

Economics 701: Macroeconomics II
Spring 2009

Lecture 1: Basic Business Cycle Facts

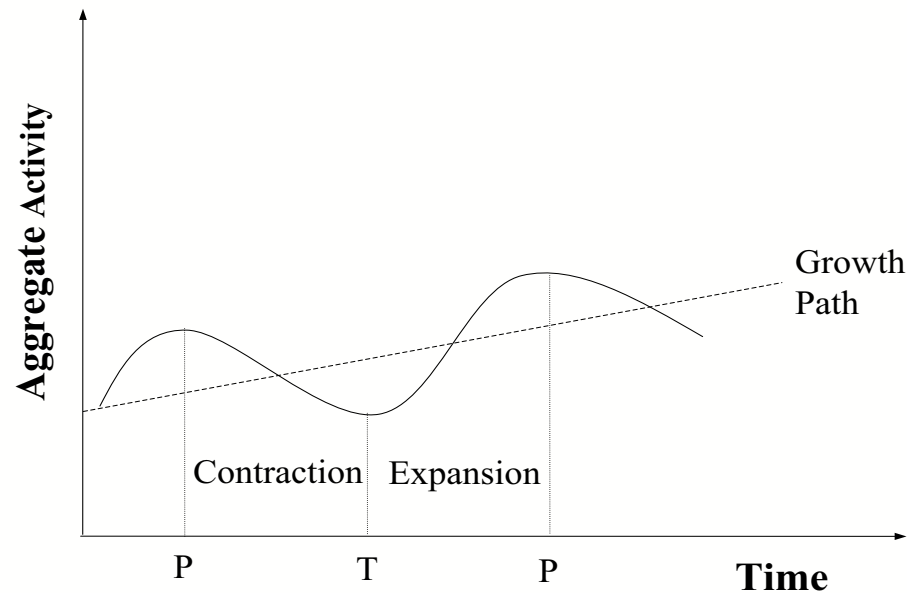
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1. Introduction to business cycles

- (a) Business Cycles (Burns and Mitchell): Recurrent but not periodic fluctuations in aggregate economic activity
- (b) Comovement

1. (c) Expansions, recessions, peaks and troughs



- Peaks and troughs are turning points
- Business cycle: peak-to-peak or trough-to-trough
- NBER business cycle chronology

1. (d) Not periodic (vs. seasonal cycles)
(e) Persistent: business cycle frequency = 3 to 8 years
2. How economic variables behave over the cycle
 - (a) Direction
 - Procyclical vs. countercyclical
 - Most macroeconomic variables are procyclical
 - Exceptions: unemployment (*countercyclical*) and real interest rates (*acyclical*)
 - (b) Relative volatility: durable goods more volatile
 - (c) Timing: leading, lagging and coincident
 - (d) Pictures

3. Historical Record

(a) Great Depression and WWII

- Great Depression
- WWII

(b) Postwar

- 1945-1973: golden years
- 1970s: OPEC and stagflation
- 1981-82 recession
- 1990+: new golden years?

(c) Pre-Depression vs. Postwar

- Traditional view: postwar cycles less severe
- Data controversy (C. Romer, 1988)
- Major policy implications
- Post-1982 stabilization: “The Great Moderation”

4. Introduction to Stochastic Processes

(a) Random variable

- Def.: Value is the result of an experiment
- X is a random variable, x is its realization
- Support: smallest set S s.t. $\Pr(X \in S) = 1$.
- Distribution function: $F(x) = \Pr(X \leq x)$.

4. (b) Expectations and moments

- For (*well-behaved*) functions $g(\cdot)$ and $F(\cdot)$, consider

$$g(e_1) [F(x_1) - F(a)] + g(e_2) [F(x_2) - F(x_1)] \\ + \dots + g(e_{n+1}) [F(b) - F(x_n)],$$

with $x_{j-1} \leq e_j < x_j$.

- As $x_j - x_{j-1}$ goes to zero ($n \rightarrow \infty$), the limit is the Stieltjes integral

$$\int_a^b g(x) dF(x).$$

4. (b) Expectations and moments (continued)

- If $F(\cdot)$ is a distribution function, the expectation of $g(X)$ is

$$E(g(X)) = \int_{-\infty}^{\infty} g(x) dF(x).$$

- Mnemonic: If $F(x) = \int_{z=-\infty}^x f(z) dz$,

$$\int_a^b g(x) f(x) dx = \int_a^b g(x) \frac{dF}{dx} dx = \int_a^b g(x) dF(x).$$

4. (b) Expectations and moments (continued)

- Mean is $\bar{X} = E(X)$.
- In general $E(g(X)) \neq g(\bar{X})$, unless $g(X) = b \cdot X$, with b constant.
- Variance is $V(X) = E\left([X - \bar{X}]^2\right)$.
- Standard deviation is $\sqrt{V(X)}$.

4. (c) Bivariate distribution

- Random vector (X, Y) .
- Joint distribution function
 $F(x, y) = \Pr(X \leq x, Y \leq y)$.
- Covariance = $C(X, Y) = E([X - \bar{X}] \cdot [Y - \bar{Y}])$
- Cross-correlation = $C(X, Y) / \sqrt{V(X) V(Y)}$
- Linearity of expectations:
 $E(aX + bY) = aE(X) + bE(Y)$.

4. (d) Stochastic process: an infinite sequence of random variables $\{X_t\}_{t=-\infty}^{\infty}$.

- Entire sequence is a single realization
- j th autocovariance $= \gamma_j = C(X_t, X_{t-j})$.
- Strict stationarity: distribution of $(X_t, X_{t+j_1}, X_{t+j_2}, \dots, X_{t+j_n})$ does not depend on t .
- Covariance stationarity: \overline{X}_t and $C(X_t, X_{t-j})$ do not depend on t .

4. (e) Detrending

- $Y_t = X_t + Z_t$
 - X_t is stationary.
 - Z_t is a trend.
- Trend stationarity
 - Z_t is deterministic.
 - Example: $Z_t = \alpha \cdot t$.
- Difference stationarity
 - Z_t is a *random walk*:

$$Z_t = Z_0 + \sum_{j=0}^{t-1} (\varepsilon_{t-j} + \alpha),$$

where $\{\varepsilon_t\}$ is a white noise process.

5. The data again

(a) Three types of detrending

- Common linear trend
 - Consistent with simple growth model
 - Common trend rejected by data
 - KPR handout
- Idiosyncratic trends & Hodrick-Prescott filter
 - Under usual settings, removes “more trend”
 - Questions: Cogley and Nason (1995)
- First difference filter: $\Delta y_t \equiv y_t - y_{t-1}$
 - Works with difference- or linear-trend stationary data
 - Emphasizes high-frequency movements: see handout.

5. (b) Results with common trend

- Low contemporaneous correlation between output and hours

(c) Results with HP filter

- Relative volatility of investment and hours rises.
- Correlation between hours and output rises.

(d) Productivity-hours correlation low or negative: key relationship