Estimando el Consumo en Argentina utilizando técnicas de Multicointegración

Alejandro Gay

Instituto de Economía y Finanzas (UNC)

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Plan de la Presentación

- El concepto de multicointegración
- Multicointegración: bibliografía y software
- El procedimiento original de Granger y Lee
- Test uni-ecuacional para variables I(2)
- Test de cointegración en el modelo VAR I(2)
- Modelo del consumo en economía abierta
- Test de los índices de integración
- La relación de multicointegración
- Consumo y Ciclo Económico

Concepto de multicointegración

- Variables estacionarias
- Variables integradas
- Orden de integración de una variable
- Cointegración, Engle y Granger (1987)
- Multicointegración Granger y Lee (1989)
  forma más profunda de cointegración que surge cuando la suma acumulada de los errores de la cointegración (suma acumulada de los desvíos en relación al equilibrio de largo plazo) cointegra con alguna(s) de las variables originales.

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- Juselius Katarina (2007), *The Cointegrated VAR model: Econometric Methodology and Macroeconomic Applications*, forthcoming, Oxford University Press, Oxford. http://www.econ.ku.dk/okokj/
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Software

- Extensión para series I(2) del programa CATS in RATS versión 1 escrito por Clara Jorgensen disponible en: www.estima.com/procs/i2index.htm
  Rahbek, Anders; Kongsted, Hans Christian and Jorgensen, Clara (1999), “Trend-stationarity in the I(2) cointegration model”, *Journal of Econometrics*, vol.90, pp.265-289.
- Hendry, David F. and Doornik, Jurgen A. (2001), *Empirical Econometric Modelling Using PcGive 10 for Windows*, London, Timberlake Consultants Press.
- Dennis, J.G., Johansen Soren and Juselius Katarina (2006), *CATS in RATS*, version 2, Estima, Evanston.

Granger y Lee (1989, 1990)

$$c_t \;,\quad y_t \sim I(1)$$

$$z_t = c_t - \beta y_t \sim I(0)$$

$$\sum_{j=1}^{t}\left(c_j - \beta y_j\right) + \phi_1 c_t + \phi_2 y_t \sim I(0)$$

$$\hat{z}_t = c_t - \hat{\beta} y_t \,,\quad \tilde{Z}_t = \sum_{j=1}^{t} \hat{z}_j \sim I(1)$$

$$\tilde{Z}_t = \phi_1 c_t + \phi_2 y_t + \phi_0 + \phi_3 t + \mu_t$$

multicointegración ➔ $\mu_t \sim I(0)$

Test uni-ecuacional variables I(2)

- Engsted, Gonzalo y Haldrup (1997)

$$\sum_{j=1}^{t}\left(c_j - \beta y_j\right) + \phi_1 c_t + \phi_2 y_t \sim I(0), \qquad c_t \sim I(1), \qquad y_t \sim I(1)$$

$$\sum_{j=1}^{t} c_j - \beta \sum_{j=1}^{t} y_j + \phi_1 c_t + \phi_2 y_t \sim I(0)$$

$$C_t - \beta Y_t + \phi_1 \Delta C_t + \phi_2 \Delta Y_t \sim I(0)\,, \qquad C_t = \sum_{j=1}^{t} c_j \sim I(2)\,,$$

$$C_t = \beta Y_t - \phi_1 \Delta C_t - \phi_2 \Delta Y_t + \phi_0 + \phi_3 t + \phi_4 t^2 + \mu_t$$

Cointegración en modelo VAR I(2)

- Engsted y Haldrup (1999)
  procedimiento de maxima verosimilitud de Johansen (1992, 1995) para variables I(2).

$$X_t = \left(C_t,\ Y_t\right)'$$

$$\Delta^2 X_t = \Pi X_{t-1} - \Gamma \Delta X_{t-1} + \sum_{i=1}^{k-2} \Phi_i \Delta^2 X_{t-i} + \Theta D_t + \varepsilon_t$$

$\Pi = \alpha\beta'$ with α, β being p x r , r < p

$\alpha'_{\perp} \Gamma \beta_{\perp} = \xi\eta'$ with ξ, η being (p-r) x s , s < (p-r)

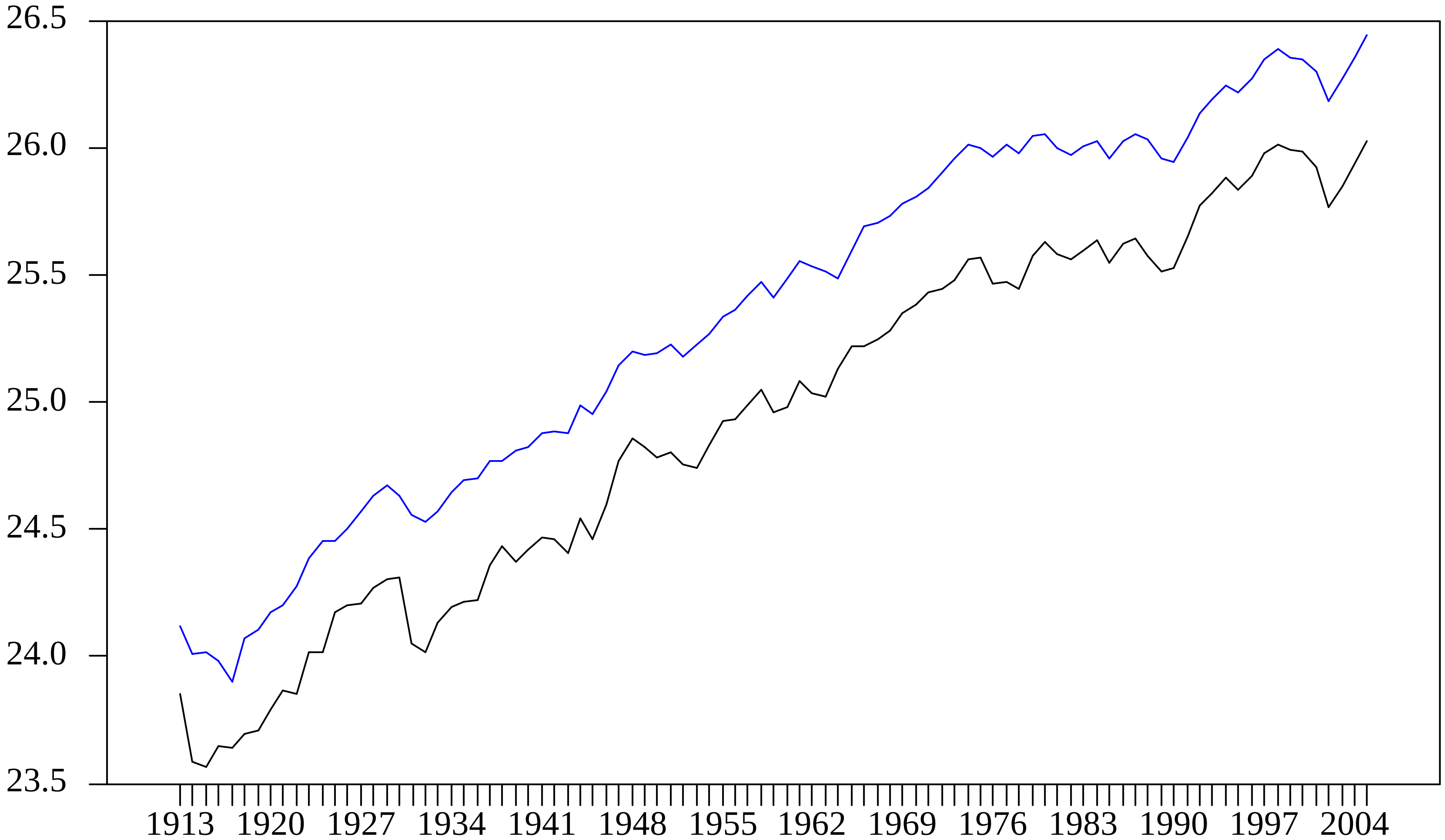
I(2) model: p different relations

r: $\beta' X_t - \delta \beta_2' \Delta X_t \sim I(0)$

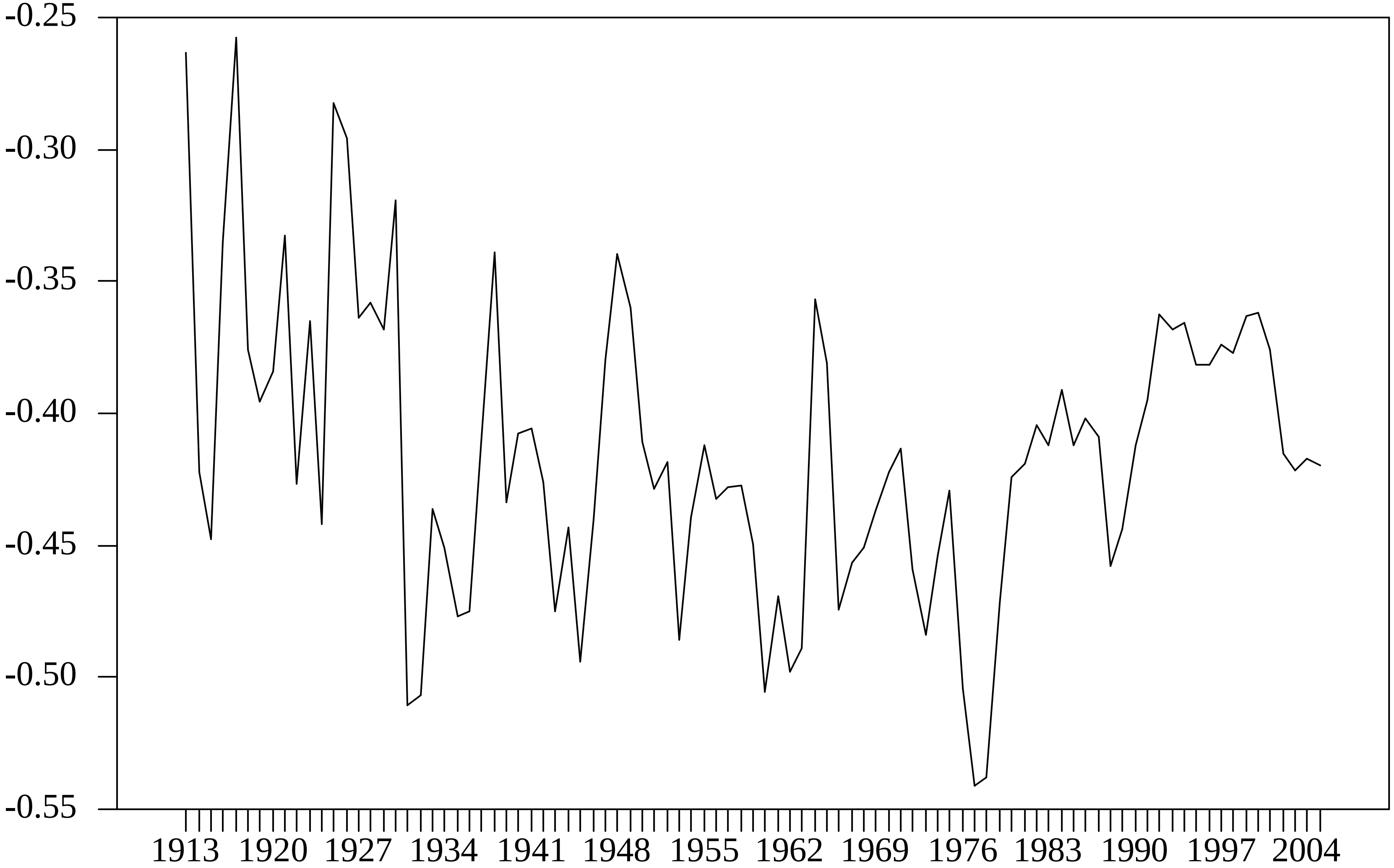
s: $\beta_1' X_t \sim I(1)$

p-r-s: $\beta_2' X_t \sim I(2)$

Real Consumption and GDP



Average propensity to consume



Consumo en economía abierta

Maximize $$U_j = \sum_{s=t}^{\infty} \beta^{s-t} \left[\frac{\sigma}{\sigma-1} C_s^{\frac{\sigma-1}{\sigma}} + \frac{\chi}{1-\varepsilon} \left(\frac{M_s}{P_s} \right)^{1-\varepsilon} - \frac{\kappa}{2} y_{Ns}^2 \right]$$

where $$C = \left[\gamma^{\frac{1}{\theta}} C_T^{\frac{\theta-1}{\theta}} + (1-\gamma)^{\frac{1}{\theta}} C_N^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}}$$

Subjected to the budget constraint

$$P_{Tt} f_{t+1} + M_t = P_{Tt}(1+r_t) f_t + M_{t-1} + p_{Nt}(j) y_{Nt}(j) + P_{Tt} y_{Tt} - P_t c_t - P_t T_t$$

where $$P = \left[\gamma P_T^{1-\theta} + (1-\gamma) P_N^{1-\theta} \right]^{\frac{1}{1-\theta}}$$

The producer also faces the demand of the non-tradable good:

$$y_{N,t}^d = \left[\frac{p(j)_{N,t}}{P_{N,t}} \right]^{-\theta} C_{N,t}$$

Condiciones de primer orden

$$\frac{C_{Tt+1}}{C_{Tt}} = [\beta(1+r_t)]^{\sigma}\left[\frac{\left(\frac{P_t}{P_{Tt}}\right)}{\left(\frac{P_{t+1}}{P_{Tt+1}}\right)}\right]^{\sigma-\theta}$$

Optimal Consumption Path

$$\frac{C_{Nt}}{C_{Tt}} = \frac{(1-\gamma)}{\gamma}\left(\frac{P_{Nt}}{P_{Tt}}\right)^{-\theta}$$

Substitution of T and NT Consumption

$$\frac{M_t}{P_t} = \left[\chi C_t^{\frac{1}{\sigma}} \frac{1+i_t}{i_t}\right]^{\frac{1}{\varepsilon}}$$

Monetary Market Equilibrium

$$y_{Nt}^{\frac{\theta+1}{\theta}} = \left(\frac{\theta-1}{\theta\kappa}\right) C_t^{-\frac{1}{\sigma}} \left(C_{Nt}^{A}\right)^{\frac{1}{\theta}} \left(\frac{P_{Nt}}{P_t}\right)$$

Equilibrium Supply of NT goods

Consumo en estado estacionario

$$\hat{c} = \sigma \hat{y} + \sigma\gamma\left(\hat{P}_N - \hat{P}_T\right) \qquad \hat{x} = \frac{dx}{x_0}$$

$$\hat{P}_N - \hat{P}_T = \frac{1+\sigma}{\theta(1+\sigma)+\gamma(\sigma-\theta)}\left[r\hat{f} + \hat{a}_T - \frac{2\sigma}{\sigma+1}\hat{a}_N + \hat{P}_T^X - \hat{P}_T^M\right]$$

$$\hat{c} = \sigma\hat{y} + \sigma\frac{\gamma(1+\sigma)}{\theta(1+\sigma)+\gamma(\sigma-\theta)}\left[r\hat{f} + \hat{a}_T - \frac{2\sigma}{\sigma+1}\hat{a}_N + \hat{P}_T^x - \hat{P}_T^M\right]$$

Ecuación a estimar:

$$\ln c_t = \eta + \beta_2 \ln y_t + \beta_3 \frac{r_t f_t}{y_t} + \beta_4 \ln\frac{a_{Tt}}{a_{Nt}} + \beta_6 \ln\frac{P_{Tt}^x}{P_{Tt}^M} + u_t$$

Cointegración en modelo VAR I(2)

$$X_t = \left(C_t,\ Y_t,\ \frac{RF}{Y},\ \frac{A_T}{A_N},\ \frac{P_T^X}{P_T^M} \right)'$$

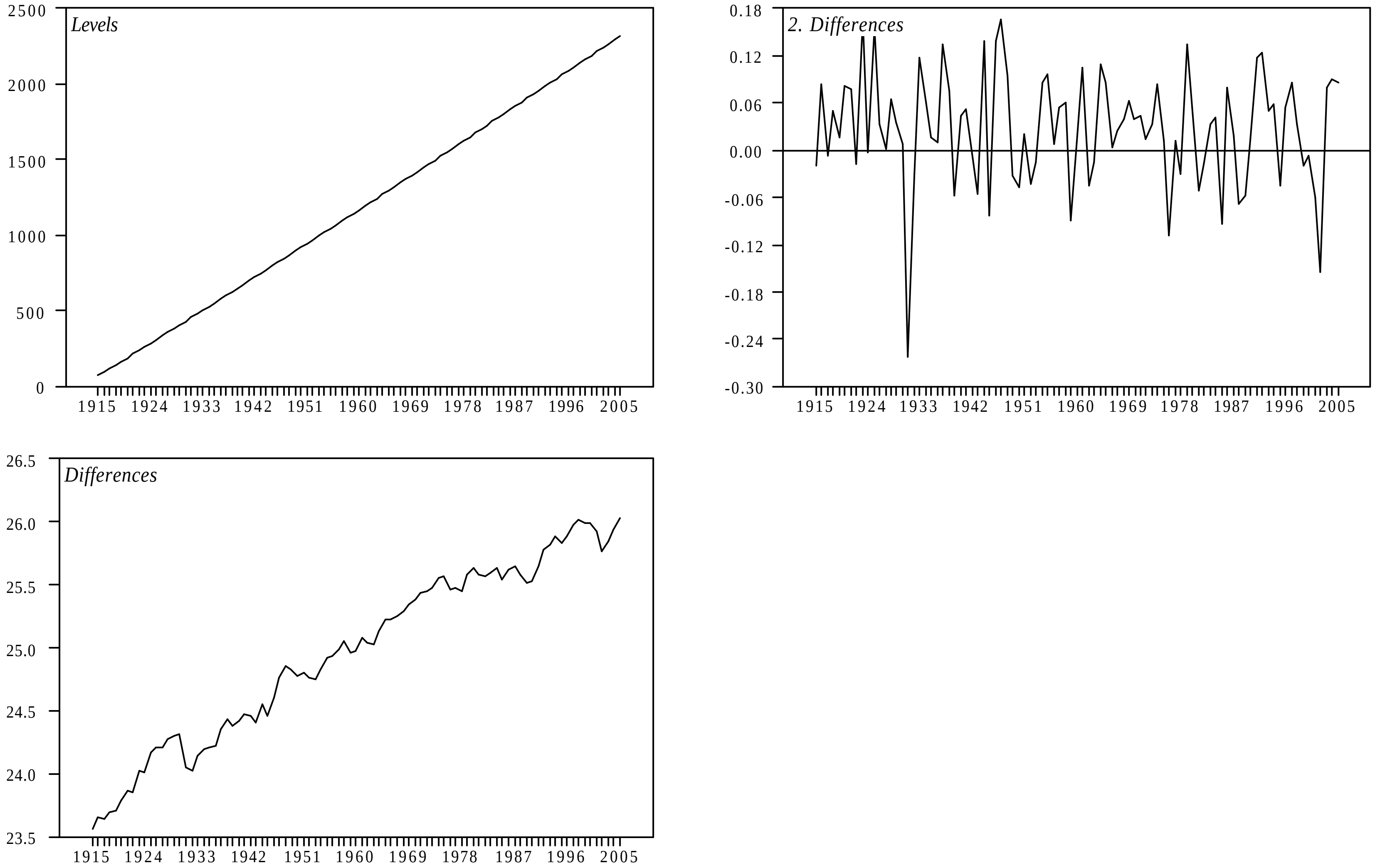
$$\Delta^2 X_t = \Pi X_{t-1} - \Gamma \Delta X_{t-1} + \sum_{i=1}^{k-2} \Phi_i \Delta^2 X_{t-i} + \Theta D_t + \varepsilon_t$$

$$\Gamma = I - \sum_{i=1}^{k-1} \Gamma_i \qquad \Phi_i = -\sum_{j=i+1}^{k-1} \Gamma_i, \quad i = 1,\ldots,k-2$$

$\Pi = \alpha\beta'$ with α, β being p x r , r < p

$\alpha'_\perp \Gamma \beta_\perp = \xi\eta'$ with ξ, η being (p-r) x s , s < (p-r)

LCC



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1000
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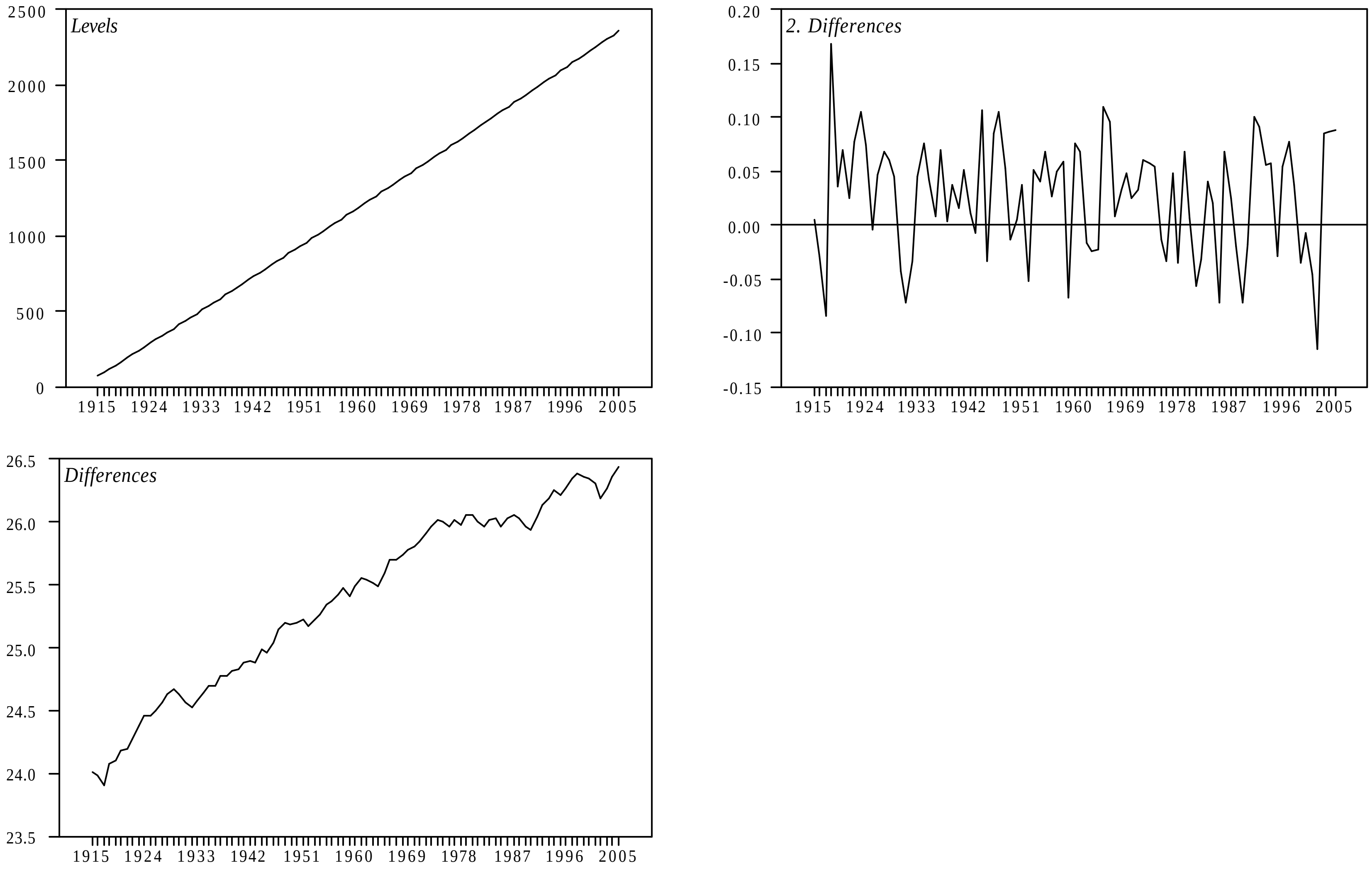
LYC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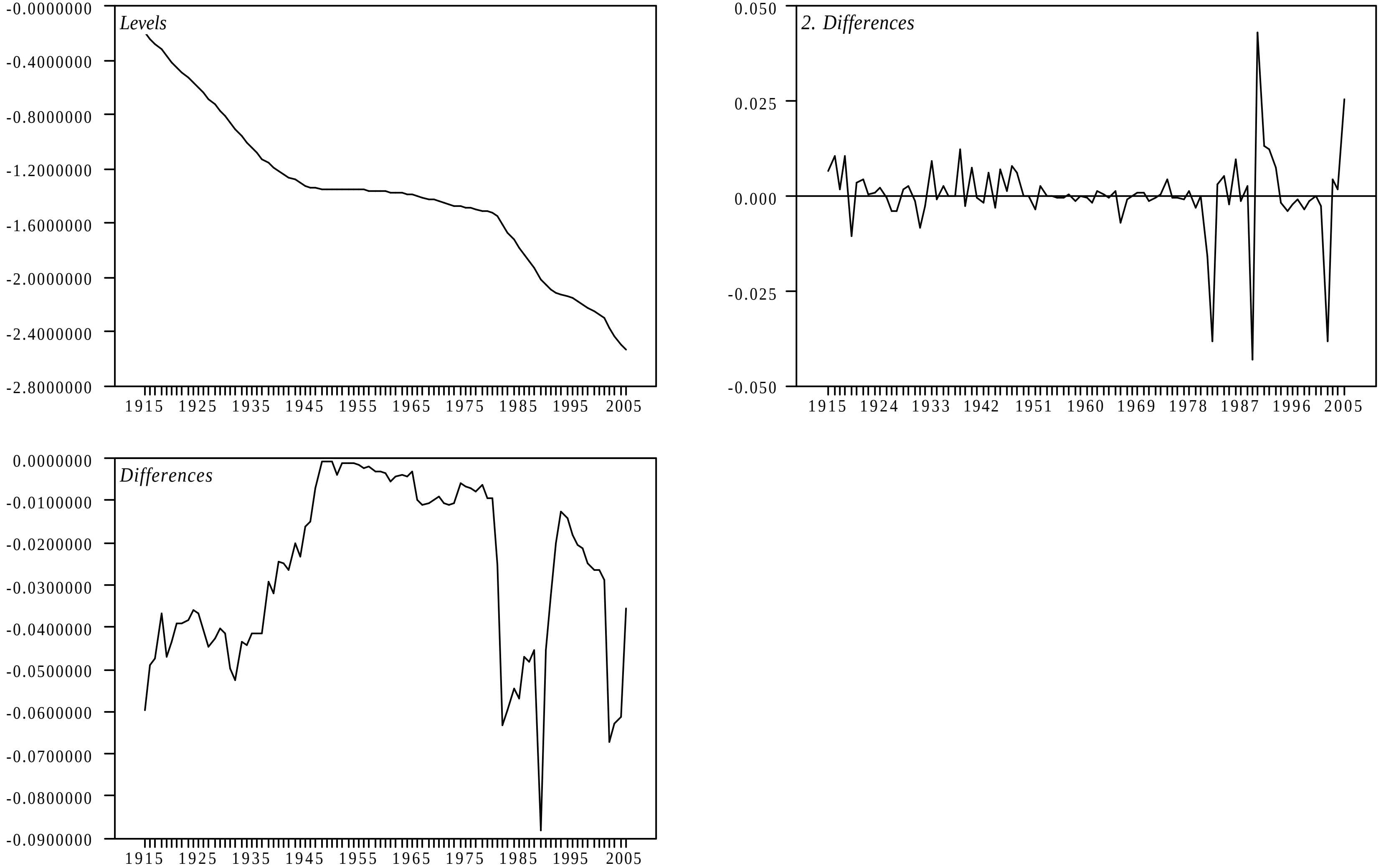
RF_YC



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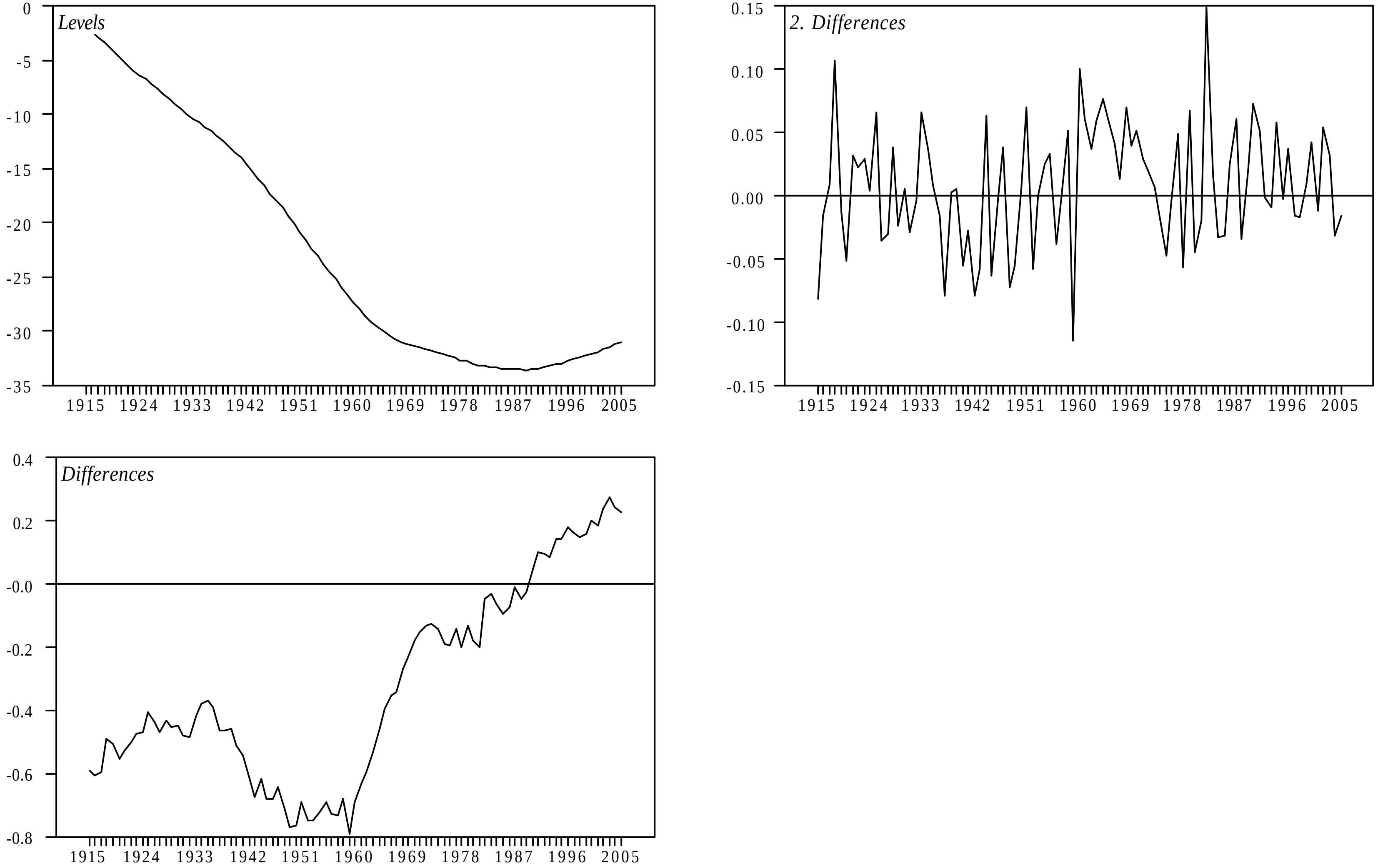
LATANC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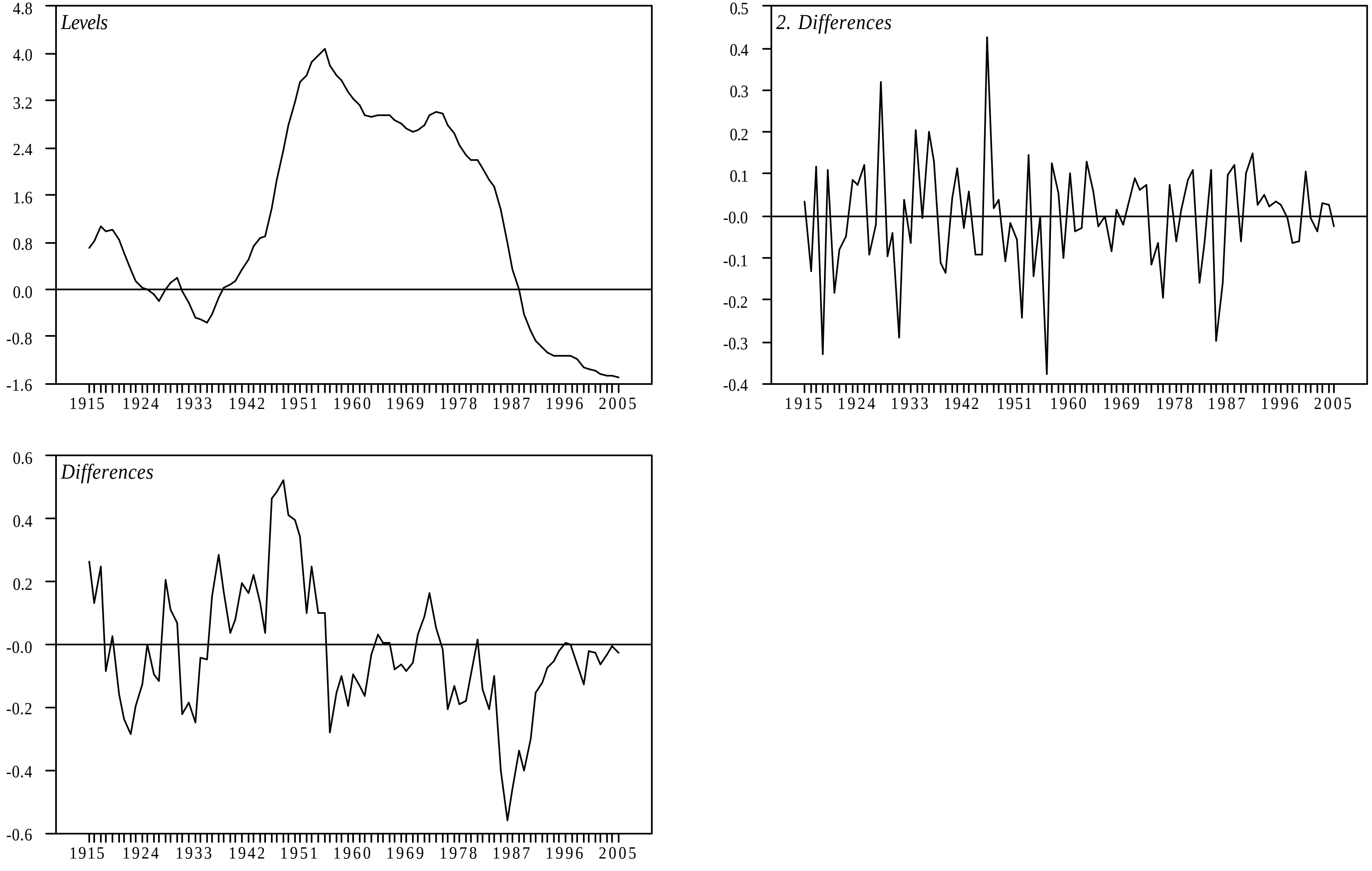
LTTTXTMC



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Differences
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0.4
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-0.2
-0.4
-0.6
1915 1924 1933 1942 1951 1960 1969 1978 1987 1996 2005

Joint test of the integration indices

I(2) ANALYSIS

Rank Test Statistics (P-Values in brackets)

s2 = p-r-s1

p-r	r	4	3	2	1	0
4	0	155.921	119.379	94.512	84.016	79.174
		(0.004)	(0.028)	(0.048)	(0.012)	(0.001)
3	1		78.974	57.332	46.830	40.709
			(0.234)	(0.342)	(0.196)	(0.081)
2	2			38.512	27.870	21.805
				(0.345)	(0.256)	(0.149)
1	3				14.271	9.462
					(0.279)	(0.157)

Approximate 95% Fractiles

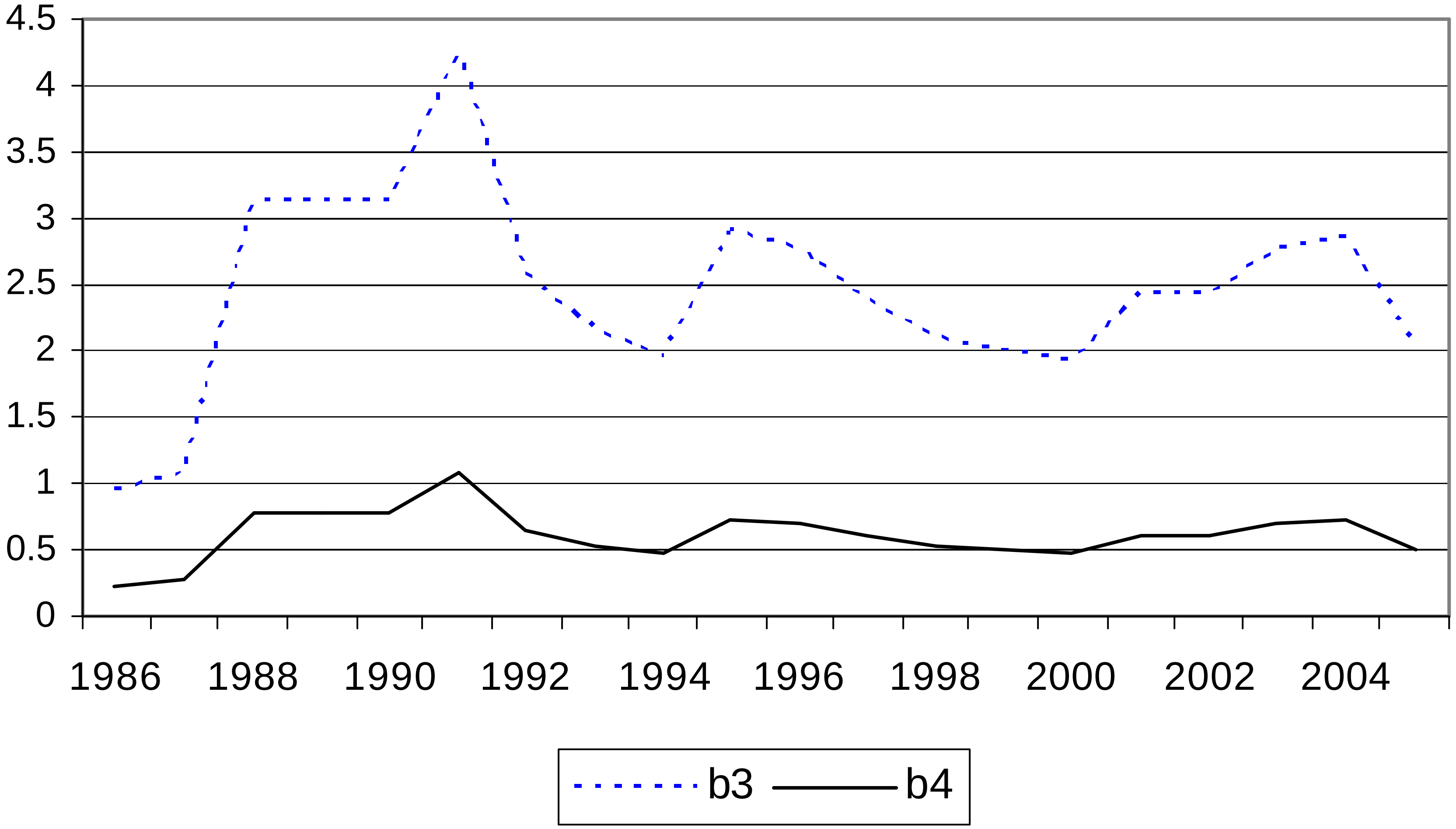
4	0	141.531	115.818	94.243	76.841	63.659
3	1		89.020	69.376	53.921	42.770
2	2			48.520	34.984	25.731
1	3				20.018	12.448

Multicointegrating relation

	r=1, s=0
Level terms	
C°	1
Y°	-0.973
rF/Y°	-3.018
AT/AN°	-0.75
T	0
First differences	
ΔC°	11.468
ΔY°	11.838
ΔrF/Y°	-0.090
ΔAN/AT°	0.299
LR test	$\chi^2(2)=0.08\ (0.96)$

$$\ln c_t = 0.97 \ln y_t + 3\frac{r_t f_t}{y_t} + 0.75 \ln \frac{a_{Tt}}{a_{Nt}} + u_t$$

Recursive Estimates of rF/Y, AT/AN



Consumo y ciclo económico

- Consumption

$$\ln c_t = 0.97 \ln y_t + 3\frac{r_t f_t}{y_t} + 0.75 \ln \frac{a_{Tt}}{a_{Nt}} + u_t$$

- Totally differencing yields

$$\frac{\Delta c}{c} = \left(0.97 - 3\frac{r\ f}{y}\right)\frac{\Delta y}{y} + 3\frac{\Delta r\ f}{y} + 0.75\frac{\Delta(a_T / a_N)}{a_T / a_N}$$

Conclusion

- We have developed a theoretic framework to estimate the Consumption Function in an Open-economy.
- The fundamentals of Consumption in this set up appear to be: domestic product (GDP), net foreign assets income, tradable productivity, non-tradable productivity and terms of trade.
- The new fundamentals are empirically tested and support is found to the idea of disaggregating the real gross national income in its domestic (real GDP) and foreign related components.

Conclusions

- The long-run GDP-consumption elasticity is found to be equal to 0.977
- The paper allows to explain the puzzle of excess volatility of consumption relative to that of output (GDP), present in some countries, particularly in Argentina.
- All in all, the paper makes a contribution for abandoning the traditional and limiting closed-economy specification of the Consumption Function.

Dickey-Fuller Test (ADF)

Variable		Structure	Lags	t-statistics
ln C	Level	Intercept + Trend	0	-2.964626
	1 diff	Intercept	1	-8.04419**
ln Y	Level		0	4.527998
	1 diff	Intercept	0	-8.74896**
rF / Y	Level		0	-1.806914
	1 diff		0	-10.0658**
Ln A_T / A_N	Level		0	-1.024225
	1 diff		0	-9.17434**
ln P^X_T/P^M_T	Level		0	-3.18456**
	1 diff		0	-11.1251**

* (**) denotes significance at 5%(1%)