Topic 1

Real Business Cycle Theory: Part 3

Business Cycle Accounting

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Business Cycle Accounting

Method for evaluating deviations of key model equations from data.
Motive: To gain insight where model needs improvement.
Two key behavioral relations in RBC:

1. Labor market equilibrium
2. Capital market equilibrium (consumption/saving)

Benchmark case where model holds perfectly:

Labor market

$$(1-\alpha)\frac{Y}{L} = L^{\varphi}/C^{-\gamma} \leftrightarrow$$
$$MPL = MRS$$

Capital market

$$1 = E_t\{\beta(\frac{C'}{C})^{-\gamma}(\alpha\frac{Y'}{K'} + 1 - \delta)\} \leftrightarrow$$
$$1 = E_t\{IMRS \cdot R'_k\}$$

Approach: Evaluate Model Residuals (Wedges)

- Measure departure of model from data as captured by residuals (or "wedges").

1. *Labor market wedge* τ_t^L :

$$\tau_t^L = \frac{MPL_t}{MRS_t} - 1$$

2. *Capital market wedge* τ_t^K :

$$\tau_t^K = E_t \{IMRS_{t+1} \cdot R_{kt+1}\} - 1$$

- The RBC model presumes $\tau_t^L = \tau_t^K = 0$.

Evaluating Model Residuals (Wedges) (con't)

- Given restrictions on preferences and technology we can measure τ_t^L and τ_t^K.

- Significant cyclical movements in τ_t^L and τ_t^K may be regarded as evidence of some form of model misspecification.

  - τ_t^L, τ_t^K countercyclical $\rightarrow$ greater inefficiency in recessions, given:
    - Competitive equilibrium is the optimum
    - Distance from competitive equilibrium is increasing in τ_t^L, τ_t^K

- Accounting for the pattern of these deviations then serves a guide for reformulating the model.

Labor Market Distortions

- Hall (1999) and Shimer (2009) present evidence that movements in τ_t^L are highly countercyclical.

  $\rightarrow$ Recessions are thus associated with periods where the marginal product of labor exceeds the (measured) marginal rate of substitution.

- Mulligan (2002) and Chari, Kehoe and McGrattan (2007) show that during the Great Depression there was a sharp increase in τ_t^L.

  $\rightarrow$ The simple neoclassical labor market cannot account for the drop in employment.

- Gali, Gertler and Lopez-Salido (2007) interpret movements in τ_t^L as reflecting countercyclical markup behavior.

Labor Wedges as Markups

Let $1 + \mu_t^P \equiv$ the gross price markup and $1 + \mu_t^W \equiv$ the gross wage markup. $\rightarrow$

$$1 + \mu_t^P = \frac{P_t}{(W_t/MPL_t)} = \frac{MPL_t}{W_t/P_t}$$

$$1 + \mu_t^W = \frac{W_t/P_t}{MRS_t}$$

where W_t/MPL_t is the nominal marginal cost of producing a unit of output
It follows that:

$$\begin{aligned}\left(1 + \mu_t^P\right)\left(1 + \mu_t^W\right) &= \frac{MPL_t}{W_t/P_t} \cdot \frac{W_t/P_t}{MRS_t} \\ &= \frac{MPL_t}{MRS_t} \\ &= 1 + \tau_t^L\end{aligned}$$

Labor Wedges as Markups (con't)

- Taking logs:

$$\log MPL_t - \log MRS_t \approx \mu_t^P + \mu_t^W$$

- We can rewrite the log price and wage mark-ups as:

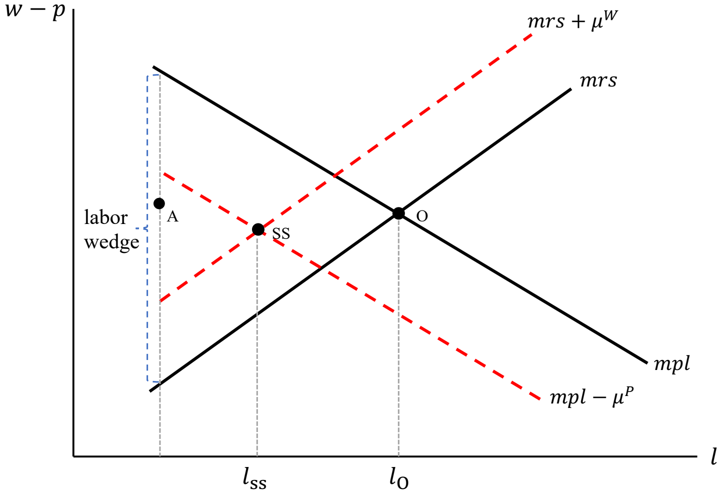
$$\begin{aligned} \mu_t^P &= \log MPL_t - \log(W_t/P_t) \\ \mu_t^W &= \log(W_t/P_t) - \log MRS_t \end{aligned}$$

- The labor wedge and markups:

$$\tau_t^L = \mu_t^P + \mu_t^W = \log MPL_t - \log MRS_t$$

- Countercyclical movements in τ_t^L reflect countercyclical movements in markups and inefficiency of the labor market.

Figure 1. The Labor Wedge



A Parametric Example

Technology:

Assume a constant elasticity of output with respect to hours (e.g. Cobb-Douglas). Then from a loglinear approximation around the steady state:

$$\begin{aligned} mpl_t &= y_t - l_t \;\rightarrow \\ \mu_t^P &= (y_t - l_t) - (w_t - p_t) \end{aligned}$$

Preferences:

From a loglinear approximation around the steady state:

$$\begin{aligned} mrs_t &= \varphi l_t + \gamma c_t \;\rightarrow \\ \mu_t^W &= (w_t - p_t) - (\varphi l_t + \gamma c_t) \end{aligned}$$

A Parametric Example (con't)

- Labor wedge:

$$
\begin{aligned}
\tau_t^L &= \mu_t^P + \mu_t^W \\
&= [(y_t - l_t) - (w_t - p_t)] + [(w_t - p_t) - (\varphi l_t + \sigma c_t)] \\
&= (y_t - l_t) - (\varphi l_t + \sigma c_t)
\end{aligned}
$$

Steady State vs. Cyclical Wedges

$\tau^L \equiv$ steady state wedge $= \mu^P + \mu^W$

$\widehat{\tau}_t^L \equiv \tau_t^L - \tau^L =$ cyclical wedge $= \widehat{\mu}_t^P + \widehat{\mu}_t^W = (\mu_t^P - \mu^P) + (\mu_t^W - \mu^W)$

Sources of steady state wedge

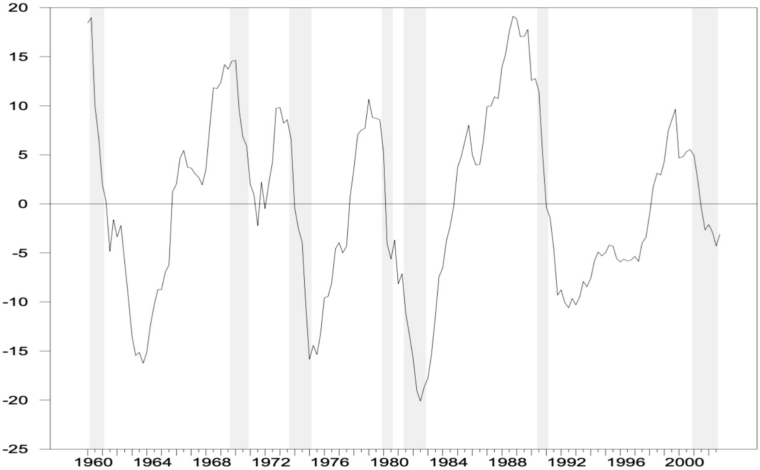
1. Imperfect competition ($\rightarrow$ steady state markup)
2. Tax distortions

Note that if a labor wedge exists in steady state, then the labor market in steady state is inefficient

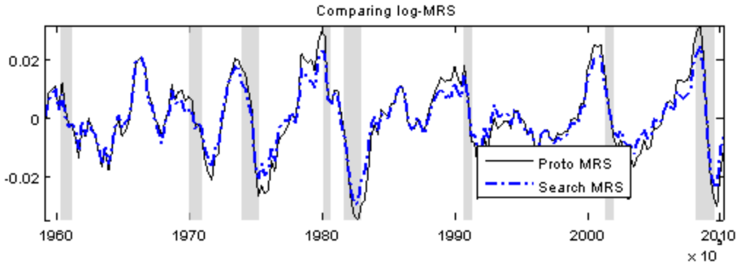
$\rightarrow$ steady state employment $<$ competitive eq. level

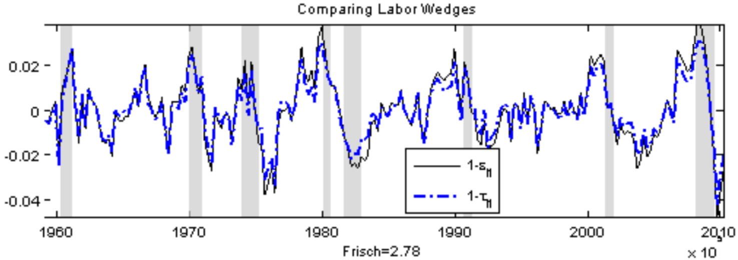
Figure 2. The Inverse Labor Wedge

Baseline Calibration (σ=5, φ=1)



Prototype vs Search Model. Business Cycle Frequency





Capital Market Wedge

- Let $R_{ft} \equiv$ risk free rate. With frictionless financial markets:

$$E_t \{IMRS_{t+1} R_{kt+1}\} = E_t \{IMRS_{t+1} \cdot R_{ft+1}\} \quad \rightarrow$$
$$E_t \{IMRS_{t+1}\} \cdot E_t\{R_{kt+1}\} + Cov(IMRS_{t+1}, R_{kt+1}\} = E_t\{IMRS_{t+1}\} \cdot R_{ft+1}$$

- From saver's first order condition for risk free bond

$$E_t\{IMRS_{t+1}\} \cdot R_{ft+1} = 1$$

- Then if

$$E_t \{IMRS_{t+1}\} \cdot E_t\{R_{kt+1}\} + Cov(IMRS_{t+1}, R_{kt+1}\} > E_t\{IMRS_{t+1}\} \cdot R_{ft+1} = 1$$

$\rightarrow$

$$\tau_t^K = E_t \{IMRS_{t+1} \cdot R_{kt+1}\} - 1 > 0$$

- Intuitively, if $E_t\{R_{kt+1}\} > R_{ft+1}$, (beyond what the equity premium explains) financial frictions are distorting investment demand.

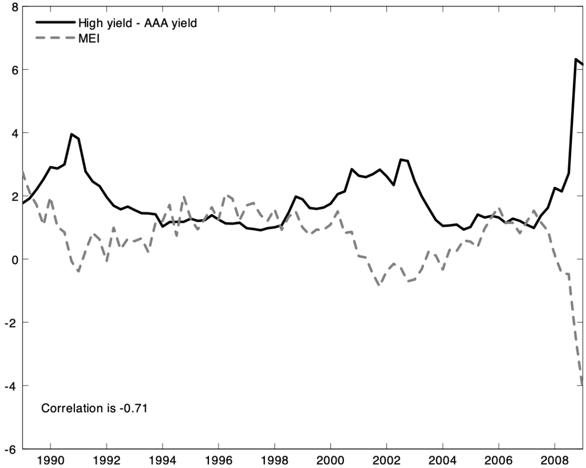


FIGURE 5. Credit spread and the marginal efficiency of investment. The credit spread (dark continuous line) is measured as the difference between the returns on high yield and AAA corporate bonds. The marginal efficiency of investment series (light dashed line) is the Kalman filter estimate of the μ_t shock at the posterior mode. Both series are standardized.