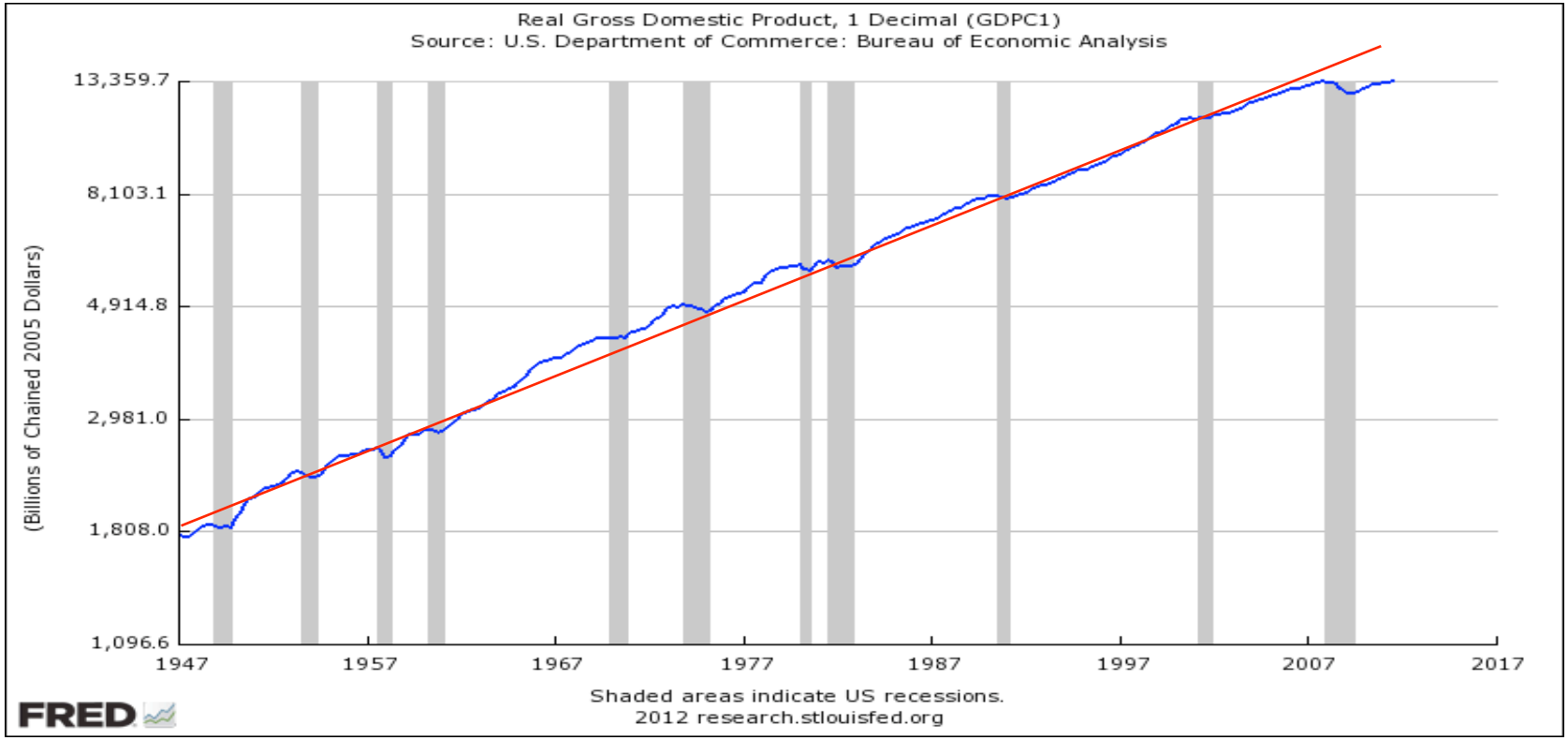
Macroeconomics

Econ 210B – Winter 2012

1. Administrative Issues

- TA: M. Shim
- Course website: http://dss.ucsd.edu/~ddebortoli
- No specific book BUT
  - Lecture notes and reading list
  - Walsh (2010) or Galí (2008) for the 2nd part
- Evaluation:
  - Midterm (40%) on February 8, 2012
  - Final (40%) on March 23, 2012
  - 7/8 Homeworks (5%), 1 Computational project (15%)

2. Motivation



In 210A: Economic Growth

In 210B: Fluctuations (Ups and Downs)

3. Goals

- Understand Theories of fluctuations of **AGGREGATE** variables
  - Why? → Sources of fluctuations
  - What? → Behavior of variables
  - What can we do? → Policy implications (Fiscal / Monetary)

- Learn a Methodology:
  - Solve (and estimate) Dynamic Stochastic General Equilibrium models (DSGE)

- Pass the Qual. Exam [… double coincidence of wants (?)]

4. Organization of the course

Introduction: **Brief History and Stylized Facts** (1 week)

Part I: **The "Neo-Classical" Real Business Cycles (RBC) -** (4 weeks)

a) Baseline model
b) Solution methods and Estimation (a primer)
c) Main Criticism and Extensions (Labor Markets, Financial Frictions, Fiscal Policy)

MIDTERM EXAM

Part II: Monetary Policy and the Business Cycle – (5 weeks)

a) Introducing money: role and effects (1.5 weeks)
b) The basic "New-Keynesian" model (1.5 weeks)
c) Monetary policy: Simple rules and Optimal Policy (1 week)
d) Extension: Medium-Scale models (1 week) **COMPUTATIONAL PROJECT**

FINAL EXAM

The Origins of the Debate

David Ricardo

- **David Ricardo (1772-1823), John Stuart Mill (1806-1873)**
  → No General Overproduction
  *"Mistakes can be made, and commodities not suited to demand may be produced - of these there may be **a glut**"* (Ricardo, 1820)

  "Production is not excessive, but merely ill-assorted" (Mill, 1848)

Simonde de Sismondi

- **Simonde de Sismondi (1772-1823), Thomas Malthus (1766-1834)**
  "Let us beware of this dangerous theory of equilibrium which is supposed to be automatically established. A certain kind of equilibrium, it is true, is reestablished in the long run, but it is after a frightful amount of suffering."

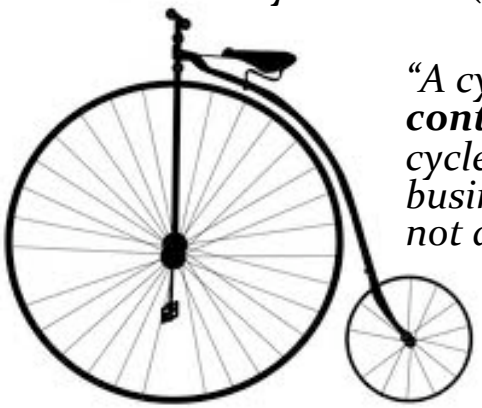
(de Sismondi, New Principles of Political Economy, vol. 1 (1819), 20-21.)

Early Theories of ``Business Cycles"

- **<u>Regular and Cyclical</u> Fluctuations**
  - **William Jevons (1835-188)**: "Sunspots and Commercial Crises", Nature 19, 588-590 (1879)
  - **Clement Juglar (1819-1905)**: "Des Crises commerciales et leur retour periodique en France, en Angleterre, et aux Etats-Unis", 1862.

  → Development of alternative theories, e,g, cycles due to consumer confidence and expectations [Beveridge (1909), Clark (1917), Pigou (1920)]

  → Keynesian theories: ENDOGENOUS CYCLES
  Oscillator theory [Samuelson (1939)], ``Multiplier-Accelerator" [Hicks (1950)]
  - **Wesley Mitchell (1874-1948)**: a systematic empirical study of "business" cycles



*"A cycle consists of **expansions** [...], followed by similarly general **recessions**, **contractions**, and **revivals** which merge into the expansion phase of the next cycle; this sequence of changes **is recurrent but not periodic**; in durations business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles [...]"*

(A. Burns and W. Mitchell: *Measuring Business Cycles*, 1946, p. 3)

Early Theories of Fluctuations

- **Failure of "endogenous" cycles** (see Boldrin and Woodford 1990)

- **Exogenous shocks as driving forces:** stochastic process can generate recurrent cycles despite the fact that the deterministic version of the model converges monotonically to a point.

  Frisch's pendolum (1933) :``damped" oscillatory behavior
  "shocks" needed to maintain energy

  Slutsky's Random shocks (1937): Sum of random shocks with large positive roots

Modern Developments

- **Background:**
  - **Neoclassical Growth model** (1960's): The behavior of the economy can be described by a low-dimensional dynamic system.
  - **Lucas' critique (1976)**: Models without microfoundations are not suitable for policy analysis. (The model's parameters need to be independent of policy)
  - **Lucas (1977) "Understanding Business Cycles":** Business cycles are characterized by large sectoral co-movements → fluctuations might be driven by aggregate shocks.
- **Kydland and Prescott: Real Business Cycle models (1982),** "Time-to-build and aggregate fluctuations".
  - Theory of fluctuations coherent with growth models (and Kaldor facts)
  - The model can be used to generate "artificial" series, that can be compared to the data. Also, the model can be used to perform policy experiments.
  - Now: Agreement on the methology
    Disagreement on sources of fluctuations (shocks) and propagation mechanisms

Measuring Fluctuations

See Stock and Watson (1999) , section 2

- "**Classical Cycles**" (NBER Business Cycles Dating Committee)
  - Step 1: Look at cyclical peaks and troughs for individual series
  - Step 2: determine "common" turning point

  … lack of statistical foundation [even though it can be approximated by non-linear filters (Stock and Watson (1987)]

- "**Growth Cycles": Deviations from Trend** $Y_t = Y_t^{Trend} + Y_t^{Cycle}$
  - Linear Trends: $Y_t^{Trend} = \alpha - \beta t \Rightarrow Y_t^{Cycle} = Y_t - Y_t^{Trend}$ …. Spurious cycles
  - First- Differencing: $Y_t^{Cycle} = Y_t - Y_{t-1}$ … too volatile series

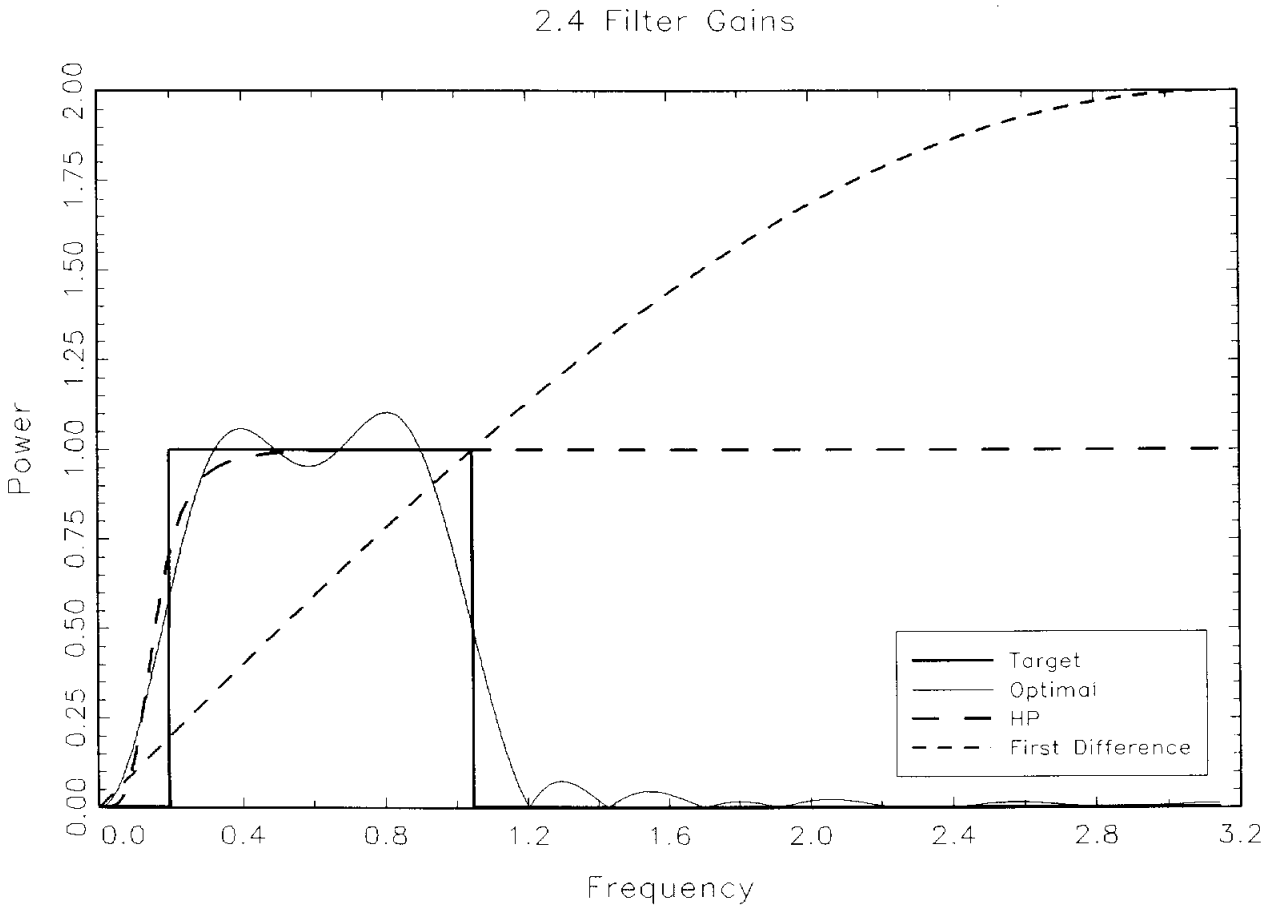
  - Hodrick-Prescott (1981) filter:

$$\min_{\{Y_t^{Trend}\}} \sum_{t=1}^{N} \left(Y_t - Y_t^{Trend}\right)^2 - \lambda \sum_{t=2}^{N-1} \left[\left(Y_{t+1}^{Trend} - Y_t^{Trend}\right) - \left(Y_t^{Trend} - Y_{t-1}^{Trend}\right)\right]^2$$

  - Band-Pass Filter (Baxter and King, 1994). It isolates the components with frequencies between 6 and 32 quarters.

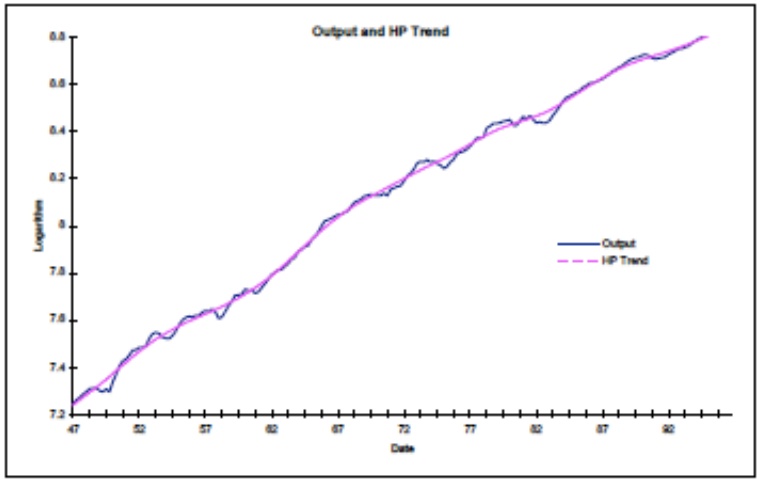
→ Ideally the resulting series should be (Covariance) stationary

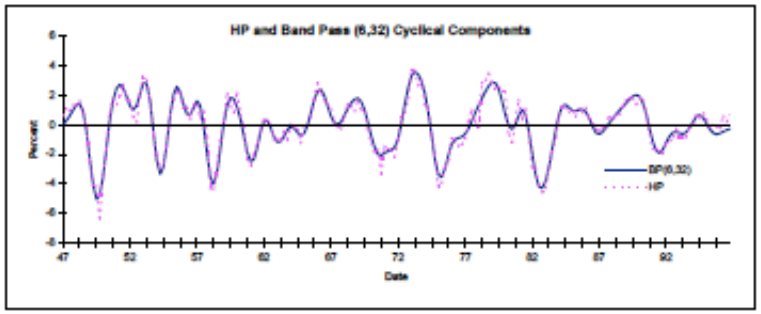
Comparison between filtering methods

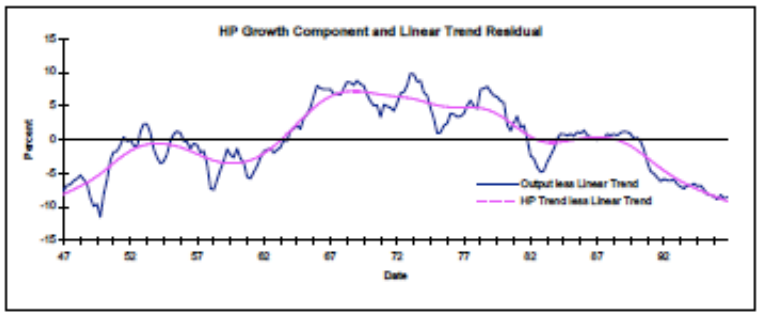


From Stock and Watson (2000), "Business Cycle Fluctuations in U.S. Macroeconomic Time Series"

Figure 1







Note: Sample period is 1947:1 - 1998:4.

From King and Rebelo (1999), “Resuscitating Real Business Cycles”

Fluctuations: Descriptive Statistics

Let y_t denote GDP and x_t another variable of interest

Four useful indicators:

1. **Amplitude** $\sigma(x)/\sigma(y)$

2. **Persistence** $\rho(x_t, x_{t-1}) = Cov(x_t, x_{t-1})/Var(x_t)$

3. **Co – movements** $\rho(x_t, y_t) = Cov(x_t, y_t)/Var(x_t)$
   → A variable is either: Procyclical, Countercylical, or Acylical

4. **Phase**: Find the k^* such that $\rho(x_t, y_{t+k})$ is maximum
   - If $k = 0$: Contemporaneous
   - If $k < 0$: Lagging
   - If $k > 0$: Leading

Stylized Facts of Fluctuations

- **(Non - Durable) Consumption:** less volatile that Output and Procyclical
  … Consumption Smoothing?

- **Investment and Durable Consumption:** more volatile that output
  … 4 times more!

- **Employment:** Total Hours as volatile as output, and procyclical
  … volatility due to # of Employees, not Hours / Worker
  … importance of endogenous labor choices

- **Labor Productivity (Y/N)** less volatile than output, and procyclical
  … role for technology shocks?

- **Real Wages (w)** much less volatile than output and acyclical
  … elastic labor supply?

- **Gov't expenditures** are acyclical
  … should we disregard them?

Table 1
Business Cycle Statistics for the U.S. Economy

	Standard Deviation	Relative Standard Deviation	First Order Auto-correlation	Contemporaneous Correlation with Output
Y	1.81	1.00	0.84	1.00
C	1.35	0.74	0.80	0.88
I	5.30	2.93	0.87	0.80
N	1.79	0.99	0.88	0.88
Y/N	1.02	0.56	0.74	0.55
w	0.68	0.38	0.66	0.12
r	0.30	0.16	0.60	-0.35
A	0.98	0.54	0.74	0.78

Note: All variables are in logarithms (with the exception of the real interest rate) and have been detrended with the HP filter. Data sources are described in Stock and Watson [1998], who created the real rate using VAR inflation expectations. Our notation in this table corresponds to that in the text, so that Y is per capita output, C is per capita consumption, I is per capita investment, N is per capita hours, w is the real wage (compensation per hour), r is the real interest rate, and A is total factor productivity.

From King and Rebelo (1999), "Resuscitating Real Business Cycles"

Table 2

Descriptive Statistics for Cyclical Components of Series, 1953 - 1996

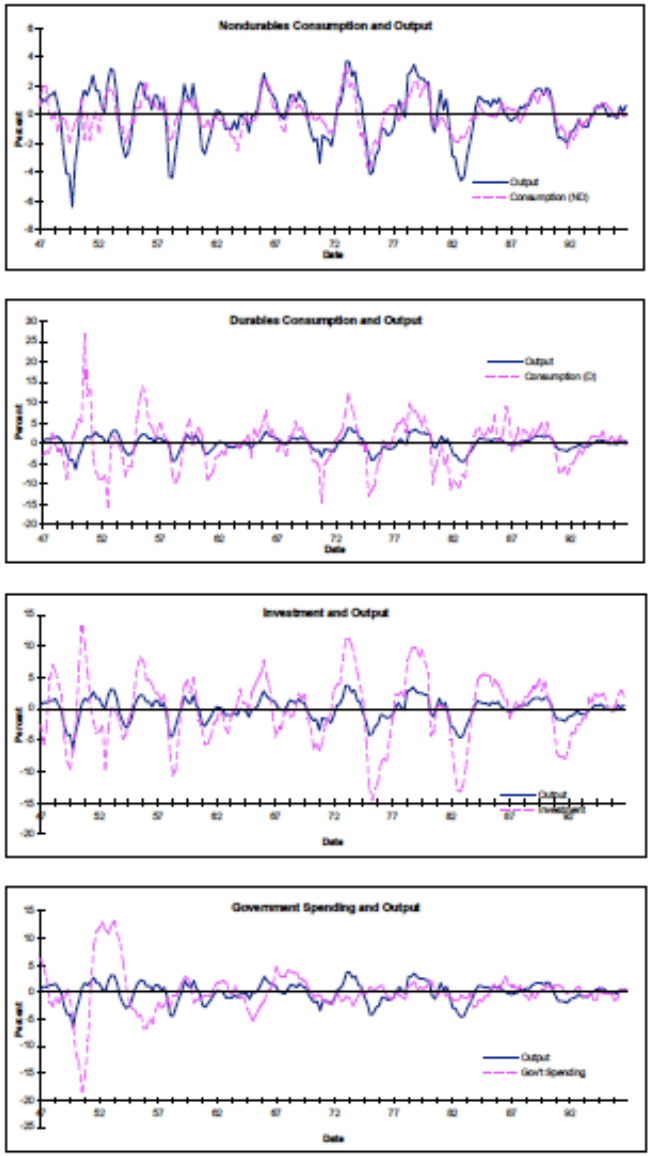
Series	Std Dev	Cross Autocorrelations With Output ($Cor(x_t y_{t+k})$) k = -6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
Gross Domestic Product	1.66	-0.29	-0.18	0.03	0.33	0.66	0.91	1.00	0.91	0.66	0.33	0.03	-0.18	-0.29
Sectoral employment														
1. Contract and Construction Employment	3.75	0.02	0.20	0.39	0.58	0.73	0.80	0.77	0.65	0.44	0.19	-0.04	-0.23	-0.35
2. Manufacturing Employment	2.61	-0.06	0.14	0.40	0.67	0.87	0.94	0.84	0.59	0.26	-0.06	-0.30	-0.43	-0.45
3. Finance, Insurance and Real Estate Employment	1.01	0.25	0.35	0.43	0.49	0.50	0.46	0.38	0.28	0.15	0.02	-0.10	-0.20	-0.28
4. Mining Employment	3.79	0.13	0.19	0.25	0.28	0.25	0.16	-0.00	-0.20	-0.40	-0.53	-0.58	-0.55	-0.45
5. Government Employment	0.82	0.51	0.53	0.49	0.43	0.35	0.29	0.23	0.15	0.04	-0.08	-0.21	-0.31	-0.37
6. Service Employment	0.83	0.20	0.33	0.49	0.63	0.71	0.69	0.55	0.34	0.08	-0.15	-0.33	-0.44	-0.50
7. Wholesale and Retail Trade Employment	1.20	-0.01	0.21	0.45	0.68	0.83	0.87	0.79	0.60	0.35	0.10	-0.10	-0.24	-0.32
8. Transportation and Public Utility Employment	1.54	0.23	0.42	0.61	0.77	0.83	0.76	0.56	0.26	-0.06	-0.33	-0.49	-0.53	-0.50
NIPA components														
9. Consumption (Total)	1.26	-0.39	-0.28	-0.07	0.21	0.51	0.76	0.90	0.89	0.75	0.53	0.29	0.09	-0.06
10. Consumption (Nondurables)	1.11	-0.36	-0.24	-0.02	0.25	0.52	0.74	0.83	0.80	0.65	0.43	0.21	0.02	-0.12
11. Consumption (Services)	0.64	-0.13	-0.00	0.14	0.31	0.49	0.66	0.78	0.80	0.70	0.51	0.27	0.05	-0.12
12. Consumption (Nondurables + Services)	0.78	-0.28	-0.15	0.05	0.29	0.55	0.75	0.87	0.85	0.71	0.49	0.25	0.03	-0.13
13. Consumption (Durables)	4.66	-0.46	-0.38	-0.19	0.09	0.42	0.70	0.85	0.86	0.73	0.53	0.32	0.15	0.03
14. Investment (Total Fixed)	4.97	-0.34	-0.19	0.04	0.32	0.61	0.82	0.89	0.83	0.65	0.41	0.18	-0.00	-0.13
15. Investment (Equipment)	5.25	-0.06	0.16	0.41	0.65	0.84	0.92	0.88	0.73	0.49	0.23	-0.01	-0.20	-0.31
16. Investment (Nonresidential Structures)	4.67	0.20	0.40	0.58	0.70	0.74	0.67	0.52	0.30	0.07	-0.14	-0.30	-0.40	-0.44
17. Investment (Residential Structures)	10.04	-0.49	-0.48	-0.37	-0.18	0.09	0.38	0.62	0.77	0.78	0.69	0.53	0.36	0.20
18. Change in Bus. Inventories (Relative to Trend GDP)	0.38	-0.58	-0.50	-0.32	-0.04	0.28	0.57	0.73	0.72	0.56	0.32	0.08	-0.08	-0.15
19. Exports	4.76	0.33	0.42	0.47	0.50	0.48	0.40	0.27	0.09	-0.11	-0.29	-0.43	-0.50	-0.51
20. Imports	4.42	-0.45	-0.28	-0.03	0.27	0.54	0.72	0.78	0.70	0.53	0.34	0.17	0.05	-0.02
21. Trade Balance (Relative to Trend GDP)	0.38	0.54	0.45	0.30	0.10	-0.11	-0.29	-0.42	-0.48	-0.49	-0.48	-0.45	-0.41	-0.35
22. Government Purchases	2.49	0.30	0.25	0.22	0.21	0.21	0.19	0.15	0.03	-0.10	-0.20	-0.23	-0.19	-0.09
23. Government Purchases (Defense)	4.66	0.21	0.18	0.15	0.14	0.12	0.09	0.05	-0.06	-0.18	-0.26	-0.27	-0.20	-0.08
24. Government Purchases (Non-Defense)	1.35	0.21	0.12	0.07	0.08	0.13	0.19	0.22	0.23	0.21	0.18	0.13	0.08	0.01

From Stock and Watson (2000), "Business Cycle Fluctuations in U.S. Macroeconomic Time Series"

Table 2 (Continued)

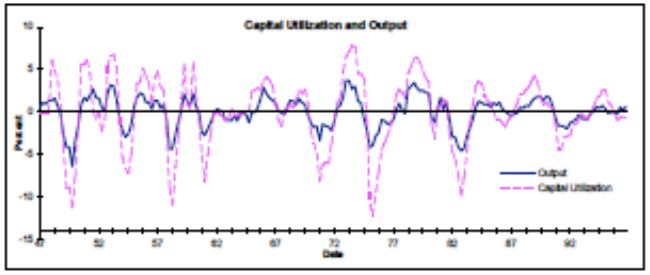
Series	Std Dev	Cross Autocorrelations With Output (Cor(x_t, y_{t+k})) k = -6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
Aggregate employment, productivity and utilization														
25. Employment: Total Employees	1.39	0.07	0.26	0.49	0.72	0.89	0.92	0.81	0.57	0.24	-0.07	-0.31	-0.44	-0.49
26. Employment: Total Hours	1.61	-0.06	0.13	0.37	0.63	0.85	0.94	0.88	0.67	0.36	0.03	-0.23	-0.39	-0.45
27. Employment: Average Weekly Hours	0.37	-0.51	-0.44	-0.24	0.05	0.38	0.66	0.82	0.80	0.64	0.40	0.16	-0.03	-0.15
28. Unemployment Rate	0.76	0.13	-0.03	-0.27	-0.55	-0.80	-0.93	-0.89	-0.69	-0.39	-0.07	0.19	0.33	0.37
29. Vacancies (Help Wanted Index)	14.52	-0.25	-0.09	0.15	0.43	0.71	0.89	0.93	0.80	0.54	0.23	-0.06	-0.26	-0.38
30. New Unemployment Claims	13.19	0.47	0.43	0.27	-0.00	-0.35	-0.67	-0.86	-0.87	-0.71	-0.43	-0.14	0.08	0.21
31. Capacity Utilization	3.07	-0.37	-0.23	0.01	0.31	0.63	0.86	0.93	0.83	0.59	0.29	0.02	-0.16	-0.25
32. Total Factor Productivity	2.29	-0.54	-0.46	-0.29	-0.03	0.27	0.56	0.77	0.86	0.82	0.68	0.50	0.31	0.16
33. Average Labor Productivity	1.05	-0.49	-0.60	-0.58	-0.41	-0.11	0.24	0.53	0.70	0.72	0.62	0.47	0.32	0.21
Prices and wages														
34. Consumer Price Index (Level)	1.35	0.34	0.24	0.12	-0.04	-0.21	-0.38	-0.51	-0.62	-0.68	-0.67	-0.59	-0.48	-0.34
35. Producer Price Index (Level)	2.26	0.36	0.33	0.27	0.18	0.05	-0.09	-0.24	-0.37	-0.47	-0.54	-0.56	-0.55	-0.50
36. Oil Prices	11.12	0.22	0.16	0.09	0.01	-0.08	-0.17	-0.26	-0.35	-0.41	-0.44	-0.42	-0.36	-0.28
37. GDP Price Deflator (Level)	0.91	0.23	0.12	-0.02	-0.18	-0.33	-0.46	-0.54	-0.60	-0.61	-0.59	-0.52	-0.42	-0.30
38. Commodity Price Index (Level)	7.43	0.18	0.28	0.36	0.41	0.41	0.38	0.30	0.18	0.04	-0.11	-0.26	-0.36	-0.43
39. Consumer Price Index (Inflation Rate)	1.44	0.34	0.47	0.58	0.64	0.62	0.52	0.35	0.14	-0.08	-0.27	-0.40	-0.48	-0.51
40. Producer Price Index (Inflation Rate)	2.64	0.10	0.21	0.33	0.43	0.49	0.49	0.43	0.34	0.21	0.07	-0.05	-0.17	-0.27
41. GDP Price Deflator (Inflation Rate)	0.96	0.45	0.55	0.61	0.58	0.48	0.32	0.15	-0.01	-0.14	-0.25	-0.34	-0.41	-0.47
42. Commodity Price Index (Inflation Rate)	10.55	-0.28	-0.23	-0.15	-0.03	0.09	0.22	0.33	0.41	0.44	0.39	0.28	0.14	-0.01
43. Nominal Wage Rate	0.94	0.22	0.13	0.02	-0.09	-0.21	-0.34	-0.45	-0.56	-0.62	-0.62	-0.54	-0.42	-0.27
44. Real Wage Rate	0.64	-0.16	-0.13	-0.07	0.00	0.08	0.14	0.16	0.14	0.10	0.07	0.05	0.05	0.07
45. Nominal Wage Rate (Rate of Change)	1.14	0.31	0.35	0.38	0.41	0.42	0.38	0.29	0.14	-0.05	-0.24	-0.39	-0.47	-0.49
46. Real Wage Rate (Rate of Change)	1.10	-0.05	-0.13	-0.18	-0.18	-0.13	-0.05	0.04	0.08	0.08	0.04	-0.00	-0.04	-0.05
Interest rates and stock prices														
47. Federal Funds Rate	1.47	0.26	0.38	0.50	0.60	0.63	0.56	0.38	0.13	-0.16	-0.41	-0.60	-0.69	-0.71
48. Treasury Bill Rate (3 Month)	1.09	0.20	0.29	0.40	0.50	0.57	0.54	0.41	0.18	-0.10	-0.38	-0.58	-0.69	-0.71
49. Treasury Bond Rate (10 Year)	0.71	0.03	0.03	0.07	0.13	0.17	0.16	0.08	-0.07	-0.24	-0.39	-0.49	-0.52	-0.48
50. Real Treasury Bill Rate (3 Month)	0.71	-0.02	-0.04	-0.05	-0.07	-0.12	-0.19	-0.28	-0.35	-0.38	-0.36	-0.29	-0.20	-0.11
51. Yield Curve Spread (Long - Short)	0.76	-0.29	-0.40	-0.52	-0.61	-0.66	-0.64	-0.52	-0.32	-0.07	0.17	0.38	0.52	0.59
52. Commercial Paper/Treasury Bill Spread	0.32	0.44	0.58	0.66	0.65	0.54	0.33	0.06	-0.20	-0.41	-0.53	-0.54	-0.49	-0.40
53. Stock Prices	8.28	-0.23	-0.32	-0.35	-0.28	-0.12	0.10	0.34	0.51	0.57	0.49	0.32	0.11	-0.08

Figure 2



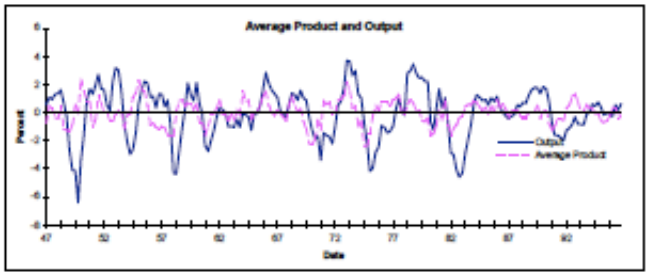
Note: Sample period is 1947:1 - 1996:4. All variables are detrended using the Hodrick-Prescott filter.

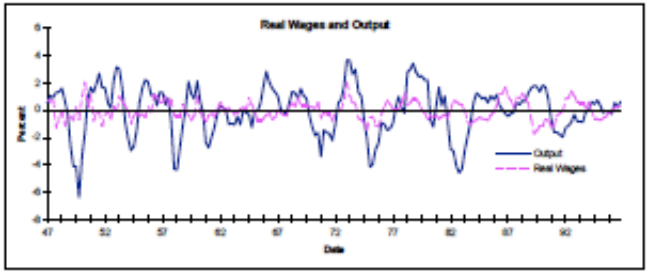
Figure 3



Note: Sample period is 1947:1 - 1996:4. All variables are detrended using the Hodrick-Prescott filter.

Figure 4





Note: Sample period is 1947:1 - 1995:4. All variables are detrended using the Hodrick-Prescott filter.