Labor Productivity during Recession of 2008: Basic Data, Facts, and Figures[*]

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Abstract

There is controversy in the literature regarding the behavior of labor productivity in the U.S. during the recession of 2008 and its comparison with productivity dynamics during other post-WWII recessions. The objective of this project is to construct and make available a dataset with relevant series to provide the common ground for the discussion. In this note we describe the data series provided in the accompanying file and present the basic graphs summarizing the data. We compare productivity dynamics depending on (1) the data source used to measure the labor input - household survey, establishment survey, and the Labor Productivity and Costs program at the BLS; (2) the definition of the labor input - employment and hours; (3) the level of aggregation - total economy and non-farm business sector; and (4) the filtering procedures - levels, Hodrick-Prescott, and Bandpass filters.

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1 Introduction

There is a renewed interest in the literature on whether productivity driven models of the business cycle, e.g, the real business cycle model (Kydland and Prescott (1982), Long and Plosser (1983)) or the search and matching model (Mortensen and Pissarides (1994), Pissarides (1985, 2000)) are consistent with key business cycle facts. One critique of this class of models, articulated in, e.g., Hall (2007), is that while productivity shocks are the driving process of business cycles in the model, at least the 1990-1991 and 2001 U.S. recessions were not driven by a drop in productivity. Similar argument was made for the recession of 2008 (e.g., Mulligan (2009)).

The issue became a matter of considerable debate and some confusion because different data series and procedures are employed by various authors. Our objective is to construct and make available a set of data series to facilitate this debate and hopefully make the path toward consensus easier.

Some of the key data and measurement choices that affect the behavior of productivity are as follows:

i) The source of labor input data. There are three major and widely used sources available. The Current Population Survey (CPS, often also referred to as the "household survey"), the Current Employment Statistics (CES, often also referred to as the "establishment survey"), and the data constructed by the Labor Productivity and Costs (LPC) program of the Bureau of Labor Statistics (BLS) that combines data fron the establishment and household surveys. It is well known that these surveys diverge occasionally but not independently of the business cycle conditions (see, e.g., Hall (2008), Hagedorn and Manovskii (2010)).

ii) The definition of the labor input. Two measures are commonly used - employment or hours. The frictionless models typically use output per hour as the measure of labor productivity. In the literature on business cycle behavior of models with search frictions output per worker represents a more typical choice (because search is typically modeled as finding a worker and not an extra hour). These two series behave somewhat differently, especially depending on the source of the labor data.

iii) The patterns are also affected by the choice of the sector under consideration. Some authors consider productivity of the aggregate economy while others consider the non-farm business sector only.

iv) Finally, different filtering procedures are often employed with some authors presenting data in levels while the more typical choice is to consider the deviations of productivity around a trend. The trend is usually defined using the Hodrick-Prescott filter (Prescott (1986)) or the bandpass filter (Baxter and King (1999)). Since the properties of the filters differ, especially, towards the beginning and the end of the series the results might be affected by the procedure used.

The accompanying data set contains all combinations of the series given the choices described above with the only exception of the data from the establishment survey (CES) which will be added shortly. This is important because some of the data series, in particular, those based on the CPS are based on the underlying micro data and are not readily available to researchers.

In what follows we describe the data sources and the variable construction procedures. We also provide a basic set of graphs describing the behavior of labor productivity during post-war recessions including the recession of 2008. The figures are arranged in the following order.

i) Figures 1 through 3 compare productivity measured as output per worker in the nonfarm business sector based on the CPS and LPC for three filtering procedures, levels, HP, and BP filters, respectively.

ii) Figures 4 through 6 compare productivity measured as output per worker for the non-farm business sector and aggregate economy for three filtering procedures, levels, HP, and BP filters, respectively. Employment data is from the CPS only.

iii) Figures 7 through 9 compare productivity measured as output per hour in the nonfarm business sector based on the CPS and LPC for three filtering procedures, levels, HP, and BP filters, respectively.

iv) Figures 10 through 12 compare productivity measured as output per hour for the non-farm business sector and aggregate economy for three filtering procedures, levels, HP, and BP filters, respectively. Data on hours worked is from the CPS only.

We abstain from drawing conclusion here except for offering several basic observations immediate from the figures presented below.

- The behavior of productivity in the 2008 recession does not appear strikingly unusual or or very different from, say, the 1981-1983 recession. More generally, for every recession since the mid-1980s one can easily find a recession from the earlier period with similar properties of labor productivity.

- Labor productivity defined with labor input from the CPS declines more during recession than productivity defined with labor input from the LPC. This pattern is particularly pronounced with output per worker.

- The rebound in productivity after the 2008 recession was somewhat sharper than usual, although the rebound is typically sharp after a deep recession, e.g., 1983.

- As expected, in all recessions output per worker declines more than output per hour.

- The filtering procedure makes relatively little difference for comparing across various samples and data sources.

We would be grateful if those who find our data useful and use it in their own research would acknowledge its source.

2 Data File Description

In this section we provide definitions, details of construction, and sources for the data in the accompanying file *labor_productivity.xls*. Last updated: 9/4/2010.

In what follows CPS stands for the Current Population Survey. LPC stands for the Labor Productivity and Costs program of the Bureau of Labor Statistics that provides data for employment, hours, and output data for sectors of the US economy. LPC does not provide data on the aggregate economy.

The final quarterly employment, hours and labor productivity series are contained in the three worksheets:

   i) "CPS nfb labor productivity"

     - Output for nonfarm business sector (nfb) from BLS LPC program

     - hours and employment for nfb from CPS monthly files

   ii) "CPS all labor productivity"

     - Output for all industries is NIPA GDP

     - CPS hours and employment for all industries (all) based on published CPS series

   iii) "LPC nfb labor productivity"

     - standard series produced by LPC program

Details of Data Construction and Sources:

   i) "CPS nfb labor productivity"

     (a) monthly series for employment (e) "CPS_e_aw_nfb" and hours (h) "CPS_h_aw_nfb" computed from CPS monthly files; included categories:
       - nonagriculture wage and salary, other private (that is, other than private households)
       - nonagriculture, self-employed
       - nonagriculture, unpaid family
       employment status is "at work";
       resulting series stored in worksheet "CPS nfb monthly";

     (b) outliers on the low side in hours are dealt with in a similar way as in Cociuba, Prescott, and Ueberfeldt (2009): if a given monthly value is lower that 95 percent of the average of the two surrounding values, then it is replaced by this average; resulting hours series stored in worksheet "CPS nfb monthly trimmed"

     (c) quarterly averages of (trimmed) monthly data stored in "CPS nfb quarterly"

     (d) quarterly series are seasonally adjusted using Census X-12 ARIMA procedure; resulting series stored in worksheet "CPS nfb quarterly sadj"

(e) divide nfb output from LPC "LPC_y_nfb" by "CPS_e_aw_nfb" ("CPS_h_aw_nfb") to obtain "CPS_ye_aw_nfb" ("CPS_yh_aw_nfb");

LPC data was downloaded on 08/31/2010, "LPC_y_nfb" is BLS series id PRS85006043;

resulting series stored in worksheet "CPS nfb labor productivity"

ii) "CPS all labor productivity"

(a) monthly series for employment (e) "CPS_e_aw_all" and hours (h) "CPS_h_aw_all" downloaded from Simona Cociuba's web-site on 9/3/2010 and updated using BLS series (downloaded on 9/4/2010):

LNU02005054 (Unadj) Average Hours, Total At Work, All Industries,

LNU02005053 (Unadj) Number Employed, At Work;

resulting series stored in worksheet "CPS all monthly"

(b) outliers on the low side in hours are dealt with in a similar way as in Cociuba, Prescott, and Ueberfeldt (2009): if a given monthly value is lower that 95 percent of the average of the two surrounding values, then it is replaced by this average; resulting hours series stored in worksheet "CPS all monthly trimmed"

(c) quarterly averages of (trimmed) monthly data stored in "CPS all quarterly"

(d) quarterly series are seasonally adjusted using Census X-12 ARIMA procedure; resulting series stored in worksheet "CPS all quarterly sadj"

(e) output is GDP from NIPA Table 1.1.6. Real Gross Domestic Product, Chained Dollars (data published July 30, 2010, downloaded 7/30/2010);

divide output "BEA_y_all" by "CPS_e_aw_all" ("CPS_h_aw_all") to obtain "CPS_ye_aw_all" ("CPS_yh_aw_all");

iii) "LPC nfb labor productivity"

BLS series downloaded on 08/31/2010:

PRS85006013 Employment Nonfarm Business

PRS85006033 Hours Nonfarm Business

PRS85006043 Output Nonfarm Business

6

PRS85006093 Output per Hour Nonfarm Business

PRS85006163 Output per Person Nonfarm Business

3   Description of Figures

Plots cover all NBER dated recessions from 1960 to 2010. The cyan-colored areas in the plots indicate NBER recessions. The recession that started in 2007Q4 is assumed to have ended in 2009Q2.

The naming convention for the variables in plots is as follows: "Source_Measure_Sample" where

i) *Source* denotes the source of the labor input and takes values in {CPS, LPC}:
   - CPS or
   - LPC

ii) *Measure* is the labor productivity measure and takes values in {ye,yh}:
   - ye is output per worker,
   - yh is output per hour.
   In case of CPS employment and hours are for workers at work only, hence "aw" modifier.

iii) *Sample* denotes the sample used and takes values in {nfb,all}
   - nfb considers the nonfarm business sector,
   - all considers aggregate economy.

Figure 1: Output per Worker. Non-Farm Business Sector. LPC vs CPS employment data. 1960-2010. No filtering applied. Series normalized to 1 at start of the corresponding recession.
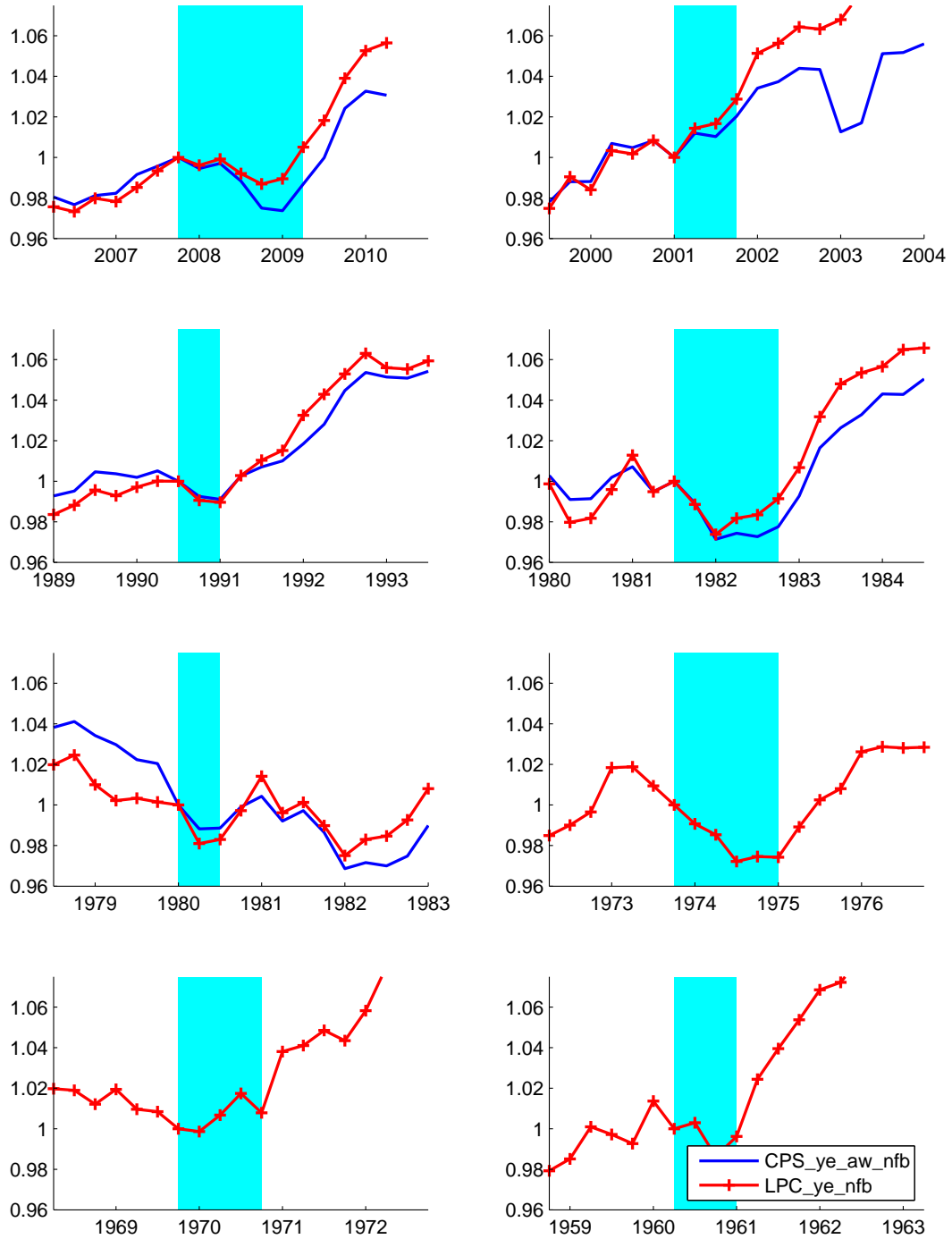
Figure 2: Output per Worker. Non-Farm Business Sector. LPC vs CPS employment data. 1960-2010. HP-Filtered (1600). Series are not normalized.
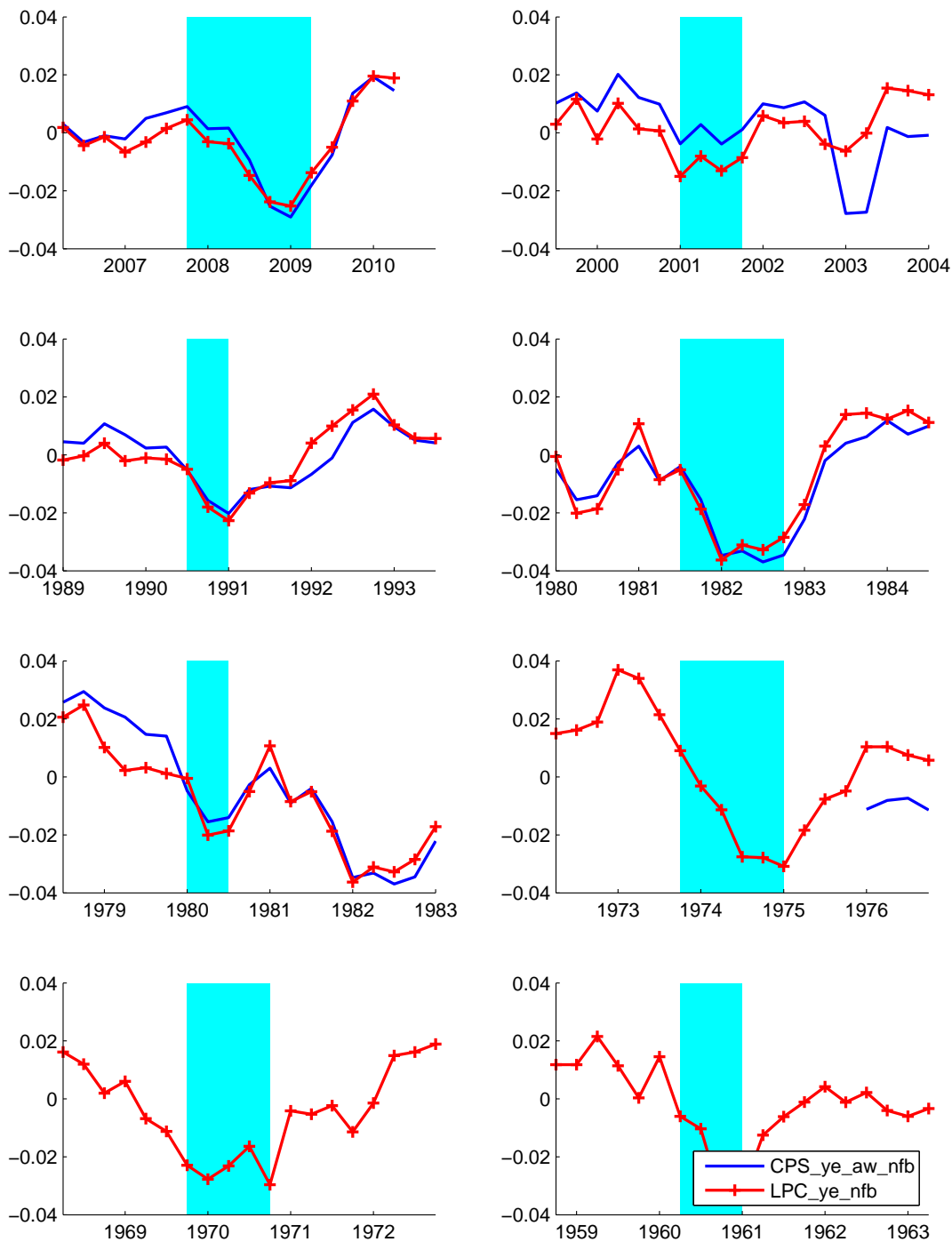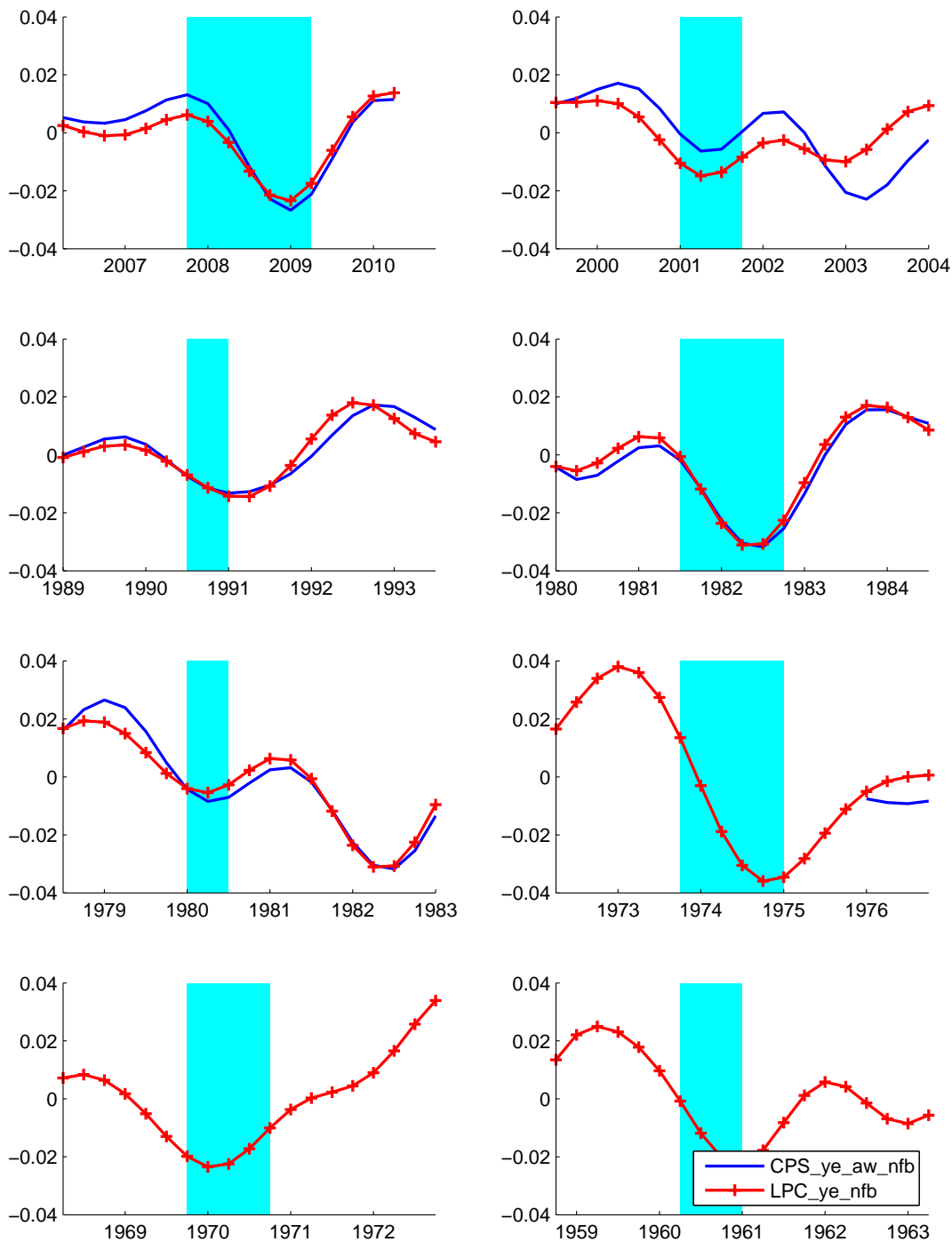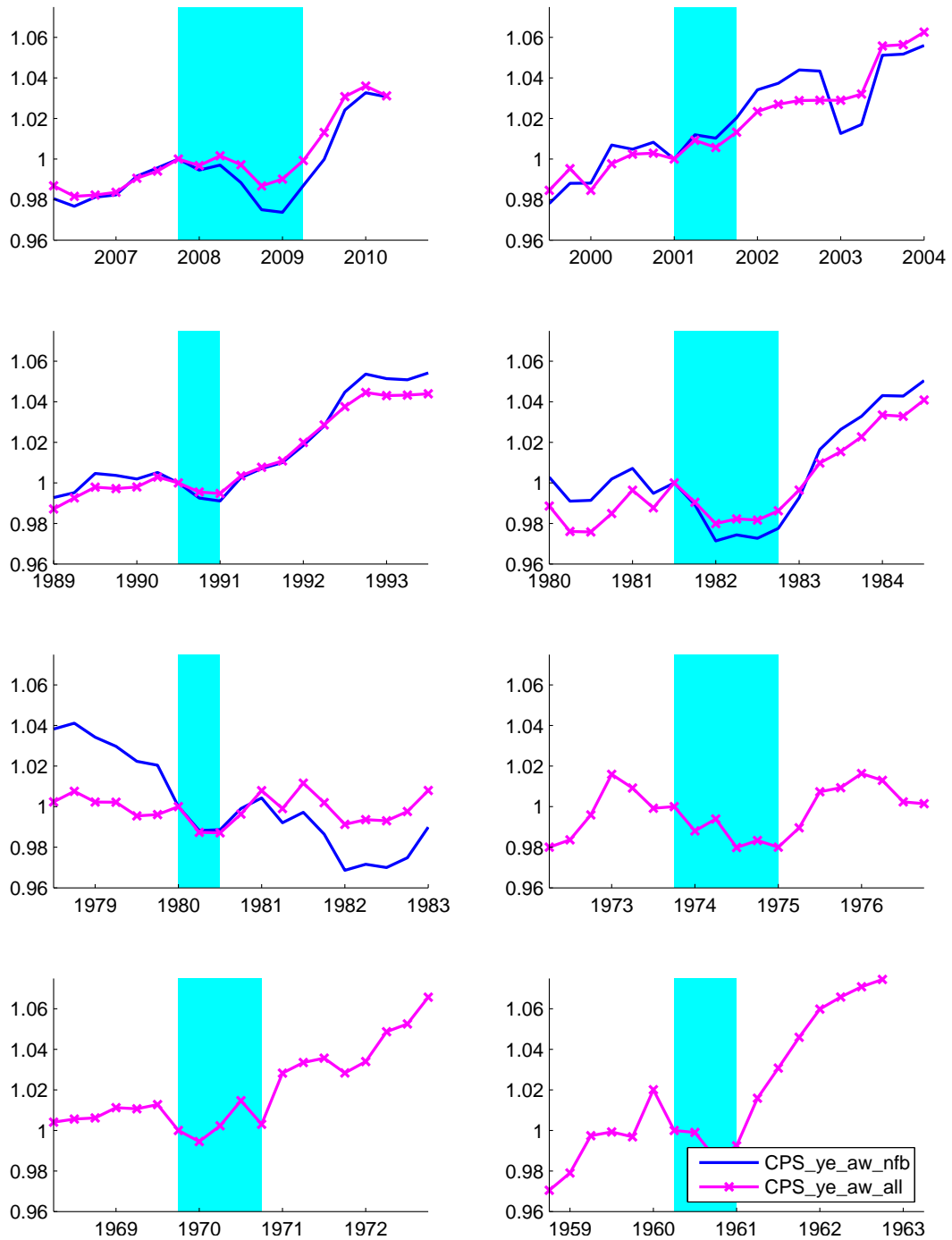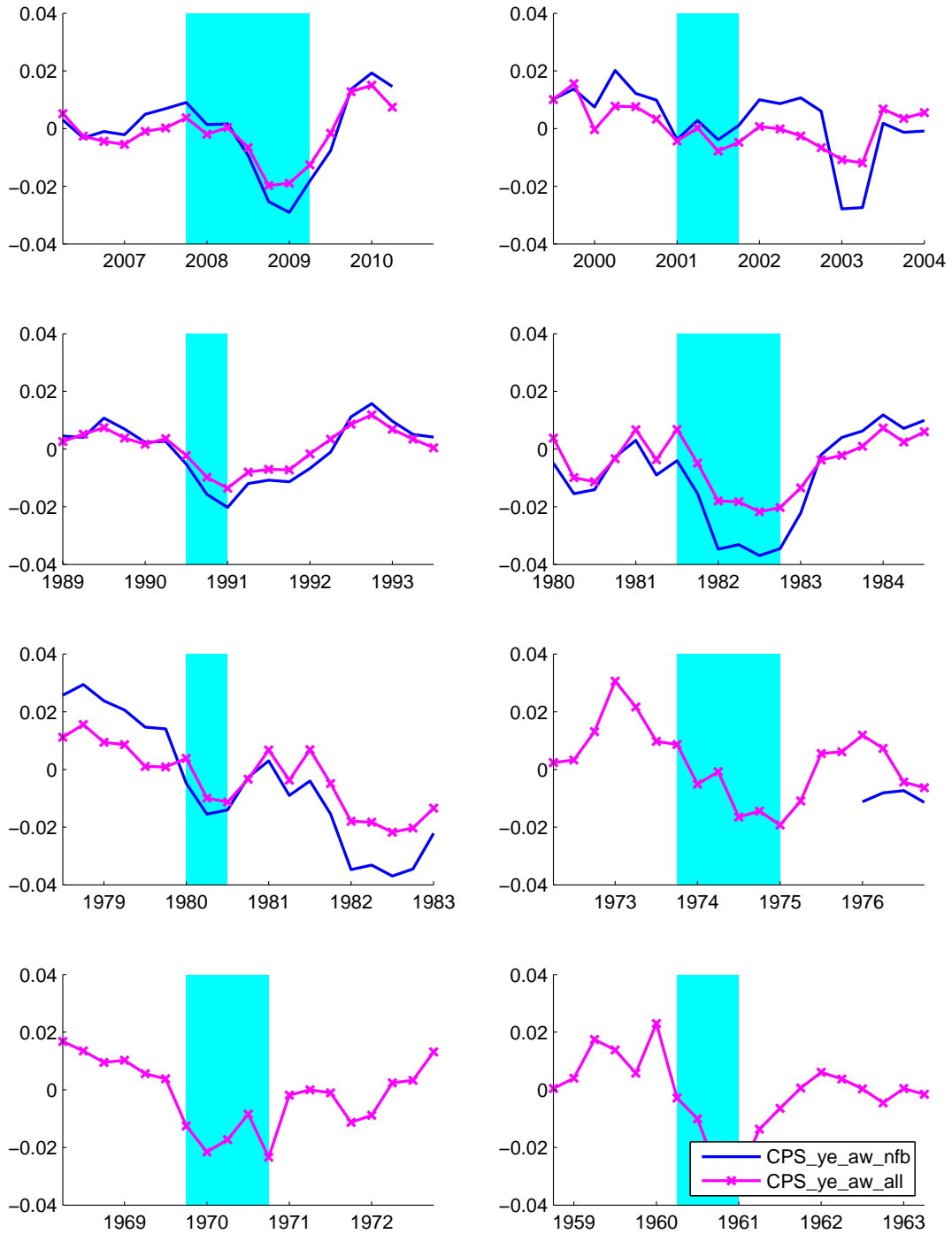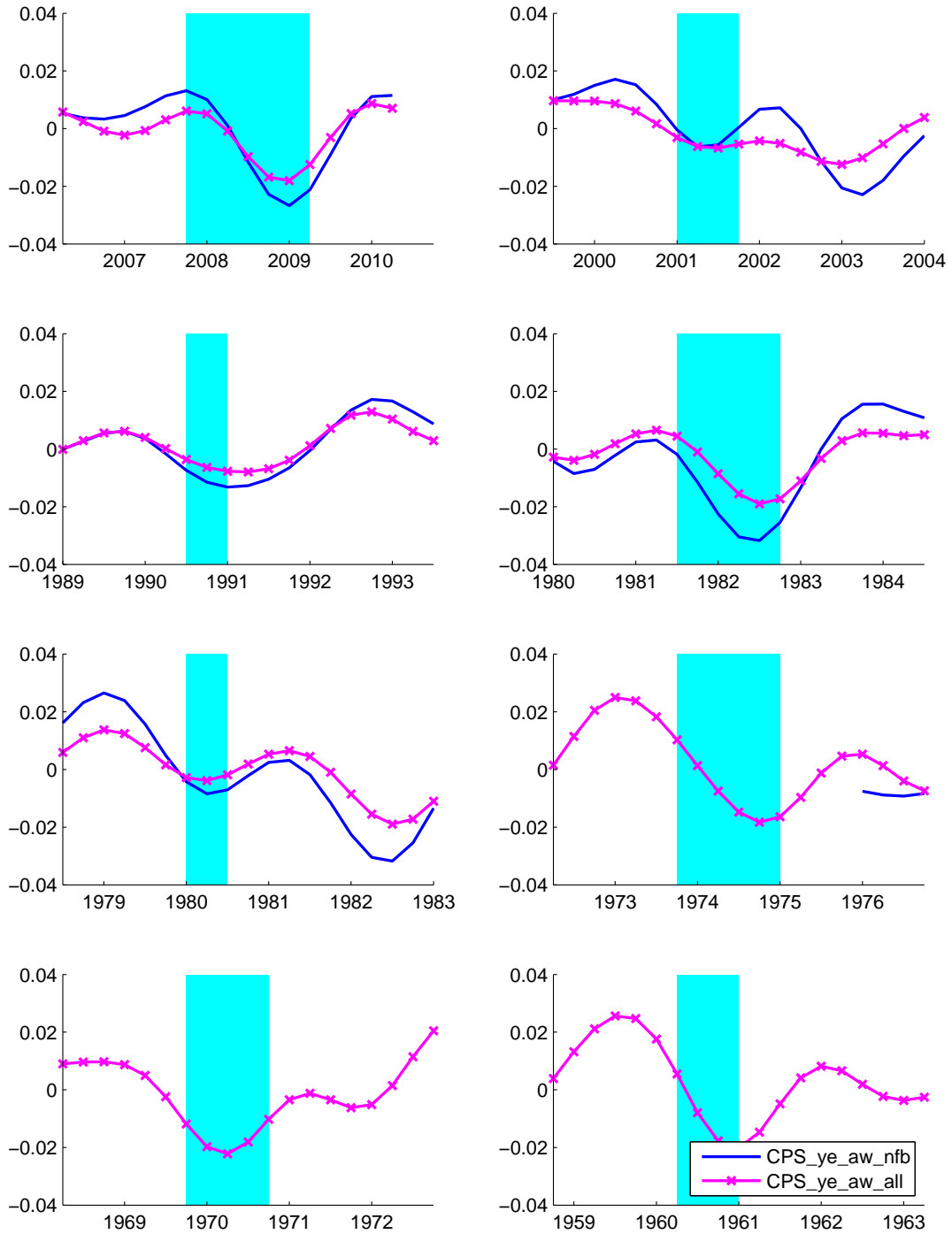
Figure 3: Output per Worker. Non-Farm Business Sector. LPC vs CPS employment data. 1960-2010. Bandpass-Filtered (6,32). Series are not normalized.

Figure 4: Output per Worker. Aggregate Economy vs. Non-Farm Business Sector. CPS employment data. 1960-2010. No filtering applied. Series normalized to 1 at start of the corresponding recession.

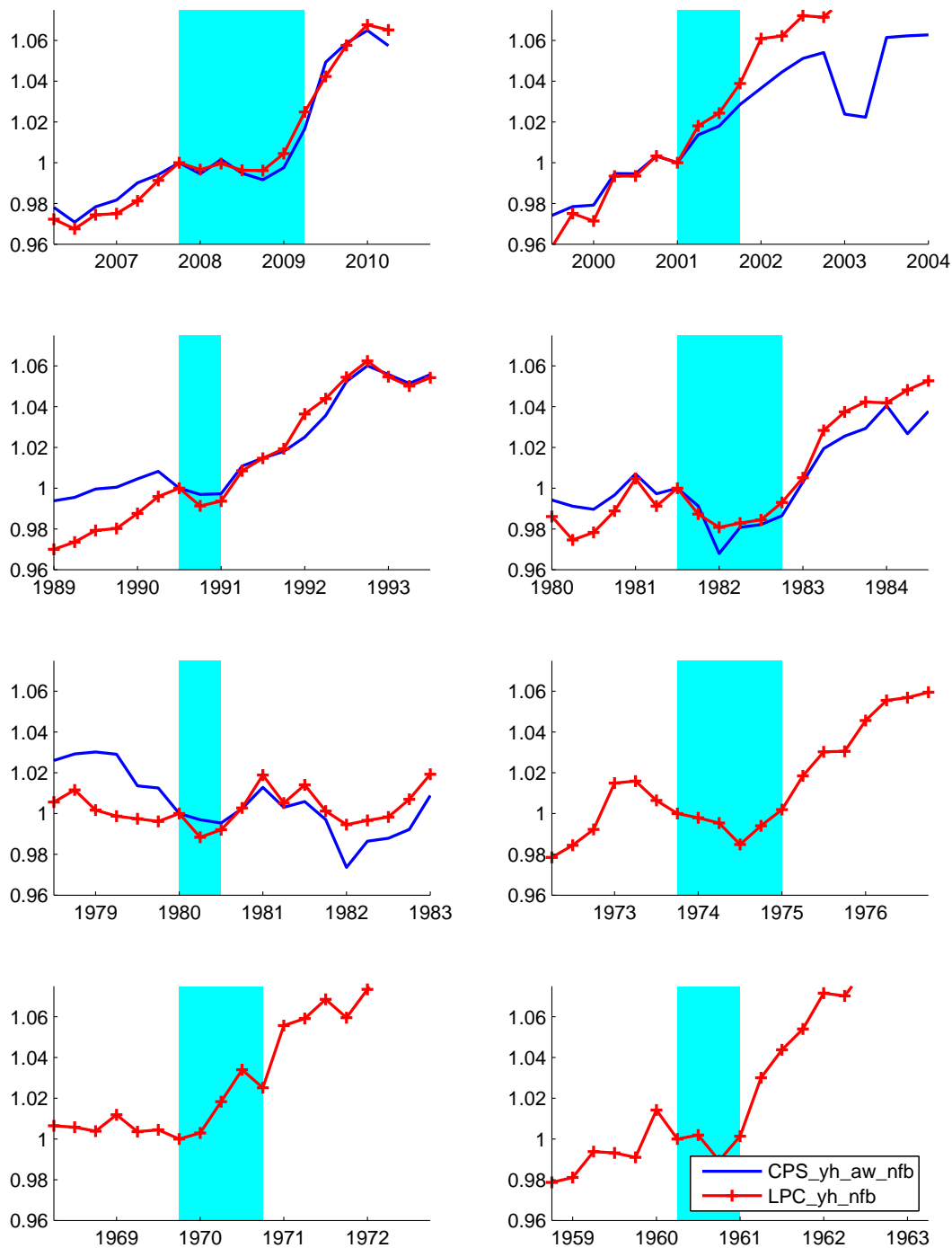Figure 5: Output per Worker. Aggregate Economy vs. Non-Farm Business Sector. CPS employment data. 1960-2010. HP-Filtered (1600). Series are not normalized.

Figure 6: Output per Worker. Aggregate Economy vs. Non-Farm Business Sector. CPS employment data. 1960-2010. Bandpass-Filtered (6,32). Series are not normalized.

Figure 7: Output per Hour. Non-Farm Business Sector. LPC vs CPS hours data. 1960-2010. No filtering applied. Series normalized to 1 at start of the corresponding recession.

Figure 8: Output per Hour. Non-Farm Business Sector. LPC vs CPS hours data. 1960-2010. HP-Filtered (1600). Series are not normalized.
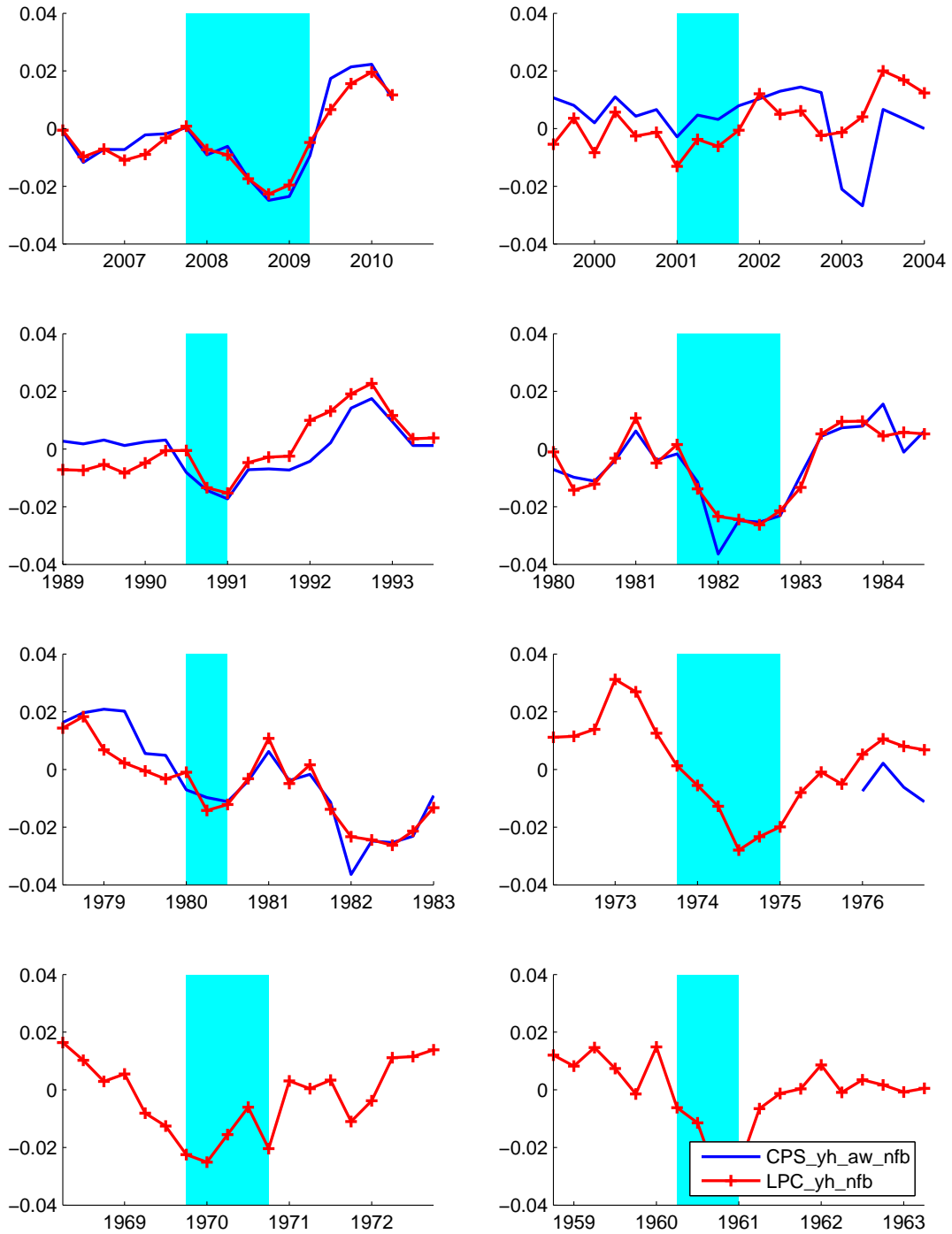
Figure 9: Output per Hour. Non-Farm Business Sector. LPC vs CPS hours data. 1960-2010. Bandpass-Filtered (6,32). Series are not normalized.
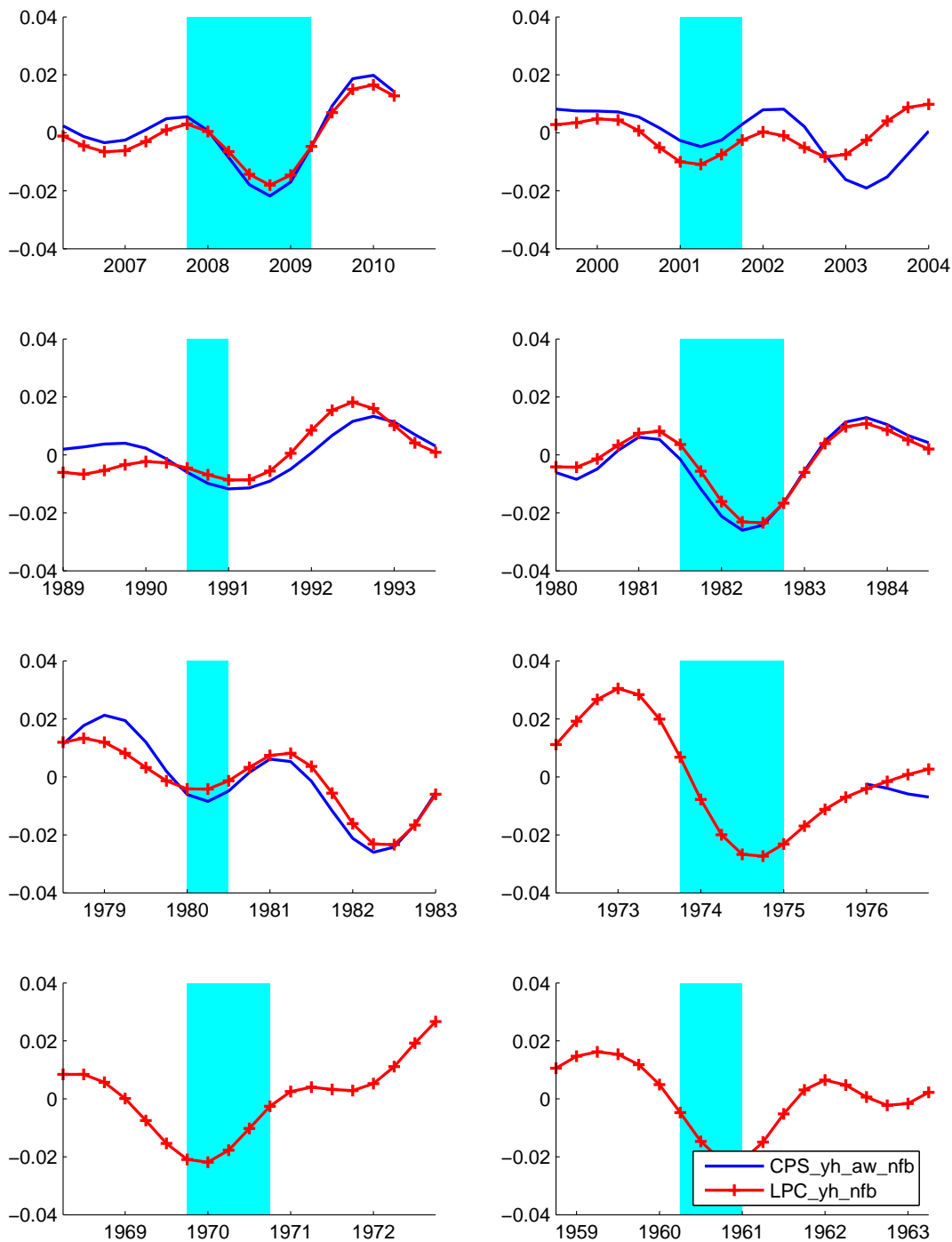
Figure 10: Output per Hour. Aggregate Economy vs. Non-Farm Business Sector. CPS hours data. 1960-2010. No filtering applied. Series normalized to 1 at start of the corresponding recession.
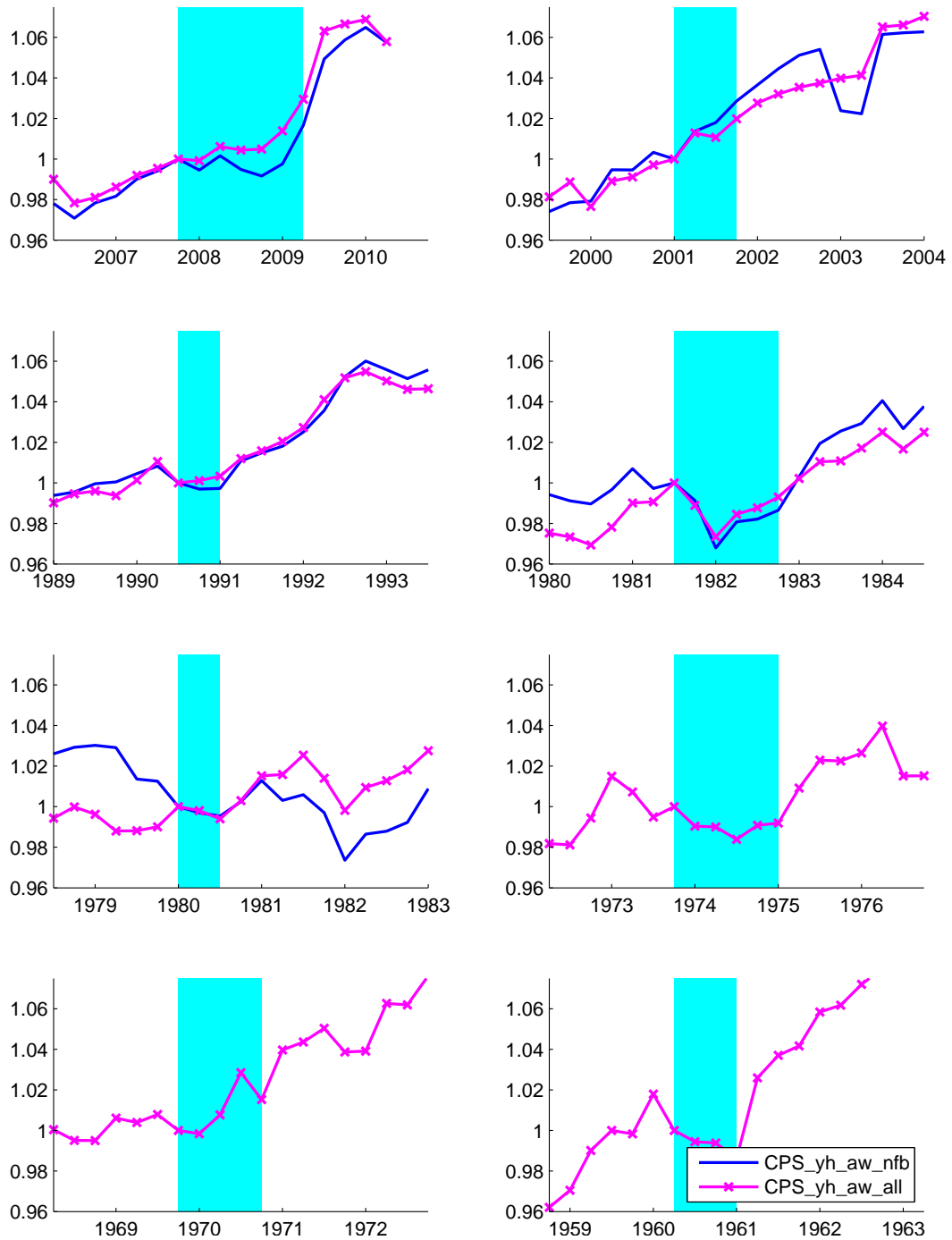
Figure 11: Output per Hour. Aggregate Economy vs. Non-Farm Business Sector. CPS hours data. 1960-2010. HP-Filtered (1600). Series are not normalized.
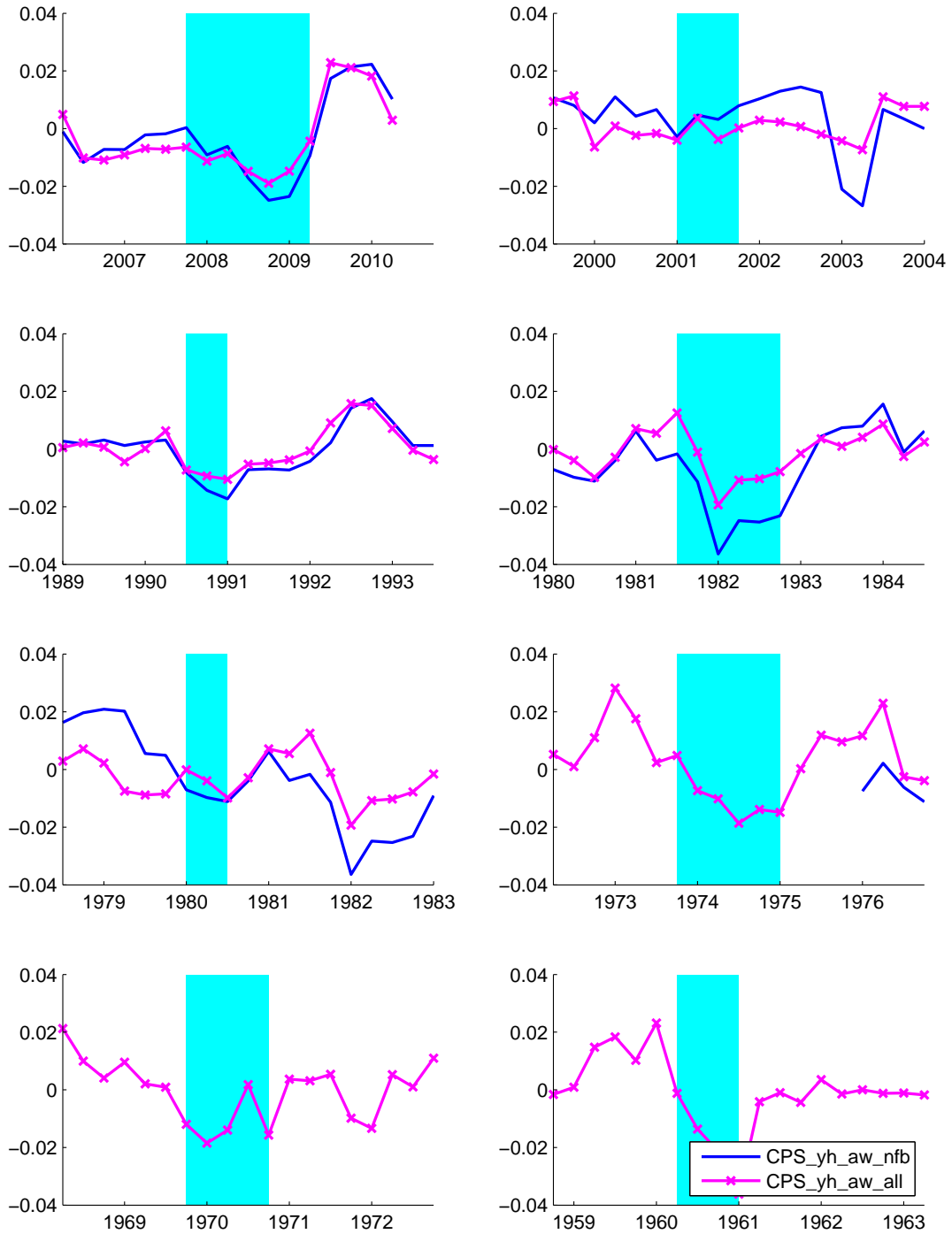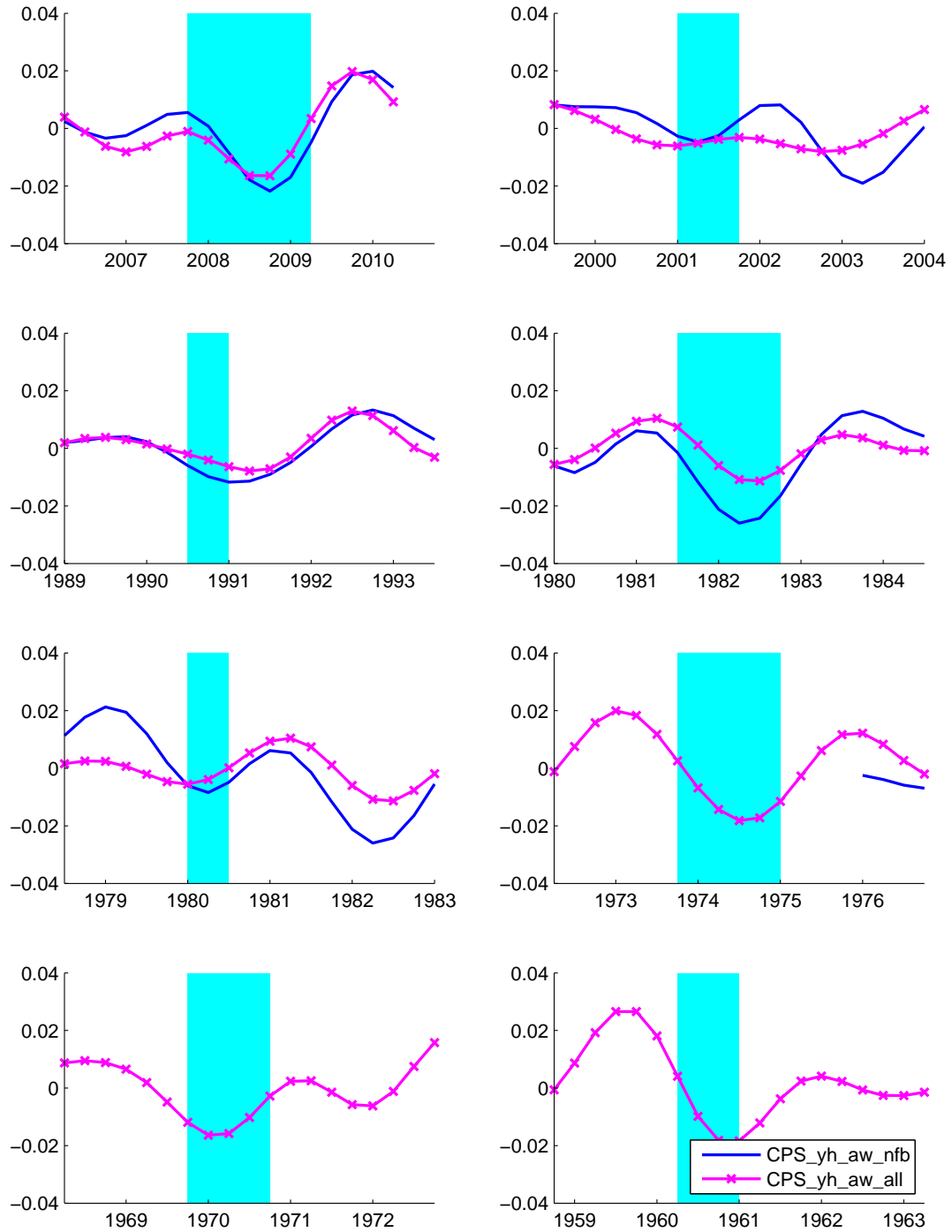
Figure 12: Output per Hour. Aggregate Economy vs. Non-Farm Business Sector. CPS hours data. 1960-2010. Bandpass-Filtered (6,32). Series are not normalized.

References

BAXTER, M., AND R. G. KING (1999): "Measuring Business-cycles: Approximate Band-Pass Filters for Economic Time Series," *Review of Economics and Statistics*, 81(4), 575–593.

COCIUBA, S., E. C. PRESCOTT, AND A. UEBERFELDT (2009): "U.S. Hours and Productivity Behavior Using CPS Hours Worked Data: 1947-III to 2009-III," Data Project, Federal Reserve Bank of Dallas.

HAGEDORN, M., AND I. MANOVSKII (2010): "Productivity and the Labor Market: Co-Movement over the Business Cycle," *International Economic Review, Forthcoming.*

HALL, R. (2007): "How Much Do We Understand about the Modern Recession?," *Brookings Papers on Economic Activity*, 2, 13–28.

———— (2008): "Cyclical Movements along the Labor Supply Function," in *Labor Supply in the New Century*, ed. by K. Bradbury, C. L. Foote, and R. K. Triest, pp. 241–278. Federal Reserve Bank of Boston.

KYDLAND, F. E., AND E. C. PRESCOTT (1982): "Time to Build and Aggregate Fluctuations," *Econometrica*, 50, 1345–1370.

LONG, J. B. J., AND C. I. PLOSSER (1983): "Real Business Cycles," *Journal of Political Economy*, 91(1), 36–69.

MORTENSEN, D., AND C. PISSARIDES (1994): "Job Creation and Job Destruction in the Theory of Unemployment," *Review of Economic Studies*, 61(3), 397–415.

MULLIGAN, C. (2009): "What Caused the Recession of 2008? Hints from Labor Productivity," Working Paper 14729, National Bureau of Economic Research.

PISSARIDES, C. (1985): "Short-Run Equilibrium Dynamics of Unemployment, Vacancies, and Real Wages," *American Economic Review*, 75(4), 676–690.

———— (2000): *Equilibrium Unemployment Theory*. MIT Press, Cambridge, MA, second ed.

PRESCOTT, E. (1986): "Theory Ahead of Business Cycle Measurement," *Federal Reserve Bank of Minneapolis Quarterly Review*, 10, 9–22.