# Comments to Financial Regulation, Financial Globalization and the Synchronization of Economic Activity

*Gabriel Pérez-Quirós, Banco de España*

**Banco de España. July 1st 2010**

# Brief summary

– Closer financial linkages imply less synchronized output

– New confidential database that reports bilateral bank assets and liabilities

– Instrumental variables estimations

–6 more directives imply 50% increase in banking integration and 0.2 percentage point decline in synchronization

# Positive aspects of the paper

– Topic has always been relevant but now it is even more relevant given the contagion effects of the recent financial crisis

–The authors are extremely careful with their estimation techniques, and they show the robustness of their results to different estimation methods.

–They are original and creative choosing the variable to use as instrument, the number of European directives that have been applied to each country

–The paper is well written, coherent and focused

# Results differ from some influential papers in the literature

– Kose, Prasat and Terrones (2004), Otto et al (2001) and Imbs (2002) find that trade and financial linkages are important in accounting for business-cycle comovement among OECD economies

–Why different results?

- Choice of variable to measure financial integration?
- Choice of instruments?
- Choice of control variables?
- Measure of comovement?

–Construct on previous research explaining up to what point your results explain the results of the related papers

# Your measure of Synchronization

– The paper is based on a measure of synchronization:

$$Sync_{i,j,t} = -\left|(\ln Y_{it} - \ln Y_{it-1}) - (\ln Y_{jt} - \ln Y_{jt-1})\right|$$

–This measure presents serious limitations:

$$\begin{pmatrix} z_{1t} \\ z_{2t} \end{pmatrix} \rightarrow N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \sigma_2^2 \end{pmatrix}\right) \quad \rho = \sigma_{12} / \sigma_1^2$$

# Your measure of Synchronization

–This measure presents serious limitations: N=10000

$$\begin{pmatrix} z_{1t} \\ z_{2t} \end{pmatrix} \rightarrow N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \sigma_2^2 \end{pmatrix}\right) \quad \rho = \sigma_{12} / \sigma_1^2$$

| | Variances=1 | | Variances=2 | | Variances=0.5 | |
|---|---|---|---|---|---|---|
| **Rho** | **Correlation** | **Synchronization** | **Correlation** | **Synchronization** | **Correlation** | **Synchronization** |
| **0.1** | **0.1** | **1.07** | **0.1** | **2.14** | **0.1** | **0.53** |
| **0.5** | **0.5** | **0.78** | **0.5** | **1.59** | **0.5** | **0.39** |
| **0.9** | **0.9** | **0.36** | **0.9** | **0.72** | **0.9** | **0.19** |

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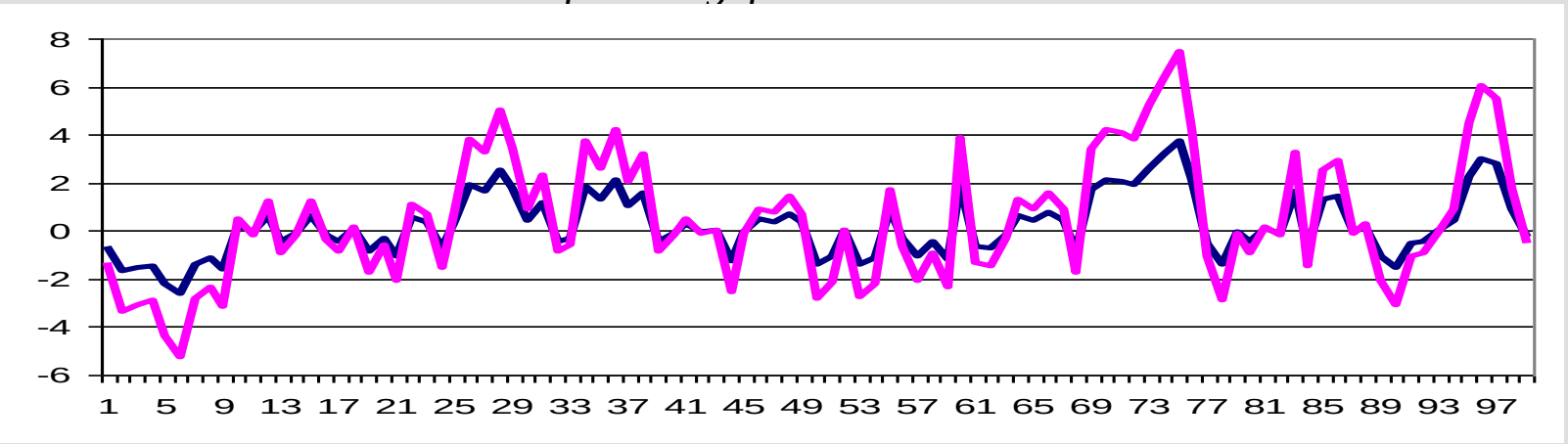
# Your measure of Synchronization

–The proposed measure also have the problem of not distinghsishing between synchronization and characteristics

$$y_t = \phi y_{t-1} + \varepsilon_t$$

$$z_t = A y_t$$




| | A=4 | A=2 | A=1 | A=0.5 |
|---|---|---|---|---|
| Synch | 2.99 | 0.99 | 0.00 | 0.49 |

## Your measure of Synchronization

– The proposed measure is static:

$$y_t = \phi y_{t-1} + \varepsilon_t$$
$$z_t = A y_{t-1} + u_t$$

**Synch=0**

– The other measure does not change anything:

$$Sync2_{i,j,t} = -|(\ln Y_{it} - a_i - a_t - \ln Y_{it-1} - a_i - a_{t-1}) -$$
$$-(\ln Y_{jt} - a_j - a_t - \ln Y_{jt-1} - a_j - a_{t-1})|$$

# Your measure of Synchronization

– The proposed measure is static:

$$y_t = \phi y_{t-1} + \varepsilon_t$$

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$$z_t = A y_{t-1} + u_t$$

– The other measure does not change anything:

$$Sync2_{i,j,t} = -|(\ln Y_{it} - \cancel{a_i} - \cancel{a_t} - \ln Y_{it-1} + \cancel{a_i} + \cancel{a_{t-1}}) -$$
$$-(\ln Y_{jt} - \cancel{a_j} - \cancel{a_t} - \ln Y_{jt-1} + \cancel{a_j} + \cancel{a_{t-1}})|$$

– And the last measure….you do not believe in it…. both of the above indices are not sensitive to various filtering methods that have been criticized previously (e.g. Canova (1998, 1999))

# Measure of Similarity of Cycles

**Are Business Cycles Similar?**

**Synchronization**

**(two-by-two comparison)**

Do the economies move together at the same time?

⇩

Comovement

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Comovement

- Transmission of Shocks.(*Den Haan, 2000*)
- Concordance (*Harding and Pagan, 2002*)
- Dynamic correlation (*Forni et al. 2001*)
- Non-linear comovements (Bengoechea et al 20008)

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**Appearance**

**(two-by-two comparison)**

Do the cyclical movements look alike?

⇩

Expansions / Recessions

- Business cycles characteristics (Harding and Pagan, 2002). Duration, Amplitude, Cumulation Excess
- Bootrapping to avoid dependence on dating CPQS (2008)

# Synchronization of cycles

**Why don´t we look at simple correlations?**

$$X_t = Y_{t-1} + e_t \qquad e_t \sim N(0, \sigma_e^2)$$

$$Y_t = Y_{t-1} + u_t \qquad u_t \sim N(0, \sigma_u^2) \quad E(e_t, u_t) = \sigma_{12}$$

$$X_t = e_t + u_{t-1} + u_{t-2} + .....u_1$$

$$Y_t = u_t + u_{t-1} + u_{t-2} + .....u_1$$

$$E(X_t, Y_t) = \sigma_{12} + (t-1) * \sigma_u^2$$

$$E(X_t^2) = \sigma_e^2 + (t-1) * \sigma_u^2 \sim (t-1) * \sigma_u^2$$

$$E(Y_t^2) = (t) * \sigma_u^2 \sim (t-1) * \sigma_u^2$$

$$Corr(X_t, Y_t) = \frac{E(X_t, Y_t)}{\sqrt{E(X_t^2) * \sqrt{E(Y_t^2)}}} = \frac{\sigma_{12} + (t-1) * \sigma_u^2}{(t-1) * \sigma_u^2} \xrightarrow{t \to \infty} 1$$

# Synchronization of cycles

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$$Y_t = Y_{t-1} + u_t \qquad u_t \sim N(0, \sigma_u^2) \;\; E(e_t, u_t) = \sigma_{12}$$

$$\Delta X_t = e_t + u_{t-1} + e_{t-1}$$

$$\Delta Y_t = u_t$$

$$E(\Delta X_t, \Delta Y_t) = \sigma_{12}$$

$$E(\Delta X_t^2) = 2\sigma_e^2 + \sigma_u^2$$

$$E(\Delta Y_t^2) = \sigma_u^2$$

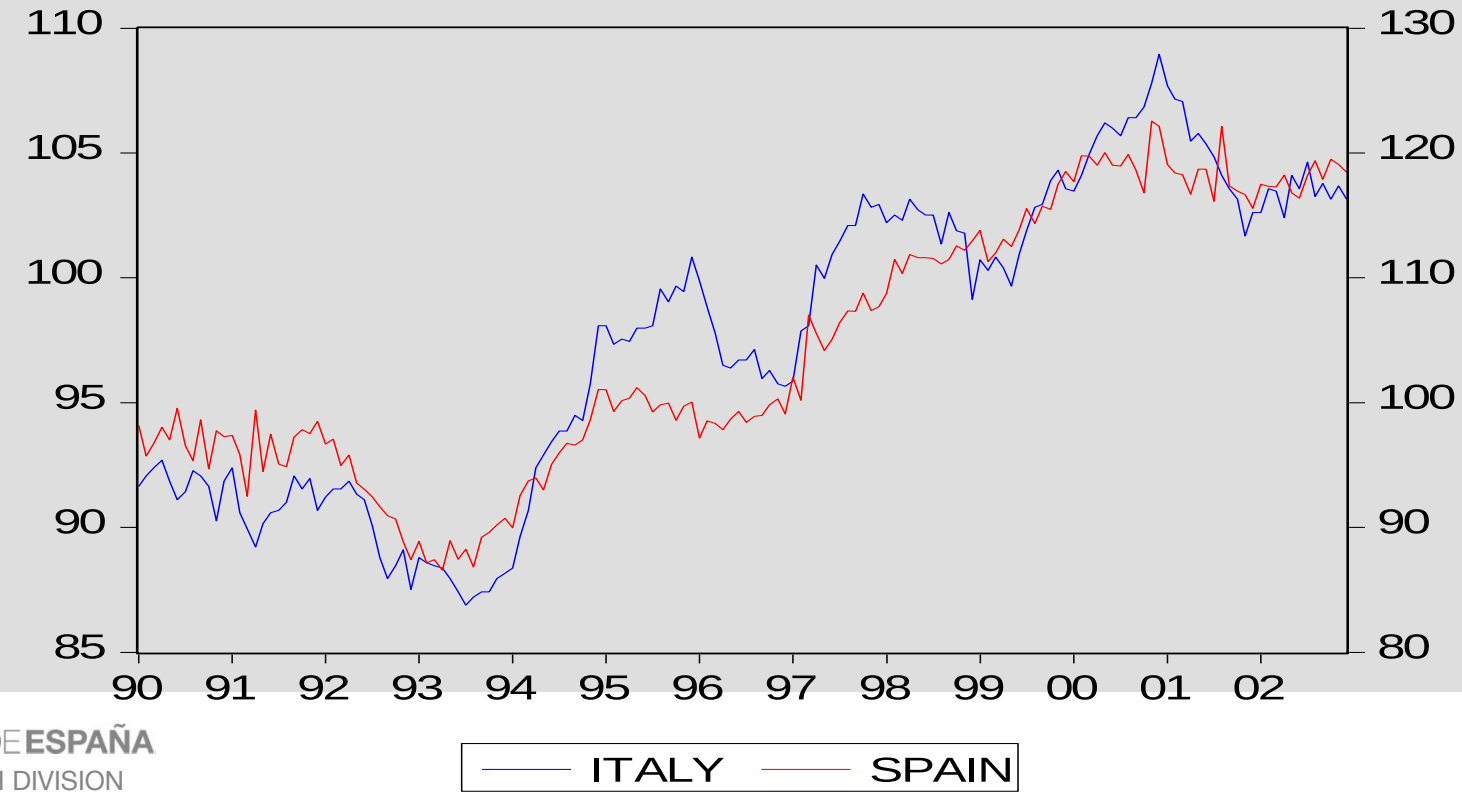
$$Corr(\Delta X_t, \Delta Y_t) = \frac{E(\Delta X_t, \Delta Y_t)}{\sqrt{E(\Delta X_t^2)} * \sqrt{E(\Delta Y_t^2)}} = \frac{\sigma_{12}}{\sqrt{2\sigma_e^2 + \sigma_u^2} * \sqrt{\sigma_u^2}}$$

# Synchronization of cycles

**Some examples.**

Correlations of log levels of Italian and Spanish IPIs. .94

Correlations of growth rates of Italian and Spanish IPIs. .09



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**Why don´t we look at simple correlations?**
**Den Haan (2000)**

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$$X_t = e_t + u_{t-1} + u_{t-2} + .....u_1$$

$$Y_t = u_t + u_{t-1} + u_{t-2} + .....u_1$$

$$\begin{pmatrix} X_t \\ Y_t \end{pmatrix} = \begin{pmatrix} 10 \\ 01 \end{pmatrix} \begin{pmatrix} e_t \\ u_t \end{pmatrix} + \begin{pmatrix} 01 \\ 01 \end{pmatrix} \begin{pmatrix} e_{t-1} \\ u_{t-1} \end{pmatrix} + \begin{pmatrix} 01 \\ 01 \end{pmatrix} \begin{pmatrix} e_{t-2} \\ u_{t-2} \end{pmatrix} + ...$$

# Synchronization of cycles

**Why don´t we look at simple correlations?**
**Den Haan (2000)**

$$t = 0$$

$$\begin{pmatrix} er_1 \\ er_2 \end{pmatrix} = \begin{pmatrix} 10 \\ 01 \end{pmatrix} \begin{pmatrix} e_t \\ u_t \end{pmatrix}$$

$$Var\begin{pmatrix} er_1 \\ er_2 \end{pmatrix} = \begin{pmatrix} 10 \\ 01 \end{pmatrix} \begin{pmatrix} \sigma_e^2 & \sigma_{12} \\ \sigma_{12} & \sigma_u^2 \end{pmatrix} \begin{pmatrix} 10 \\ 01 \end{pmatrix}$$

$$Corr(er_1, er_2) = \frac{\sigma_{12}}{\sigma_e * \sigma_u}$$

# Synchronization of cycles

**Why don´t we look at simple correlations?**
**Den Haan (2000)**

$$t = 1$$

$$\begin{pmatrix} er_1 \\ er_2 \end{pmatrix} = \begin{pmatrix} 10 \\ 01 \end{pmatrix} \begin{pmatrix} e_t \\ u_t \end{pmatrix} + \begin{pmatrix} 01 \\ 01 \end{pmatrix} \begin{pmatrix} e_{t-1} \\ u_{t-1} \end{pmatrix}$$

$$Var\begin{pmatrix} er_1 \\ er_2 \end{pmatrix} = \begin{pmatrix} 10 \\ 01 \end{pmatrix} \begin{pmatrix} \sigma_e^2 & \sigma_{12} \\ \sigma_{12} & \sigma_u^2 \end{pmatrix} \begin{pmatrix} 10 \\ 01 \end{pmatrix} + \begin{pmatrix} 01 \\ 01 \end{pmatrix} \begin{pmatrix} \sigma_e^2 & \sigma_{12} \\ \sigma_{12} & \sigma_u^2 \end{pmatrix} \begin{pmatrix} 01 \\ 01 \end{pmatrix}$$

$$Corr(er_1, er_2) = \frac{\sigma_{12} + \sigma_e}{\sqrt{\sigma^2{}_e + \sigma^2{}_e} * \sqrt{(\sigma^2{}_u + \sigma^2{}_e)}}$$

# Synchronization of cycles

**Why don´t we look at simple correlations?**
**Den Haan (2000)**

$$t = 2$$

$$\begin{pmatrix} er_1 \\ er_2 \end{pmatrix} = \begin{pmatrix} 10 \\ 01 \end{pmatrix} \begin{pmatrix} e_t \\ u_t \end{pmatrix} + \begin{pmatrix} 01 \\ 01 \end{pmatrix} \begin{pmatrix} e_{t-1} \\ u_{t-1} \end{pmatrix} + \begin{pmatrix} 01 \\ 01 \end{pmatrix} \begin{pmatrix} e_{t-2} \\ u_{t-2} \end{pmatrix}$$

$$Var\begin{pmatrix} er_1 \\ er_2 \end{pmatrix} = \begin{pmatrix} 10 \\ 01 \end{pmatrix} \begin{pmatrix} \sigma_e^2 & \sigma_{12} \\ \sigma_{12} & \sigma_u^2 \end{pmatrix} \begin{pmatrix} 10 \\ 01 \end{pmatrix} + \begin{pmatrix} 01 \\ 01 \end{pmatrix} \begin{pmatrix} \sigma_e^2 & \sigma_{12} \\ \sigma_{12} & \sigma_u^2 \end{pmatrix} \begin{pmatrix} 01 \\ 01 \end{pmatrix} + \begin{pmatrix} 01 \\ 01 \end{pmatrix} \begin{pmatrix} \sigma_e^2 & \sigma_{12} \\ \sigma_{12} & \sigma_u^2 \end{pmatrix} \begin{pmatrix} 01 \\ 01 \end{pmatrix}$$

$$Corr(er_1, er_2) = \frac{\sigma_{12} + 2 * \sigma_e}{\sqrt{\sigma^2{}_e + 2 * \sigma^2{}_e} * \sqrt{(\sigma^2{}_u + 2 * \sigma^2{}_e)}}$$

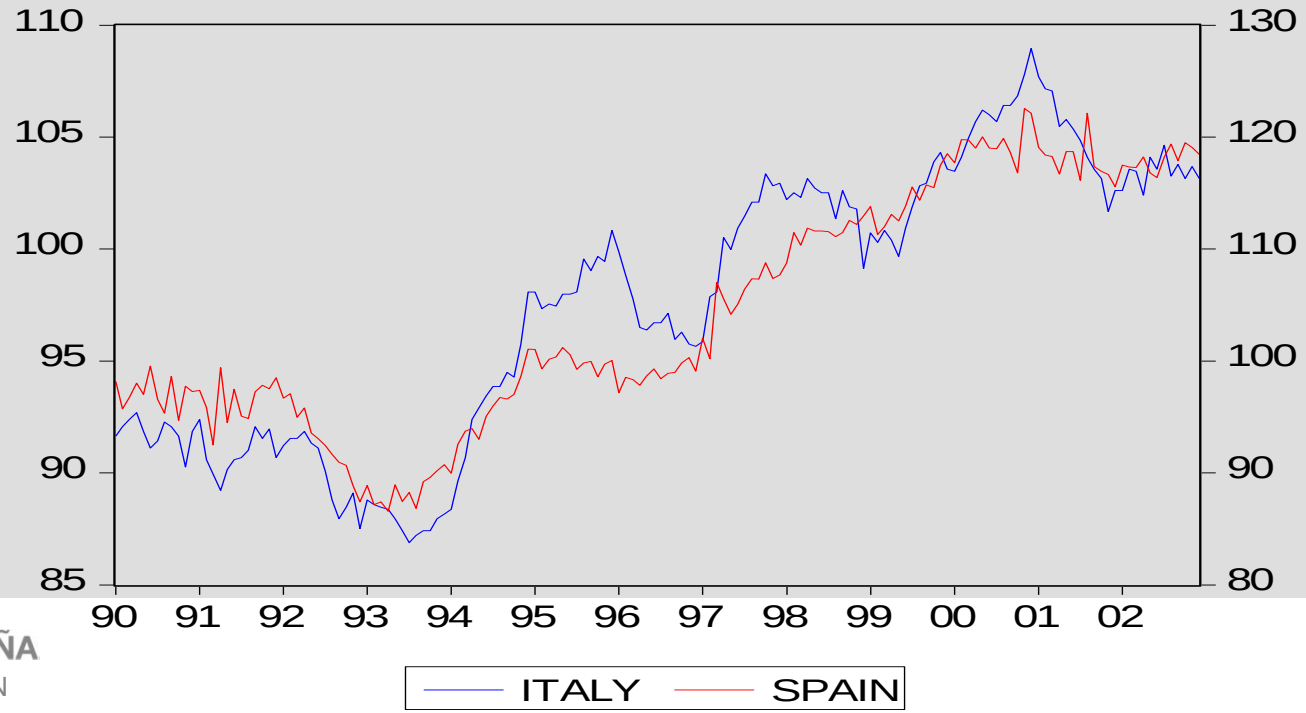
# Synchronization of cycles

**Some examples.**

Correlations of log levels of Italian and Spanish IPIs. .94

Correlations of growth rates of Italian and Spanish IPIs. .09

Dynamyc correlations den Haan (2000) 12 months horizon 0.60



# Synchronization of cycles

**Combination of correlation coefficients**

The correlation between two variables in a sample is not the average correlation of the subsamples.

- ✓ The correlation across the Euro-area economies is not the average of the correlations between each pair of countries.
- ✓ The hyperbolic tangent, allows to obtain a statistic with a known distribution for the correlation.

$$\varsigma = \tanh^{-1}(r) = \frac{1}{2}(\ln(1+r) - \ln(1-r))$$

where $\zeta \sim N(r,1/n)$, r is the correlation coefficient and n is the sample size.This is also call the Fisher's z-transformation (David, F. N, 1949).

# Synchronization of cycles

**Combination of correlation coefficients**

When we want to combine different correlations coefficients (e.i. two correlations $r_1$ and $r_2$), we operate in the following way:

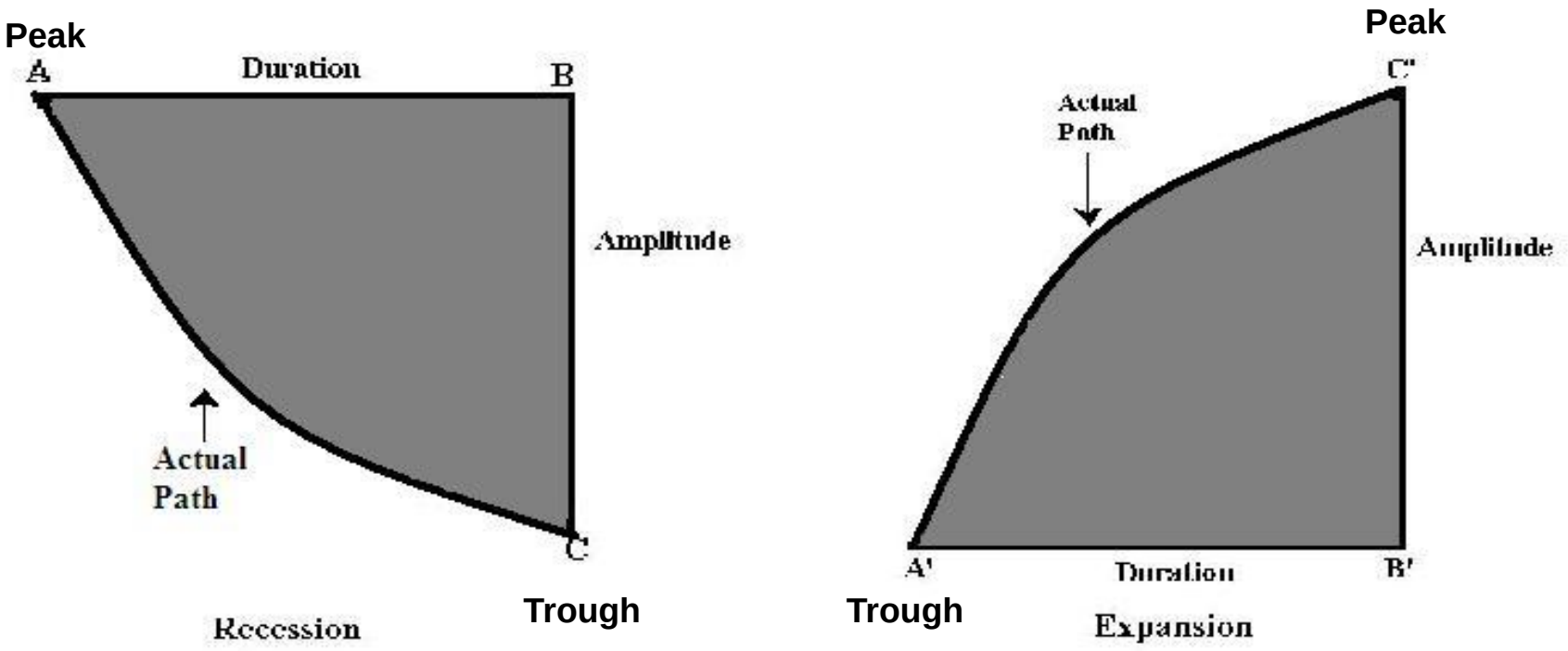
$$\varsigma' \approx N\left(\frac{1}{n_1+n_2}\left(n_1 \tanh^{-1}(r_1)+n_2 \tanh^{-1}(r_2)\right), \frac{1}{n_1+n_2}\right)$$

- In this way we combine $r_1$ and $r_2$ to obtain $\zeta$'. Then , we undo the transformation to get a new correlation coefficient by means of:

$$r = \tanh(\varsigma')$$

# Business Cycles Characteristics.

## Amplitude and Cumulative Gain/Loss

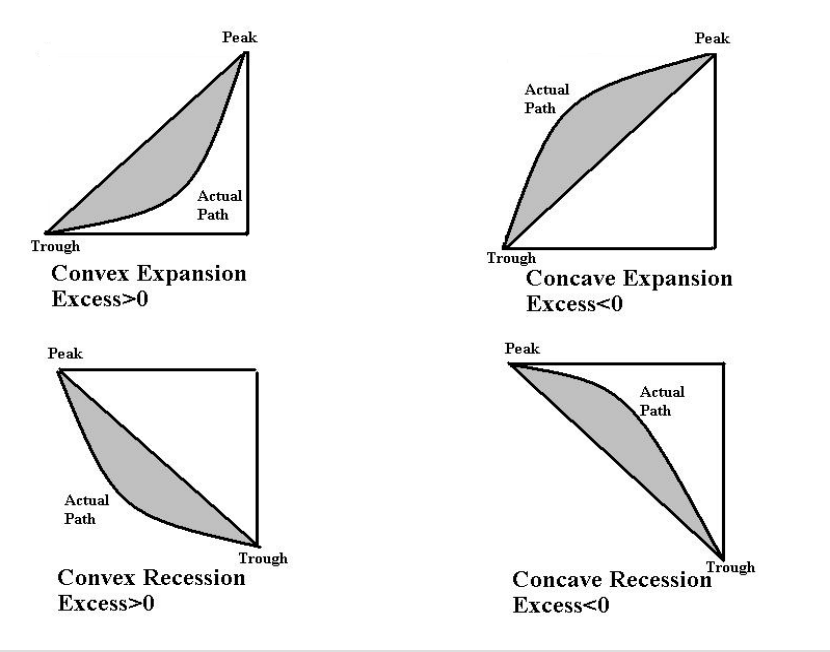


# Business Cycles Characteristics

## 3- Shape of rises and descents

- Excess in Expansions and Recessions (*Harding and Pagan, 2002*)
- Steepness *(Sichel,1993)*

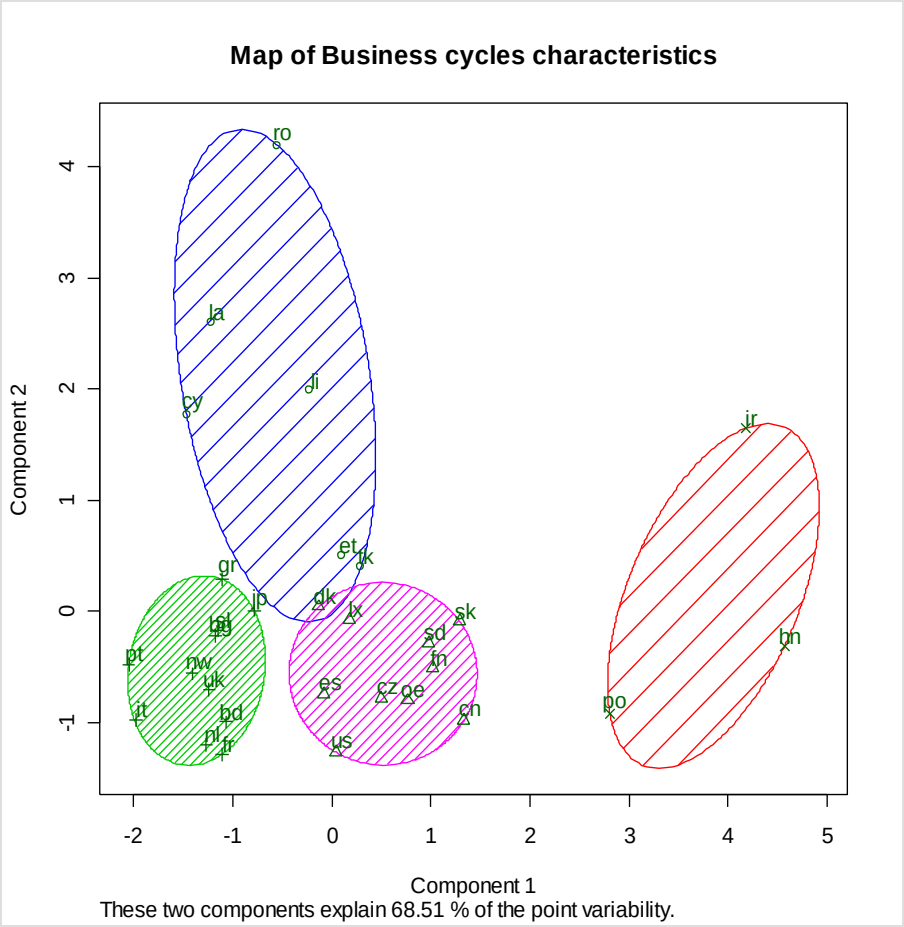
### Excess



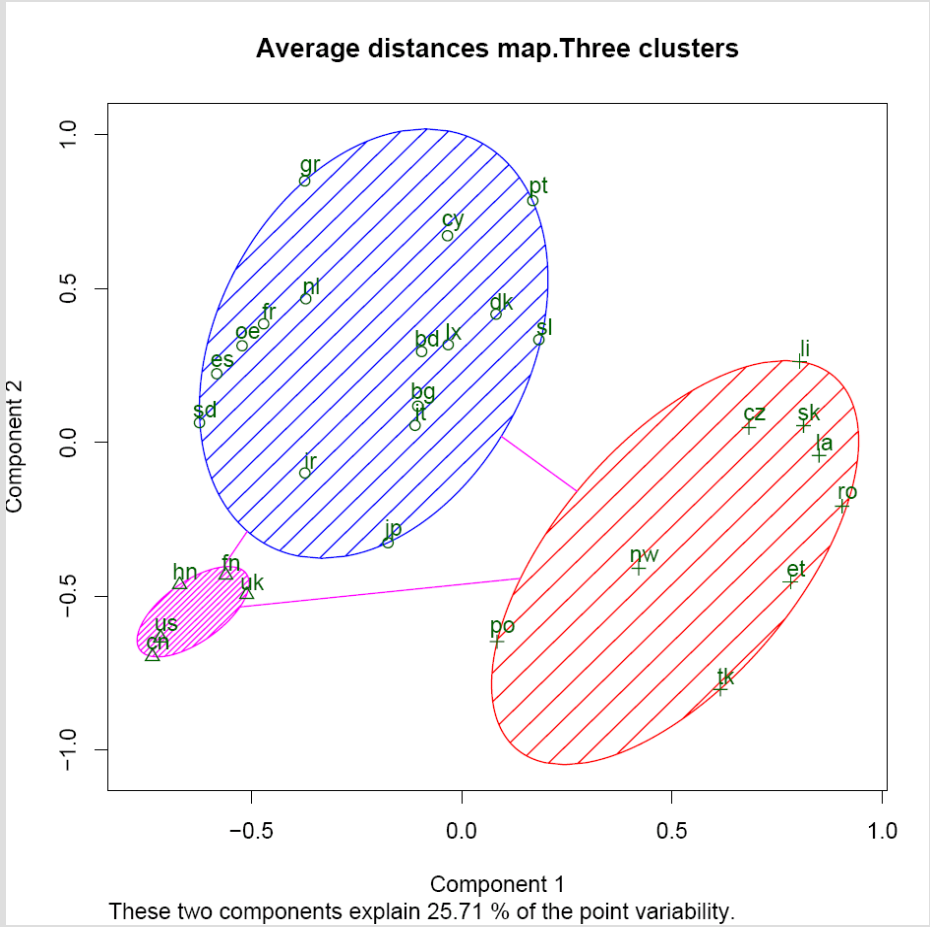

| | Shape | Start | End |
|---|---|---|---|
| **EXPANSION** | **CONVEX** | Smooth | Abrupt |
| | **CONCAVE** | Abrupt | Smooth |
| **RECESSION** | **CONVEX** | Abrupt | Smooth |
| | **CONCAVE** | Smooth | Abrupt |

# Synchronization and Appearance of Business Cycles

## BCs Characteristics

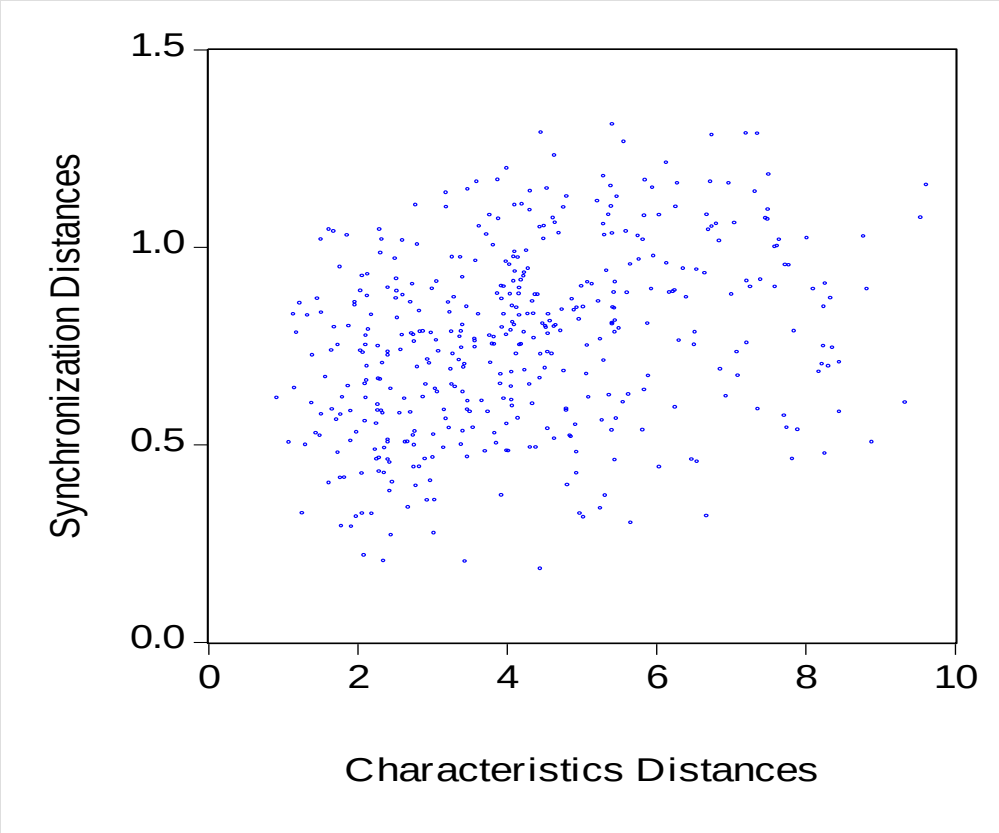



## BCs Synchronization



# Synchronization and Appearance of Business Cycles

**Not clear relation……**




**Correlation coefficient: .32**

Note: Synchronization Distances are obtained from *Camacho, Pérez-Quirós and Sáiz, 2006.*

Characteristics Distances are obtained from Camacho, Pérez-Quirós and Sáiz, 2008.

# Your Measure of financial linkages

– Banking penetration is not the only way in which two countries can be financially interconnected

- Other papers use Foreign Direct Investment and Capital controls. Should be interesting to compare the evolution of financial integration using different measures.

– The Instrument chosen only applies to EU countries. How do you solve the problem of Australia, Canada, Switzerland, Japan and the US? (25% of your sample)

– Your results might be biased for the absence of financial shocks in the sample. Policy implications for the current crisis difficult to obtain.

# To conclude….

– I think that the topic of the paper is extremely relevant and I think it is necessary to have a good measure of the macro implications of financial linkages.

–The results of the paper are different from those reported in the literature and the general consensus. The authors should explain what is the main reason than drive their findings

–The authors are very careful with their techniques, but, perhaps, they should check again what kind of input are they including in the model