Understanding Business Cycle Synchronization:
Is Inflation Targeting Paving the way to Asian Monetary Union?

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Motivation

- Focus here on *Business Cycle Synchronization* ("BCS")

    o BCS key to understanding international policy

      coordination, shock transmission, monetary union

    o Monetary union: countries with high BCS more likely to

      enter CU since opportunity cost lower (foregone national

      monetary sovereignty)

        ▪ Intuition from Mundell, Alesina-Barro

What Determines Business Cycle Synchronization? Trade

- Intensity of trade between pair of countries affects BCS,

  though theoretically ambiguous in sign (Frankel-Rose)

  - Factor-Proportions trade and industry-specific

    (productivity?) shocks imply real integration *reduces* BCS

  - Intra-Industry trade and demand shocks imply opposite

    (relevant case empirically)

- Here: review literature quantitatively

Different Focus Here: Monetary Regime

1. Allows investigation of "Decoupling", idea that business cycles becoming more independent and less synchronized

2. Direct effect of monetary regime on BCS

Three Monetary Regimes of Interest

1. Monetary Union (highly oriented towards foreigners)

   • Asian Monetary Union?

2. Fixed Exchange Rate (foreign-oriented)

   • Common in Asia and elsewhere

3. Inflation Target "IT" (domestic orientation)

Particular Focus on Inflation Targeting

- Fast-Spreading, durable monetary regime

- Adopted by Indonesia, Korea, Philippines, Thailand and 22 others world-wide

- Does IT provide "insulation" from foreign shocks and lower BCS?

    o Here, investigate this issue empirically

Quick Summary of Findings

- Little evidence of decoupling in data

    o Business cycles *not* becoming less synchronized

- IT *not* associated with lower BCS

    o In fact, inflation targeters have *more* correlated business

       cycles

- Perhaps IT is not only intrinsically desirable, but a possible

   way-station to AMU?

Effect of Trade on BCS

- 21 papers estimate effect of trade on BCS using

$$BCS_{i,j,\tau} = \theta Trade_{i,j,\tau} + Controls + \epsilon_{i,j,\tau}$$

where:

- BCS typically a correlation coefficient for detrended output

  for countries i and j over time period τ (more on this below)

- Trade a bilateral measure of trade intensity

Many Estimates of θ! (not all published)

Authors	θ Estimate	Std.Err. of θ
Baxter and Kouparitsas	.134	.032
Bower and Guillenmineau	.021	.005
Calder	.013	.004
Calderon, Chong and Stein	.015	.003
Choe	.027	.008
Clark and Wincoop	.09	.03
Crosby	.048	.063
Fidrmuc	.021	.045
Fiess	.123	.062
Frankel and Rose	.086	.015
Gruben, Koo and Mills	.059	.017
Imbs	.031	.020
Imbs	.074	.022
Inklaar, Jong-a-Pin and de Haan	.115	.041
Kalemli-Ozcan, Papaioannou and Peydro	-.034	.020
Kose and Yi	.091	.022
Kose, Prasad and Terrones	.011	.005
Kumakura	.058	.035
Kumakura	.056	.012
Otto, Voss and Willard	.046	.090
Shin and Wang	.077	.077

Survey Literature Quantitatively with Meta-Analysis

- Can reject Ho: $\theta=0$ using p-values from (21) underlying θ estimates; 277 should be drawn from $\chi^2(42)$ under null

- Can estimate composite fixed- and random-effect meta-estimates of θ:

Estimator	Pooled Estimate of θ	Lower Bound of 95%	Upper Bound of 95%
Fixed	.019	.016	.023
Random	.040	.028	.051

Significantly Positive Effect

- Lots of heterogeneity!

- Still, clear that *rising trade increases BCS*

  o .02 a conservative estimate of semi-elasticity

     ▪ Mean values of BCS vary between .16 and .22

        (depends on detrending technique)

- Note: *just a nuisance parameter*, ambiguously signed in

  theory (may not be constant either)

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How Much is Trade Rising for Asia?

	Trade/GDP (%)			Intra-Asian Trade		
	1990	**2007**	**Growth Rate**	**1990**	**2007**	**Growth Rate**
Australia	32.6	42.1	1.4	.38	.54	2.3%
Bangladesh	19.7	50.8	3.6	.49	.58	1.0%
China	34.8	72.0	3.2	.51	.43	-.9%
Hong Kong	252.6	404.1	2.2	.68	.77	0.7%
India	15.7	45.8	3.9	.20	.34	3.9%
Indonesia	49.1	54.7	0.6	.49	.62	1.5%
Japan	10.0	15.2	2.0	.31	.45	2.5%
Korea	57.0	90.4	2.2	.37	.49	1.8%
Malaysia	147.0	210.0	1.8	.55	.62	0.7%
New Zealand	53.4	58.6	0.5	.45	.62	2.1%
Pakistan	38.9	36.2	-0.4	.32	.38	1.0%
Papua New Guinea	89.6	146.7	2.4	.80	.91	0.8%
Philippines	60.8	92.3	2.0	.43	.56	1.7%
Singapore	226.0	433.0	2.8	.50	.55	0.6%
Thailand	75.8	132.5	2.5	.55	.59	0.4%
Vietnam	81.3	159.3	2.9	.34	.71	6.0%

Trade and thus BCS Rising

- Trade rising relative to output

- Intra-Asian trade rising fast

- Potential further jump if AMU consummated

    o Size uncertain but much studied; can summarize with meta-

      analysis

    o EMU data; minimum of 8%

    o RoW suggests at least 33%

What Determines Business Cycle Synchronization? Monetary

- Standard theory suggests BCS determined by choice of

  monetary regime

  o But macro-economy (structure, shocks) also dictates choice

    of monetary regime

- Two-way causality!

Business Cycles *should* be less synchronized for IT

- IT countries all float (mostly pretty cleanly)

- Compare "Insulation" properties of fixed and floating regimes:

  o Negative foreign shock hits with nominal rigidities

  ▪ Requires fall in real exchange rate

  o Faster, less costly to adjust nominal exchange rate

  ▪ Alternative is wait for excess supply in labor, goods markets

  to push nominal wages, prices down

  ▪ But that implies decline in output, employment

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Mundell's "Insulation" Argument

- Shock type, size dictate choice of monetary regime, thus BCS

2-country model	Foreign Shock	Domestic Effect
Fix	Financial	+
	Real	ambiguous,* probably +
Float	Financial	-
	Real	+, small except for v/large

* Depends on effect of higher world interest rate (-) vs higher demand for domestic exports

Intellectual Heritage of this Argument

- Friedman: "In effect, flexible exchange rates are a means of combining interdependence among countries through trade with a maximum of internal monetary independence; they are a means of permitting each country to seek for monetary stability according to its own lights, without either imposing its mistakes on its neighbors or having their mistakes imposed on it."

Modern Theorists Agree

 "Any economics undergraduate worthy of a B learns this key

policy implication of the Mundell-Fleming model: if any

economy is predominantly hit by foreign real shocks, flexible

exchange rates dominate fixed rates."

- Céspedes, Chang and Velasco (2004)

- Also Devereux and Engel (1999, 2003)

Little Empirical Work of Relevance

- Kose, Otrok and Prasad (2008)

    o Factor model, analyze interdependence of business cycles

    o More countries, annual frequency

    o Univariate focus

My Data Set

- Want many observations with, or comparable to, the set of

  inflation targeters.

    o Include EMU for purposes of comparison

- NZ began IT in 1990; 26 other IT countries since

    o Include all countries at least as large as smallest IT

    (Iceland) and as rich as poorest IT (Philippines)

Data Set continued

- 1974 - 2007(span pre-, post-IT era)

    o Quarterly data for business cycles

- 64 countries have reliable GDP data

    o Stick to national data: business cycles, policies national

    o Includes many fixed exchange rates

    o Includes 15 EMU countries, Ecuador (CU)

    o Many missing observations; All SA

Sample of 64 Countries with Reliable GDP Data

- Many IT, fixes, currency unions (mostly EMU)

  o Mishkin's 5 criteria for IT

- Nine East Asians

- Many missing observations

List of Countries

	IT	Data
Argentina		1994
Australia	1993	1974
Austria		1974
Belarus		1996
Belgium		1974
Brazil	1999	1995
Bulgaria		2002
Canada	1991	1974
Chile	1991	1984
China		1998
Colombia	1999	1998
Costa Rica		2004
Croatia		1997
Cyprus		1999
Czech Republic	1998	1998
Denmark		1974
Ecuador		1995
Estonia		1997
Finland	1993	1974
France		1974
Georgia		2000
Germany		1974

Greece		1974
Hong Kong, China		1977
Hungary	2001	1999
Iceland	2001	2001
Indonesia	2005	1997
Iran		1999
Ireland		1974
Israel	1992	1984
Italy		1974
Jamaica		2000
Japan		1974
Korea	1998	1974
Latvia		1996
Lithuania		1997
Luxembourg		1999
Macao, China		2002
Malta		1974
Mauritius		2003
Mexico	1999	1997
Morocco		2002
Netherlands		1974
New Zealand	1990	1974
Norway	2001	1974

Peru	2002	1983
Philippines	2002	1985
Poland	1998	1999
Portugal		1974
Romania	2005	2002
Russia		1995
Singapore		1987
Slovakia	2005	1997
Slovenia		1996
South Africa	2000	1994
Spain	1995	1974
Sweden	1993	1974
Switzerland	2000	1974
Thailand	2000	1997
Tunisia		2004
Turkey	2006	1991
USA		1974
United Kingdom	1992	1974
Venezuela		2001

Dates indicate year of entry into inflation targeting, and year of earliest reliable output data.

Sources of Real GDP Data

- IMF's *International Financial Statistics*

- IMF's *World Economic Outlook*

- OECD

  o Many checks for mistakes, errors

  o Also construct analogues for G-3 and G-7

    ▪ Weights from sample averages of PPP-adjusted

      aggregate GDP from PWT 6.2

De-Trending Techniques

- Focus here is business cycles, deviations from trend

- Four Models for Underlying Trends:

  - Hodrick-Prescott filter (smoother = 1600)

  - Baxter-King band-pass filter (6-32 quarters)

  - Fourth-Differences (growth rates)

  - Linear Regression Model (linear, quadratic trends,

    quarterly dummies)

Create Business Cycle Deviations

- $y_{i,t}^{HP} \equiv y_{i,t} - \hat{y}_{i,t}^{HP}$

- $y_{i,t}^{BK} \equiv y_{i,t} - \hat{y}_{i,t}^{BK}$

- $y_{i,t}^{Growth} \equiv y_{i,t} - y_{i,t-4}$

- $y_{i,t}^{Linear} \equiv y_{i,t} - (\hat{\alpha} + \hat{\beta}t + \hat{\gamma}t^2 + \widehat{\delta_1}D_{1,t} + \widehat{\delta_2}D_{2,t} + \widehat{\delta_3}D_{3,t})$

- Natural Logarithms throughout

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Measures of Business Cycle Synchronization (BCS)

- Conventional Pearson Correlation Coefficient

$$\widehat{\rho}_{i,j,\tau}^{d} \equiv \frac{1}{T-1} \sum_{t=1}^{\tau} \left(\frac{y_{i,t}^{d} - \bar{y}_{i,\tau}^{d}}{\sigma_{i}^{d}}\right) \left(\frac{y_{j,t}^{d} - \bar{y}_{j,\tau}^{d}}{\sigma_{j}^{d}}\right)$$

  o Estimated *over time* (from 20 quarterly observations/5 years) *for a pair of countries* ("dyad")

- Alternatives (Alesina, Barro and Tenreyro) give similar results, less popular

What Drives BCS? Empirical Literature (Regressors)

- Follow Baxter-Kouparitsas (*JME* 2005) in using four robust

    conventional variables (nuisance effects):

    1. Trade between i and j at τ

        - Most important, only time-varying

    2. Log distance between i and j

    3. Dummy for both i and j developed countries

    4. Dummy for both i and j developing countries

Trade Measure

- Measured a la BK (bilateral trade of i,j over aggregate of i's

  trade and j's trade)

    o Computed with IMF DoT data

    o Frankel-Rose (1998)

- Sometimes add financial analogue with CPIS data

    o Imbs (2006)

    o Stocks, not flows, for 2002-2006

First Look at the Time Series

- Look for:

  - Evidence of "Decoupling" of business cycles over time?

    - (Few; and BCS often *rises*!)

  - Lots of volatility over time
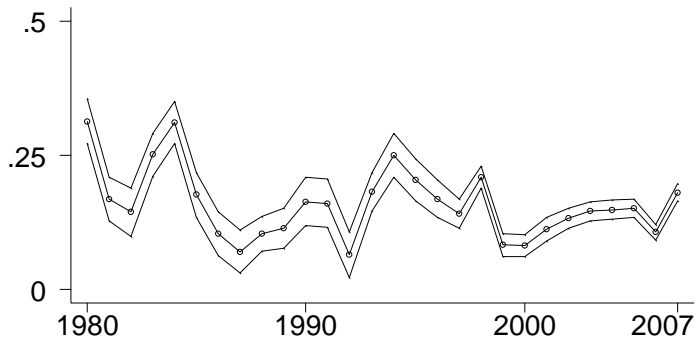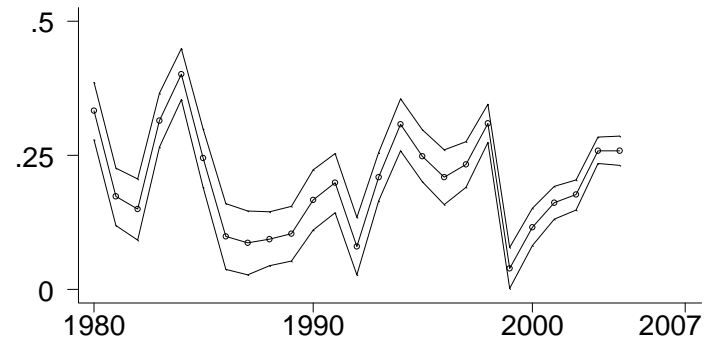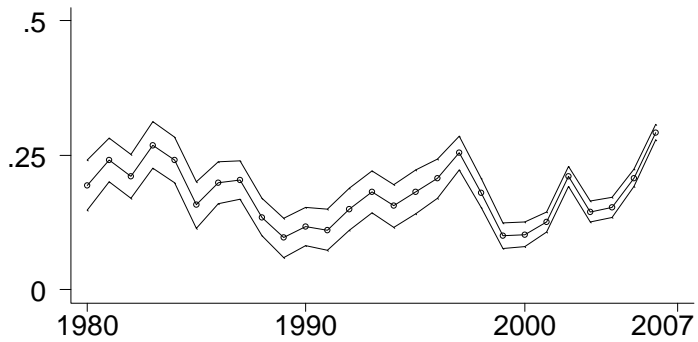
.5
.25
0
1980   1990   2000   2007

HP Detrending

.5
.25
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1980   1990   2000   2007

BK Detrending

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1980   1990   2000   2007

Growth Detrending

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1980   1990   2000   2007
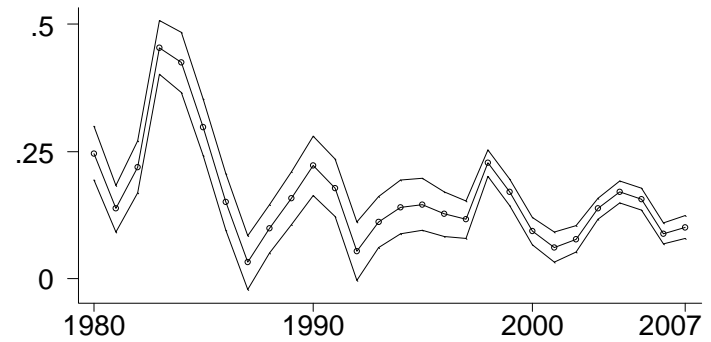
Linear Detrending

Mean, +/-2 standard deviations of mean
Bivariate GDP Correlations

The Entire Data Distribution: Is that a Downward Trend?
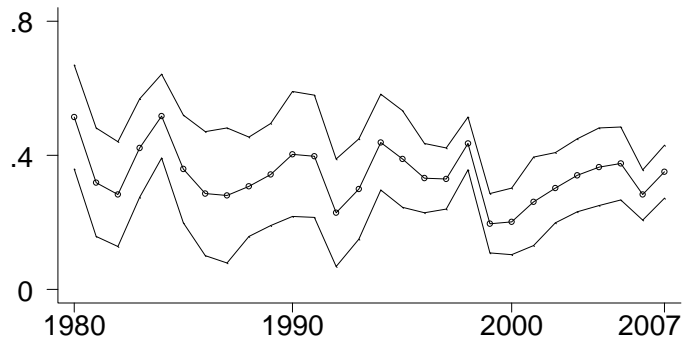
HP Detrending
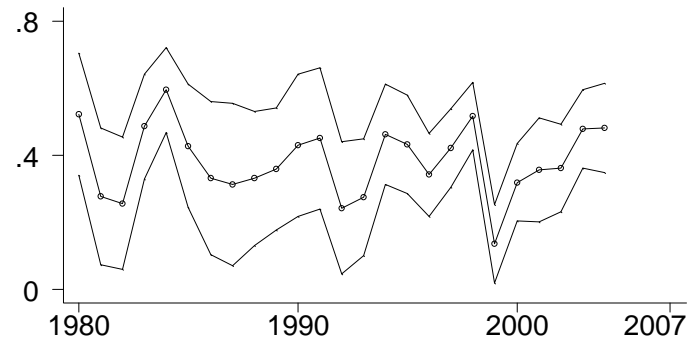
BK Detrending
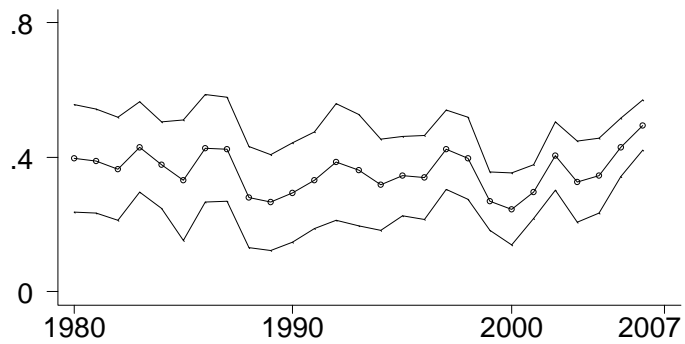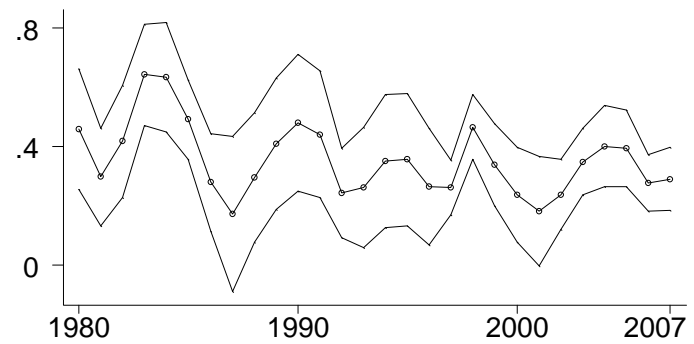
Growth Detrending

Linear Detrending

Mean, +/-2 standard deviations of mean

GDP Correlations with G7

Countries Paired with the G-7
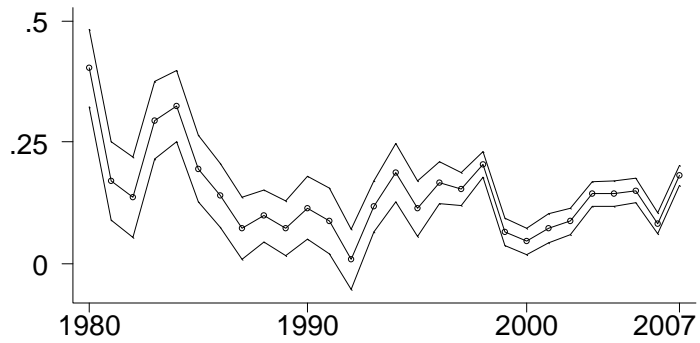
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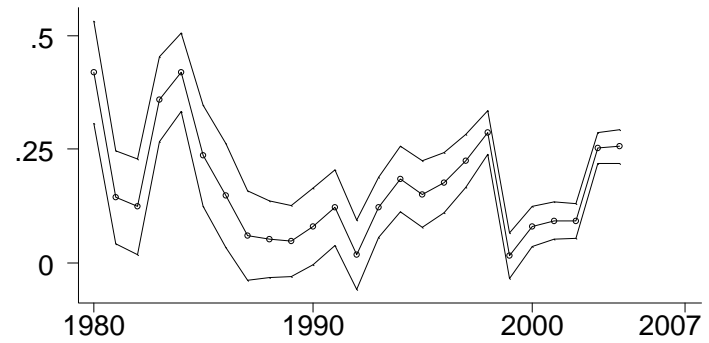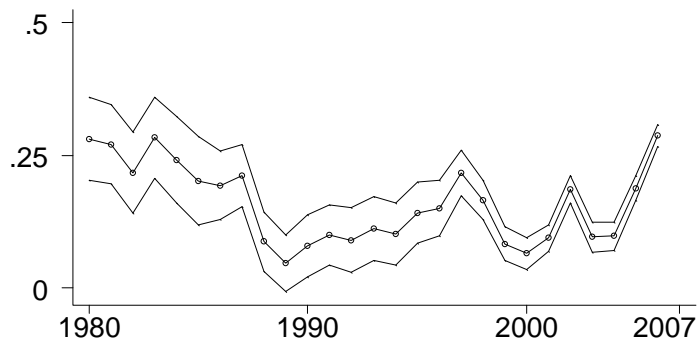
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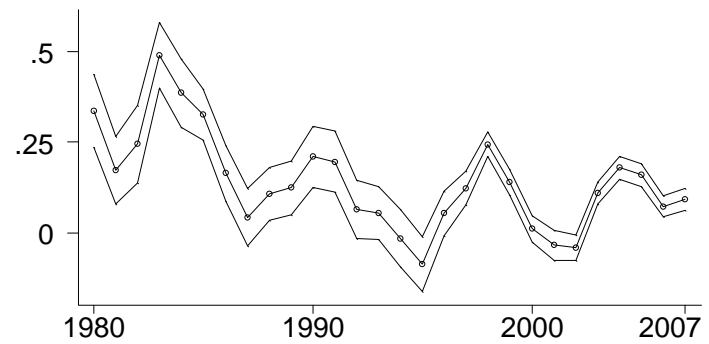
Growth Detrending

Linear Detrending

Mean, +/-2 standard deviations of mean

Bivariate GDP Correlations, Industrial-LDC pairs

Industrial Country-LDC Pairings
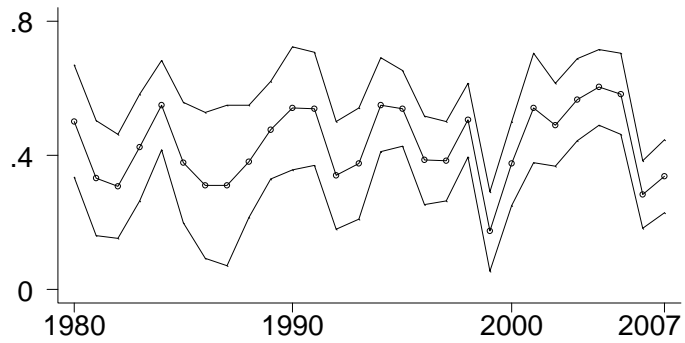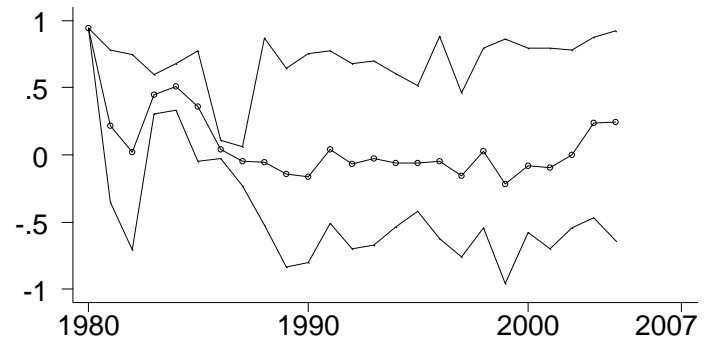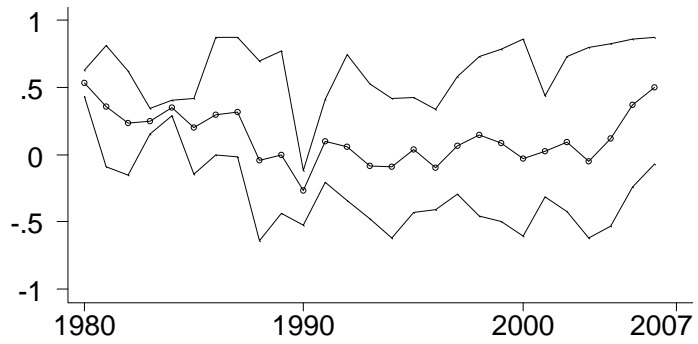
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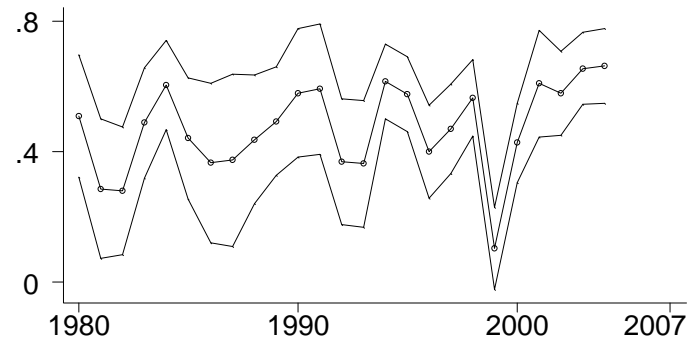
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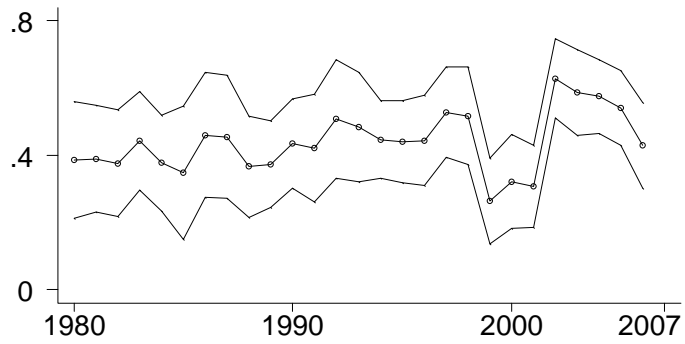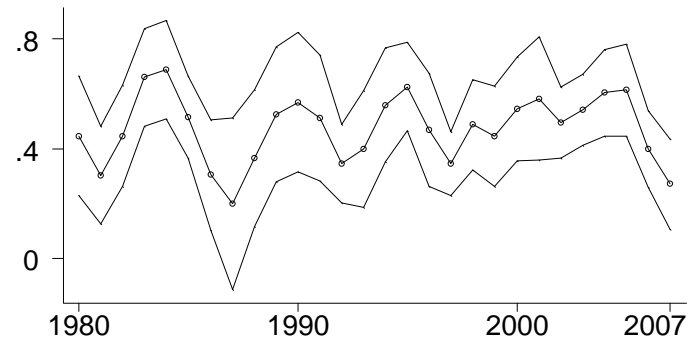
Growth Detrending

Linear Detrending

Mean, +/-2 standard deviations of mean

GDP Correlations with G7, LDCs only
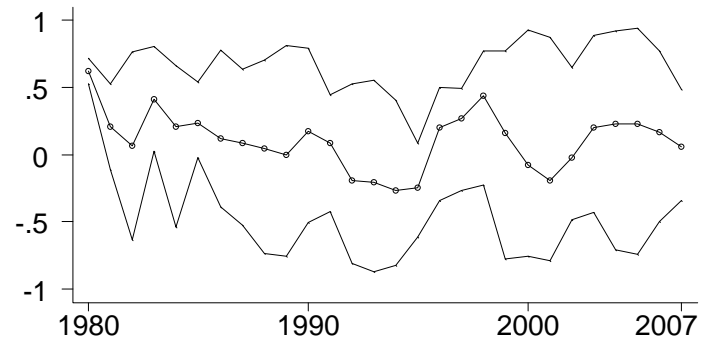
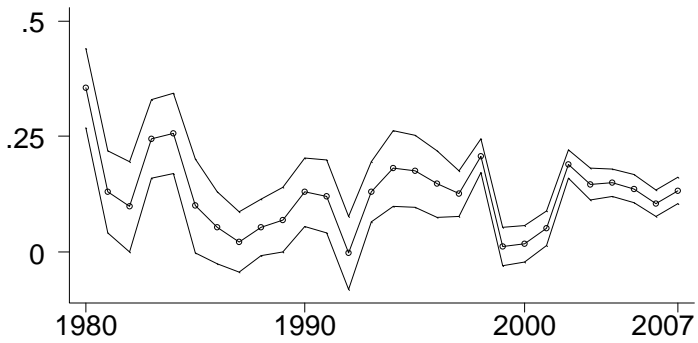# Developing Countries and the G-7
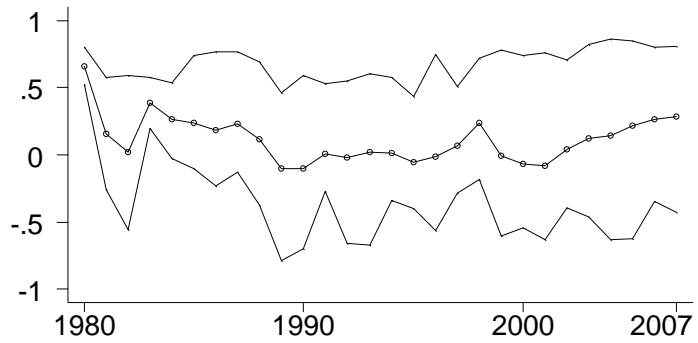
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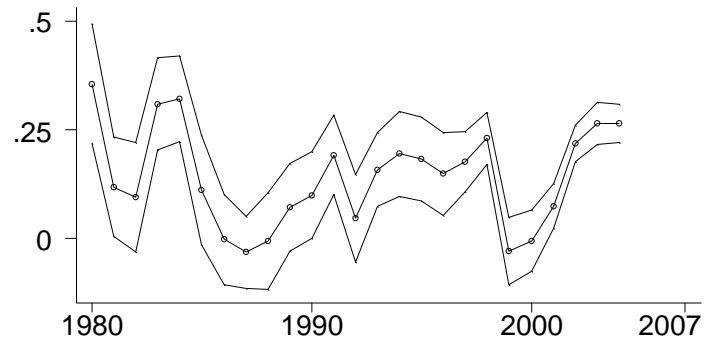
BK Detrending

Growth Detrending

Linear Detrending

Mean, with (5%,95%) Confidence Interval

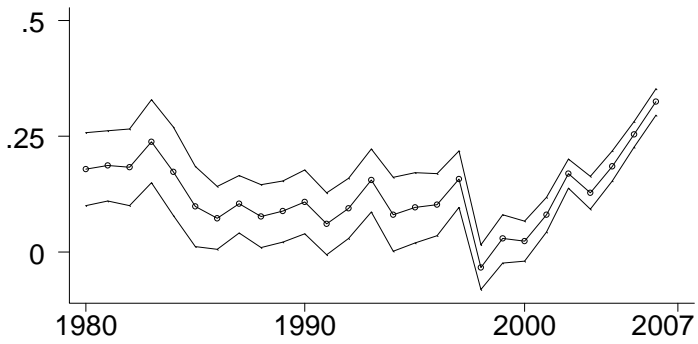Bivariate GDP Correlations, US-LDC pairs
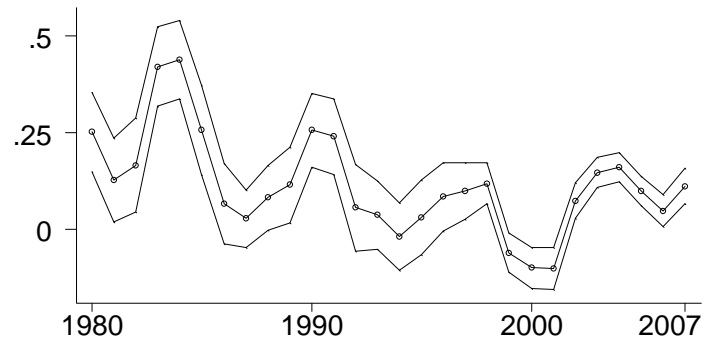
Developing Countries and the US

HP Detrending

BK Detrending

Growth Detrending

Linear Detrending
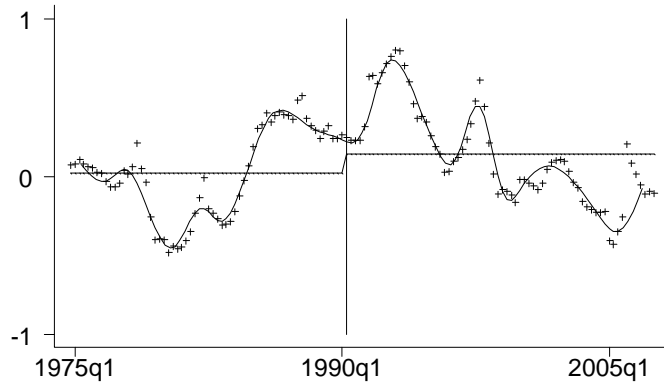
Mean, +/-2 standard deviations of mean

Bivariate GDP Correlations, at least one Asian
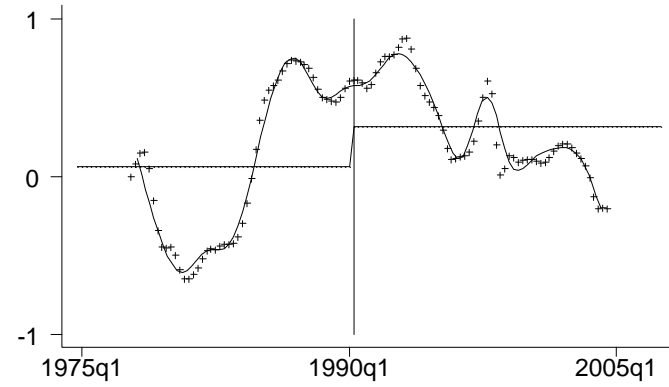
Asia

Asian Focus

A Further Look at the Time Series

- Look for:

  o Breaks at onset of inflation targeting?

    ▪ (Few; and BCS often *rises*!)

HP Detrending

BK Detrending
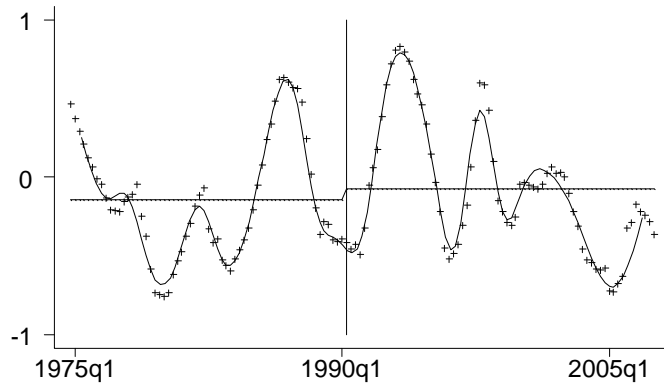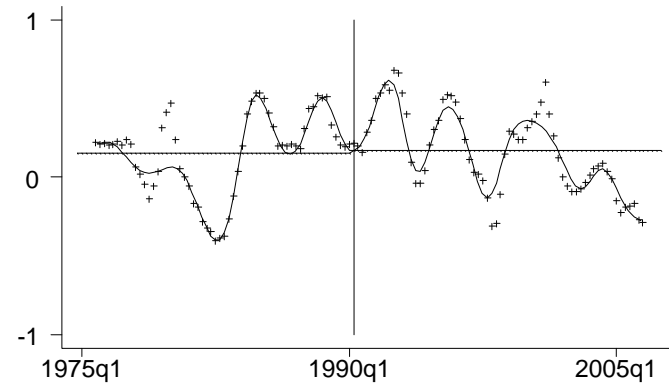
Linear Detrending

Growth Detrending

5-year MA correlation with G7

Business Cycle Synchronization: New Zealand

The First Inflation Targeter
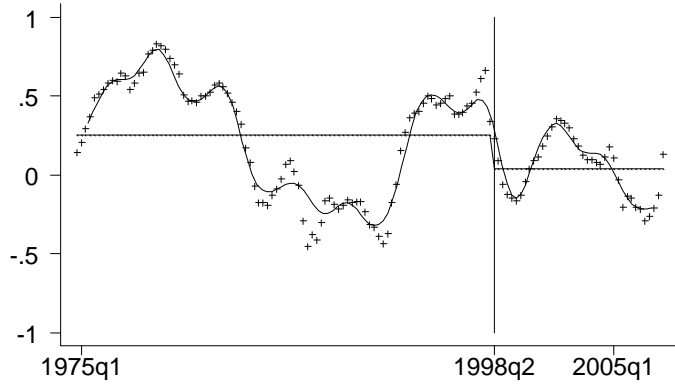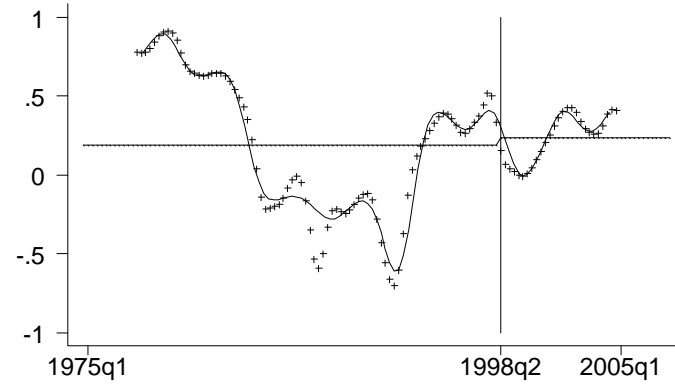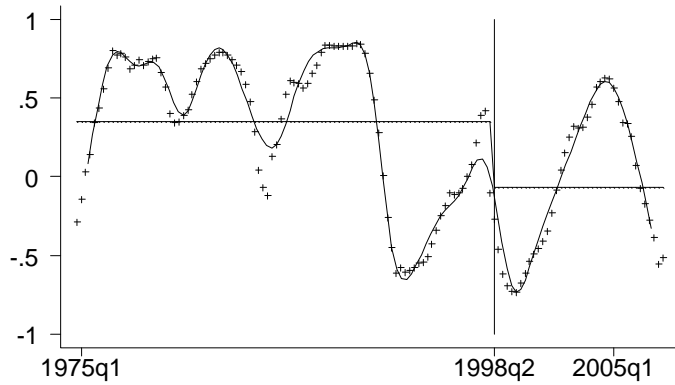
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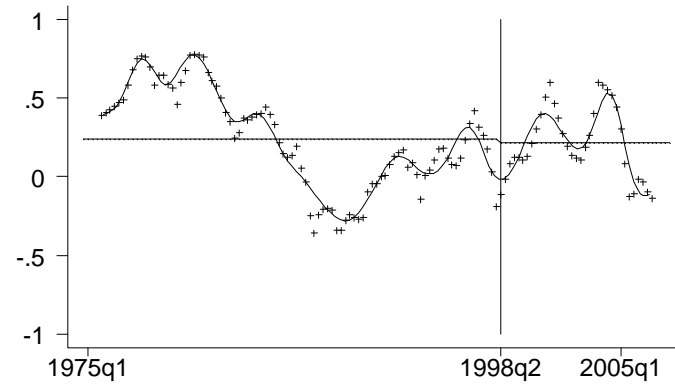
Linear Detrending

Growth Detrending

5-year MA correlation with G7

Business Cycle Synchronization: Korea

Early Asian Inflation Targeter
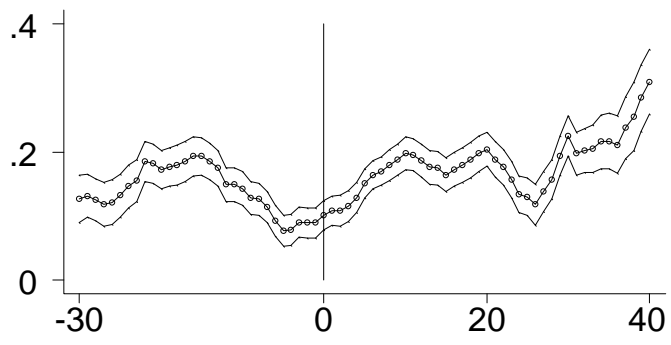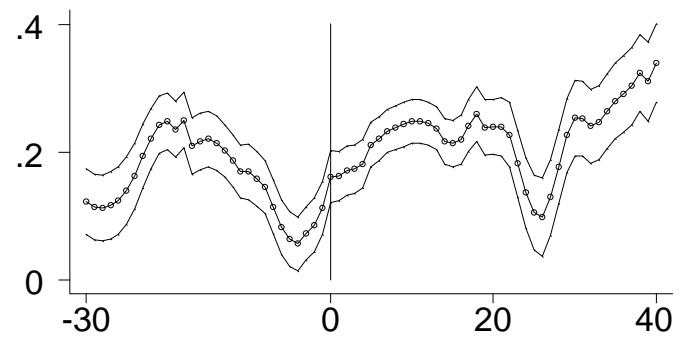
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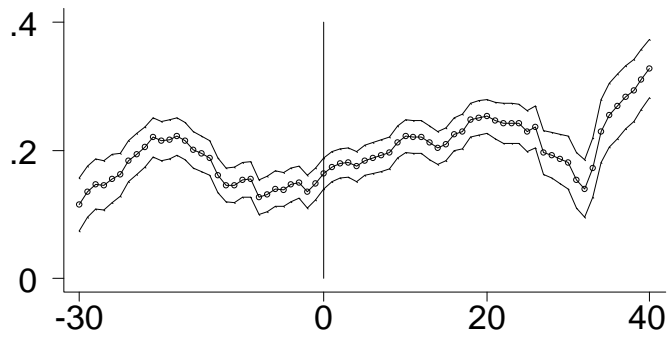
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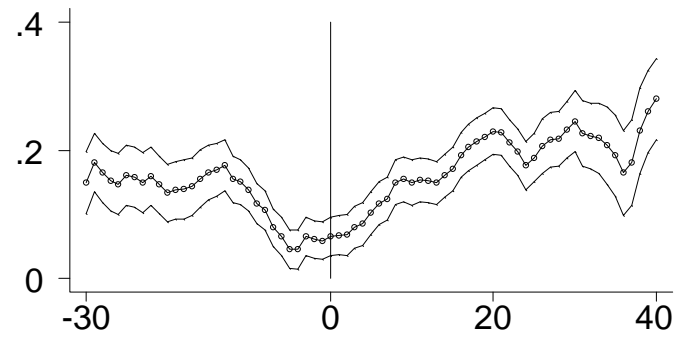
Growth Detrending

Linear Detrending

Bivariate GDP Correlations around IT Entry

An Event Study for *all* Inflation Targeters
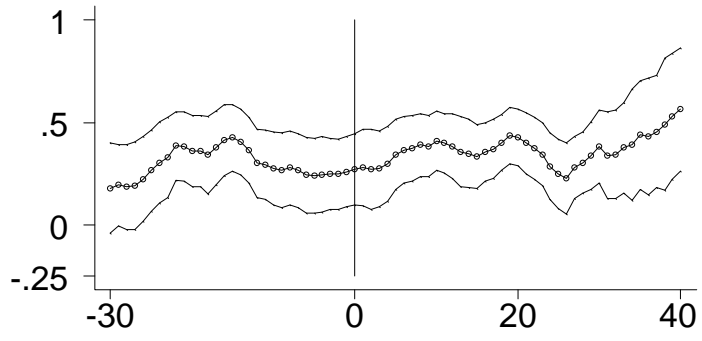
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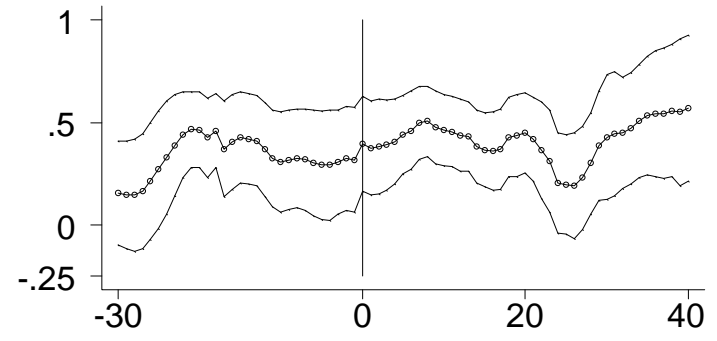
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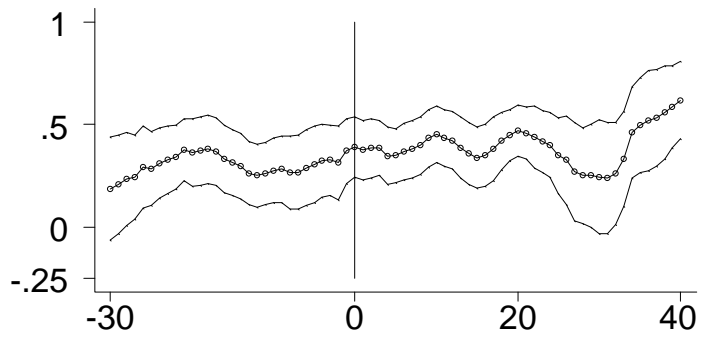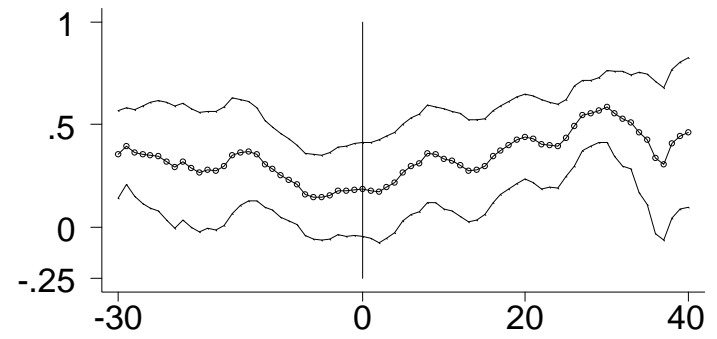
Growth Detrending

Linear Detrending

Bivariate GDP Correlations with G7 around IT Entry

Does that Positive Drift Vanish?
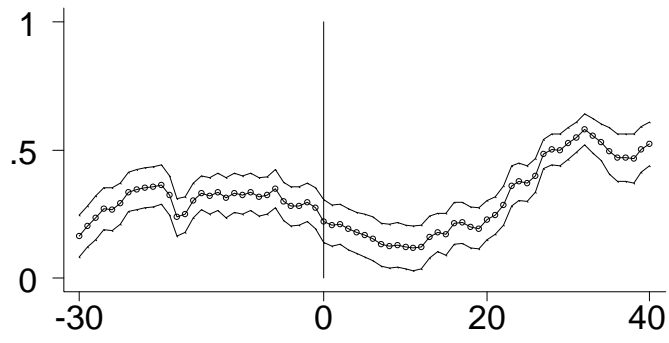
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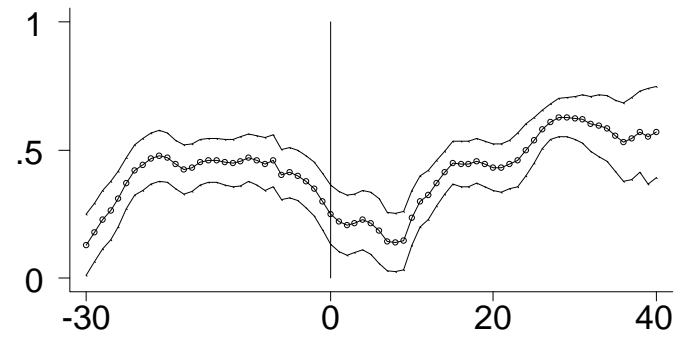
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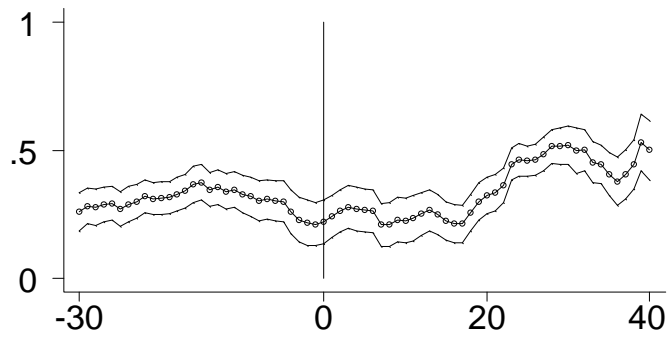
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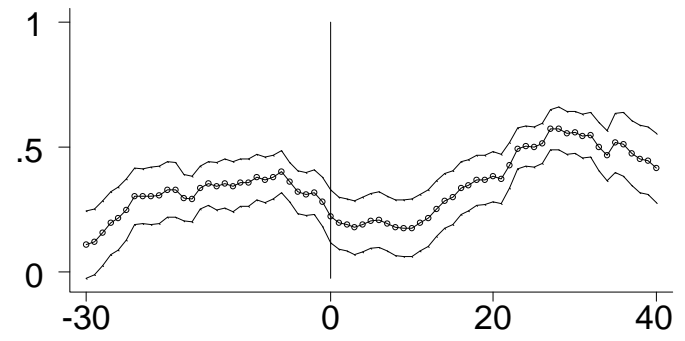
Linear Detrending

Bivariate GDP Correlations around Entry into Fixed Exchange Rate

Contrast: entries into Reinhart-Rogoff Fixed Exchange Rates

Summary

- Little evidence of decoupling

  o Business cycles have simply *not* become less synchronized

- Entry into Inflation Targeting *not* associated with BCS decline

  o Synchronization seems to *rise* not fall

  o But BCS does rise (sensibly!) for entry into fixes/monetary

    union

Regression Analysis

- Event studies intrinsically univariate; do not control for other

  reasons why BCS might vary across countries / time

  o Also use limited data

- Remedy both problems with standard regression techniques

Regression Model

$$\widehat{\rho}^{\mathbf{d}}_{\mathbf{i,j,\tau}} = \boldsymbol{\beta_1}\mathbf{IT(1)_{i,j,\tau}} + \boldsymbol{\beta_2}\mathbf{IT(2)_{i,j,\tau}} + \boldsymbol{\gamma_{Fix,1}}\mathbf{Fix(1)_{i,j,\tau}}$$

$$+ \boldsymbol{\gamma_{Fix,2}}\mathbf{Fix(2)_{i,j,\tau}} + \boldsymbol{\gamma_{MU,1}}\mathbf{MU(1)_{i,j,\tau}}$$

$$+ \boldsymbol{\gamma_{MU,2}}\mathbf{MU(2)_{i,j,\tau}} + \boldsymbol{\theta_T}\mathbf{Trade_{i,j,\tau}} + \boldsymbol{\theta_D}\mathbf{Dist_{i,j}}$$

$$+ \boldsymbol{\theta_I}\mathbf{Ind_{i,j}} + \boldsymbol{\theta_L}\mathbf{LDC_{i,j}} + \left\{\boldsymbol{\delta_{i,j}}\right\} + \left\{\boldsymbol{\delta_\tau}\right\} + \boldsymbol{\epsilon}^{\mathbf{d}}_{\mathbf{i,j,\tau}}$$

- Coefficients of interest: $\{\beta\}$, the effects of IT on BCS

  o Common-Sense checks: $\{\gamma\}$, effects of Fixes/MU

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Controls from Baxter-Kouparitsas

- Bilateral Trade (normalized by multivariate aggregates of both countries)

  o Also, log distance, dummies for both countries being both industrial/developing

- All four of the BK robust effects on BCS

Estimation Technique

- Least Squares

    o Time Effects

    o With and without dyadic fixed effects

- Sample data every 20th observation (avoid dependence, since

    BCS measure is moving average)

	One IT	Both IT	Fixed ER	Both MU	One IT	Both IT	Fixed ER	Both MU
HP Detrending	.03 (.02)	.05* (.02)	.27** (.05)	.41** (.03)	.03 (.02)	-.04 (.03)	.14** (.05)	.08 (.05)
BK Detrending	.02 (.04)	.06 (.04)	.21 (.12)	.59** (.01)	.03 (.04)	.02 (.06)	.04 (.07)	.11* (.05)
Linear Detrending	.05* (.02)	.07 (.04)	.34** (.07)	.55 (.22)	.14** (.03)	.01 (.05)	.24** (.07)	.18** (.06)
Growth Detrending	.03 (.02)	.01 (.05)	.20* (.07)	.23** (.01)	.00 (.03)	-.10* (.04)	.10* (.05)	-.02 (.05)
Fixed Effects	Time	Time	Time	Time	Time, Dyads	Time, Dyads	Time, Dyads	Time, Dyads

Bilateral, without Controls

	One IT	Both IT	Fixed ER	Both MU	One IT	Both IT	Fixed ER	Both MU
HP Detrending	.03 (.02)	.05 (.02)	.22** (.05)	.29** (.03)	.03 (.02)	-.03 (.03)	.14** (.05)	.11* (.05)
BK Detrending	.04 (.02)	.07 (.03)	.09 (.10)	.40** (.03)	.03 (.04)	.02 (.06)	.01 (.09)	.15** (.05)
Linear Detrending	.06** (.01)	.07 (.04)	.28** (.05)	.41 (.18)	.14** (.03)	.02 (.05)	.26** (.07)	.22** (.06)
Growth Detrending	.02 (.02)	.01 (.05)	.12 (.06)	.06* (.02)	.01 (.03)	-.10* (.04)	.07 (.05)	-.03 (.06)
Fixed Effects	Time	Time	Time	Time	Time, Dyads	Time, Dyads	Time, Dyads	Time, Dyads

Bilateral, with Controls

Results

- Effect of IT on BCS: Generally Weak Results

    o 32 coefficients (= 4 detrenders x 2 FE x 2 controls x 2 #IT)

        ▪ 2 significantly negative at 5% (none at 1%)

        ▪ 28 positive (!), 5 at 5% (1 at 1%)

    o Generally insensitive results

        ▪ Detrending/fixed effects/controls

Strong Signs that Fixing/Monetary Union Raise BCS

- 11 of 32 coefficients positive at 1%; 5 more at 5%

  o 2/32 negative, neither significantly

- So data/methodology able to reveal significant, sensible results

- Analogues for BCS with G-7 deliver similar results

- Ditto observations that include at least one Asian

Country in:	IT	Fix	MU	IT	Fix	MU
HP Detrending	.11 (.07)	.03 (.05)	.15 (.19)	-.02 (.11)	.03 (.10)	-.04 (.14)
BK Detrending	.16 (.09)	.05 (.10)	.44** (.02)	.00 (.13)	.23* (.11)	.27* (.12)
Linear Detrending	.14 (.07)	.13 (.12)	.37 (.19)	.08 (.13)	.20 (.10)	.27* (.12)
Growth Detrending	.04 (.09)	.04 (.05)	.21* (.08)	-.09 (.10)	.10 (.10)	-.03 (.14)
Fixed Effects	Time	Time	Time	Time, Dyads	Time, Dyads	Time, Dyads

G-7, without Controls

Country in:	IT	Fix	MU	IT	Fix	MU
HP Detrending	.07 (.05)	.01 (.03)	.02 (.15)	.01 (.11)	.07 (.10)	-.03 (.14)
BK Detrending	.12 (.07)	.03 (.10)	.20** (.04)	.05 (.13)	.27* (.11)	.29* (.14)
Linear Detrending	.09 (.06)	.13 (.10)	.20 (.12)	.13 (.12)	.26** (.10)	.28* (.12)
Growth Detrending	.00 (.07)	.02 (.04)	-.00 (.06)	-.07 (.11)	.13 (.10)	-.03 (.14)
Fixed Effects	Time	Time	Time	Time, Dyads	Time, Dyads	Time, Dyads

G-7, with Controls

	One IT	Both IT	Fixed ER	One IT	Both IT	Fixed ER
HP Detrending	-.02 (.04)	-.09 (.05)	.10 (.13)	-.01 (.04)	-.07 (.05)	.28 (.44)
BK Detrending	.01 (.04)	.02 (.02)	-.05 (.10)	.05 (.07)	.01 (.12)	.48 (.34)
Linear Detrending	.00 (.05)	-.03 (.03)	-.05 (.15)	.05 (.05)	-.06 (.08)	.53** (.16)
Growth Detrending	-.06 (.05)	-.12 (.07)	.15 (.06)	-.06 (.04)	-.15* (.08)	.28 (.22)
Fixed Effects	Time	Time	Time	Time, Dyads	Time, Dyads	Time, Dyads

Excluding non-Asian Country Pairs, without Controls

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	One IT	**Both IT**	**Fixed ER**	**One IT**	**Both IT**	**Fixed ER**
HP Detrending	-.02 (.04)	-.08 (.05)	.10 (.11)	-.01 (.04)	-.07 (.05)	.27 (.44)
BK Detrending	.02 (.04)	.03 (.02)	.03 (.12)	.04 (.07)	.01 (.12)	.47 (.34)
Linear Detrending	.01 (.05)	-.03 (.03)	-.05 (.16)	.05 (.05)	-.06 (.08)	.52** (.16)
Growth Detrending	-.05 (.05)	-.12 (.07)	.11 (.08)	-.05 (.04)	-.15* (.08)	.29 (.22)
Fixed Effects	Time	Time	Time	Time, Dyads	Time, Dyads	Time, Dyads

Excluding non-Asian Country Pairs, with Controls

Adding Financial Integration

	One IT	Both IT	Fix	MU	One IT	Both IT	Fix	MU
HP	.07* (.01)	.02 (.02)	.25 (.07)	.29* (.01)	.19** (.06)	.06 (.07)	-.39** (.05)	n/a
BK	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Linear	.11* (.004)	.05 (.04)	.26 (.02)	.39 (.17)	.40** (.06)	.19 (.12)	-.22** (.06)	n/a
Growth	.02 (.05)	-.02 (.09)	.07 (.03)	.05 (.04)	.23** (.07)	-.01 (.13)	-.14 (.15)	n/a
Fixed Effects	Time	Time	Time	Time	Time, Dyads	Time, Dyads	Time, Dyads	Time, Dyads

- Little effect (little data!)

Conclusion

- Little regression evidence that targeting inflation appreciably

  lowers BCS by significant amount

Problems with OLS

- Many potentially serious problems with LS

    o Most important: monetary regimes not chosen randomly

        ▪ Fixes, currency union may be chosen to affect BCS

        ▪ Perhaps countries target inflation to insulate themselves

        ▪ So worry about exogeneity!

    o IT countries may not be random sample

        ▪ Special features which linear controls may not capture

Treatment Methodology

- Consider relevant observations (dyad x period) as "treatments" (IT participation), compare treatments to "controls" (non-IT)

- Match treatments to controls using propensity score, conditional probability of assignment to treatment given vector of observed covariates

Methodological Details

- Since $\{\hat{\rho}^d_{i,j,\tau}\}$ constructed from MA of 20 observations, only use

  every 20th observation

- Use Baxter-Kouparitsas vector of 4 variables for covariates

  o Check by adding financial integration (2002-2006 data)

- Initial estimator: nearest neighbor (5 matches)

  o Check with 4 different estimators

Initial Choice of Treatment/Control

- Treatment: dyads with one IT country (1,041 obs.)

- Control: observations since 1990 without IT (5,038 obs.)

  o Check with 6 other treatment/control combinations

Treatment	IT, any (1041)	IT, any (30)	IT, any (1041)	IT, any (1041)	IT, any (1041)	IT, any (1041)	IT, Fix/MU (276)
Control	Any (5038)	G-7 (532)	Fix or MU (469)	Fix (267)	Fix or MU* (3185)	No fix or MU (1853)	Fix or MU (478)
HP	.08** (.01)	.08 (.07)	-.03 (.05)	-.08 (.06)	.09** (.02)	.06** (.02)	.08* (.04)
BK	.14** (.03)	.11 (.10)	.03 (.07)	-.04 (.08)	.15** (.03)	.12** (.03)	.17** (.06)
Linear	.10** (.02)	.07 (.09)	.02 (.07)	-.02 (.08)	.12** (.02)	.08** (.02)	.01 (.06)
Growth	.13** (.02)	.14* (.06)	.03 (.05)	-.06 (.06)	.15** (.02)	.11** (.02)	.11** (.04)

Default and Changes to Treatment/Control

	NN (5)	NN (1)	NN (5)	Strat.	Kernel	Radius
HP	.08** (.01)	.08** (.02)	.07** (.02)	.06** (.01)	.07** (.02)	.08** (.01)
BK	.14** (.03)	.12** (.03)	.16** (.04)	.08** (.02)	.10** (.02)	.12** (.02)
Linear	.10** (.02)	.10** (.03)	.12** (.03)	.11** (.02)	.11** (.02)	.12** (.02)
Growth	.13** (.02)	.13** (.02)	.17** (.02)	.13** (.01)	.13** (.01)	.13** (.01)
PS	Standard	Standard	Augment	Standard	Standard	Standard
Effect	Average	Average	Average	Treated	Treated	Treated

Default and Different Estimators

Monetary Regimes, Treatment Pair	IT, any	IT, any	IT, any	IT, any
Monetary Regimes, Control Pair (number)	Any	Fix or MU	Fix or MU*	No fix or MU
HP Detrending	.04 (.03)	-.01 (.17)	.06 (.03)	.00 (.03)
BK Detrending	.11* (.05)	.28 (.16)	.18** (.05)	.03 (.05)
Linear Detrending	.05 (.04)	.18 (.22)	.10** (.04)	-.01 (.04)
Growth Detrending	.09** (.03)	-.03 (.14)	.13** (.03)	.03 (.03)

Excluding non-Asian dyads

Results: Default Estimates

- For all four de-trending techniques, treatment effect of IT on

  BCS is *positive*

  o All four statistically significantly positive at 1%

  o Having one IT country raises $\{\hat{\rho}^{d}_{i,j,\tau}\}$ by around .10

  o Average value of $\{\hat{\rho}^{d}_{i,j,\tau}\}$ is only .15, so treatment effect is

    economically large

Sensitivity

- IT seems to *increase* BCS with G-7!

  o Statistically insignificant effects though

- Effect of IT "treatment" on BCS close to that of fixing

  exchange rate/monetary union!

  o Smaller effects, but statistically insignificant differences

- Different estimators/Asian sample make little difference to

 economic or statistical significance

Natural Contrast to IT: EMU

| Estimator	NN, (5)	NN (2)	NN (5)	Strat.	Radius	Kernel
Model	standard	standard	augmented	standard	standard	standard
HP Detrending	.171* (.077)	.161 (.107)	.139 (.090)	.077 (.046)	.147** (.042)	.108** (.036)
BK Detrending	.240** (.093)	.219 (.128)	.376** (.080)	.096 (.052)	.194** (.051)	.146* (.064)
Linear Detrending	.275** (.099)	.234 (.149)	.247* (.126)	.122* (.052)	.206** (.054)	.156** (.051)
Growth Detrending	.101 (.069)	.107 (.095)	-.029 (.088)	.139** (.037)	.179** (.040)	.154** (.037)

- Positive, bigger effects than those of IT (methodology works!)

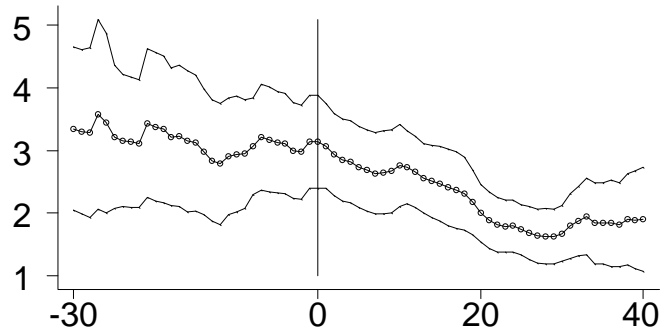**Trying to Understand the *Positive* Effect of IT on BCS**

- Fewer common shocks? (Stock and Watson)

    o Including time-specific fixed effects does little

- Decline in Output Volatility (through 2007)

    o Start of IT coincides with "Great Moderation"

    o As output volatility falls, denomination of correlation
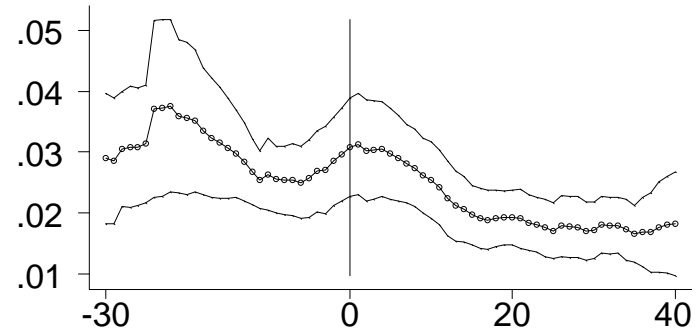
      coefficient falls mechanically
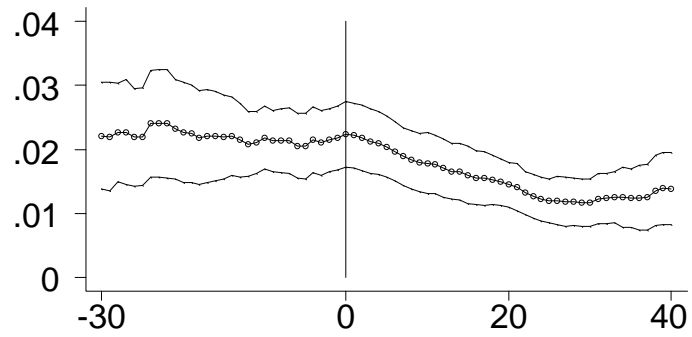
HP Detrending
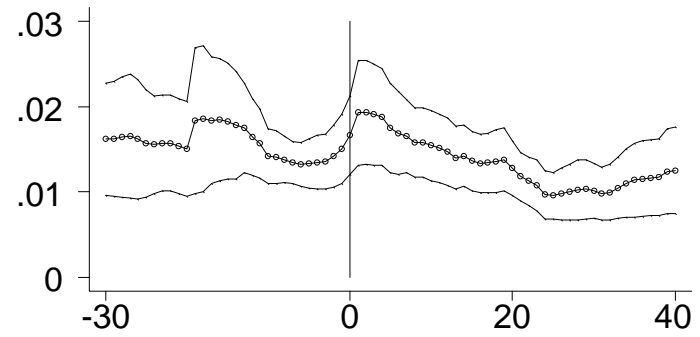
BK Detrending

Growth Detrending

Linear Detrending

GDP Standard Deviation around IT Entry

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But Covariances seem generally to *rise*!

Treatment (number)	IT, any (1041)	IT, any (1041)	IT, any (1041)	IT, any (1041)	IT, any (1041)	IT, Fix/MU (276)
Control (number)	Any (5038)	Fix or MU (469)	Fix (267)	Fix or MU* (3185)	No fix or MU (1853)	Fix or MU (478)
HP	-.000 (.001)	-.001 (.001)	-.002 (.001)	.001 (.001)	-.002 (.001)	.001 (.001)
BK	.003** (.001)	.001 (.001)	.000 (.001)	.003** (.001)	.003** (.001)	.002 (.001)
Linear	.008** (.002	-.002 (.003)	-.004 (.004)	.006** (.002)	.009** (.003	-.003 (.003)
Growth	53** (19)	23 (24)	-10 (29)	58** (15)	45 (23)	24 (15)

Coefficients, standard errors, multiplied by 100

So Rise in BCS Associated with IT remains a Mystery

- Countries surprised by type of shocks?

- Countries choose non-optimally?

    o Need more structural investigation (here reduced-form)

- Still, seems clear that IT has *not* resulted in general, significant

    decline in BCS

Summary: Few Monetary Strategies exist

- Currency Union

- Fixed exchange rates

- Money growth targets

- Hybrid/Ill-defined strategies

- Inflation Targets; special focus here

Inflation Targeting

- Popular, swiftly-spreading, durable monetary institution

- Much studied

    o Theoretical work on normative properties

      ▪ Ex: Benigno and Benigno, Obstfeld and Rogoff

    o Empirical work on domestic aspects of IT

      ▪ Ex: Ball and Sheridan: does IT matter for inflation?

      ▪ Ex: Siklos: did inflation process change?

- Little empirical work on international aspects of IT

Focus Here: Monetary Sovereignty

- Does IT provide insulation from foreign shocks?

- Focus is on domestic *real* phenomena

- Are business cycles less synchronized for countries that target

  inflation?

  o No; BCS seems to *rise* for countries entering IT

  o Natural comparison is countries that fix exchange rates or

    are in monetary union; also rise (reasonable!)

Conclusion

- Inflation Targeting an attractive monetary regime intrinsically

- High Business Cycle Synchronization desirable for Monetary

  Union (Asian or otherwise)

- If IT raises BCS (for whatever reasons), it becomes even more

  attractive monetary regime

  o Can either be way-station en route to AMU or sustainable

    permanent regime

Caveat

- Still, caution appropriate because of mysterious positive effect

  of IT on BCS