

ESRI INTERNATIONAL CONFERENCE 2018

STRUCTURAL CHANGE

AND BUSINESS CYCLE FLUCTUATIONS

PART 1

Tokyo, 31 July 2018

Satoshi URASAWA
ESRI, Cabinet Office



Research Questions

- 1st question:

Have there been any changes in the nature of business cycle patterns in the wake of structural changes in the economy?

- Examine the relationships among various macroeconomic time series and changes in these relationships using traditional frequency domain analysis.

*Note: business cycles are represented by the cyclical component of real GDP.

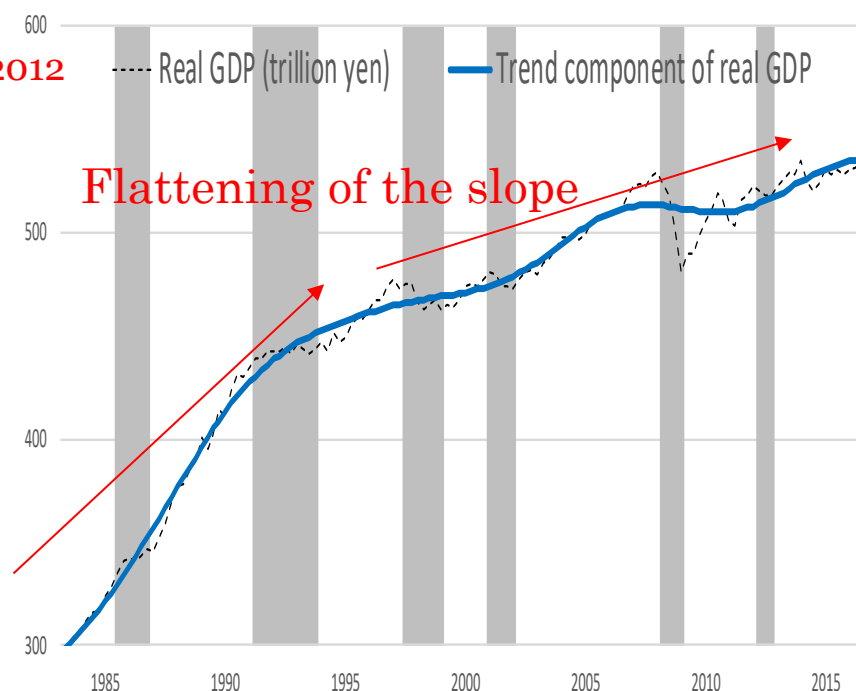
- 2nd question:

1. Are there any economic structural changes (changes on parameters of DFM) in Japan?
2. Is there business cycle indicator that is robust to economic structural changes?
 - Employ a robust statistical test to detect changes in business cycle patterns using a dynamic factor model (DFM).

*Note: business cycles are measured by the common component of GDP estimated from the macroeconomic indicators.

Brief Overview of the Japanese Economy

- Japan's business cycles fluctuate with some regularity.
- Meanwhile, the overall trend of the economy shows a deceleration in GDP growth from around the mid to late 1990s.



Notes:

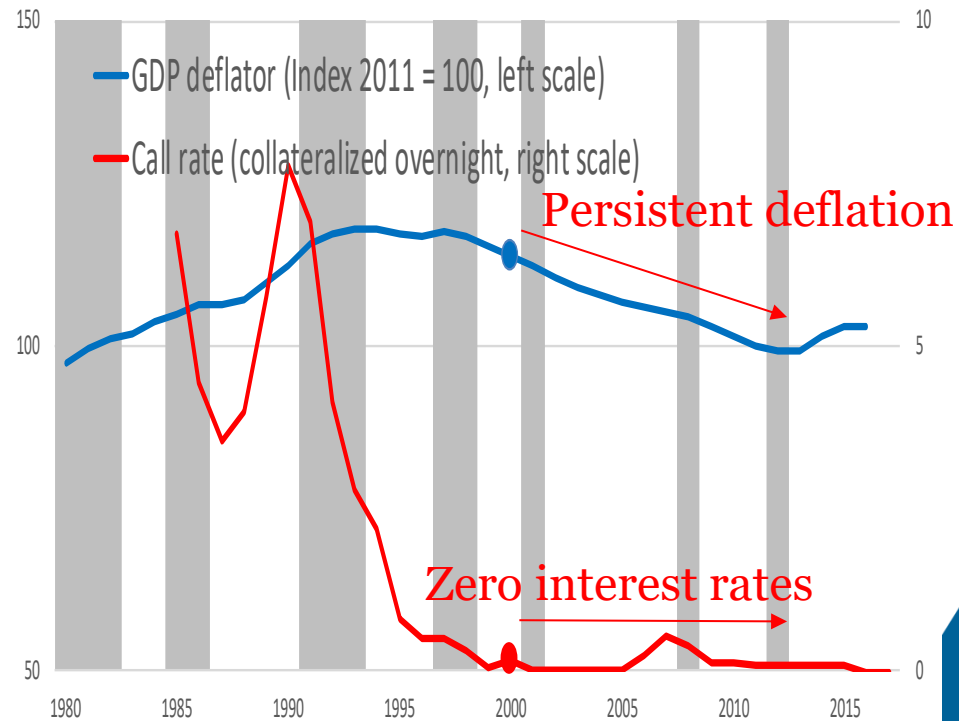
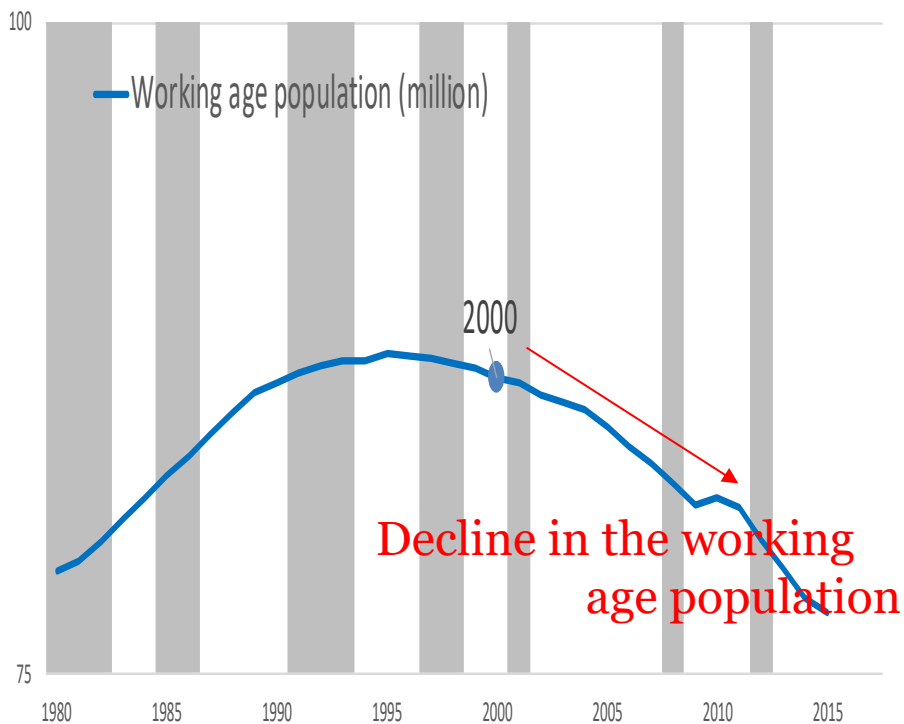
1. The business cycle is defined as the cyclical component of real GDP falling within a range of 6 to 32 quarters. The figure shows the business cycle component obtained using the BP filter (left). The broken line shows real GDP (trillion yen), while the solid line shows the trend component of real GDP obtained using the BP filter (right).
2. Shaded areas represent recessions as officially identified by ESRI.

Structural Changes in Japan

- The decline in the trend growth rate of the economy reflects a host of structural changes.
 - What are the implications for Japan's business cycle patterns?
- The 1st study investigates developments in Japan's business cycles under economic structural change, focusing on changes since the late 1990s.
- In fact, Japan's economy has experienced various structural changes since the late 1990s.

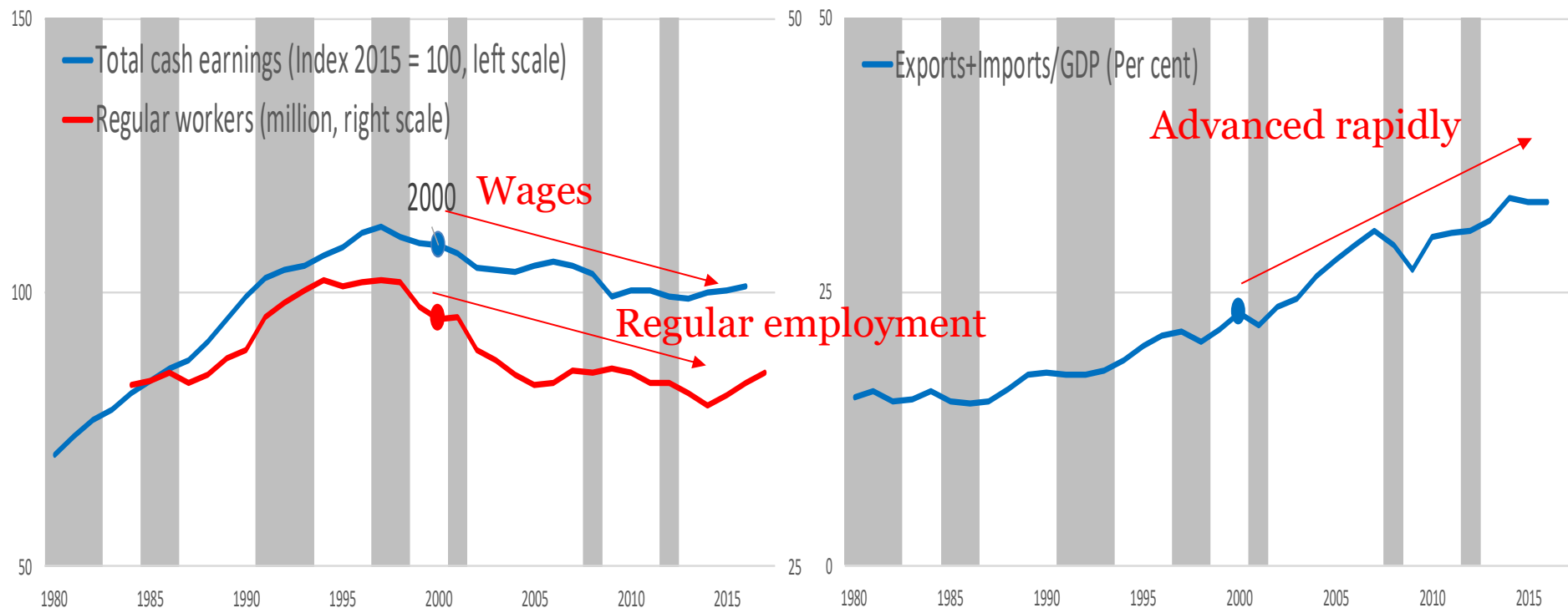
Structural Changes in Japan

- Supply side: aging and shrinking of population (left).
- Demand side: persistent deflation and zero interest rates (right).



Structural Changes in Japan

- Labor market:
Wages have fallen and regular employment has decreased (left).
- Globalization has continued to advance rapidly (right).



Analytical Framework

- Japan's economy experienced substantial structural change in the late 1990s.
 - To investigate changes in business cycle characteristics, the overall observation period from 1980 to 2016 will be divided into two sub-periods:
 - Period before 2000 (“period before structural change”); 1980Q1 to 1999Q1
 - Period from 2000 (“period after structural change”); 1999Q1 to 2016Q3
- *1999Q1 represents the beginning of Japan's 13th postwar business cycle
- Then, the nature of business cycles during each of the periods is characterized and compared.

Analytical Framework

- To empirically characterize business cycle fluctuations based on macroeconomic time series, a band-pass filter is applied.
 - More than 60 macroeconomic time series are employed:

GDP demand components, aggregate employment, wages, deflators and prices, interest rates and stock prices, money, exchange rates, and overseas economies
 - Several conventional statistics are examined:

Standard deviation

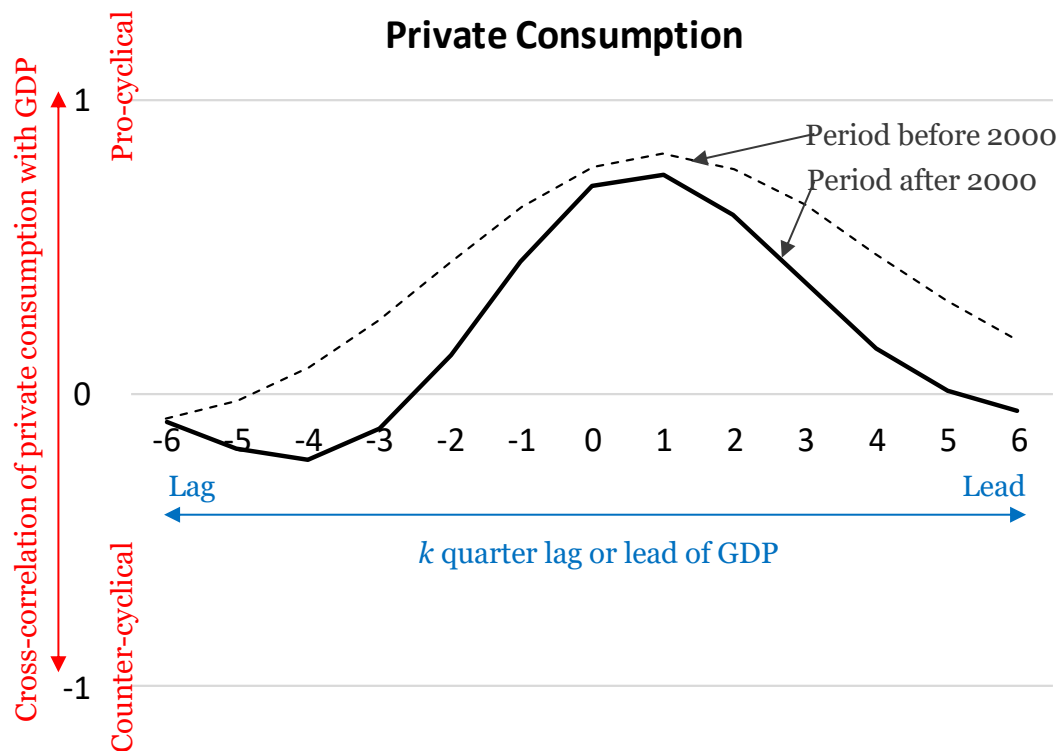
First order auto-correlation of the cyclical component of each series

Six orders of cross-correlation of the cyclical component of each series with the cyclical component of real GDP

*Notes: The standard deviation and the cross-correlation of each series measure the size of the variation and the strength of its correlation with the BC, respectively, assuming that series are pro-cyclical if their cross-correlation is positive and counter-cyclical if their cross-correlation is negative; moreover, series are said to lag the BC if their maximum correlation lags real GDP observations.

Changes in Business Cycle Characteristics

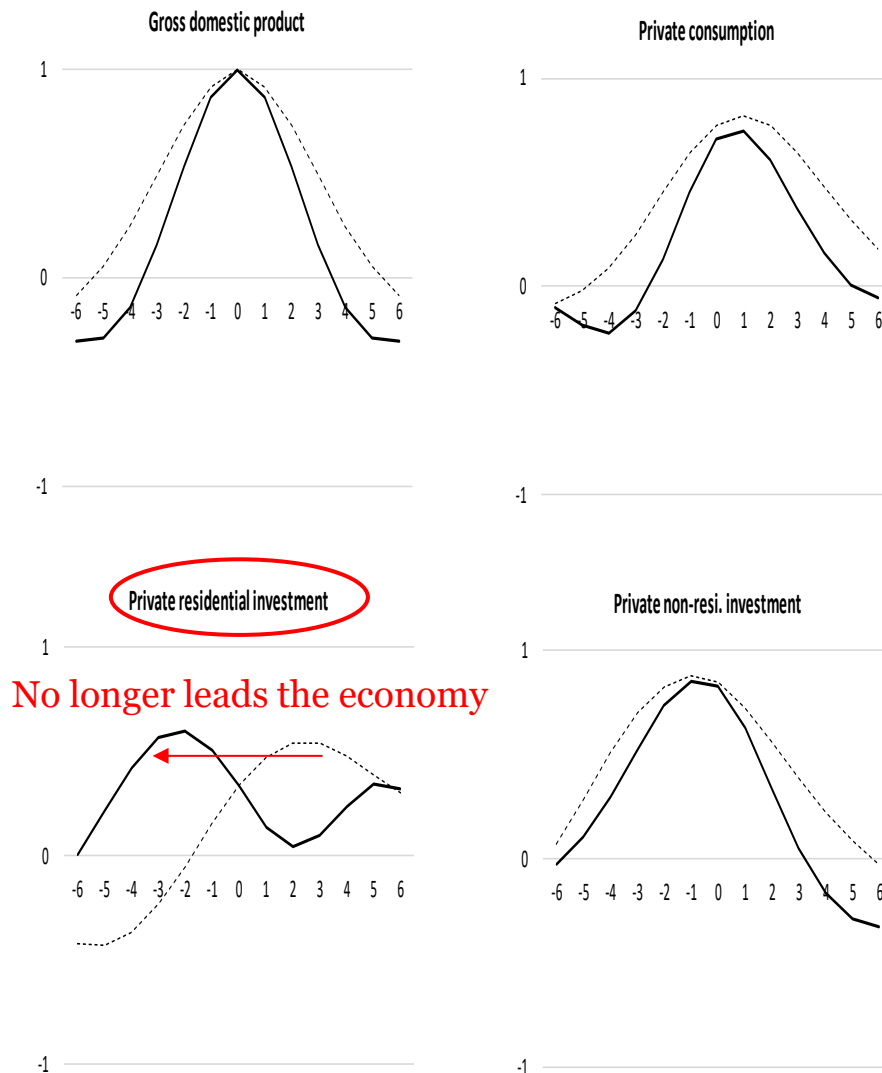
- Comparison of the cross-correlation coefficient for selected macroeconomic time series vis-à-vis the business cycle (GDP) before and since 2000.



Private Consumption

- Strongly and almost contemporaneously pro-cyclical.
- This characteristic has remained broadly unchanged.

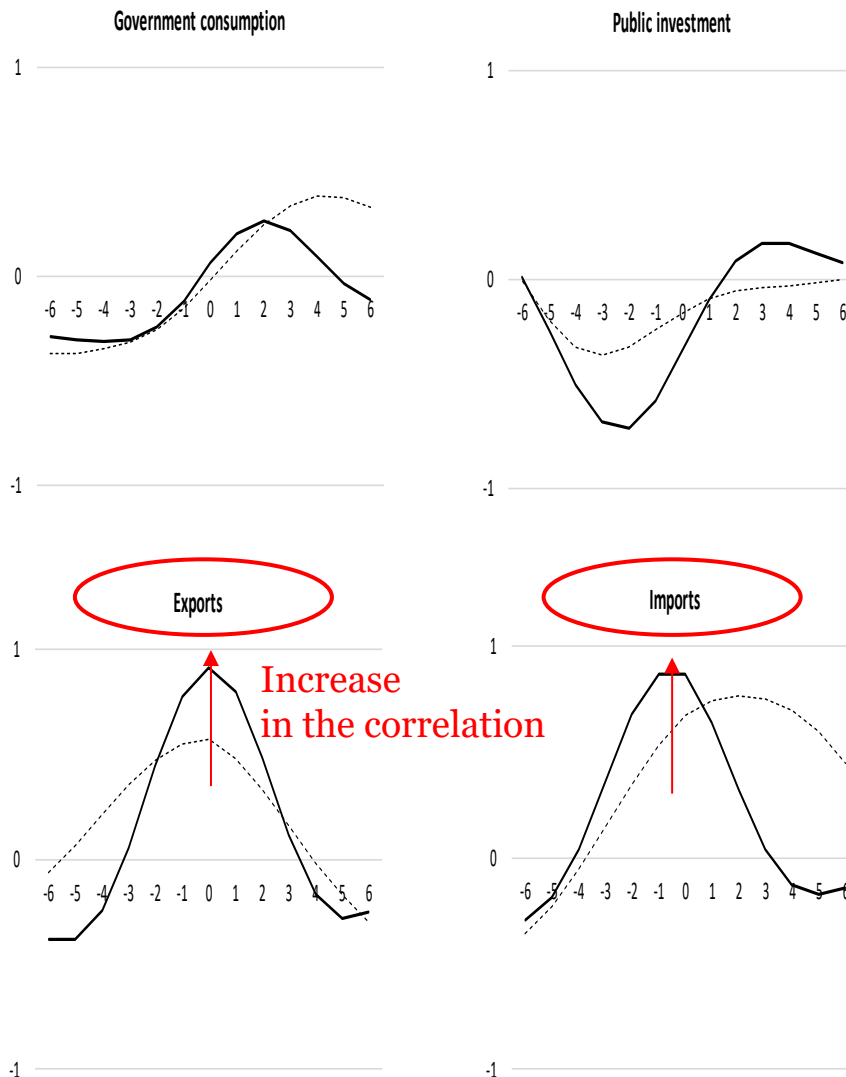
Changes in Business Cycle Characteristics



Residential investment

- It no longer leads the economy.
- Changes in the market environment such as the consistent fall in house prices since the early 1990s.
- Institutional factors are also likely to have played a role, given that the promotion of housing construction has served as a pillar of stimulus measures by the government.

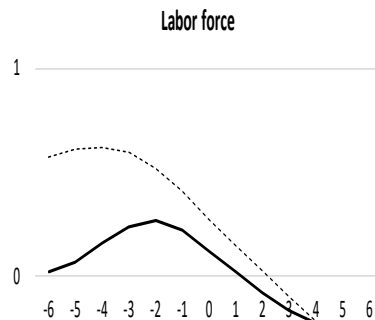
Changes in Business Cycle Characteristics



Exports and Imports

- An increase in the correlation with the business cycle, reflecting the fact that as a result of further advances in globalization, economic ties among countries around the world have continued to strengthen.
- This appears to result in a stronger impact on developments in Japan's domestic economy.

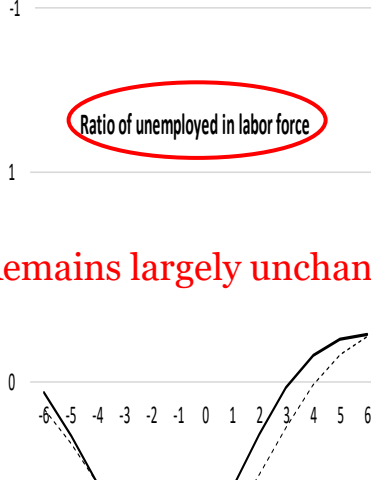
Changes in Business Cycle Characteristics



The correlation for longer lags has decreased

Unemployment rate

- The link remains largely unchanged.

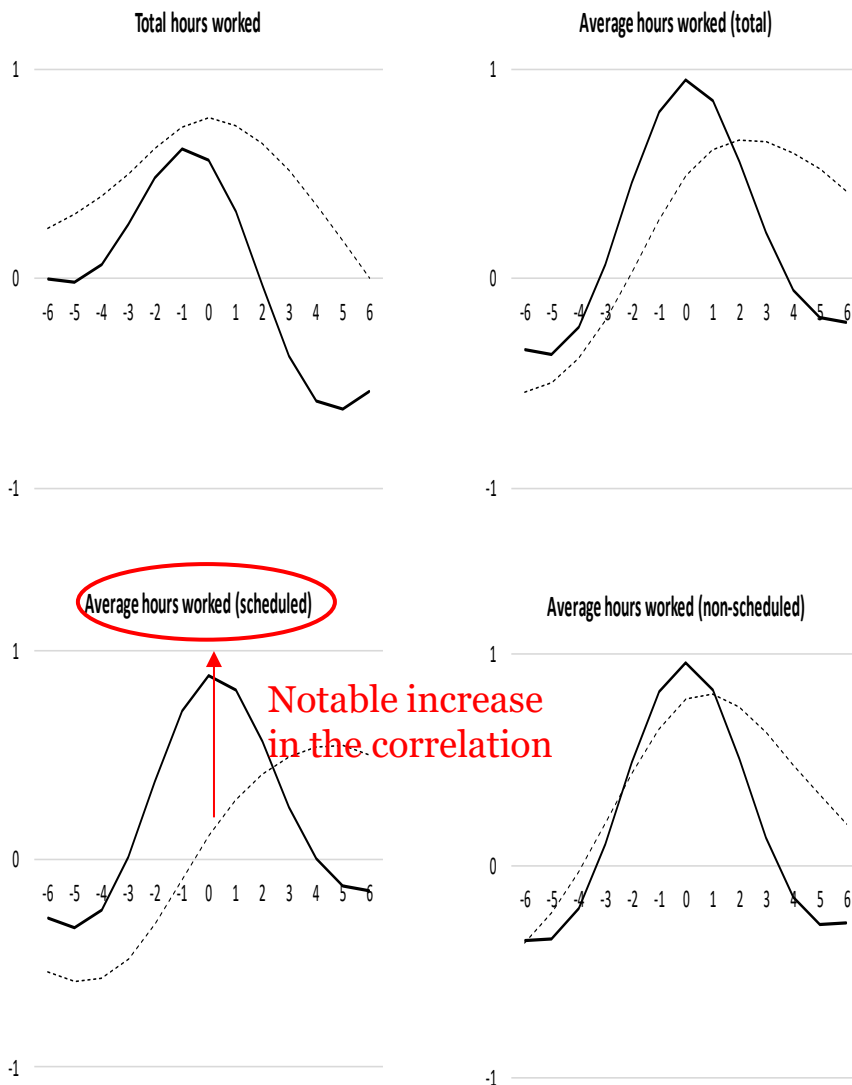


Remains largely unchanged

Total employed/Employees

- While the strength of the correlation with the business cycle at the peak, as well as the timing of the peak of about 2-3 quarters behind the business cycle, are generally unchanged, in both cases the correlation for longer lags has decreased.

Changes in Business Cycle Characteristics



Scheduled hours worked

- A notable increase in the correlation, suggesting that scheduled hours worked play an increasingly important role as a buffer to adjust labor input.
- The increased role of adjustments in hours worked largely reflects the increase in part-time workers, whose hours worked can be adjusted more flexibly.

See the paper for details and other series:

“Structural Change and Business Cycle Fluctuations in Japan: Revisiting the Stylized Facts,” (Satoshi Urasawa) *ESRI Discussion Paper Series*, no.341, October 2017.

http://www.esri.go.jp/en/archive/e_dis/abstract/e_dis341-e.html

Summary of the 1st study

- Have there been any changes in the nature of business cycle patterns in the wake of structural changes?
 - The frequency domain analysis comparing the periods before and since 2000 showed that
 - Particularly **notable changes in business cycle characteristics can be observed in terms of hours worked and employment** (in the area of labor input adjustment by firm).
 - On the other hand, **in most other areas, no major changes** in business cycle patterns can be observed, implying that structural change does not necessarily affect the cyclical regularities in all macroeconomic time series.

Work-in-progress research:

Business cycle asymmetries

(Outline)

- We estimate a Threshold VAR (TVAR) model to quantify the differences in propagation mechanisms in the Japanese economy between a deflationary and a non-deflationary regime.
- Our preliminary results provide evidence in favor of asymmetric spillover effects from demand shocks on economic variables such as wages and consumption.
- In contrast to the non-deflationary period, during the deflationary period demand shocks are not clearly transmitted to the economy overall due mainly to the rigidity of nominal wages.
- The findings highlight that the state of the economy also matters when we consider the nature of the business cycle.

Work-in-progress research: Business cycle asymmetries

(Technical notes on the analytical framework)

Structure of the model

Consider the following TVAR (p) model with two regimes ($j = 1, 2$) and a p^{th} order lag, assuming that there is an observable threshold variable q_t , belonging to y , which is a $(k \times 1)$ vector consisting of k observed variables:

$$y_t = \sum_{i=1}^p A_{j,i} y_{t-i} + \varepsilon_{t,j}$$

where $j = 1$ (deflationary regime) if $q_{t-d} < \gamma$ and $j = 2$ (non-deflationary regime) otherwise; γ is the value of the threshold; d is the lag of the threshold variable relevant for regime changes; $A_{j,i}$ is the matrix of coefficients of regime j and lag i . Each regime can be characterized by a variance-covariance matrix Σ_j .

Note that the model is linear within each regime, while the changes in the parameters across regimes account for non-linearities. The TVAR model can be estimated using OLS conditional on the threshold variable, q_{t-d} , the number of regimes and the order p . Given the linearity of the model within each regime, we apply conditional least squares (for all possible threshold values) and — under the assumption of a given number of regimes — we estimate the model by minimizing the sum of squares of the residuals.

Work-in-progress research: Business cycle asymmetries

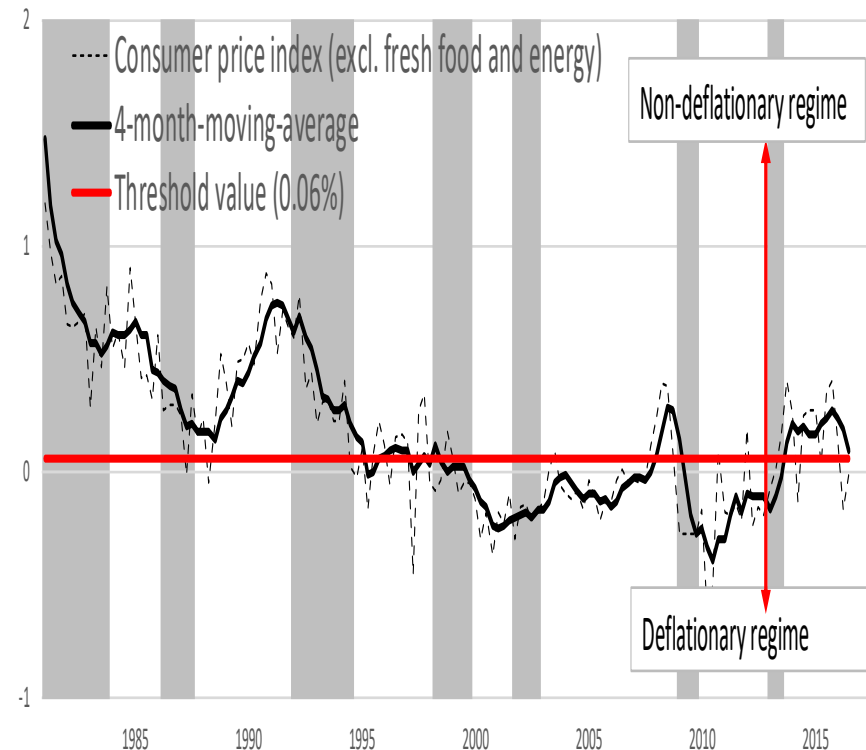
Data and settings

The TVAR model used in this preliminary study is based on four time series consisting of real GDP (GDP), nominal wages (NWG), nominal private consumption (NPC) and the consumer price index (CPI). For the estimation, data from 1980Q1 to 2016Q3 is employed using log differences. The identification of structural shocks is achieved through the recursive approach assuming that the time ordering of variables is GDP, NWG, NPC and CPI.

In our estimation, the threshold variable is assumed to be the 1st lag of CPI, and the threshold γ is assumed to be unknown parameter.

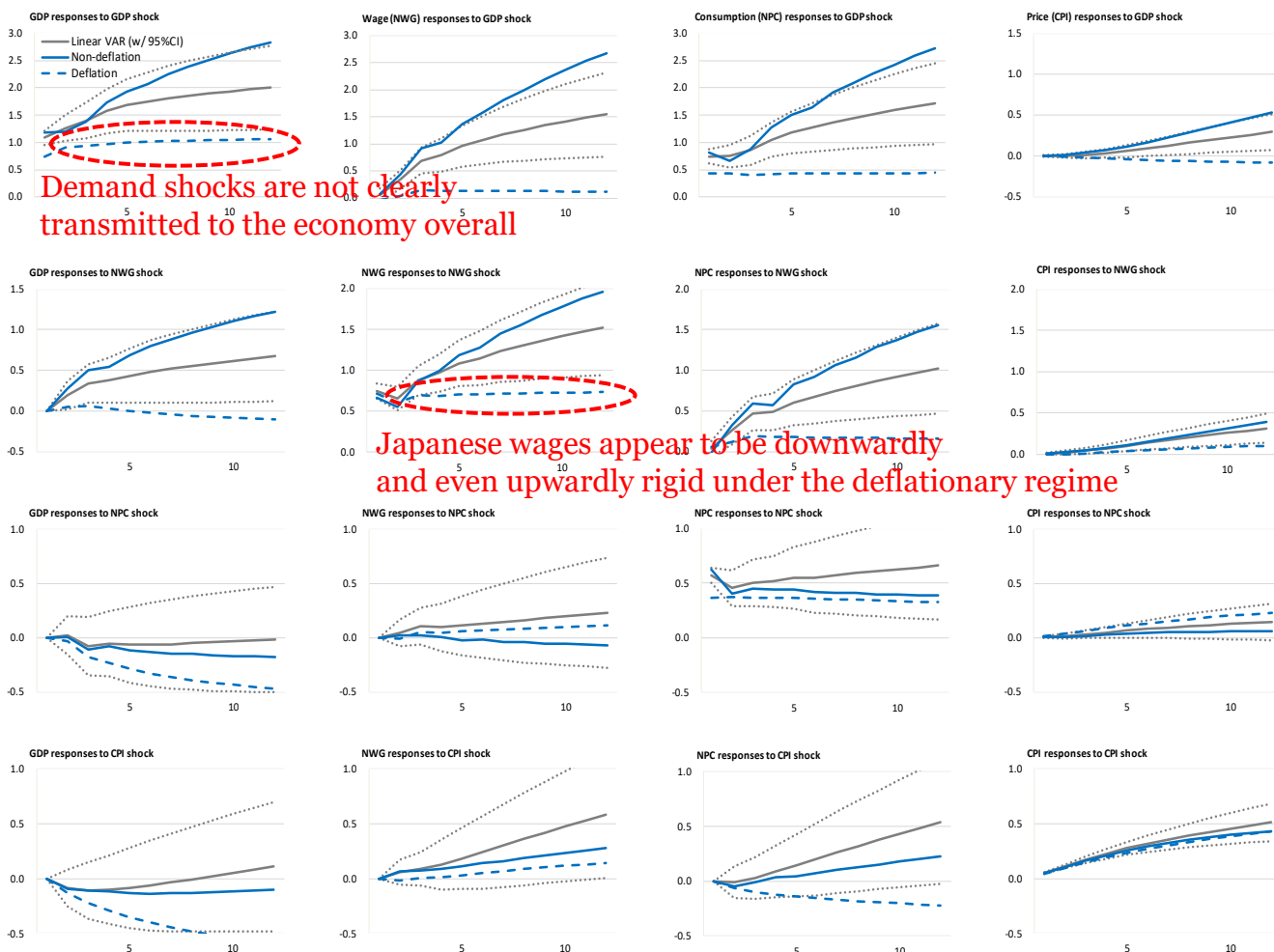
We examine the differences in propagation mechanisms between the deflationary and the non-deflationary regime, focusing on nominal rigidity. Specifically, we examine how the response of wages, consumption, and the CPI to a structural shock in GDP (demand shock) differs between the two regimes.

The model allows two ways in which the propagation of structural shocks can differ: contemporaneous via differences in covariance matrices for disturbances; dynamic via differences in lag polynomials.



Work-in-progress research: Business cycle asymmetries

(Preliminary results)



The response of GDP to a demand shock is weaker in the deflationary regime, indicating that the propagation mechanisms differ between the deflationary and the non-deflationary regime.

A likely explanation is that nominal wages appear to be downwardly and even upwardly rigid under the deflationary regime, so that they do not respond to demand shocks, resulting in weaker spillover effects on the economy through the consumption channel.

Panel: IRs to a one-standard deviation shock to GDP, NWG, NPC, and CPI in the deflationary and the non-deflationary regime, together with IRs obtained in a linear VAR.