

# Leading Indicators

- The goal for good forecasting is to locate variables which are **leading indicators** – variables which reduce the MSE of multi-step forecast errors
- This requires that the leading indicator move in advance of the variable of interest
- Economic theory can be a good guide to help select leading indicators

# Business Cycle

- Measures of the business cycle include
  - GDP growth
  - Unemployment rates
  - Production growth rates
- All of these require leading indicators of the business cycle

# Common Leading Indicators

- Housing starts
- Building permits
- Orders for consumer goods
- Term spread
  - Difference between Long Rate and Short Rate
- Junk bond spread
  - Difference between rates on BAA and AAA corporate bonds

# Term Spread

- Spread=Long-Short
- Term Structure theory
  - Long Rate is average of expected short rates
- Asset pricing theory
  - Long Bonds have greater risk
    - Small changes in rates imply large changes in bond price
    - Unless you hold bond until maturity the return is uncertain
  - Risky assets receive a **risk premium**: higher expected returns than lower risk assets
- Together, long rates should be higher than short rates, but are forecasts of future short rates.
  - The difference – the spread – is a leading indicator

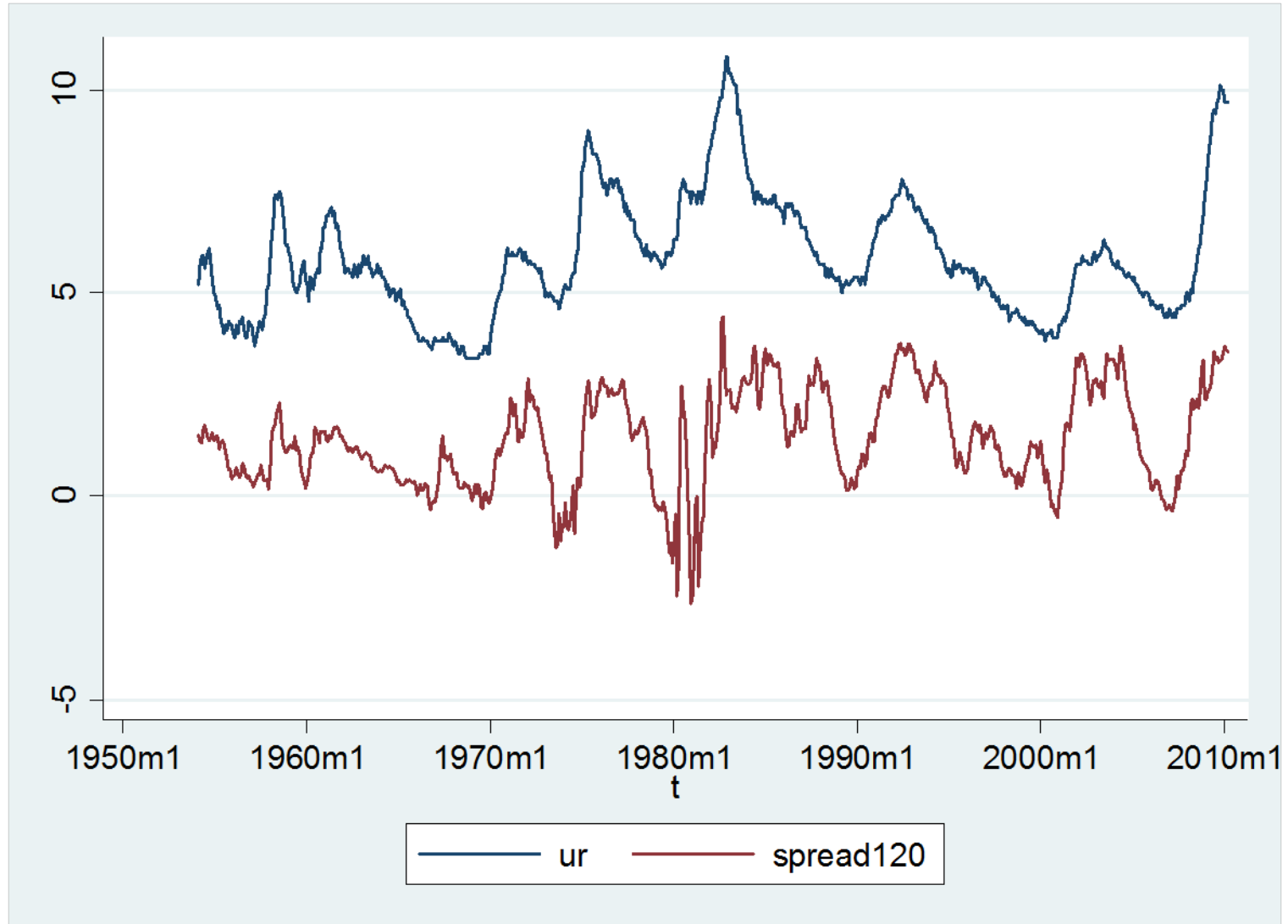
# Term Structure in March 2010

Term (months)	Rate	Spread (over 3 month)
3	0.15	
6	0.22	0.07
12	0.39	0.24
60	2.41	2.26
120	3.7	3.55

# Interest Rate Spreads



# Spread and Unemployment Rate



# Term Inversion

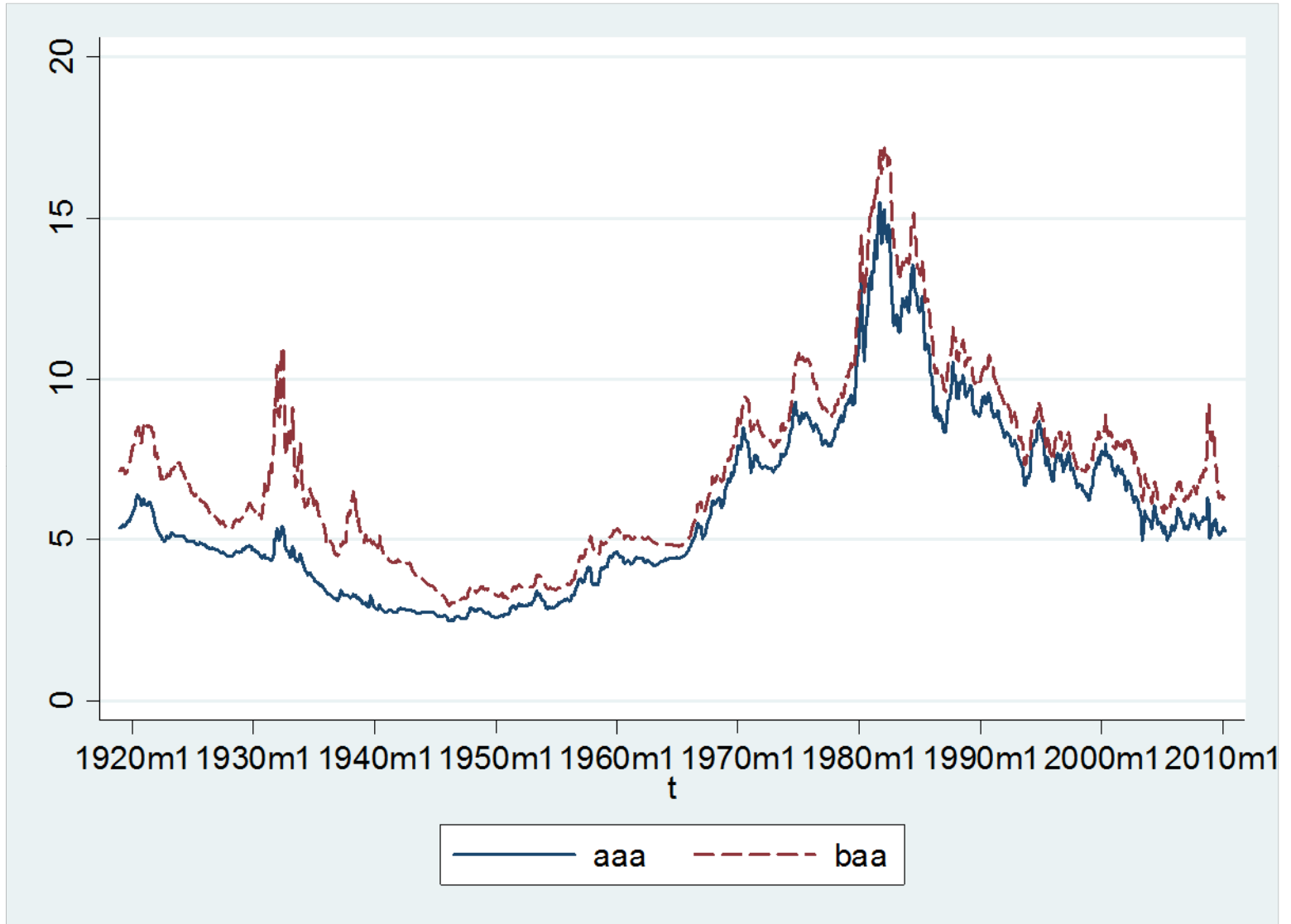
- Before many recessions, the long rate dropped below the short
  - Negative spread predicts a future recession
    - An increase in the unemployment rate



# Junk Bond Spread

- A bond is called “Junk” or “high-yield” if it was rated below investor grade at the time of purchase
- Credit rating agencies assess risk of a bond, and give each a rating:
  - AAA, AA, A, BBB, BB, B, CCC, CC, C
- BB and lower typically called “high-yield”
  - Viewed as having a higher risk of default
  - Earn a higher interest rate to compensate

# AAA and BAA rates

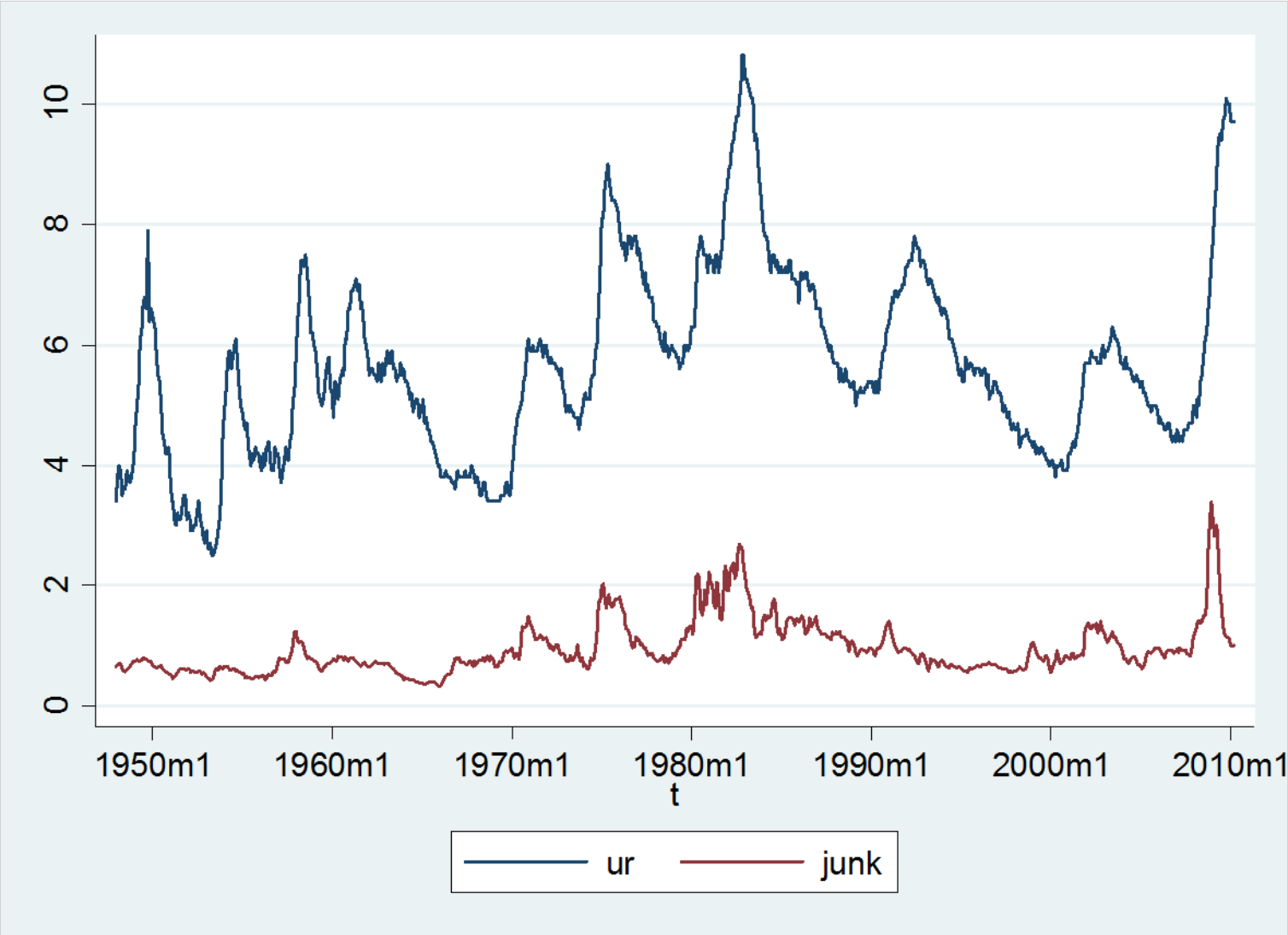


# Junk Bond Spread as Leading Indicator

- Idea due to Mark Gertler and Cara Lown
  - Gertler is a 1973 UW grad, currently professor at NYU
- Increased junk bond spread is a financial symptom of the business cycle
- Useful leading indicator



# Junk Spread and Unemployment Rate



# Example: Leading Indicators for Unemployment Rate

- Interest Rate Spreads
  - $\text{Spread}_{120} = T_{120} - T_3$  (10 years versus 3 month)
  - $\text{Spread}_{60} = T_{60} - T_3$  (5 years versus 3 month)
  - $\text{Spread}_{12} = T_{12} - T_3$  (1 year versus 3 month)
- Junk Bond Spread
  - $\text{Junk} = \text{AAA} - \text{BAA}$
- All available starting 1953Q4

# Baseline

- To start, we need a baseline AR model for the unemployment rate
- Lowest AIC attained by AR(13), with
  - AIC = -2337

# UR on Spread120

spread120						
L1.	-.0230784	.0262251	-0.88	0.379	-.0745727	.0284159
L2.	.0682533	.0445325	1.53	0.126	-.0191885	.1556951
L3.	-.0562514	.0286638	-1.96	0.050	-.1125342	.0000313
_cons	.0760671	.0343462	2.21	0.027	.0086267	.1435076

---

. dis ln(e(rss)/e(N))\*e(N)+e(rank)\*2  
-2323.6922

- Slightly lower AIC than AR
- Increase in spread predicts higher UR

# UR on Spread60

spread60						
L1.	-.0344966	.0268074	-1.29	0.199	-.0871342	.018141
L2.	.0849417	.0441115	1.93	0.055	-.0016732	.1715567
L3.	-.063567	.0298969	-2.13	0.034	-.1222711	-.0048629
_cons	.0759534	.0343282	2.21	0.027	.0085483	.1433585

---

. dis ln(e(rss)/e(N))\*e(N)+e(rank)\*2  
-2324.2633

- Slightly lower AIC than AR and Spread120
- Increase in spread predicts higher UR



# UR on Spread12

<b>spread12</b>						
L1.	<b>-.0691418</b>	<b>.0413491</b>	<b>-1.67</b>	<b>0.095</b>	<b>-.1503328</b>	<b>.0120491</b>
L2.	<b>.1679888</b>	<b>.061623</b>	<b>2.73</b>	<b>0.007</b>	<b>.0469891</b>	<b>.2889885</b>
L3.	<b>-.07681</b>	<b>.0458367</b>	<b>-1.68</b>	<b>0.094</b>	<b>-.1668126</b>	<b>.0131927</b>
<b>_cons</b>	<b>.0972857</b>	<b>.0325185</b>	<b>2.99</b>	<b>0.003</b>	<b>.0334341</b>	<b>.1611374</b>

---

**. dis ln(e(rss)/e(N))\*e(N)+e(rank)\*2**  
**-2327.2553**

- Even lower AIC

# UR on Junk Spread

<b>junk</b>						
<b>L1.</b>	<b>.2160887</b>	<b>.080553</b>	<b>2.68</b>	<b>0.007</b>	<b>.0579191</b>	<b>.3742583</b>
<b>L2.</b>	<b>-.0372205</b>	<b>.1298854</b>	<b>-0.29</b>	<b>0.775</b>	<b>-.2922567</b>	<b>.2178158</b>
<b>L3.</b>	<b>-.0576731</b>	<b>.0840394</b>	<b>-0.69</b>	<b>0.493</b>	<b>-.2226885</b>	<b>.1073424</b>
<b>_cons</b>	<b>.096636</b>	<b>.030995</b>	<b>3.12</b>	<b>0.002</b>	<b>.0357759</b>	<b>.1574962</b>

---

**. dis ln(e(rss)/e(N))\*e(N)+e(rank)\*2**  
**-2359.2678**

- Lowest AIC (considerably)
- Junk Spread positively related to unemployment rate

# Both Junk and Spread

- Best model:
  - AR(13)
  - 2 lags of Junk Spread (BAA over AAA)
  - 3 lags of Spread<sub>12</sub> (one year over 3 month)
  - AIC=-2366

# Coefficients

<b>junk</b>						
<b>L1.</b>	<b>.2294261</b>	<b>.0764511</b>	<b>3.00</b>	<b>0.003</b>	<b>.0793099</b>	<b>.3795424</b>
<b>L2.</b>	<b>-.099095</b>	<b>.0770899</b>	<b>-1.29</b>	<b>0.199</b>	<b>-.2504655</b>	<b>.0522756</b>
<b>spread12</b>						
<b>L1.</b>	<b>-.073974</b>	<b>.0363155</b>	<b>-2.04</b>	<b>0.042</b>	<b>-.1452817</b>	<b>-.0026662</b>
<b>L2.</b>	<b>.1653918</b>	<b>.0583849</b>	<b>2.83</b>	<b>0.005</b>	<b>.0507495</b>	<b>.280034</b>
<b>L3.</b>	<b>-.1038665</b>	<b>.0442904</b>	<b>-2.35</b>	<b>0.019</b>	<b>-.1908333</b>	<b>-.0168998</b>
<b>_cons</b>	<b>.0946371</b>	<b>.0326686</b>	<b>2.90</b>	<b>0.004</b>	<b>.0304904</b>	<b>.1587837</b>

---

**. dis ln(e(rss)/e(N))\*e(N)+e(rank)\*2**  
**-2365.9628**

# 12-step Forecast Regression

```
. reg ur L(12/24).ur L(12/13).junk L(12/14).spread12 if t>tm(1953m7),r
```

<b>junk</b>						
<b>L12.</b>	<b>2.309457</b>	<b>.3792786</b>	<b>6.09</b>	<b>0.000</b>	<b>1.5647</b>	<b>3.054214</b>
<b>L13.</b>	<b>-.7634711</b>	<b>.4020907</b>	<b>-1.90</b>	<b>0.058</b>	<b>-1.553022</b>	<b>.0260802</b>
<b>spread12</b>						
<b>L12.</b>	<b>.2454128</b>	<b>.2682187</b>	<b>0.91</b>	<b>0.361</b>	<b>-.2812655</b>	<b>.772091</b>
<b>L13.</b>	<b>.1079342</b>	<b>.3760434</b>	<b>0.29</b>	<b>0.774</b>	<b>-.6304701</b>	<b>.8463385</b>
<b>L14.</b>	<b>-.5389572</b>	<b>.2582045</b>	<b>-2.09</b>	<b>0.037</b>	<b>-1.045971</b>	<b>-.031943</b>

# Forecast Inputs

- Current Unemployment rate= 9.7%
- Junk Spread= 1.0% (past 3 months)
- Spread12=0.29% in March, 0.24% in Feb and Jan

```
tsappend, add(12)
reg ur L(1/13).ur L(1/2).junk L(1/3).spread12
predict y1
gen y1L=y1-1.645*e(rmse)
gen y1U=y1+1.645*e(rmse)
reg ur L(2/14).ur L(2/3).junk L(2/4).spread12
predict y2
gen y2L=y2-1.645*e(rmse)
gen y2U=y2+1.645*e(rmse)
reg ur L(3/15).ur L(3/4).junk L(3/5).spread12
predict y3
gen y3L=y3-1.645*e(rmse)
gen y3U=y3+1.645*e(rmse)
reg ur L(4/16).ur L(4/5).junk L(4/6).spread12
```

```
egen p=rowfirst(y1 y2 y3 y4 y5 y6 y7 y8 y9 y10 y11 y12) if t>=tm(2010m4)
egen pL=rowfirst(y1L y2L y3L y4L y5L y6L y7L y8L y9L y10L y11L y12L) if t>=tm(2010m4)
egen pU=rowfirst(y1U y2U y3U y4U y5U y6U y7U y8U y9U y10U y11U y12U) if t>=tm(2010m4)
label variable p "forecast"
label variable pL "lower forecast interval"
label variable pU "upper forecast interval"
tsline ur p pL pU if t>=tm(2008m1), title(Unemployment Rate) lpattern (solid dash longdash
shortdash)
```

# Unemployment Rate

