENTA Method: Least Squares
Sample: 1 93 Included observations: 87 Excluded observations: 6

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.446	0.125	67.285	0.000
MACRO	-0.879	0.119	-7.329	0.000
INSTITUTIONS_MACRO	1.663	0.200	8.307	0.000

R-squared	0.594	Mean dependent var	7.688
Adjusted R-squared	0.584	S.D. dependent var	1.029
S.E. of regression	0.664	Akaike info criterion	2.052
Sum squared resid	37.018	Schwarz criterion	2.137
Log likelihood	-86.28	F-statistic	61.35
Durbin-Watson stat	2.25	Prob(F-statistic)	0.000



7. *Sugerencias*

Excessive summary of sample information

El modelo más general, modelo ARCH-Poisson-Gausiano se especifica como sigue:

$\Delta r_t = \mu_t + \sigma_t \Delta z_t + J_t \Delta n_t$; $\Delta z_t \sim N(0,1)$; $J_t \sim N(\theta_t, \psi^2)$; Δz_t y J_t son independientes.; $\sigma_t^2 = \omega_0 + \omega_1 [\Delta r_{t-1} - E_{t-2}(\Delta r_{t-1})]^2$; μ_t y θ_t están definidos en la siguiente tabla.

	$\mu_t = \alpha(r_{t-1} - r^*_{t-1})$		$\mu_t = \alpha_1(r_{t-1} - r^*_{t-1})^+ + \alpha_2(r_{t-1} - r^*_{t-1})^-$	
Parámetros	Modelo *i* $\theta_t = \theta$	Modelo *ii* $\theta_t = \gamma(r_{t-1} - r^*_{t-1})$	Modelo *iii* $\theta_t = \theta$	Modelo *iv* $\theta_t = \gamma(r_{t-1} - r^*_{t-1})$
α	-0.046 (-6.601)	-0.0344 (-6.365)	-------	--------
α_1	--------	--------	-0.0465 (-6.244)	-0.0388 (-7.832)
α_2	-------	--------	-1.0928 (-263.81)	-0.9943 (-61.837)
ω_0	0.00003 (5.123)	0.00003 (7.189)	0.0004 (10.127)	0.0004 (12.833)
ω_1	0.6240 (5.922)	0.6092 (5.542)	0.6651 (6.338)	0.6482 (6.053)
θ or γ	-0.0087 (-1.196)	-0.4152 (-8.179)	-0.009 (-1.170)	-0.2758 (-4.406)
ψ	0.2101 (12.939)	0.1903 (14.249)	0.2003 (12.294)	0.1930 (13.035)
δ_0	0.1209 (7.841)	0.1128 (6.917)	0.1025 (7.005)	0.1023 (7.209)
δ_1	0.5260 (10.201)	0.5271 (11.546)	0.5500 (10.714)	0.5347 (10.431)
δ_2	0.5257 (8.838)	0.5076 (9.830)	0.5233 (8.486)	0.5306 (8.460)
δ_3	0.1421 (3.582)	0.1309 (4.239)	0.1344 (3.493)	0.1476 (3.568)
δ_4	0.8307 (10.345)	0.8060 (10.055)	0.8763 (10.372)	0.8847 (10.998)
δ_5	0.3896 (2.741)	0.3569 (3.080)	0.4368 (2.843)	0.4373 (3.367)
Log-L [SIC]	2186.46 [2147.01]	2222.14 [2182.69]	2237.55 [2194.51]	2256.05 [2218.01]

Resultados de la estimación por máxima verosimilitud con desviaciones típicas robustas de Bollerslev y Wooldridge (1992). Estadístico *t* entre paréntesis. Log-L es el logaritmo de la función de verosimilitud Los coeficientes δ ... y δ designan respectivamente las probabilidades de salto: (i) en los

1. Models with the same measure of fit: R2, log-likelihood. Do they explain the same?

2. What is the difference between models with statistically significant differences in their log-likelihood values?

3. What is the final question? How does the answer to that changes across alternative models?
   - •volatilidad
   - •saltos
   - •VaR

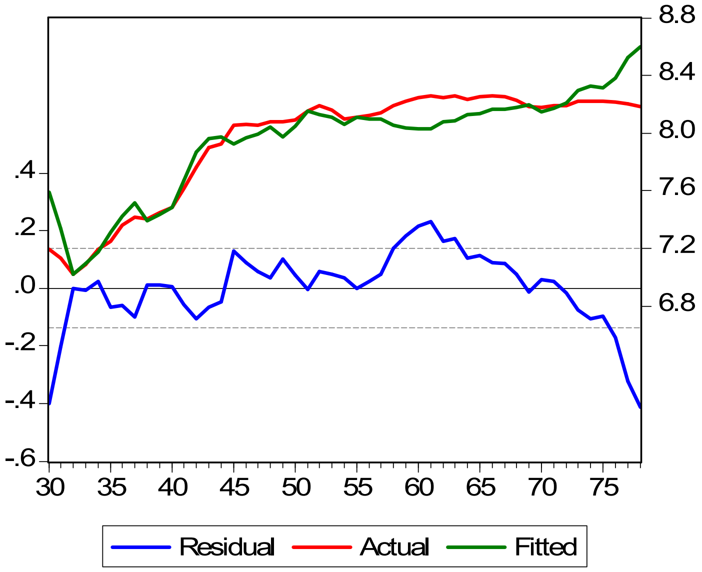
S1. Avoid an excessive summary of sample information

Examine the residuals in detail

- ¿When do two alternative models have “the same” explanatory power?
- Graphical representations of actual data, fitted data and residuals
  - They contain complete information on the estimated model
  - Avoiding too much information reduction
  - Search for local information content: a specific but short period of time, a particular set of observations in cross-section data sharing some common characteristic: omitted variables.
- Discover subsamples of poor model fitting
- How to compare alternative models:
  - How much similarity between sets of residuals should we expect to find?
  - What is explained by a model which is not explained by others?

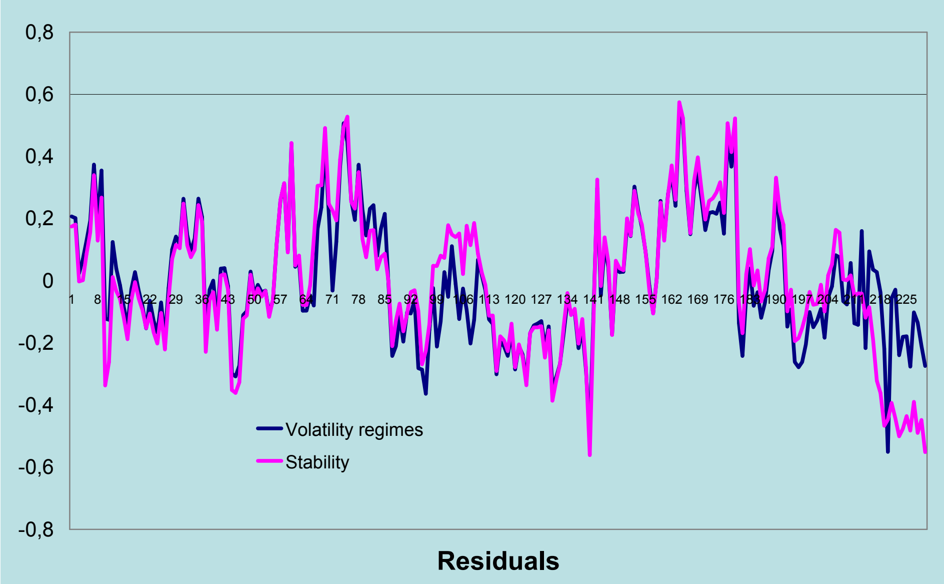
Subsamples of model deterioration

Consumo de tabaco explicado por la renta y el precio



What is explained by a model which is not explained by competing models?

Explaining credit spreads by regime switching models



S2. Alternative approach to testing parametric constraints

- *The constraints being tested cannot be rejected on the basis of the sample evidence if and only if the residuals of the restricted and unrestricted models contain the same information regarding the question which is the ultimate object of research*

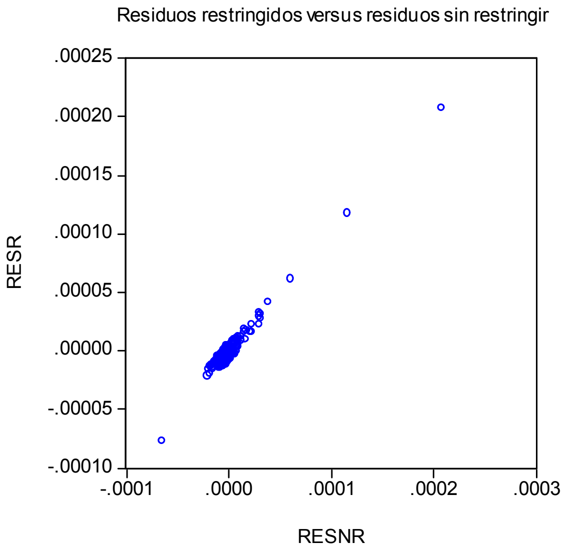
- What matters is not so much the test, but the detailed comparison between the two sets of residuals.

- Different approaches to testing for equality of residuals:
  - Nonparametric point-to-point tests for equality of residual sets
  - Tests for reduction in absolute size and in variance in subsamples of largest residuals or in the whole sample.
  - Any appropriate test?

Dependent Variable: VAAA   Sample (adjusted): 1997M02 2012M01
Included observations: 180 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	7.37E-06	2.84E-06	2.596229	0.0102
VAAA(-1)	0.290072	0.073017	3.972664	0.0001
TERM	0.000365	0.000137	2.669464	0.0083

R-squared	0.159143	Mean dependent var	1.94E-05
Adjusted R-squared	0.149642	S.D. dependent var	2.33E-05
S.E. of regression	2.15E-05	Akaike info criterion	-18.64311
Sum squared resid	8.16E-08	Schwarz criterion	-18.58990
Log likelihood	1680.880	Hannan-Quinn criter.	-18.62154
F-statistic	16.74978	Durbin-Watson stat	2.029103
Prob(F-statistic)	0.000000		



Dependent Variable: VAAA   Sample (adjusted): 1997M02 2012M01
Included observations: 180 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	1.25E-05	2.12E-06	5.897115	0.0000
VAAA(-1)	0.354143	0.070136	5.049362	0.0000

R-squared	0.125290	Mean dependent var	1.94E-05
Adjusted R-squared	0.120376	S.D. dependent var	2.33E-05
S.E. of regression	2.18E-05	Akaike info criterion	-18.61475
Sum squared resid	8.49E-08	Schwarz criterion	-18.57928
Log likelihood	1677.328	Hannan-Quinn criter.	-18.60037
F-statistic	25.49606	Durbin-Watson stat	2.091023
Prob(F-statistic) 0.000001			

S3. How can we decide on information content?

- *Variable x_t adds information to vector z_t to explain y_t iff the residuals of the model that explains y_t by vector z_t are significantly different from those of the model that explains y_t by (z_t, x_t).*

- We move from testing for statistical significance to testing for equality of sets of residuals

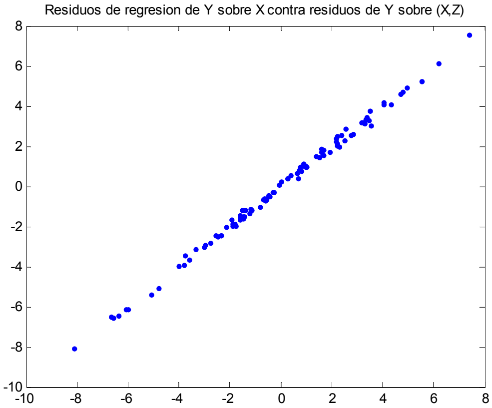
- Questions that are often asked:
  - *Does Z add any information to X to explain Y ?*
  - *Is it X or Z that contains more information on Y?*
    - Look at residuals from single variable projections
    - Orthogonalize using different orderings
    - Are we interpreting correctly the *omitted variable bias*?

Testing for additional information content by comparing residuals from restricted and unrestricted models

Irrelevant Z-variable

Correlations:

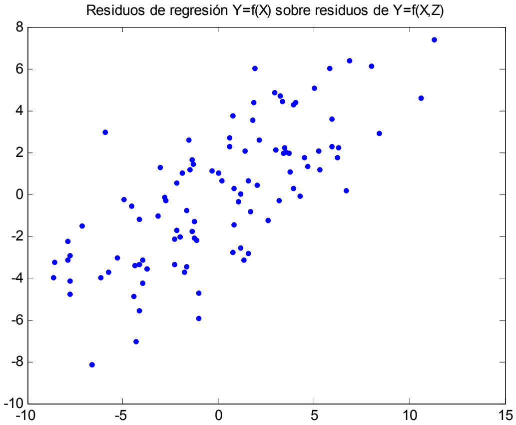
	Y	X	Z	u
Y	1.00	0.85	-0.01	0.49
X	0.85	1.00	0.02	-0.04
Z	-0.01	0.02	1.00	-0.05
u	0.49	-0.04	-0.05	1.00



Relevant Z-variable

Correlations:

	Y	X	Z	u
Y	1.00	0.79	0.49	0.58
X	0.79	1.00	0.09	0.11
Z	0.49	0.09	1.00	0.12
u	0.58	0.11	0.12	1.00



S4. Evaluate restrictions on the basis of their implications for the issue being analyzed

- What a difference does it make a given restriction for the final question under analysis? What implications do alternative models have for the final question?
- Compare alternative models using loss functions defined on the value of the final objective function under each model: predicción, estimación de una volatilidad o una correlación, gestión de carteras, …
- ***What is the final question*?**
  - what is the implication of asymmetric effects on conditional variance on VaR calculations?
  - is there any forecasting improvement from imposing long-run cointegration relationships?
  - Is time between trades weakly exogenous with respect to volume?

Pero ¿no es esto lo que ya venimos haciendo?

Lo que NO debe hacerse:

1. *No identificar significación estadística y contenido informativo/capacidad explicativa*
2. *No contrastar la significación estadística de un coeficiente*
   - *Evaluar el contenido informativo en una variable.*
   - *Considerar el contenido informativo en una variable explicativa como un concepto condicional, y evaluarlo de modo apropiado.*
3. *No resumir excesivamente la información muestral*
4. *No apoyarse exclusivamente en estadístico tipo t y F al evaluar restricciones paramétricas o al comparar modelos alternativos*
5. *No comparar el contenido informativo de distintas variables examinando sus coeficientes o sus estadísticos t*
   - *No practicar econometría de signos o de asteriscos*
6. *No poner mucho énfasis en coeficientes individuales estimados en regresiones múltiples*
7. *Tratar la colinealidad y tener en cuenta la variabilidad muestral de cada variable*
8. *No contrastar demasiado…*
   - *… y si se contrasta, no olvidar analizar la potencia del contraste*

Pautas que deben seguirse:

1. *Comenzar definiendo con claridad la (única) cuestión objeto de análisis. No perder dicha referencia a lo largo del trabajo empírico*
2. *Analizar los datos desde distintos puntos de cista, utilizando una variedad de procedimientos estadísticos*
   - *Describiendo en detalle las características de los datos : rango muestral, histogramas, diagramas stem and leaf, evaluación no paramétrica de asociación entre variables*
   - *Diseño de contrastes paramétricos y no paramétricos acerca de:*
     - ✓ *características que deberían observarse si la hipótesis en estudio fuese correcta*
     - ✓ *características que **no** deberían observarse en los datos si la hipótesis en estudio **no** fuese correcta*
   - *Contrastar hipótesis paramétricas mediante comparación punto a punto de residuos de la regresiones restringida y sin restringir*
3. *Comparar modelos (evaluar restricciones) desde el punto de vista de su impacto sobre la cuestión que se analiza: predicción, medición de riesgo, gestión de carteras…*
   - *Qué explica un modelo que no es explicado por otros modelos?*
   - *Cómo de distintos son dos modelos alternativos?*
   - *Simulación de modelos*
4. *Proporcionar evidencia acerca de variabilidad paramétrica*

FIN (por ahora)

Significación estadística frente a contenido informativo: Algunas aparentes paradojas

Problema: El BCE quiere reducir la inflación un punto porcentual elevando los tipos de interés ¿en cuánto debe hacerlo?

Modelo: $\pi_t = \alpha + \beta r_t + u_t$
H0: β=1 versus: H1: β<1

- **Paradoja 1:** Estimación: β =.65 (.25)   No rechazamos H0 (!!!) [reducida precisión]
  - *Cuestión clave: Relación entre precisión en la estimación y potencia en el contraste*
  - *No deberíamos contrastar*

- **Paradoja 2:** Estimación: β =.95 (.05)   Rechazamos H0 [“excesiva” precisión?]

- **Paradoja 2:** Estimación: β =1.45 (.10)
  - No rechazamos H0 (!!!) [Solo se cumple una de las 2 condiciones precisas para rechazar]
  - *No tiene sentido contrastar*