Industry Productivity Growth Cycles

EMG 2016
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Outline

- The Problem

- Solution and Methods

- Estimation and Results

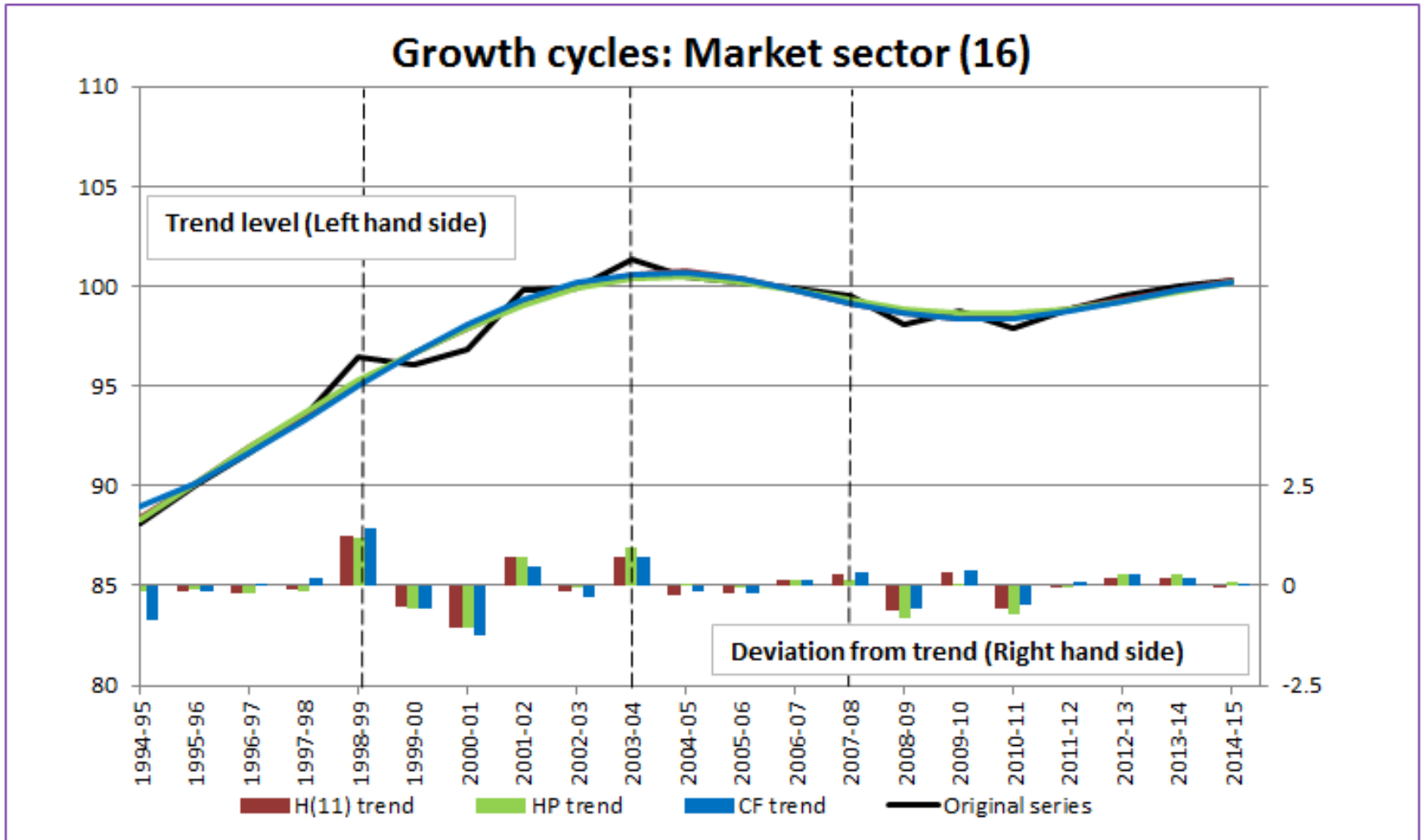- Points for Discussion

The problem

- In theory, MFP as an indicator of technological progress

- In practice, technological progress masked by many temporary influences (utilisation, noise, measurement error etc)

- These influences amplify for higher frequency data and at more granular levels (industry, state dimension)

- A key influence is (unobserved) variation in utilisation rates.

- Changes in utilisation unaccounted for in inputs and noise effects can mask true growth patterns, hard to interpret

Solution 1: growth cycles

- Taking into account these factors (no reliable utilisation rate data!), MFP is probably most useful when viewed as average growth rates between growth-cycle peaks

- We determine growth cycles with reference to peak deviations from long-term trend MFP

  - Available for aggregates (12 and 16 industries)

  - Trend estimated using Henderson 11

Aggregate growth cycles

Growth cycles: Market sector (16)

Trend level (Left hand side)

Deviation from trend (Right hand side)

H(11) trend   HP trend   CF trend   Original series

Dampening utilisation distortion

- Usually, capacity utilisation is high during times of strong economic growth, but inputs become underutilised as economic activity declines.

- By matching years when capacity utilisation is at its highest, growth cycles compare productivity growth when economic activity is at a maximum (i.e., at the peaks).

- The peaks provide the basis for more consistent comparisons by netting out variations between the peaks.

Solution 2: Growth accounts

- Productivity growth accounting framework improves interpretability by:

    - Weighting contributions by their income share

    - Showing the key "drivers" of output growth (contributions to growth are additive)

    - Reducing distortions in MFP from short term volatility and variations in utilisation rates

More granular growth accounts

- Extended the growth accounts:
  - KLEMS growth accounts for 16 industries in datacubes 5260.055.003 & .004
  - Contributions to Market sector labour productivity from Capital Deepening and MFP in 5260.055.002
  - Contributions to Mining GVA from mineral & energy inputs, capital, labour & MFP in .002
- Increased granularity (volatility !)

Determine growth cycle peaks

- For aggregates, Henderson 11 term symmetrical filter
- For industries, three filters:
  - Henderson (11) cubic weighted least squares with weights chosen to minimise the sum of squares of their 3rd differences (the smoothing criterion). Symmetrical with surrogates at endpoints

  - Hodrick-Prescott (1997) a high pass filter used to separate the series into trend and cyclical components through the solution of the constrained minimisation problem

  - Christiano and Fitzgerald (2003) a finite length linear band-pass filter that that minimises the mean squared error between the original and filtered series

Defining the peaks…

- A peak is considered to be "robust" if it is identified by the three filters and:

  - Shows positive deviations ≥ 1%, peaks four or more years apart (95% of cycles met this rule)

  - Deviations < 1% next to a neighbouring trough, four or more years apart (5% of cycles met this rule)

- Some peaks were discarded (too close together)

Growth cycles: Manufacturing

Legend: H(11) trend | HP trend | CF trend | Original series
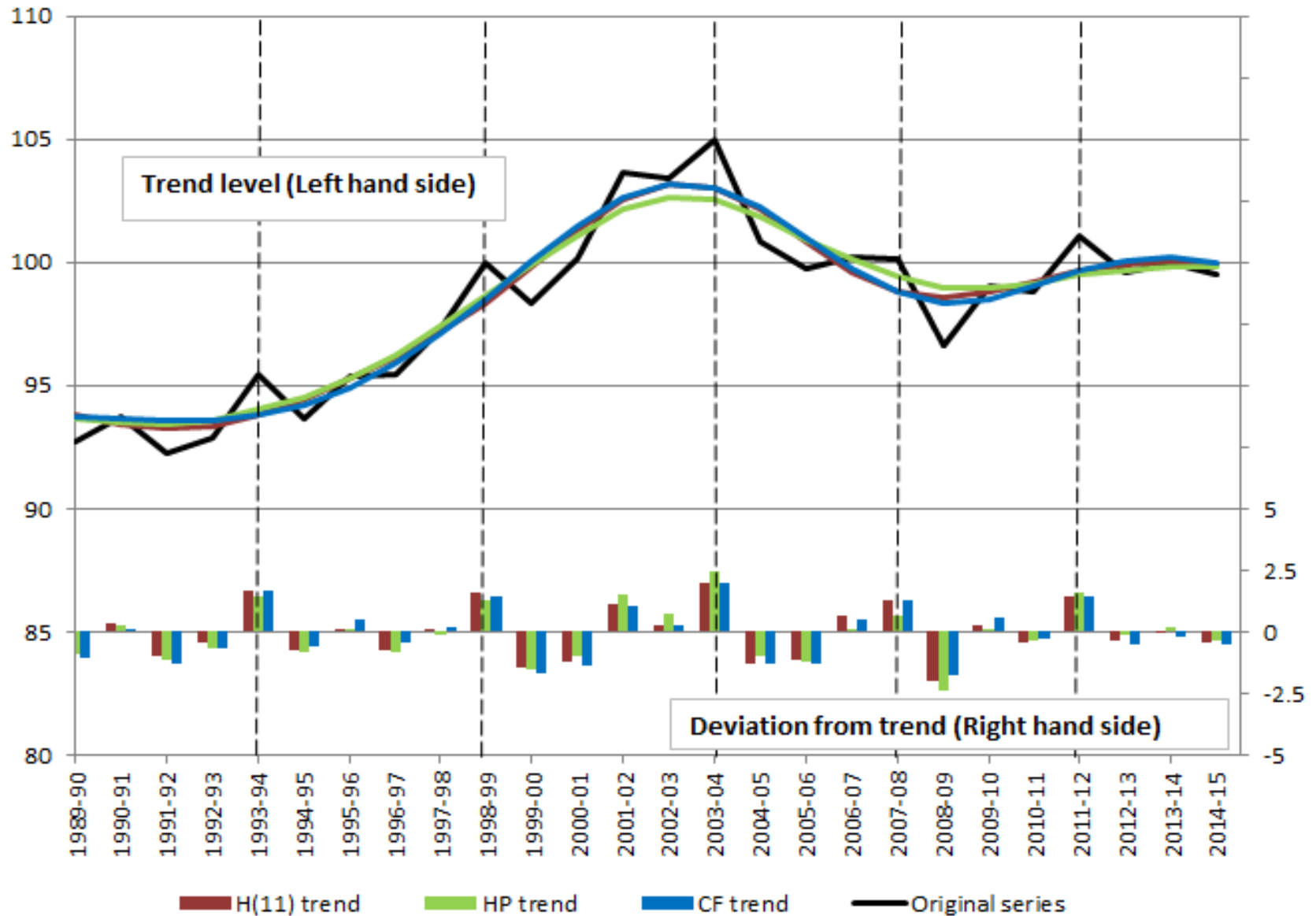
Key Findings

- Only two industries had cycles aligning with aggregate cycles (2 cycles in Manufacturing & 2 cycles in Info, media & telco)
- 2 to 5 cycles per industry (Half (8) of the industries have 4 cycles
- Longest cycle: Professional, scientific (12 years)
- Shortest cycle: 4 Years (common place)

- Considerable variation in industry cycles, confirms Barnes (PC, 2011). Caution using standardised averaging !

	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
AGRICULTURE		■			■			■				■					■									
EGWWS		■							■			■						■						■		
MINING			■				■											■			■					■
ARTS & REC				■							■					■					■					
RETAIL				■				■				■			■						■					
RENTAL & HIRING						■				■				■				■					■			
TRANSPORT, POSTAL					■			■							■			■					■			
WHOLESALE						■			■			■					■						■			
FINANCE & INSUR					■						■			■					■						■	
ADMIN & SUPPORT						■							■						■				■			
OTHER SERVICES						■					■								■							
CONSTRUCTION					■					■				■				■								
ACCOMM & FOOD	■				■					■									■							
INFO, MEDIA & TELCO			■			■				■					■							■			■	
PROFESSIONAL					■					■			■						■					■		
MANUFACTURING					■										■				■			■				
MARKET (16)																										
MARKET (12)																										

Barnes (2011)

Cap stock revisions

Sample of the study

Underlying trend criteria?

Results for underlying trend using the Augmented Dickey-Fuller test based on Schwarz Information Criterion

Industry	Trend on MFP level	Industry	Trend on MFP level
Agriculture	-4.77***	Transport, Postal & Warehousing	-1.66
Mining	-1.31	Information, Media & Teleco	-2.82*
Manufacturing	-2.08	Financial & Insurance	-4.37***
EGWWS	-2.55	Rental, Hiring & Real Estate	-2.53
Construction	-3.53	Professional, Scientific & Technical	-4.17***
Wholesale Trade	-1.89	Administrative & Support	-2.20
Retail Trade	-5.03***	Arts & Recreation	-2.94*
Accommodation & Food Services	-2.26	Other Services	-2.24

no stars: Not rejected at 10% level of significance.

* : Rejected at 10% level of significance

**: Rejected at 5% level of significance.
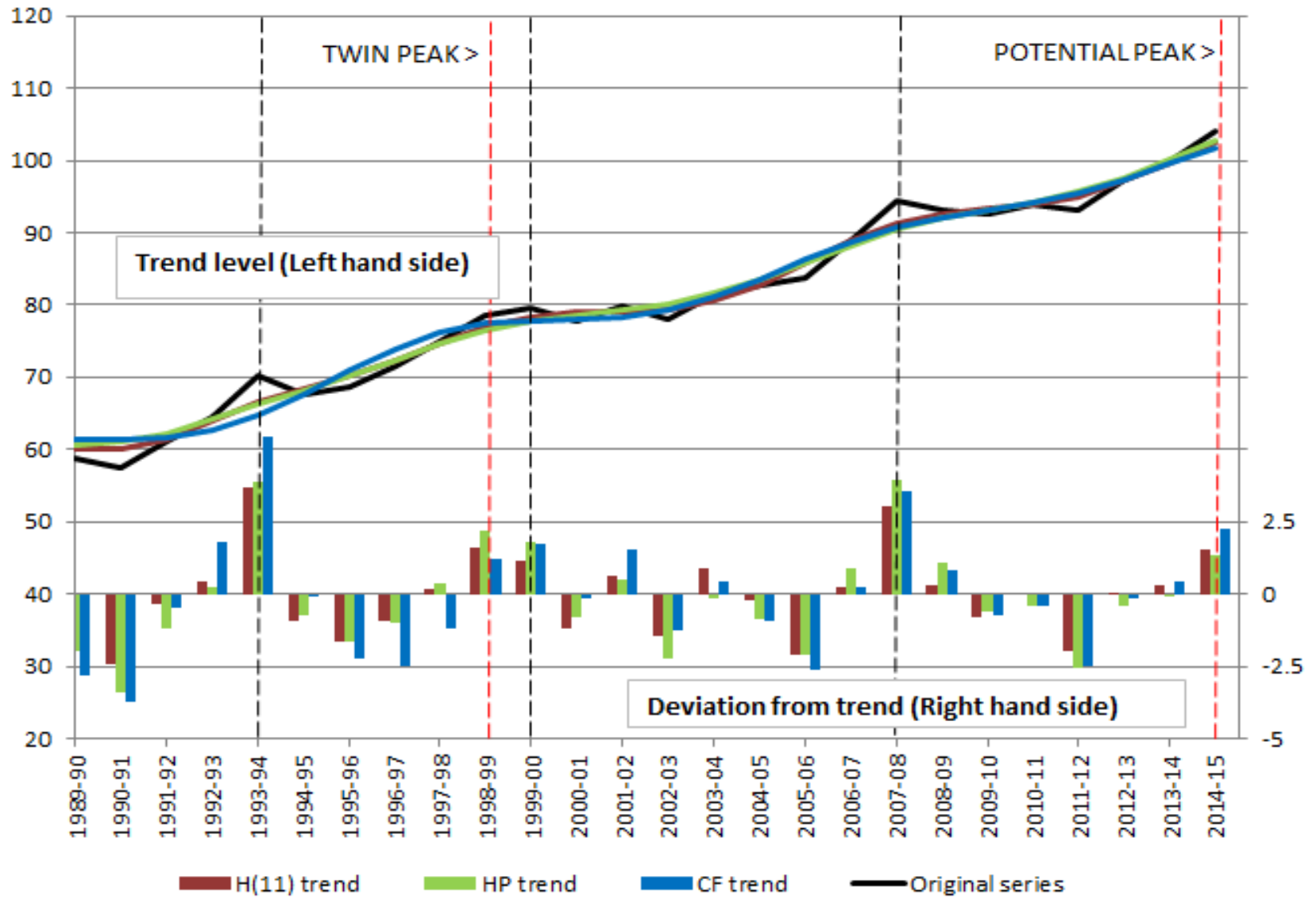
*** : Rejected at 1% level of significance.

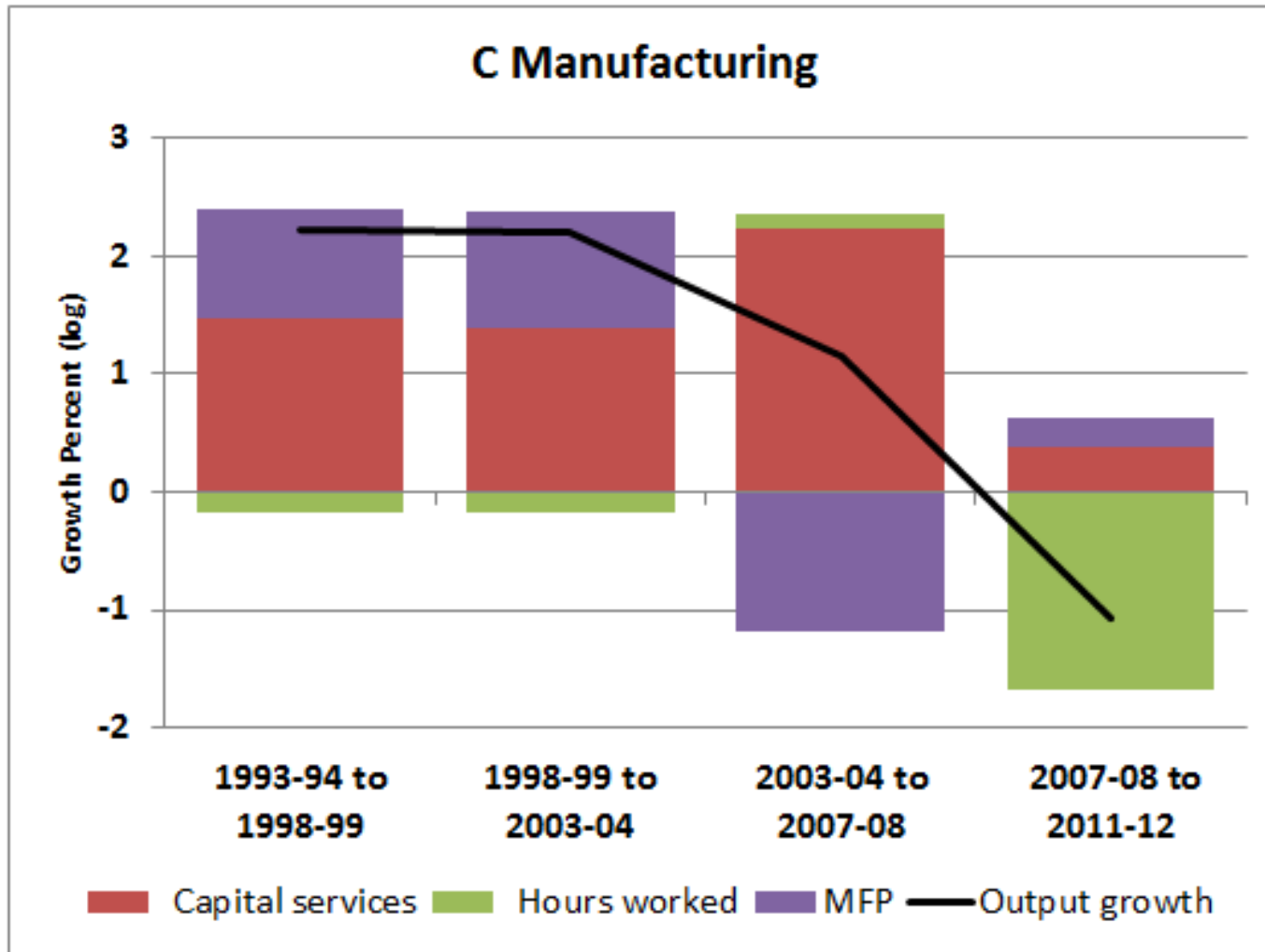**Growth cycles: Arts and recreation services**

Trend level (Left hand side)

Deviation from trend (Right hand side)

Legend: H(11) trend — HP trend — CF trend — Original series
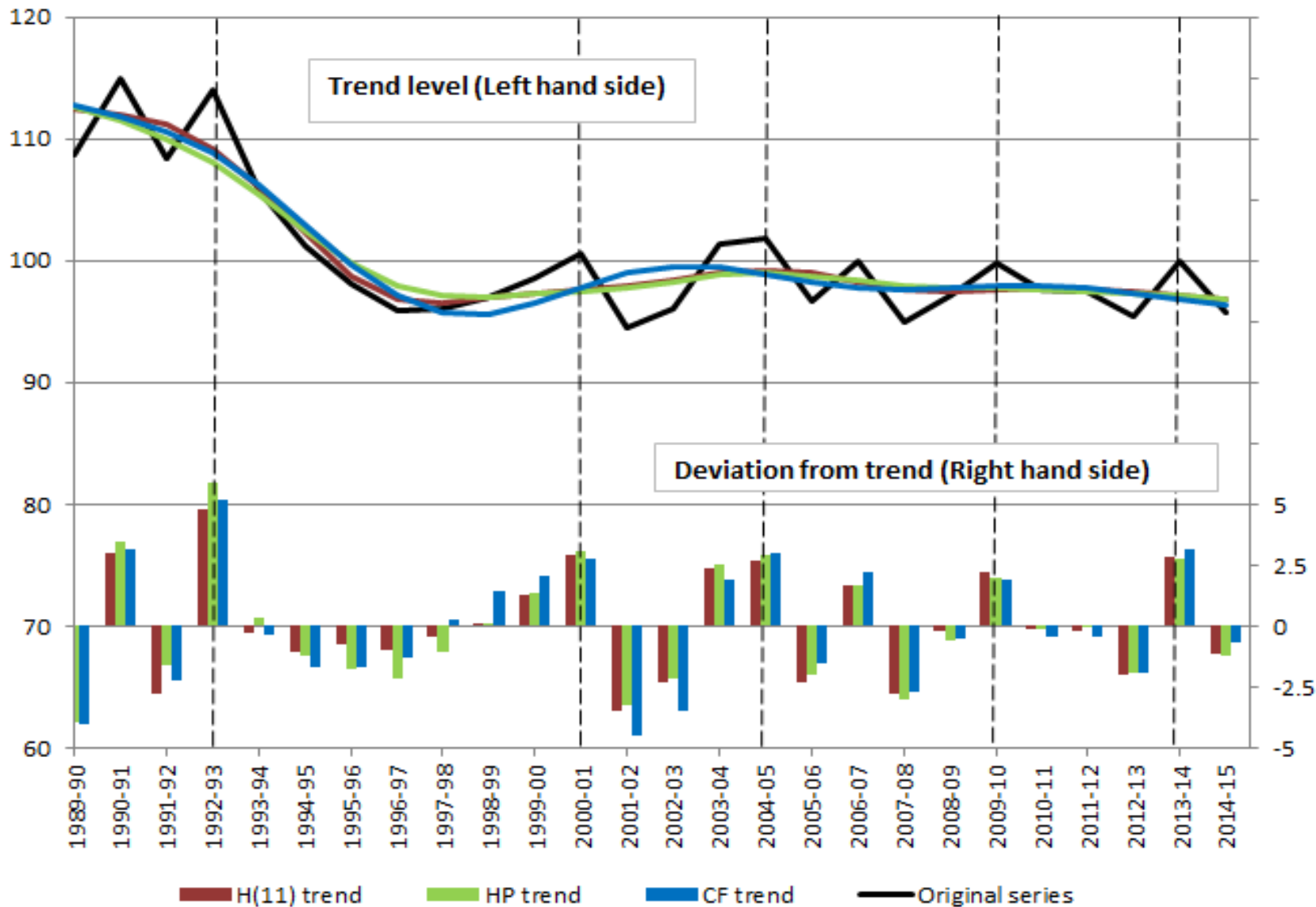
Growth cycles: Rental, hiring & real estate services
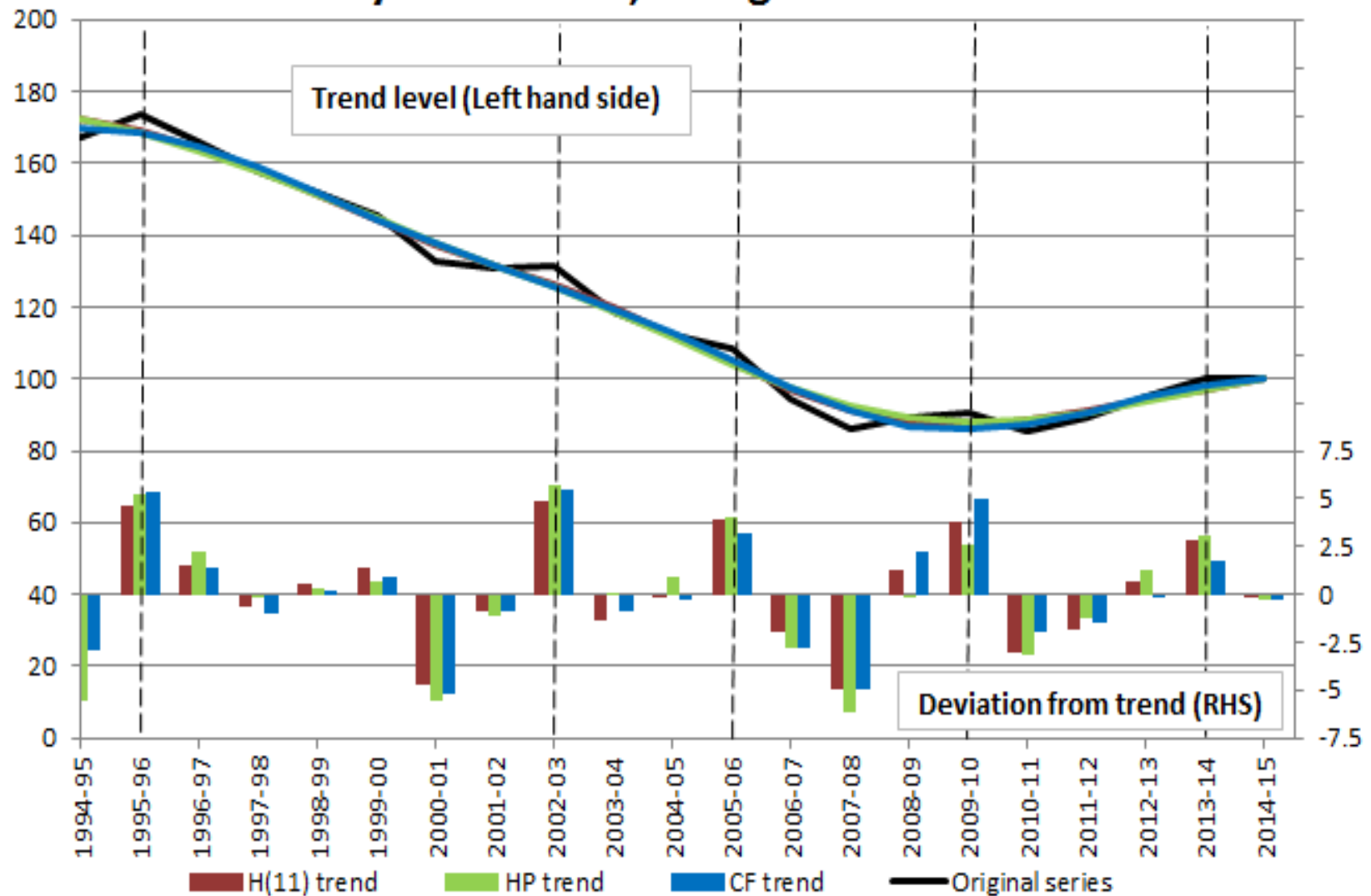
Growth cycles: Finance & insurance services

TWIN PEAK >

POTENTIAL PEAK >

Trend level (Left hand side)

Deviation from trend (Right hand side)

Legend: H(11) trend — HP trend — CF trend — Original series

Growth Cycle Results

C Manufacturing

Growth Cycle Results…

A Agriculture, Forestry and Fishing

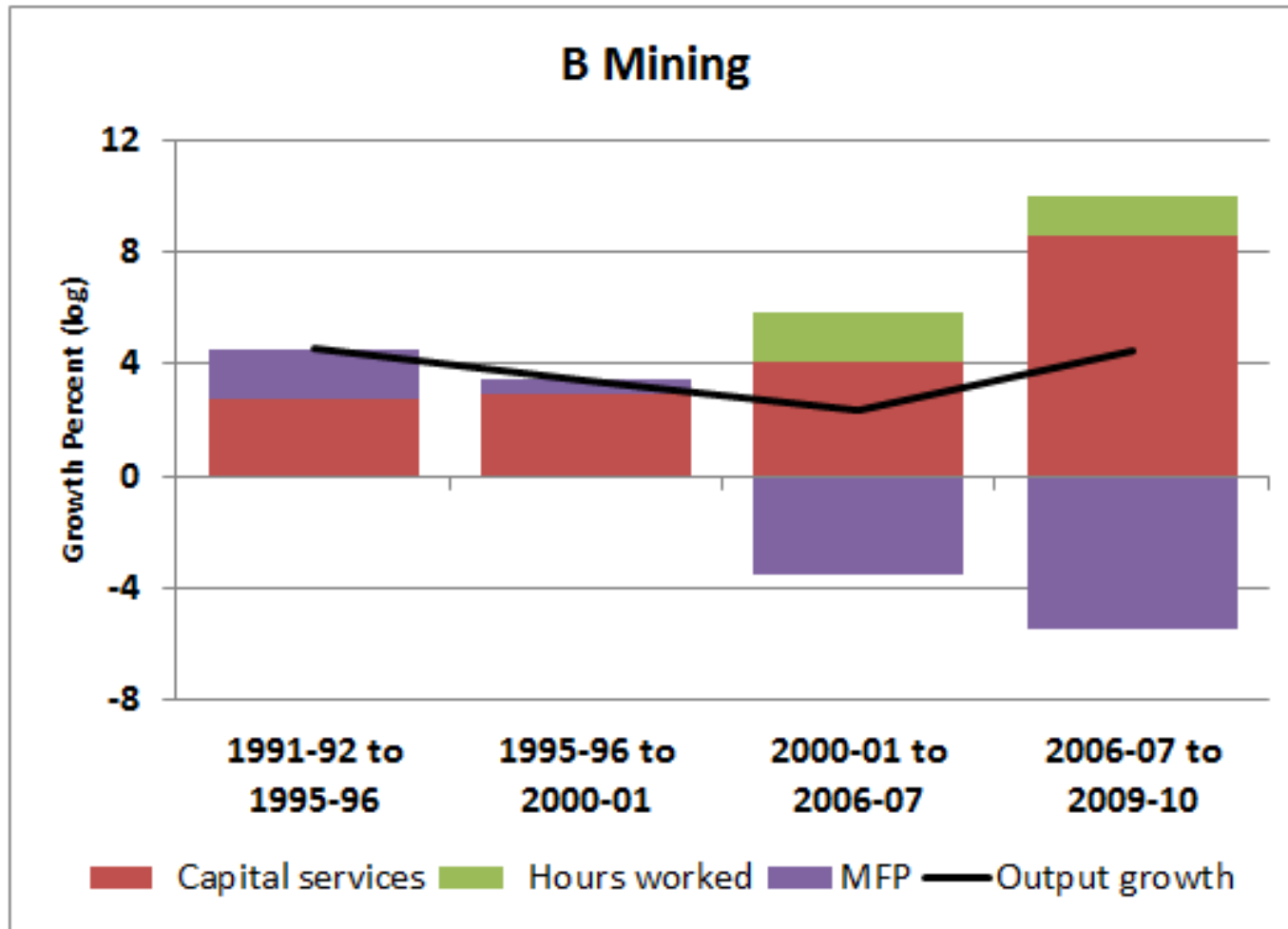# Growth Cycle Results…

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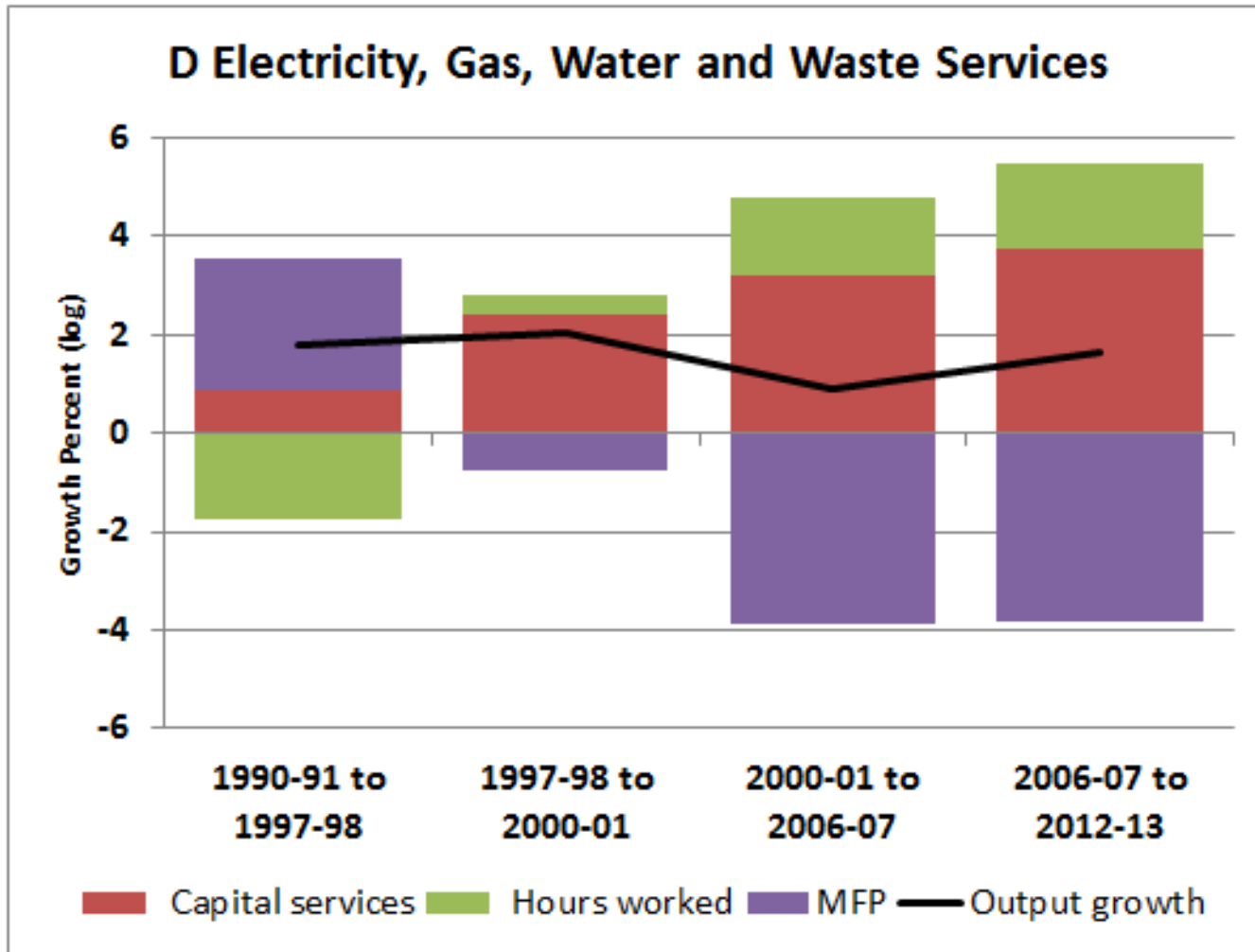
Conclusions

Overall, the industry growth cycle results show that

- Growth cycles vary considerably at the industry level, helping to reveal the diversity across industries

- Growth accounts for growth cycles are a useful tool for analysing drivers of growth with (potentially) less distortion from utilisation

- Supports the industry policy analyst in uncovering 'real world' industry growth patterns

- Care needs to be taken when applying a standardised averaging method across all industries (like 5 year averages).