

APS 425
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Short-term Interest Rates as
Predictors of Inflation

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Inflation & Interest Rates

- Fama (1975) AER: Expected real interest rates are (approximately) constant over time, so:

- $E(\rho_t | \Phi_{t-1}) = R_t - E(r)$

- where $E(\rho_t | \Phi_{t-1})$ is expected inflation given information available at time t-1, R_t is the nominal yield on a riskless bond from t-1 to t, and $E(r)$ is the constant expected real return on this bond

Inflation & Interest Rates: Fama

- Slope coefficient is .98
 - Fama predicts 1
- Intercept is -.0007
 - expected real rate of 1% per year
- R² is 23%
 - So expected inflation is 23% of realized inflation

Dependent Variable: INFL
 Method: Least Squares
 Sample: 1953M01 1971M07
 Included observations: 223
 White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000685	0.000355	-1.931250	0.0547
INT	0.975178	0.109887	8.874382	0.0000

R-squared	0.232796	Mean dependent var	0.001890
Adjusted R-squared	0.229325	S.D. dependent var	0.002641
S.E. of regression	0.002318	Akaike info criterion	-9.287148
Sum squared resid	0.001188	Schwarz criterion	-9.256591
Log likelihood	1037.517	Hannan-Quinn criter.	-9.274812
F-statistic	67.05914	Durbin-Watson stat	2.191581
Prob(F-statistic)	0.000000		

Inflation & Interest Rates: Fama

- Residual autocorrelations look pretty good
- Spike at lag 12 may represent seasonality in measured inflation that does not affect interest rates
 - e.g., infrequently sampled prices for some items

Correlogram of Residuals

Sample: 1953M01 1971M07
 Included observations: 223

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
1		-0.105	-0.105	2.5012	0.114
2		0.169	0.160	9.0118	0.011
3		-0.021	0.011	9.1136	0.028
4		-0.003	-0.032	9.1158	0.058
5		-0.062	-0.066	10.009	0.075
6		-0.022	-0.028	10.120	0.120
7		-0.091	-0.078	12.062	0.099
8		0.093	0.090	14.079	0.080
9		0.087	0.136	15.835	0.070
10		0.017	0.004	15.904	0.102
11		0.001	-0.045	15.904	0.145
12		0.205	0.204	25.916	0.011
13		0.068	0.135	27.009	0.012
14		-0.025	-0.075	27.165	0.018
15		0.140	0.137	31.865	0.007
16		-0.020	0.057	31.960	0.010
17		0.013	-0.041	32.001	0.015
18		-0.026	-0.025	32.161	0.021
19		-0.067	-0.011	33.261	0.022
20		0.001	-0.019	33.261	0.032
21		0.132	0.092	37.559	0.015
22		-0.067	-0.030	38.666	0.015
23		0.119	0.062	42.237	0.009
24		0.046	0.003	42.771	0.011

Inflation ARIMA(0,1,1): Nelson-Schwert

•Std error of regression is .00238, compared with .00232 for Fama model

Dependent Variable: D(INFL)
 Method: Least Squares
 Sample: 1953M01 1971M07
 Included observations: 223
 Convergence achieved after 7 iterations
 White heteroskedasticity-consistent standard errors & covariance
 MA Backcast: 1952M12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.87E-05	1.15E-05	1.624397	0.1057
MA(1)	-0.931027	0.025432	-36.60871	0.0000

R-squared	0.523740	Mean dependent var	1.10E-05
Adjusted R-squared	0.521585	S.D. dependent var	0.003442
S.E. of regression	0.002381	Akaike info criterion	-9.234053
Sum squared resid	0.001252	Schwarz criterion	-9.203495
Log likelihood	1031.597	Hannan-Quinn criter.	-9.221717
F-statistic	243.0327	Durbin-Watson stat	2.238622
Prob(F-statistic)	0.000000		

Inflation ARIMA(0,1,1): Nelson-Schwert

•Residual autocorrelations look pretty good

•Same spike at lag 12

Correlogram of Residuals

Sample: 1953M01 1971M07
 Included observations: 223
 Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
█	█	1 -0.127	-0.127	3.6277	
█	█	2 0.164	0.151	9.7510	0.002
█	█	3 -0.030	0.007	9.9508	0.007
█	█	4 0.006	-0.022	9.9578	0.019
█	█	5 -0.050	-0.050	10.523	0.032
█	█	6 -0.007	-0.015	10.533	0.061
█	█	7 -0.089	-0.080	12.380	0.054
█	█	8 0.100	0.089	14.717	0.040
█	█	9 0.088	0.140	16.522	0.035
█	█	10 -0.005	-0.014	16.529	0.057
█	█	11 -0.030	-0.078	16.749	0.080
█	█	12 0.167	0.167	23.403	0.015
█	█	13 0.018	0.086	23.482	0.024
█	█	14 -0.066	-0.122	24.536	0.027
█	█	15 0.087	0.083	26.368	0.023
█	█	16 -0.048	0.022	26.925	0.029
█	█	17 -0.025	-0.095	27.073	0.041
█	█	18 -0.047	-0.067	27.608	0.050
█	█	19 -0.096	-0.039	29.878	0.039
█	█	20 -0.027	-0.054	30.052	0.051
█	█	21 0.108	0.062	32.931	0.034
█	█	22 -0.100	-0.047	35.426	0.025
█	█	23 0.087	0.051	37.340	0.022
█	█	24 0.013	-0.008	37.383	0.030

Nelson-Schwert/Fama Horse Race

- INFLF is forecast from ARIMA(0,1,1) model for inflation

- It looks like there is some evidence that the expected real rate of interest is not constant

- With CPI data available at the time of Fama's paper, the t-statistic on INFLF was 2.42

- Probably due to changes in the way CPI is measured

Dependent Variable: INFL
Method: Least Squares
Sample: 1953M01 1971M07
Included observations: 223
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000650	0.000358	-1.814963	0.0709
INT	0.732327	0.212318	3.449201	0.0007
INFLF	0.320795	0.222613	1.441040	0.1510

R-squared	0.241464	Mean dependent var	0.001890
Adjusted R-squared	0.234568	S.D. dependent var	0.002641
S.E. of regression	0.002310	Akaike info criterion	-9.289541
Sum squared resid	0.001174	Schwarz criterion	-9.243705
Log likelihood	1038.784	Hannan-Quinn criter.	-9.271037
F-statistic	35.01613	Durbin-Watson stat	2.265658
Prob(F-statistic)	0.000000	Wald F-statistic	42.79793
Prob(Wald F-statistic)	0.000000		

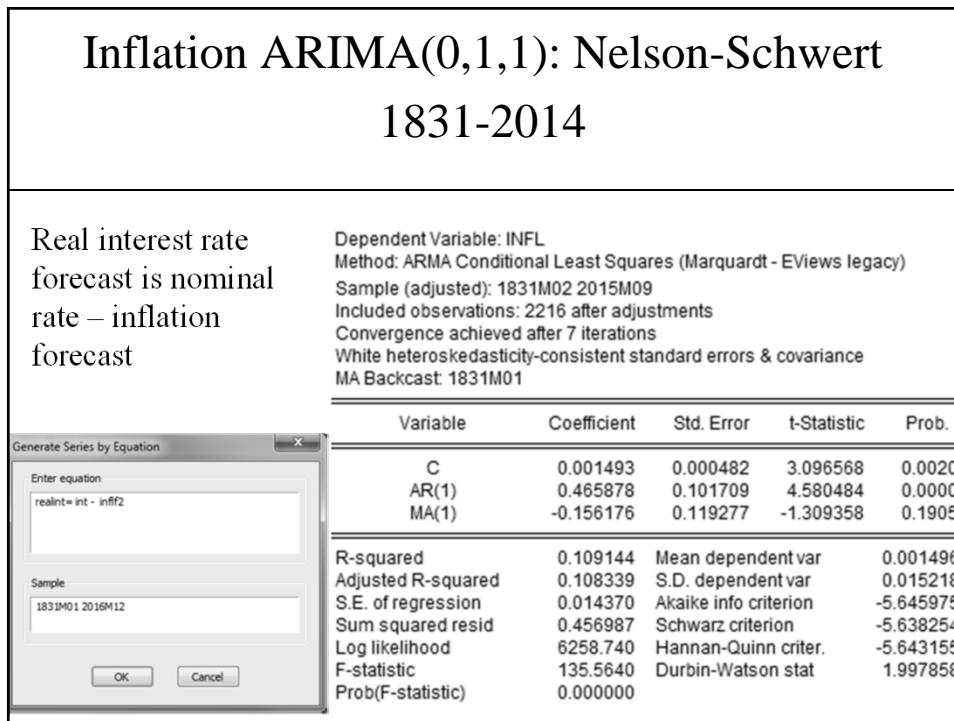
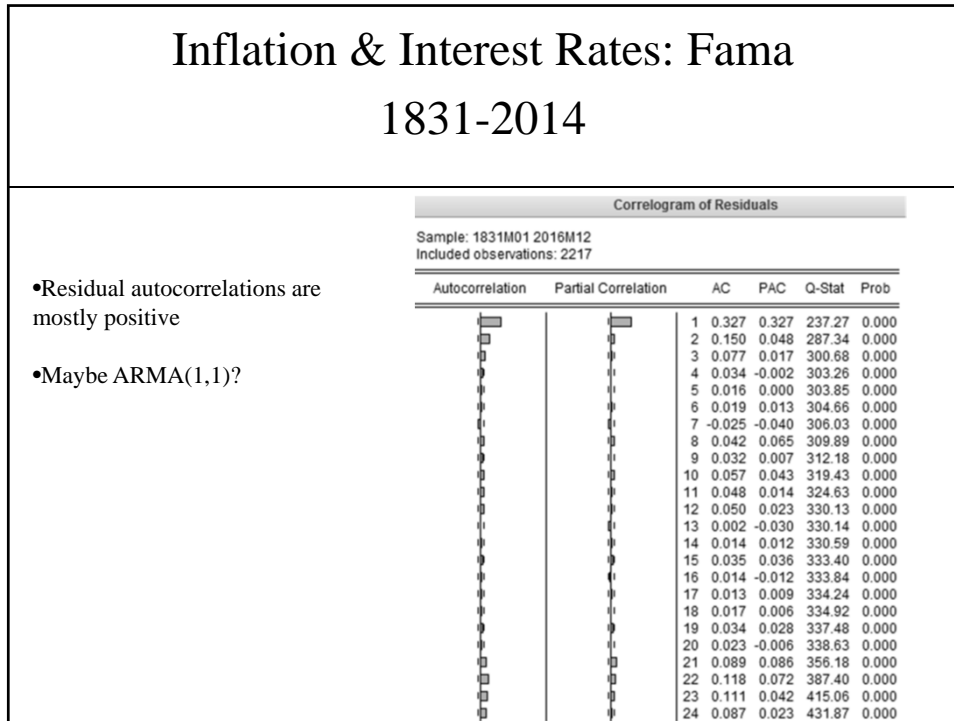
Inflation & Interest Rates: Fama
1831-2015

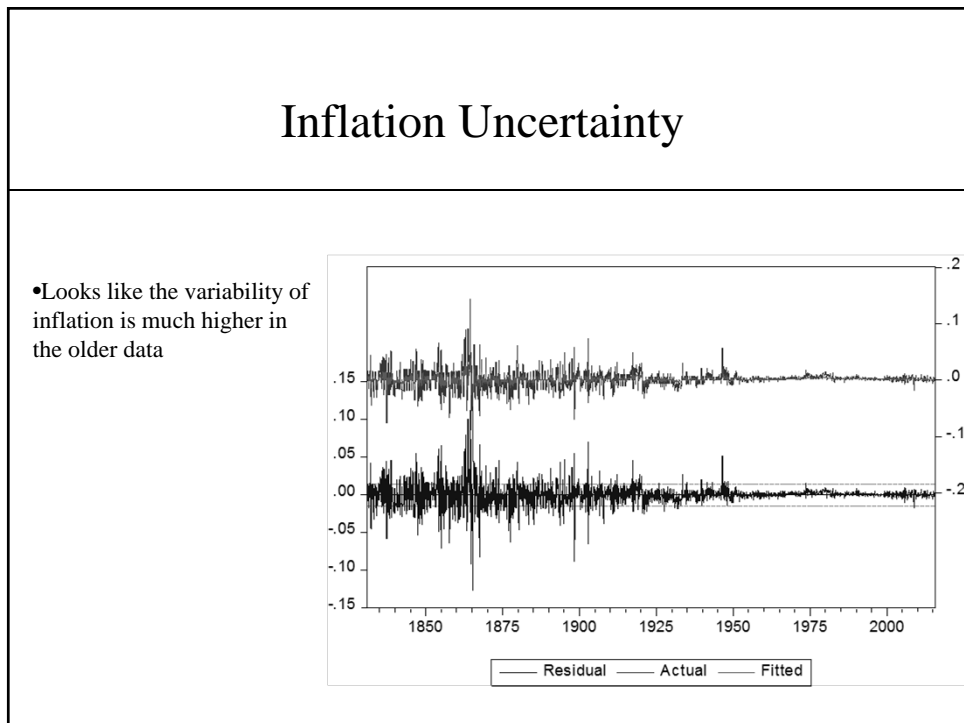
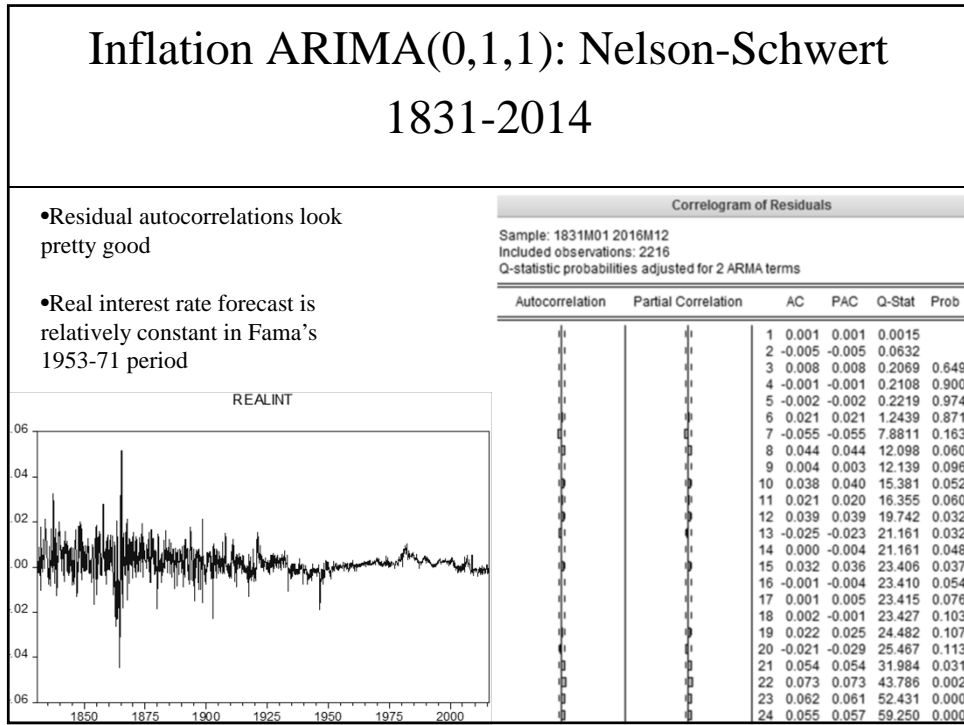
- Slope coefficient is -.16
 - Significantly lower than 1
- Negative relation between inflation and nominal interest rates
- R² is 0%

Dependent Variable: INFL
Method: Least Squares
Sample (adjusted): 1831M01 2015M09
Included observations: 2217 after adjustments
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002060	0.000558	3.693038	0.0002
INT	-0.161042	0.175657	-0.916800	0.3593

R-squared	0.000629	Mean dependent var	0.001495
Adjusted R-squared	0.000178	S.D. dependent var	0.015215
S.E. of regression	0.015213	Akaike info criterion	-5.532382
Sum squared resid	0.512654	Schwarz criterion	-5.527237
Log likelihood	6134.646	Hannan-Quinn criter.	-5.530503
F-statistic	1.394889	Durbin-Watson stat	1.346127
Prob(F-statistic)	0.237708	Wald F-statistic	0.840522
Prob(Wald F-statistic)	0.359347		



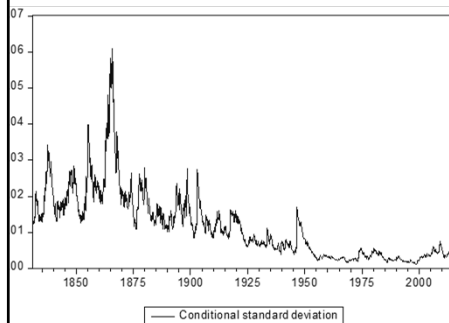


ARMA(1,1) and EGARCH(1,1) Model for CPI Inflation

- Much more persistence in inflation in the latter (low variance period)
- Lots of persistence in volatility

Dependent Variable: INFL
Method: ML ARCH - Normal distribution (Marquardt / EViews legacy)
Sample (adjusted): 1831M02 2015M09
Included observations: 2216 after adjustments
Convergence achieved after 26 iterations
MA Backcast: 1831M01
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(4) + C(5)*ABS(RESID(-1))*SQRT(GARCH(-1)) + C(6)
*RESID(-1))*SQRT(GARCH(-1)) + C(7)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.002975	0.000268	11.11024	0.0000
AR(1)	0.864527	0.019560	44.19775	0.0000
MA(1)	-0.612283	0.029870	-20.49818	0.0000
Variance Equation				
C(4)	-0.192387	0.015539	-12.38099	0.0000
C(5)	0.211841	0.012668	16.72189	0.0000
C(6)	0.050722	0.008041	6.307829	0.0000
C(7)	0.996612	0.001108	899.4101	0.0000



R-squared	0.072448	Mean dependent var	0.001496
Adjusted R-squared	0.071609	S.D. dependent var	0.015218
S.E. of regression	0.014663	Akaike info criterion	-6.744637
Sum squared resid	0.475811	Schwarz criterion	-6.726621
Log likelihood	7480.058	Hannan-Quinn criter.	-6.738056
Durbin-Watson stat	1.835438		

Links

Eviews worksheets

http://schwert.ssb.rochester.edu/a425/a425_int_infl.wf1

APS 425 Home Page

<http://schwert.ssb.rochester.edu/a425/a425main.htm>