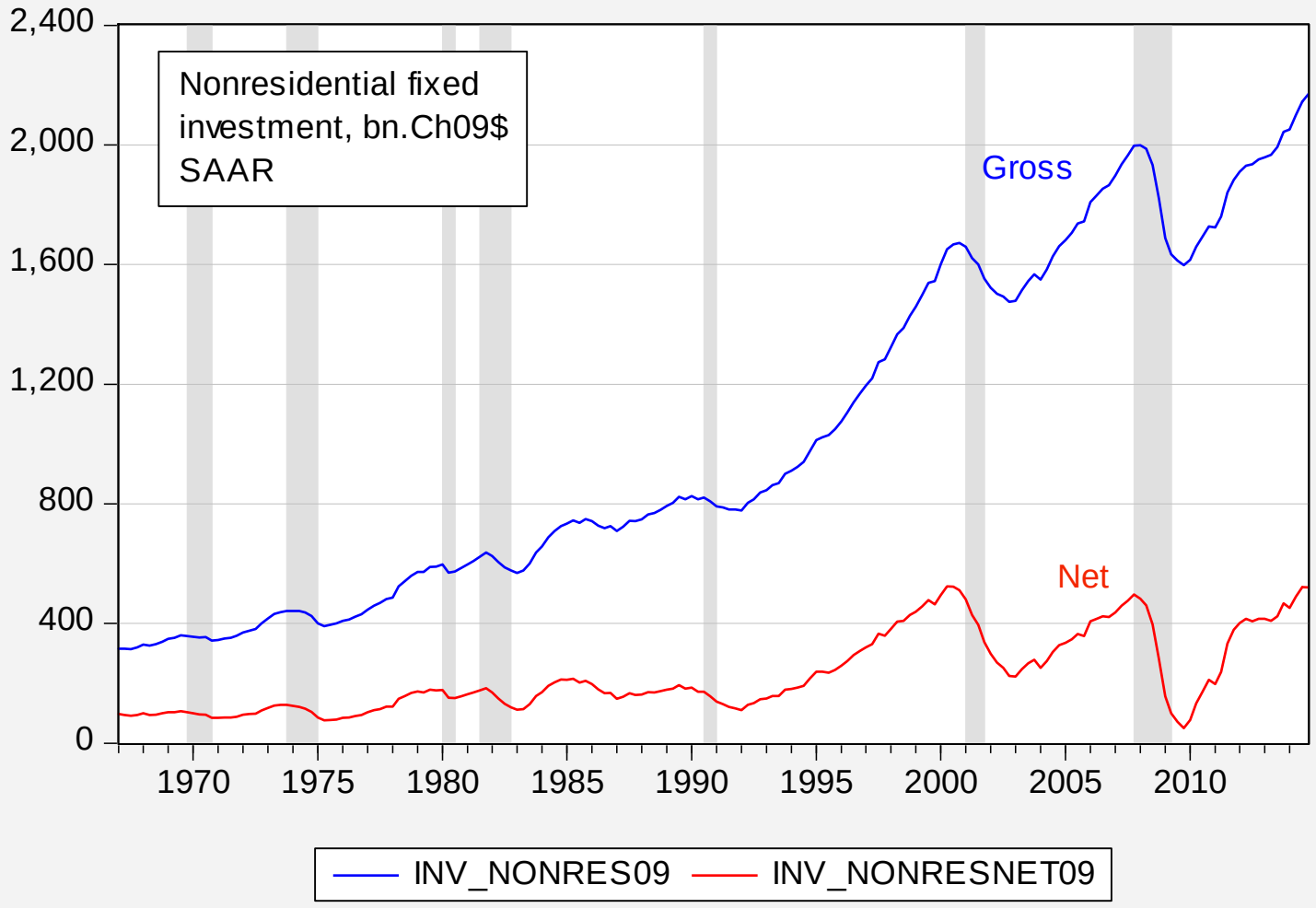
Economics 442
Macroeconomic Policy
(Spring 2016)
3/16-28/2015

Instructor: Prof. Menzie Chinn
UW Madison

Nonresident Fixed Investment



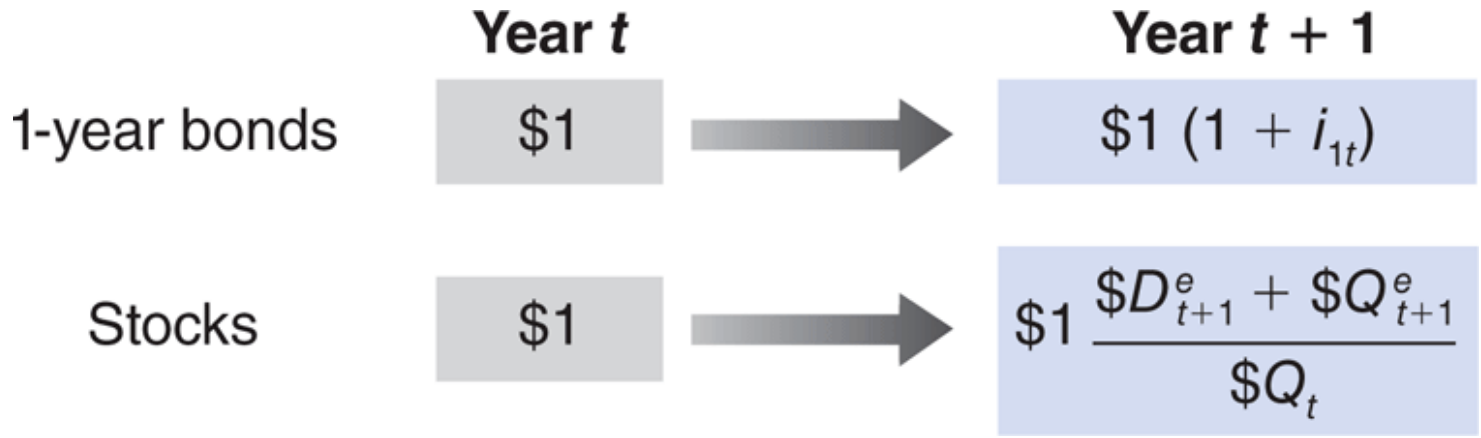
15-2 The Stock Market and Movements in Stock Prices

Figure 15-6 Standard and Poor's Stock Price Index, in Real Terms, since 1970

Source: Calculated using series SP500 and CPIAUSCL, Federal Reserve Economic Data (FRED) http://research.stlouisfed.org/fred2/

15-2 The Stock Market and Movements in Stock Prices

Figure 15-7 Returns from Holding One- Year Bonds or Stocks for One Year



15-2 The Stock Market and Movements in Stock Prices

$$\$Q_t = \frac{\$D^e_{t+1}}{(1 + i_{1t})} + \frac{\$Q^e_{t+1}}{(1 + i_{1t})} \tag{15.9}$$

$$\$Q_t = \frac{\$D^e_{t+1}}{(1 + i_{1t})} + \frac{\$D^e_{t+2}}{(1 + i_{1t})(1 + i^e_{1t+1})} + \cdots + \frac{\$D^e_{t+n}}{(1 + i_{1t}) \cdots (1 + i^e_{1t+n-1})} + \frac{\$Q^e_{t+n}}{(1 + i_{1t}) \cdots (1 + i^e_{1t+n-1})} \tag{15.10}$$

15-2 The Stock Market and Movements in Stock Prices

$$\$Q_t = \frac{\$D^e_{t+1}}{(1 + i_{1t})} + \frac{\$D^e_{t+2}}{(1 + i_{1t})(1 + i^e_{1t+1})} + \cdots + \frac{\$D^e_{t+n}}{(1 + i_{1t}) \cdots (1 + i^e_{1t+n-1})} \quad (15.11)$$

$$Q_t = \frac{D^e_{t+1}}{(1 + r_{1t})} + \frac{D^e_{t+2}}{(1 + r_{1t})(1 + r^e_{1t+1})} + \cdots \quad (15.12)$$

15-3 Risk, Bubbles, Fads, and Asset Prices

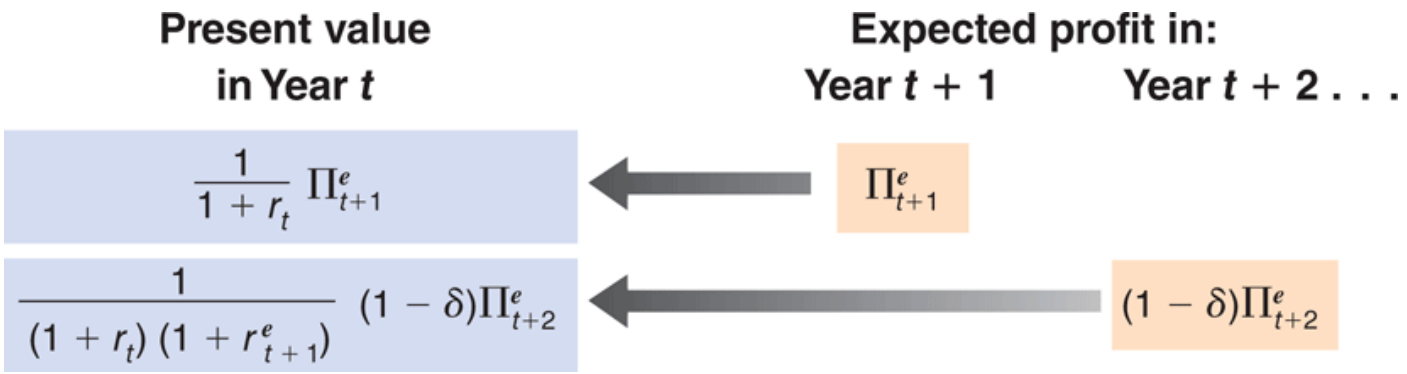
$$\$Q_t = \frac{\$D^e_{t+1}}{(1 + i_{1t} + \theta)} + \frac{\$D^e_{t+2}}{(1 + i_{1t} + \theta)(1 + i^e_{1t+1} + \theta)} + \cdots + \frac{\$D^e_{t+n}}{(1 + i_{1t} + \theta) \cdots (1 + i^e_{1t+n-1} + \theta)} \tag{15.13}$$

16-2 Investment

$$V(\Pi_t^e) = \frac{1}{1 + r_t}\,\Pi_{t+1}^e + \frac{1}{(1 + r_t)(1 + r_{t+1}^e)}\,(1 - \delta)\,\Pi_{t+2}^e + \cdots \qquad (16.3)$$

16-2 Investment

Figure 16-2 Computing the Present Value of Expected Profits



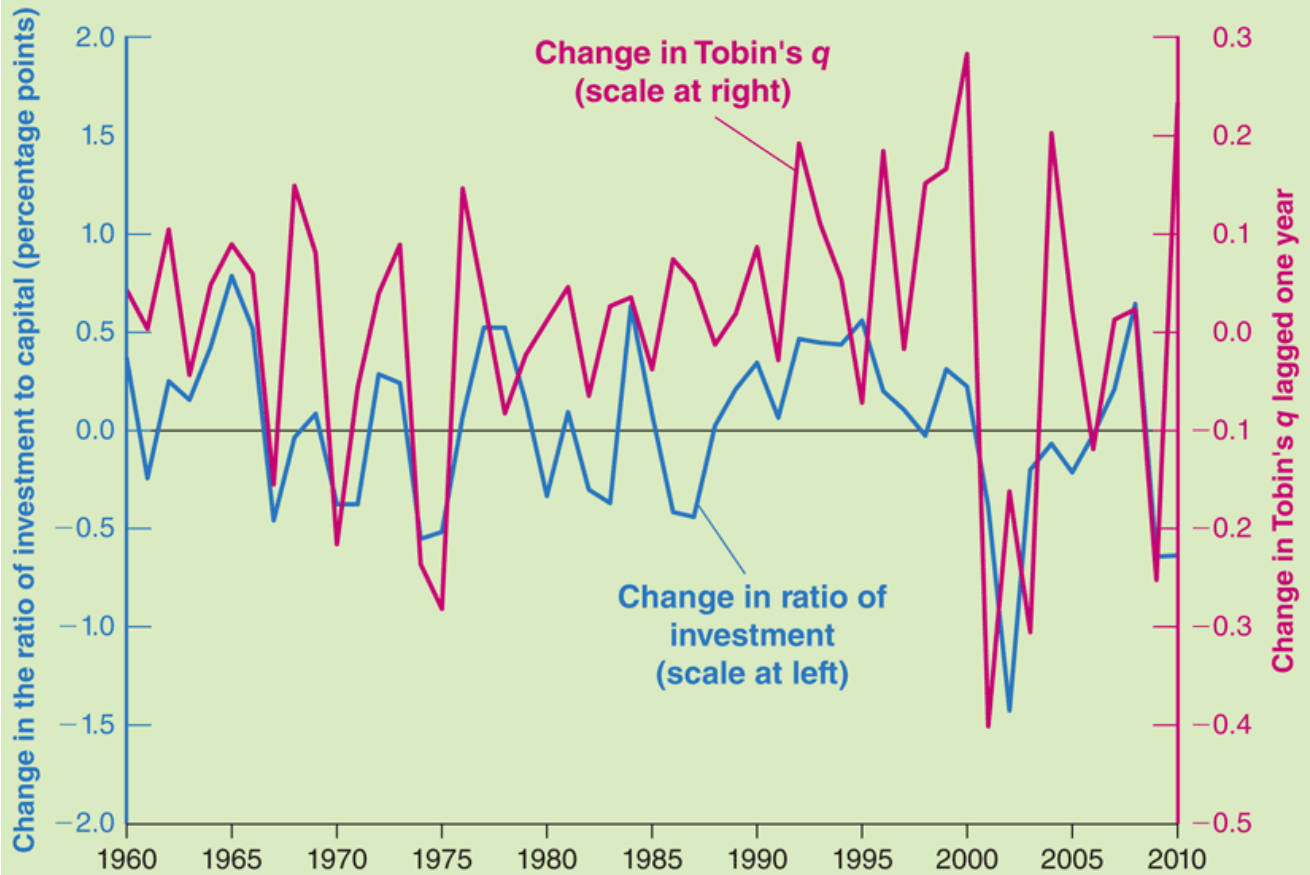
16-2 Investment

$$I_t = I\left[\, V(\Pi_t^e) \,\right] \qquad (16.4)$$
$$\qquad\quad (\quad + \quad)$$

$$V(\Pi_t^e) = \frac{\Pi_t}{r_t + \delta} \qquad (16.5)$$

Focus: Investment and the Stock Market

Figure 1 Tobin's *q* versus the Ratio of Investment to Capital. Annual Rates of Change, since 1960



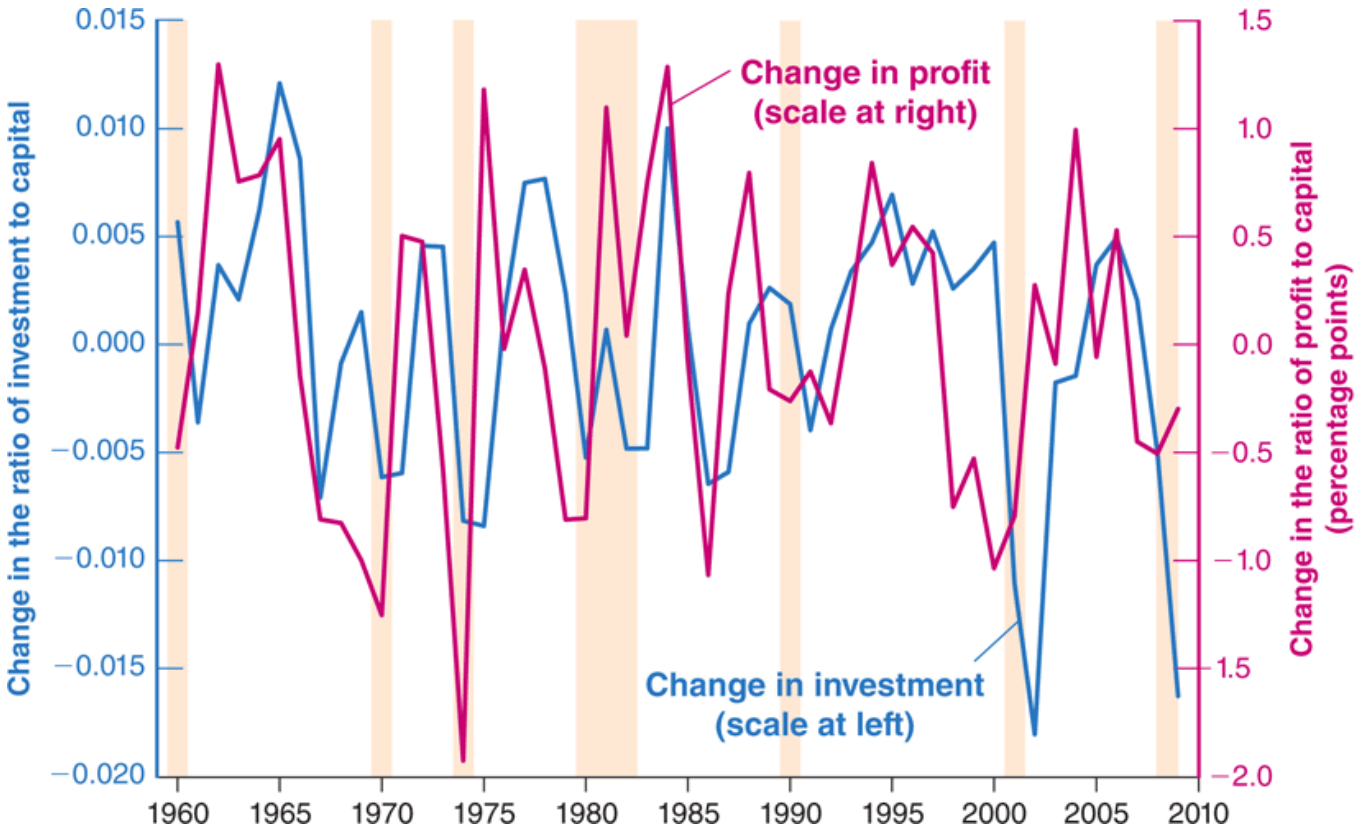
Source: Flow of Funds Accounts Nonfarm Nonfinancial Corporate Business. Investment (line 12, Table F102). Capital measured by Nonfinancial assets (line 2, Table B102). Numerator of q: Market value of Equity (line 35) + [Financial Liabilities (line 21) − (Financial Assets (Total assets (line 1) − Nonfinancial assets (line 2))] all Table B102. Denominator of q: Nonfinancial assets (line 2, Table B102).

16-2 Investment

$$I_t = I\left(\frac{\Pi_t}{r_t + \delta} \right) \tag{16.6}$$

16-2 Investment

Figure 16-3 Changes in Investment and Changes in Profit in the United States, since 1960



Source: Gross investment, Flow of funds variable FA105013005.A; Capital Stock Table 4.1, Bureau of Economic Analysis; Profit is constructed from After-tax profits and Net interest of nonfinancial corporations, Table B14, Economic Report of the President.

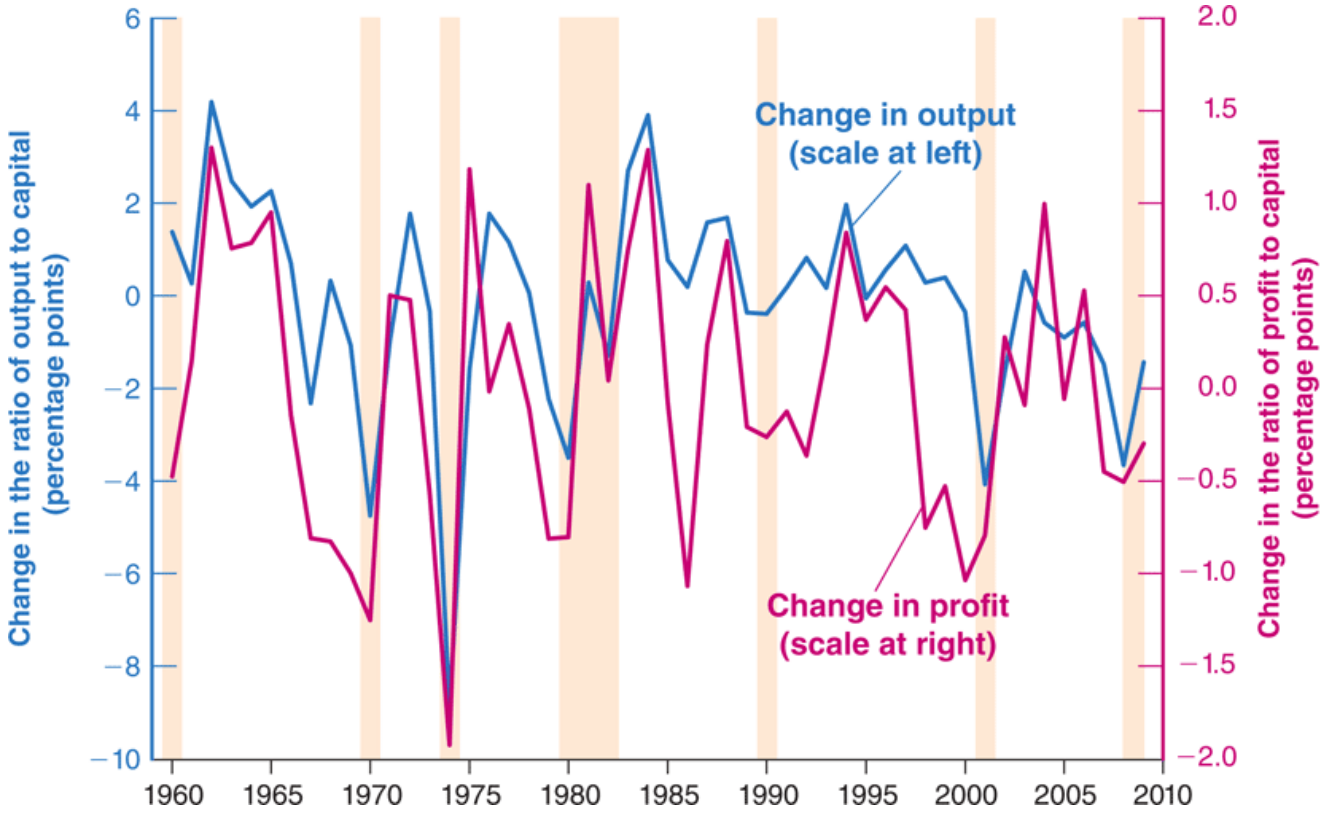
16-2 Investment

$$I_t = I\left[\, V(\Pi_t^e),\ \Pi_t \,\right] \qquad (16.7)$$
$$(\ +\ ,\ +\ )$$

$$\Pi_t = \Pi\left(\frac{Y_t}{K_t}\right) \qquad (16.8)$$
$$(\ +\ )$$

16-2 Investment

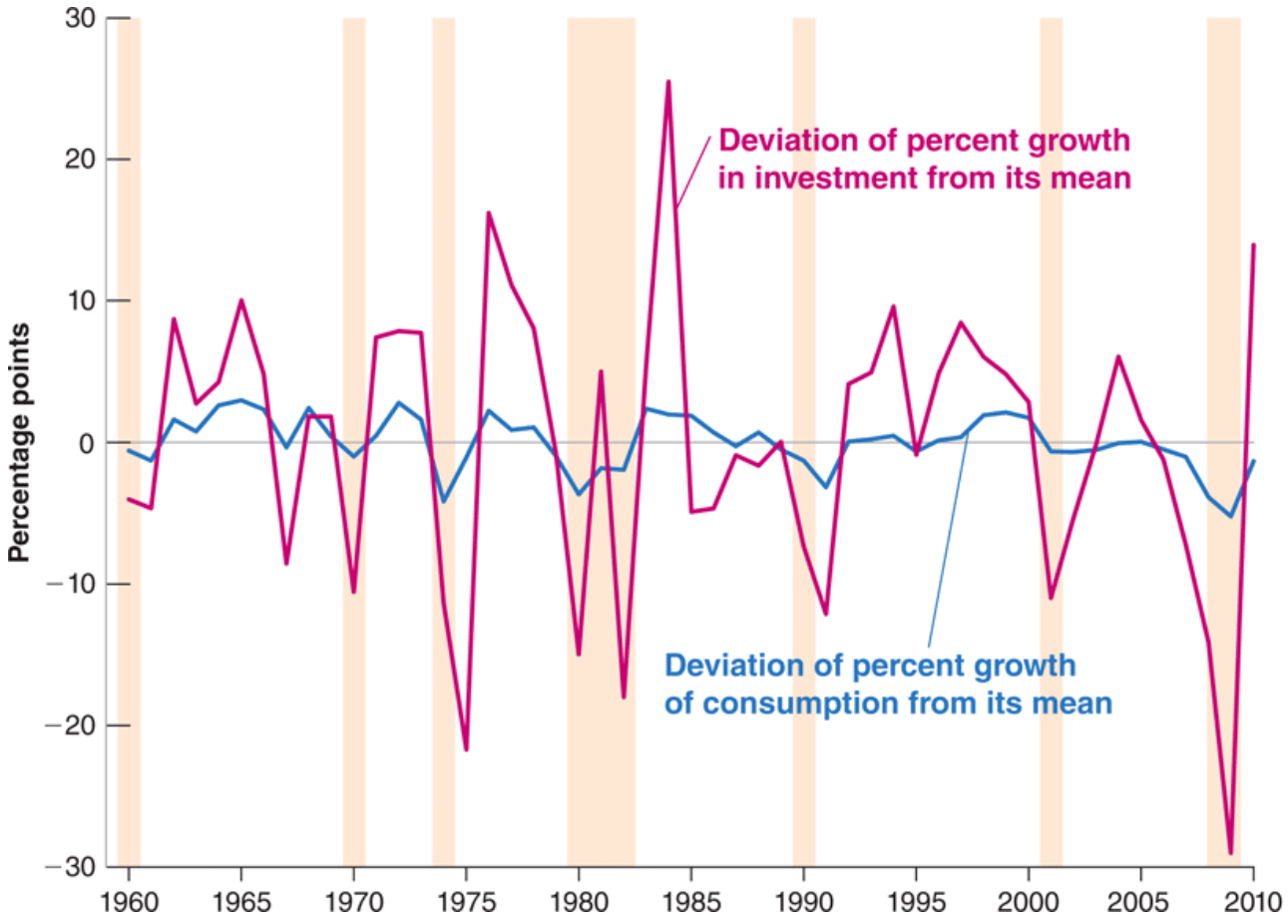
Figure 16-4 Changes in Profit per Unit of Capital versus Changes in the Ratio of Output to Capital in the United States, since 1960



Source: Capital stock: Table 4.1, Bureau of Economic Analysis; profit is constructed from After-Tax Profits and Net Interest of Nonfinancial Corporations, Table B14, Economic Report of the President. Output of the nonfinancial corporate sector is measured by gross value added using Table B14, Economic Report of the President.

16-3 The Volatility of Consumption and Investment

Figure 16-5 Rates of Change of Consumption and Investment, in the United States, since 1960



Source: Series PCECC96, GDPIC96 Federal Reserve Economic Data (FRED) http://research.stlouisfed.org/fred2/

Appendix: Derivation of the Expected Present Value of Profits under Static Expectations

$$V(\Pi_t^e) = \frac{1}{1 + r_t} \Pi_t \left(1 + \frac{1 - \delta}{1 + r_t} + \cdots \right) \qquad (16.A1)$$

The Models of Investment

Accelerator

$$I_t = \sum_{i=0}^{n} a_i Q_{t-i} + cK_{t-1}$$

Neoclassical

$$I_t = \sum_{i=0}^{n} a_i \frac{Q_{t-i}}{UCC_{t-i}} + \sum_{i=0}^{n} b_i \frac{Q_{t-i}}{UCC_{t-1-i}} + cK_{t-1}$$

Modified Neoclassical

$$I_t = [\sum_{i=0}^{n} a_i \log(Q_{t-i}) + \sum_{i=0}^{n} b_i \log(UCC_{t-i})]K_{t-1} + cK_{t-1}$$

q

$$I_t = \sum_{i=0}^{n} a_i [(q_{t-i} - 1)K_{t-1-i}] + cK_{t-1}$$

Cash Flow

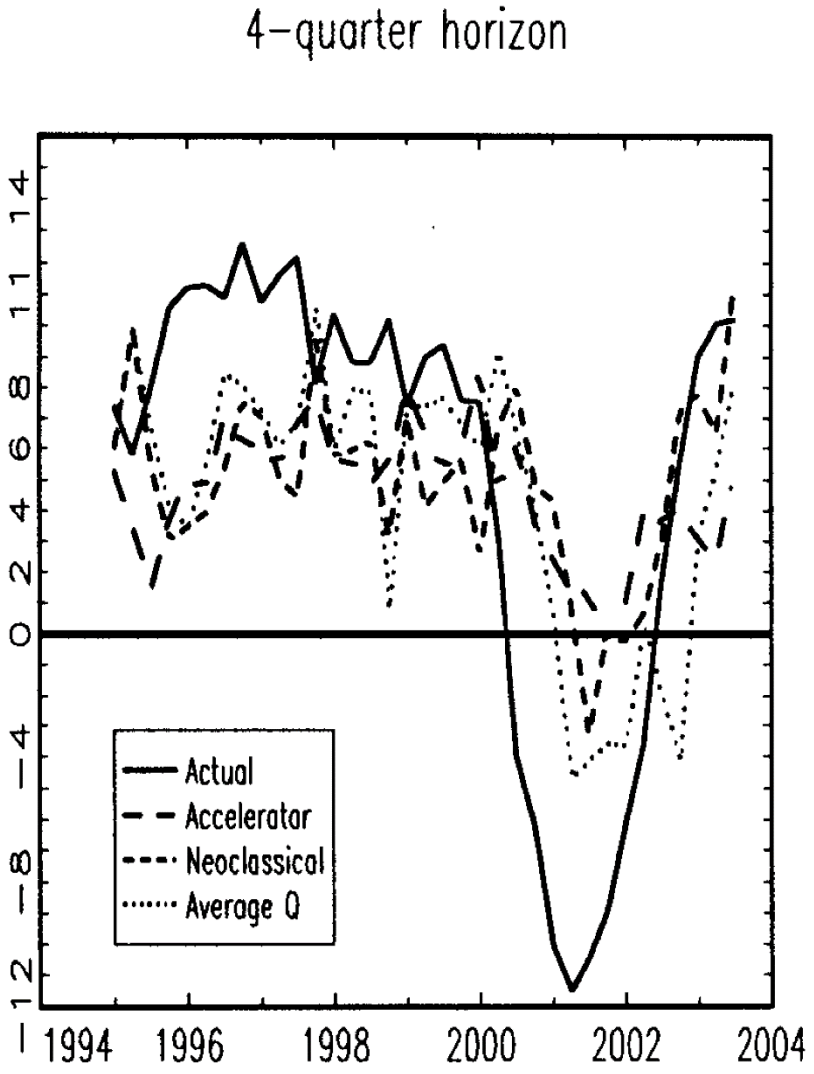
$$I_t = \sum^{n} a_i (\frac{F}{D})_{t-i} + cK_{t-1}$$

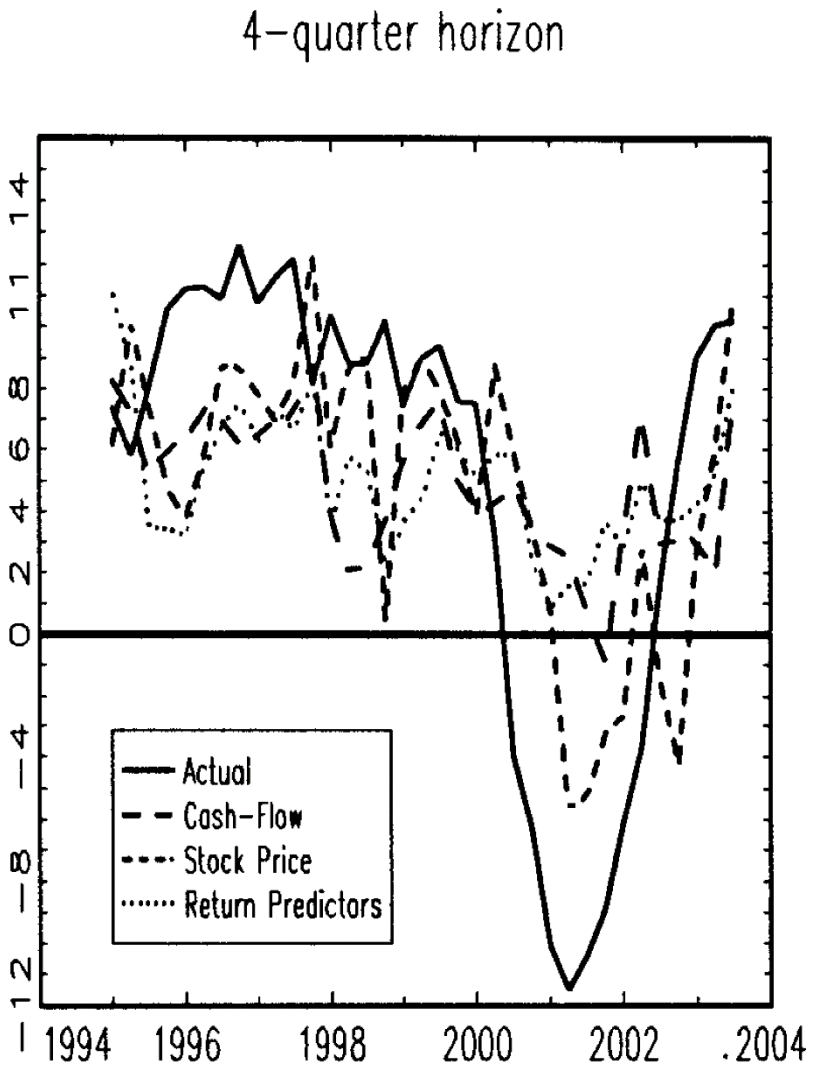
Explanation of Symbols

F	cash flow
I	investment
K	existing stock of capital goods
P_K	price index for capital goods
Q	output
q	ratio of financial markets' valuation of capital to its replacement cost
UCC	user cost of capital

http://www.bostonfed.org/economic/neer/neer2001/neer201a.pdf

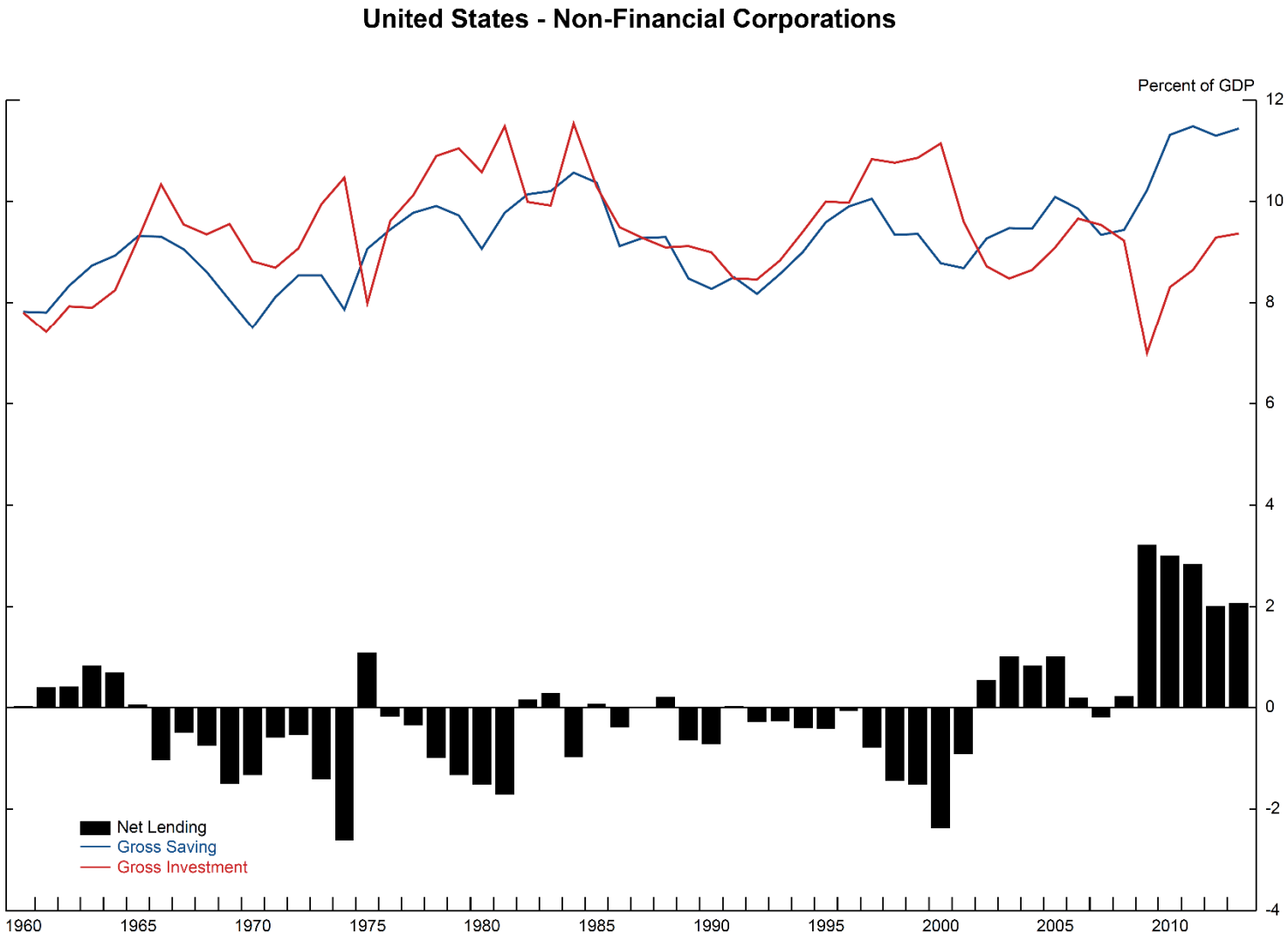
Out-of-sample Forecasts



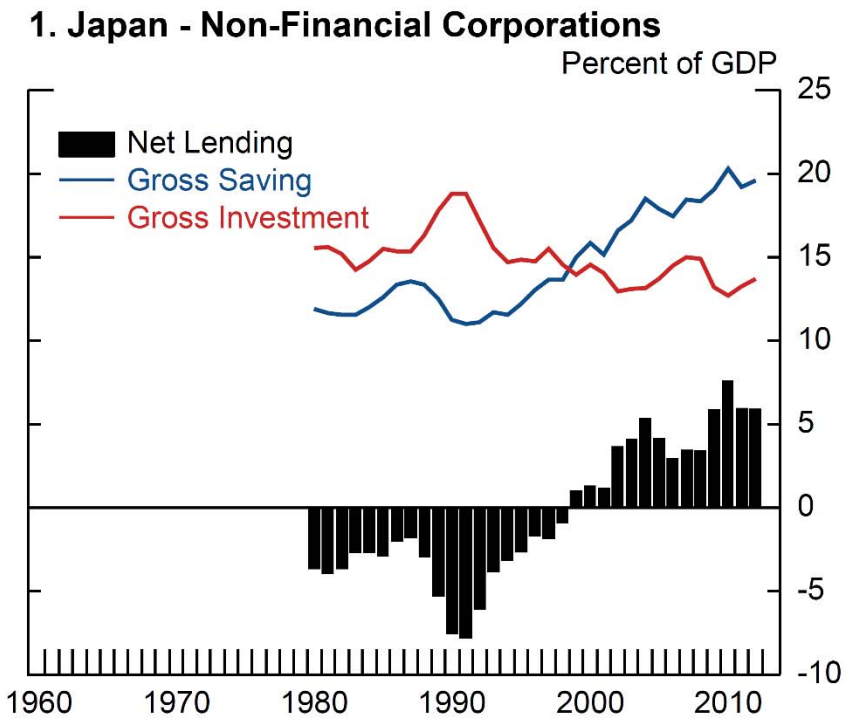


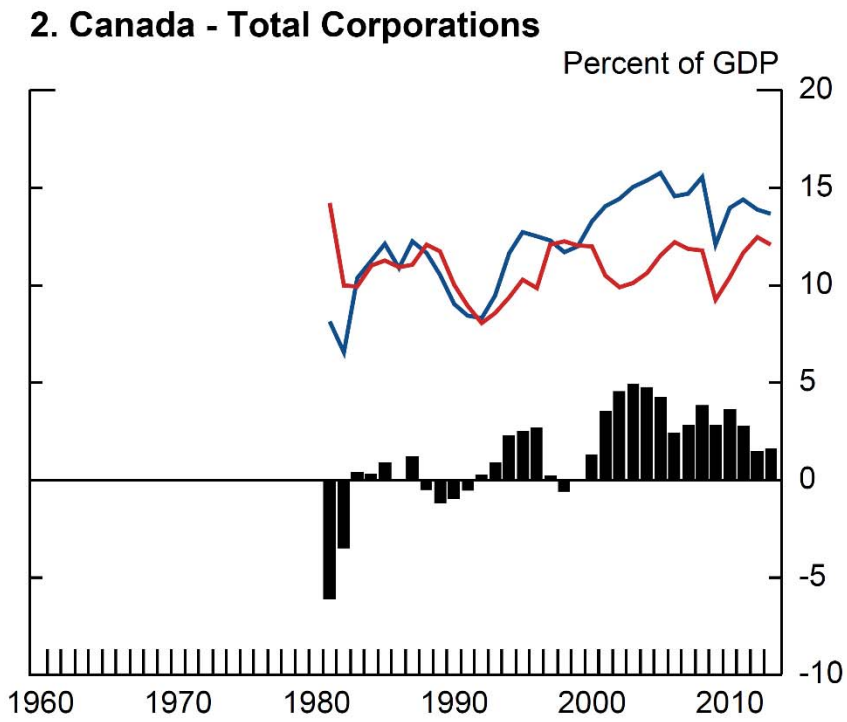
http://cba2.unomaha.edu/faculty/mwohar/WEB/links/WorkPap/invest_Race.pdf

Gruber-Kamin: US

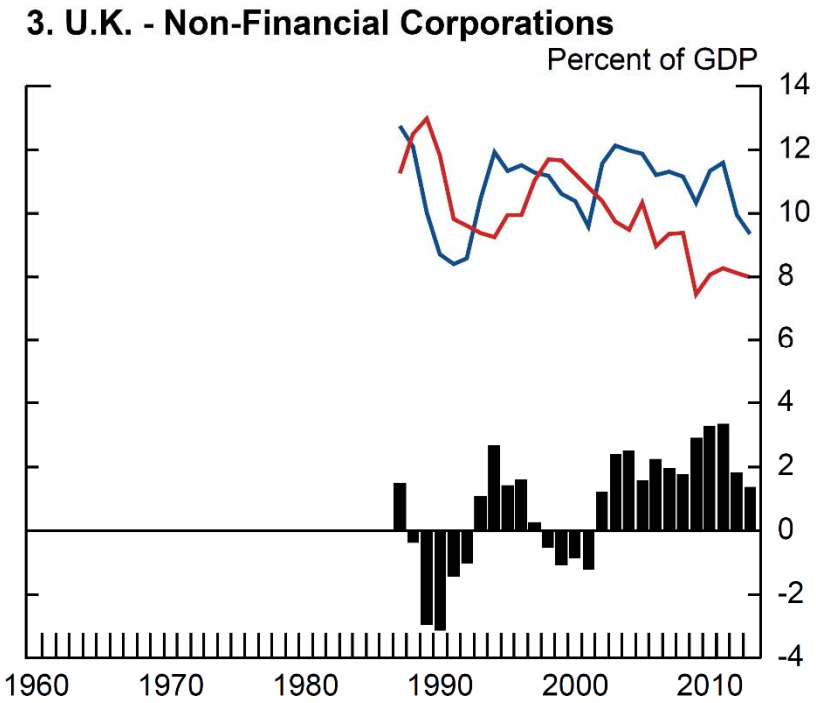


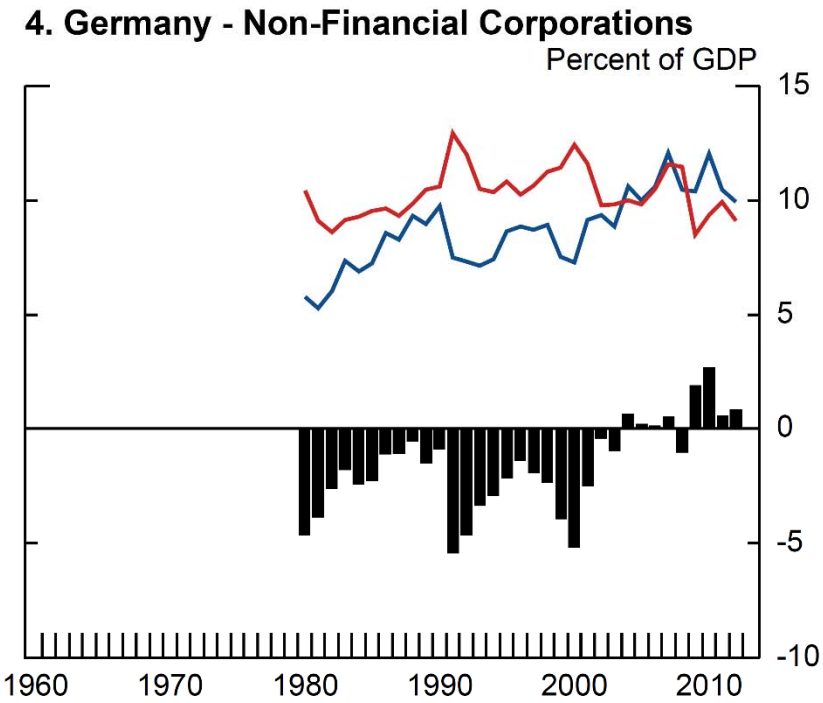
Gruber-Kamin: Japan, Canada



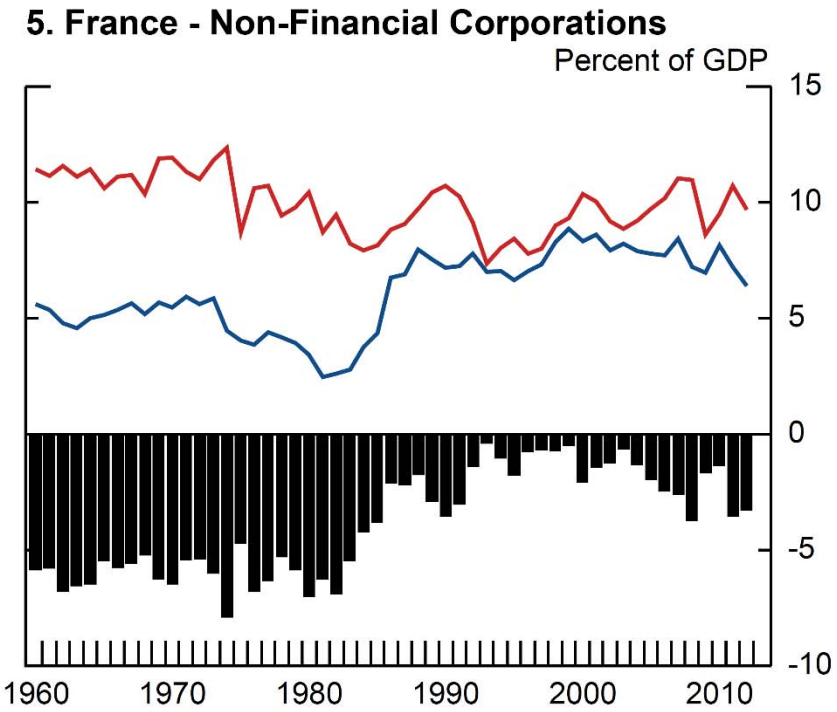


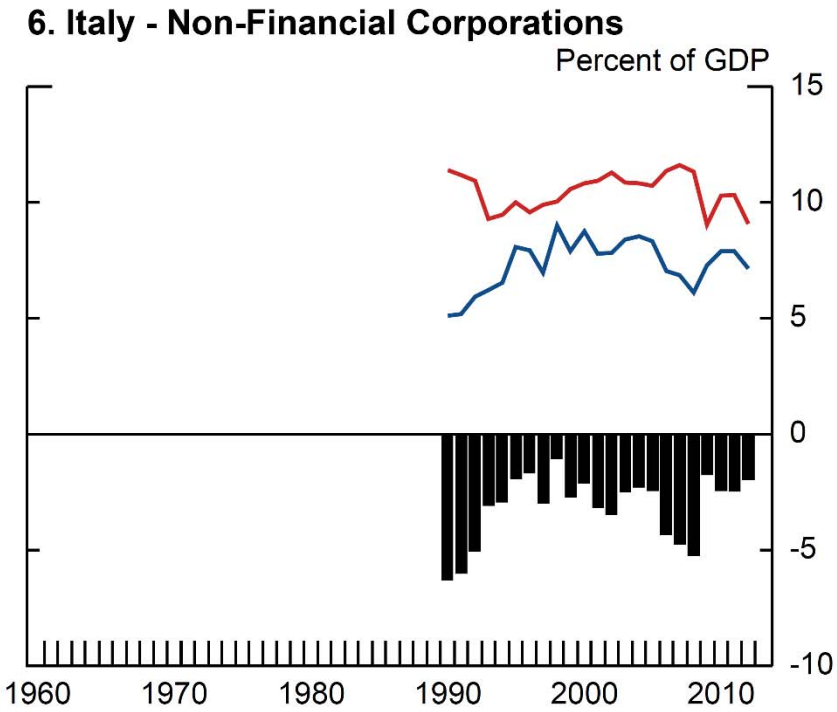
Gruber-Kamin: UK, Germany



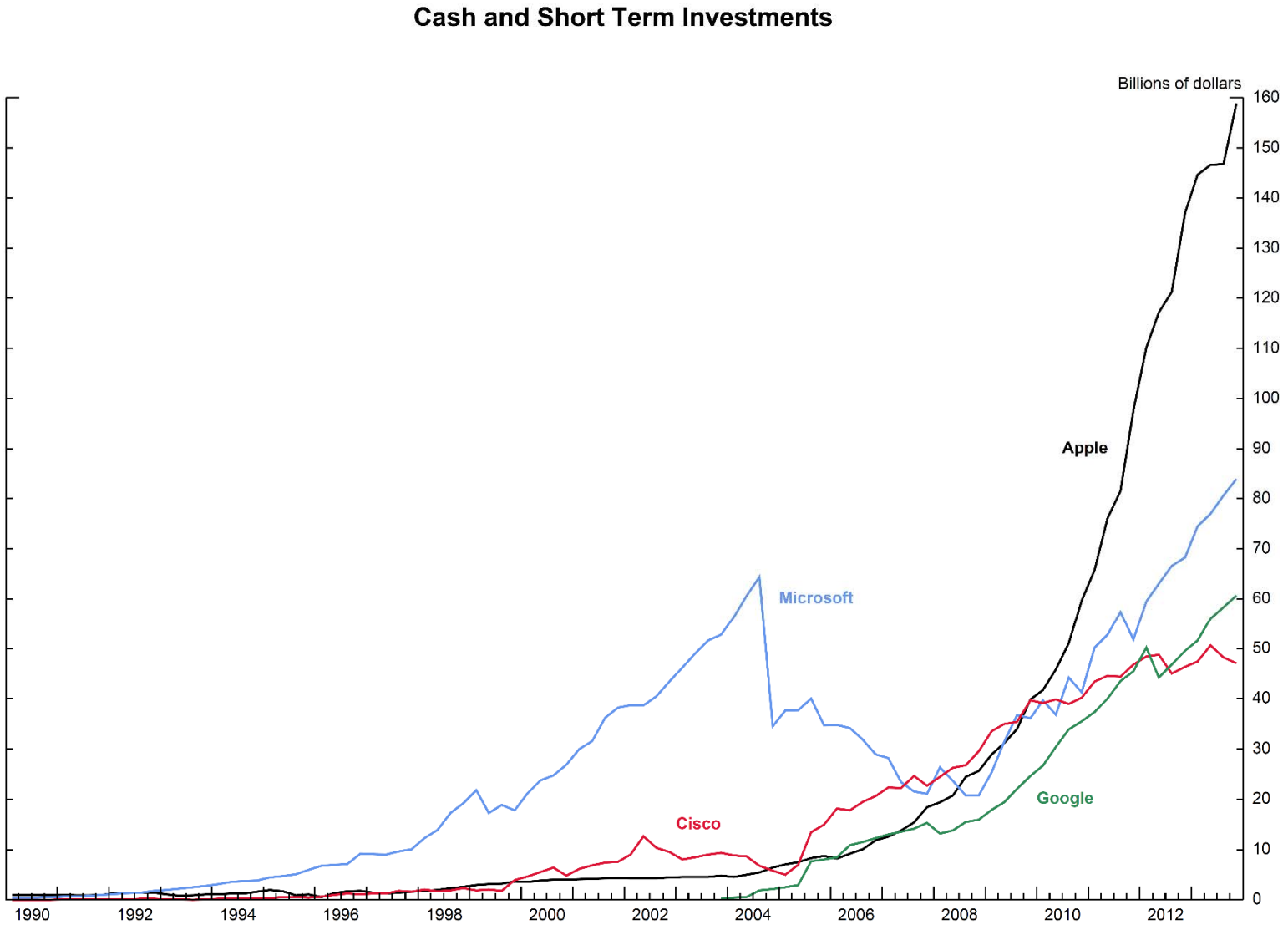


Gruber-Kamin: France, Italy





Net Lending vs. Cash



Gruber-Kamin: Panel Regression

Table 2: Dependent Variable - Gross Investment / GDP

	(1) US	(2) Germany	(3) Japan	(4) UK	(5) France	(6) Italy	(7) Panel
Time Trend	**0.001**	**0.002**	**-0.003**	**-0.002**	0.000	0.000	0.000
	3.963	2.008	-1.973	-3.275	0.684	0.167	0.884
Lagged Investment	**0.662**	0.041	**1.116**	-0.318	**0.628**	**0.395**	**0.770**
	7.170	0.139	4.451	-1.390	4.630	3.588	15.418
Lagged Real Growth	**0.131**	**0.467**	0.116	**0.219**	**0.102**	**0.131**	**0.165**
	4.530	3.153	0.773	2.411	2.343	1.906	5.996
Lagged Slope of the Yield Curve	**-0.122**	0.043	0.550	**-0.766**	0.096	-0.024	**0.079**
	-1.907	0.321	1.628	-4.018	1.539	-0.201	1.710
Lagged Real Interest Rate	**-0.092**	0.044	0.281	**-0.397**	-0.045	**-0.287**	-0.014
	-3.129	0.417	1.068	-2.978	-1.463	-4.297	-0.696
Lagged Relative Investment Price	**4.056**	1.621	**-18.776**	1.311	4.667	**17.988**	1.030
	4.144	0.241	-1.810	0.423	1.440	2.691	1.346
Lagged Profits	**0.135**	-0.283	**0.416**	**0.656**	**0.156**	-0.037	**0.059**
	1.769	-1.005	1.870	3.865	2.111	-0.398	1.884
Range	1962-2007	1981-2007	1982-2007	1988-2007	1971-2007	1991-2007	
# Observations	46	27	26	20	37	17	173
R^2	0.87	0.61	0.84	0.88	0.77	0.91	0.95
SER	0.003	0.007	0.006	0.004	0.003	0.002	0.005

Note: Bold denotes significance at the 10 percent level. Regressions include unreported constant.

Panel Regressions include unreported fixed effects.

Gruber-Kamin: Panel Regression

Table 3: Dependent Variable - Profits / GDP

	(1) US	(2) Germany	(3) Japan	(4) UK	(5) France	(6) Italy	(7) Panel
Time Trend	0.000	**0.001**	0.002	**-0.002**	**0.001**	**-0.003**	0.000
	1.368	1.990	1.171	-2.395	1.863	-2.315	0.322
Lagged Profits	**0.796**	0.403	**0.879**	0.255	**0.782**	0.175	**0.937**
	6.369	1.364	6.296	1.255	7.187	0.527	20.373
Lagged Real Growth	**-0.086**	0.005	-0.154	0.198	0.025	0.373	**-0.116**
	-1.794	0.041	-1.459	1.263	0.324	1.603	-3.539
Lagged Nominal Interest Rate	-0.097	-0.102	-0.194	-0.181	-0.090	-0.278	-0.041
	-1.567	-0.599	-0.879	-0.764	-1.557	-1.434	-1.547
Lagged Relative Investment Price	2.961	**-13.415**	15.528	**-9.441**	3.129	**-49.951**	0.121
	1.242	-2.083	1.261	-2.159	1.002	-2.321	0.124
Range	1962-2007	1981-2007	1982-2007	1988-2007	1962-2007	1991-2007	
# Observations	46	27	26	20	46	17	182
R^2	0.65	0.92	0.95	0.69	0.94	0.74	0.97
SER	0.005	0.008	0.006	0.007	0.006	0.008	0.007

Note: Bold denotes significance at the 10 percent level. Regressions include unreported constant.

Panel Regressions include unreported fixed effects.

Gruber-Kamin: Panel Regression

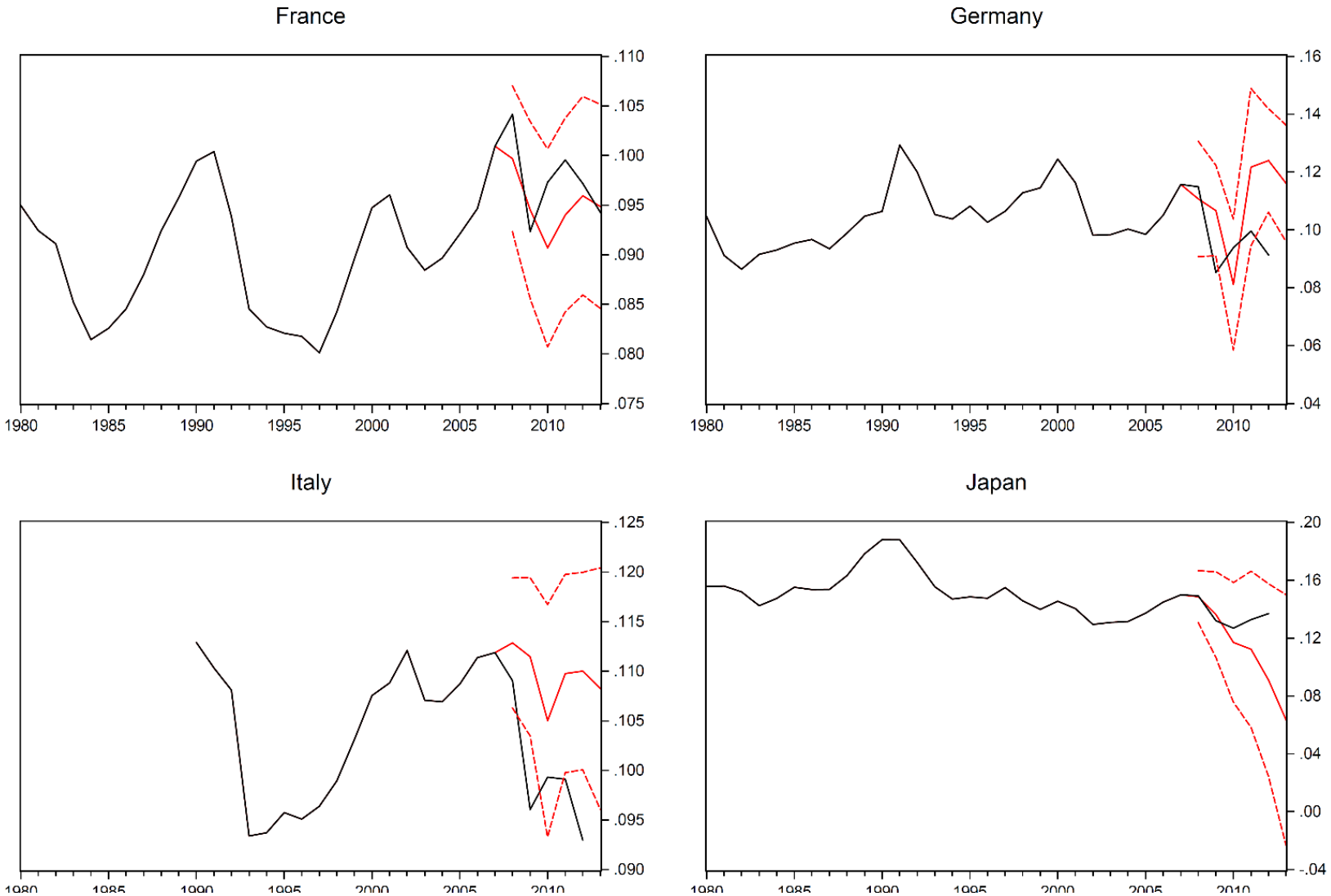
Table 4: Dependent Variable - Adjusted Net Lending / GDP

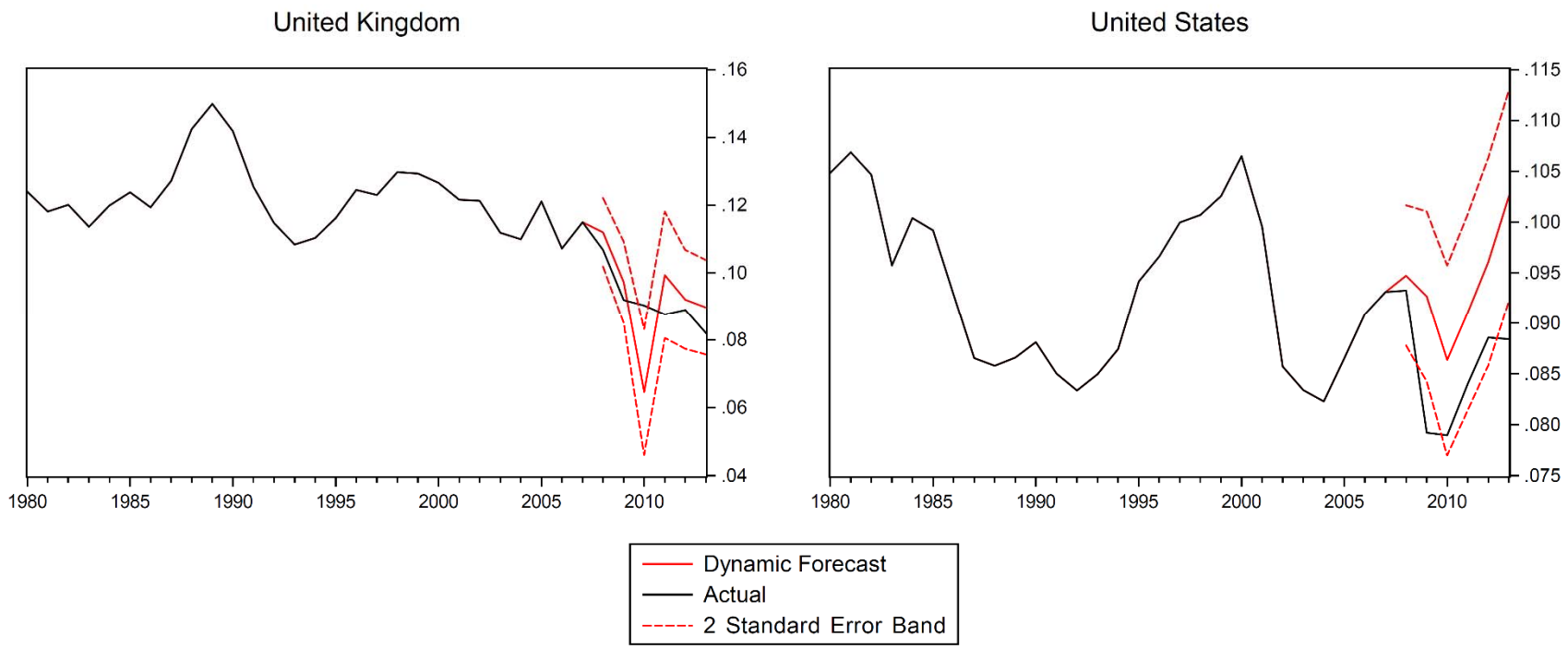
	(1) US	(2) Germany	(3) Japan	(4) UK	(5) France	(6) Italy	(7) Panel
Time Trend	**0.000**	0.001	0.002	0.001	0.000	-0.001	0.000
	-1.909	1.498	1.013	1.554	0.093	-0.724	-0.383
Lagged Adjusted Net Lending	**0.751**	**0.631**	**0.846**	-0.201	**0.786**	**0.686**	**0.925**
	6.202	2.266	9.326	-0.797	5.329	2.945	27.465
Lagged Real Growth	**-0.212**	**-0.305**	**-0.505**	-0.091	-0.079	-0.007	**-0.270**
	-4.066	-2.262	-3.631	-0.708	-0.988	-0.029	-7.006
Lagged Slope of the Yield Curve	0.147	-0.038	-0.196	**0.998**	0.099	0.280	0.009
	1.452	-0.172	-0.554	4.204	0.921	0.612	0.138
Lagged Real Interest Rate	0.050	-0.046	0.156	**0.430**	**0.133**	**0.445**	**0.067**
	0.946	-0.294	0.435	2.222	2.296	2.234	2.075
Lagged Relative Investment Price	**-3.168**	-8.639	12.185	-7.162	-3.671	**-58.629**	-0.727
	-1.913	-0.801	0.794	-1.548	-0.569	-2.288	-0.680
Range	1962-2007	1981-2007	1982-2007	1988-2007	1971-2007	1991-2008	
# Observations	46	27	26	20	37	17	173
R^2	0.66	0.83	0.94	0.89	0.94	0.74	0.95
SER	0.006	0.011	0.010	0.006	0.006	0.008	0.008

Note: Bold denotes significance at the 10 percent level. Regressions include unreported constant.

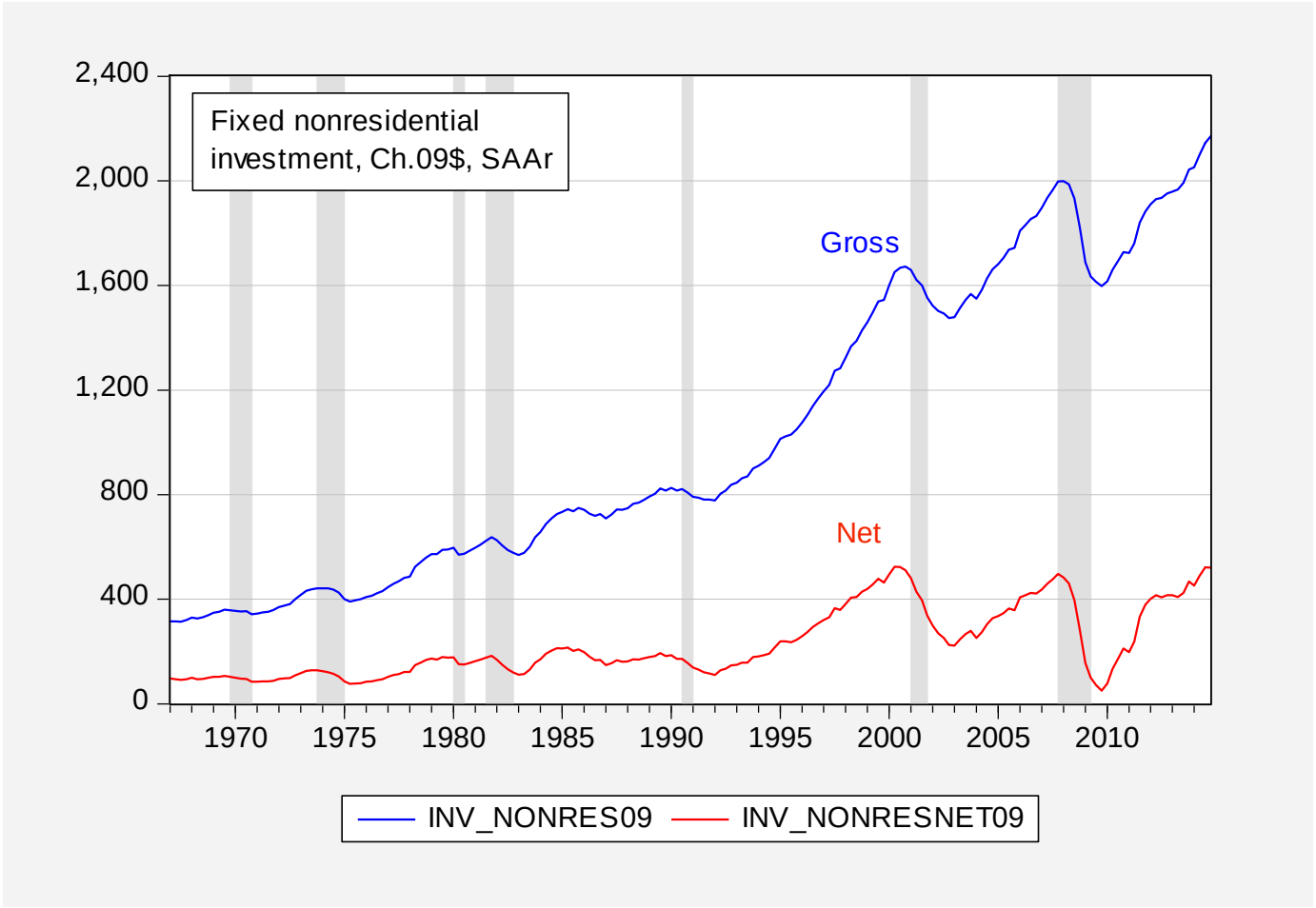
Panel Regressions include unreported fixed effects.

Figure 14.A: Investment / GDP - Country-Specific Model Forecasts

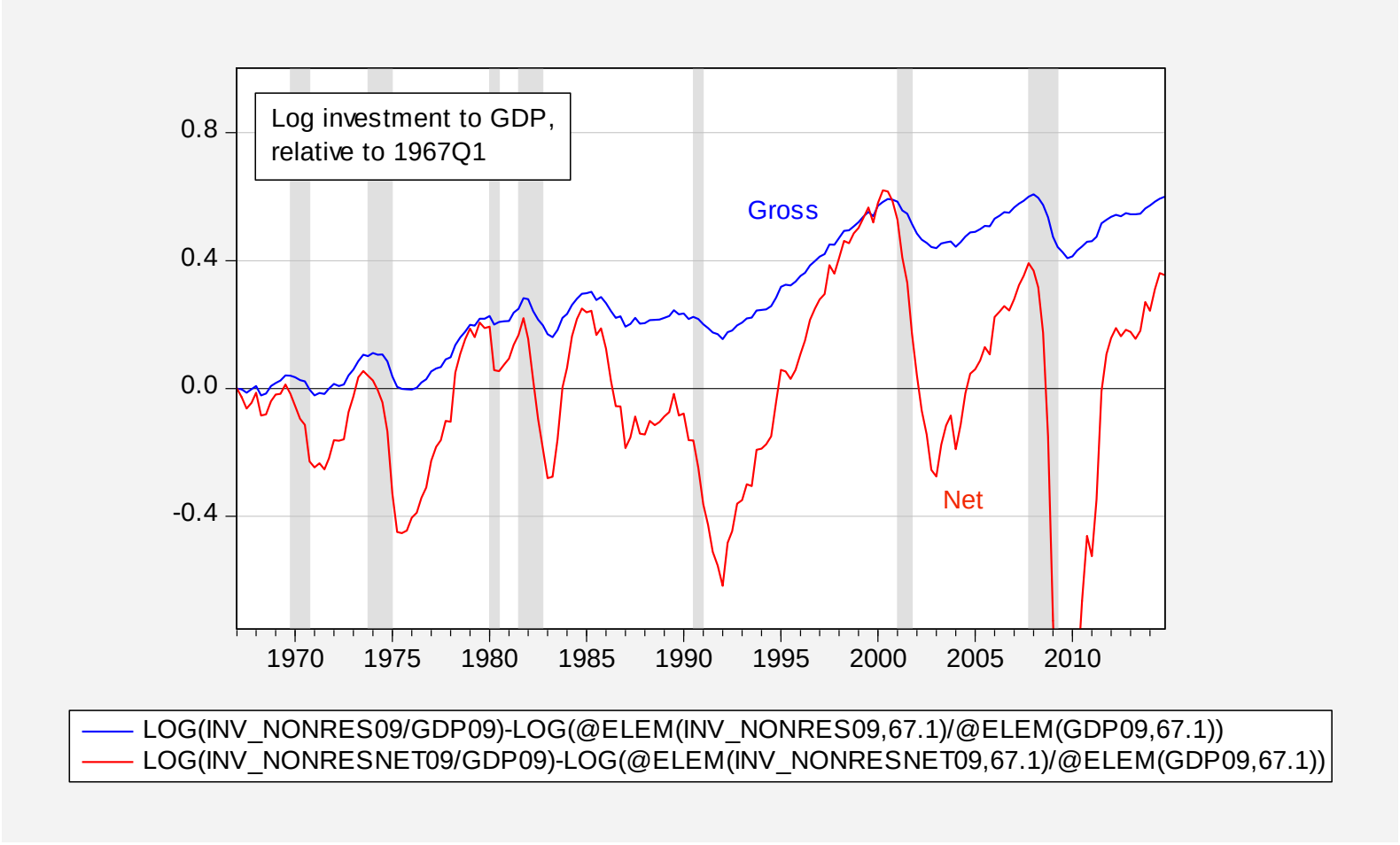



United Kingdom
United States
.16
.14
.12
.10
.08
.06
.04
.115
.110
.105
.100
.095
.090
.085
.080
.075
1980
1985
1990
1995
2000
2005
2010
Dynamic Forecast
Actual
2 Standard Error Band

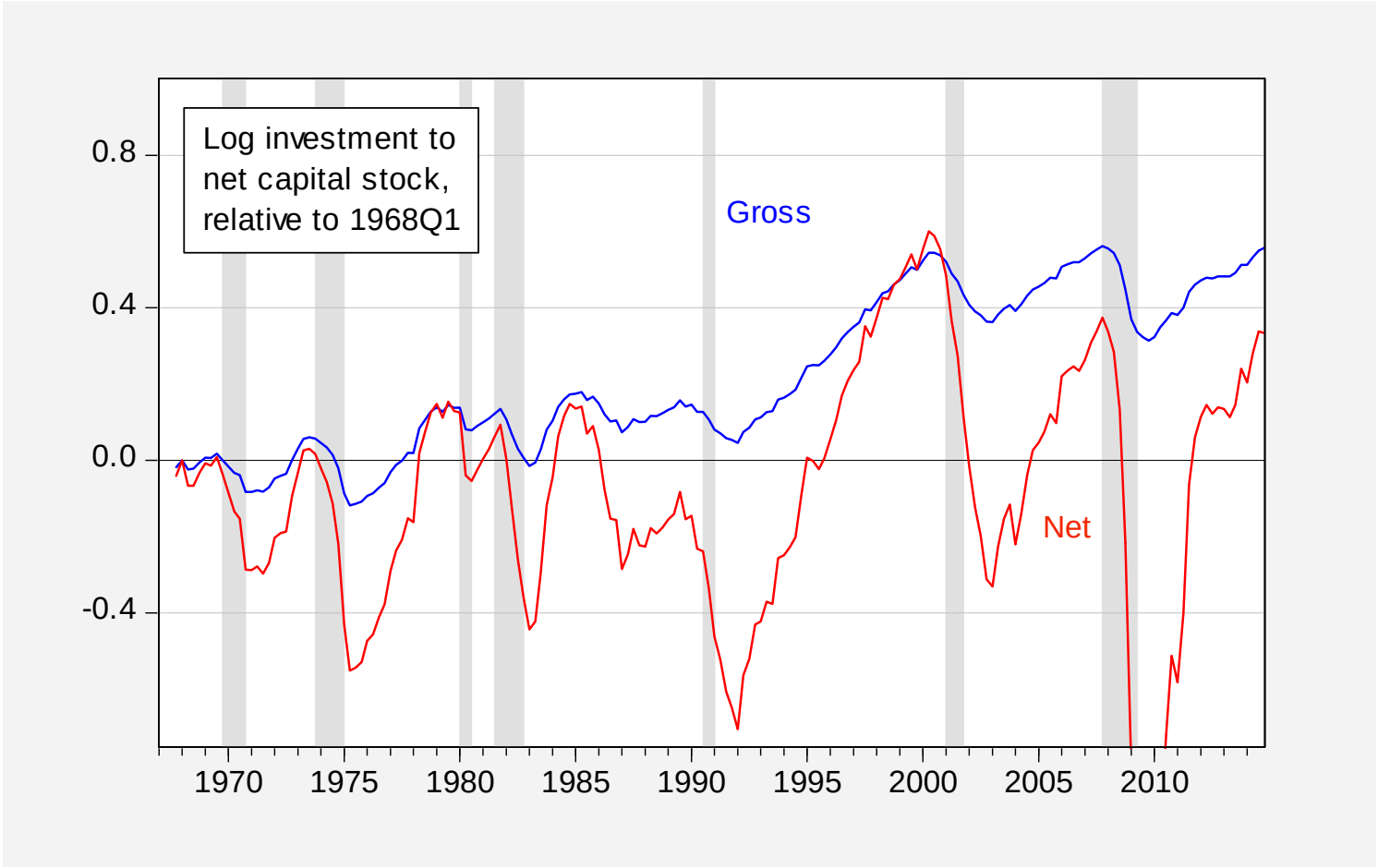
Levels


Fixed nonresidential investment, Ch.09$, SAAr
2,400
2,000
1,600
1,200
800
400
0
Gross
Net
1970
1975
1980
1985
1990
1995
2000
2005
2010
INV_NONRES09
INV_NONRESNET09

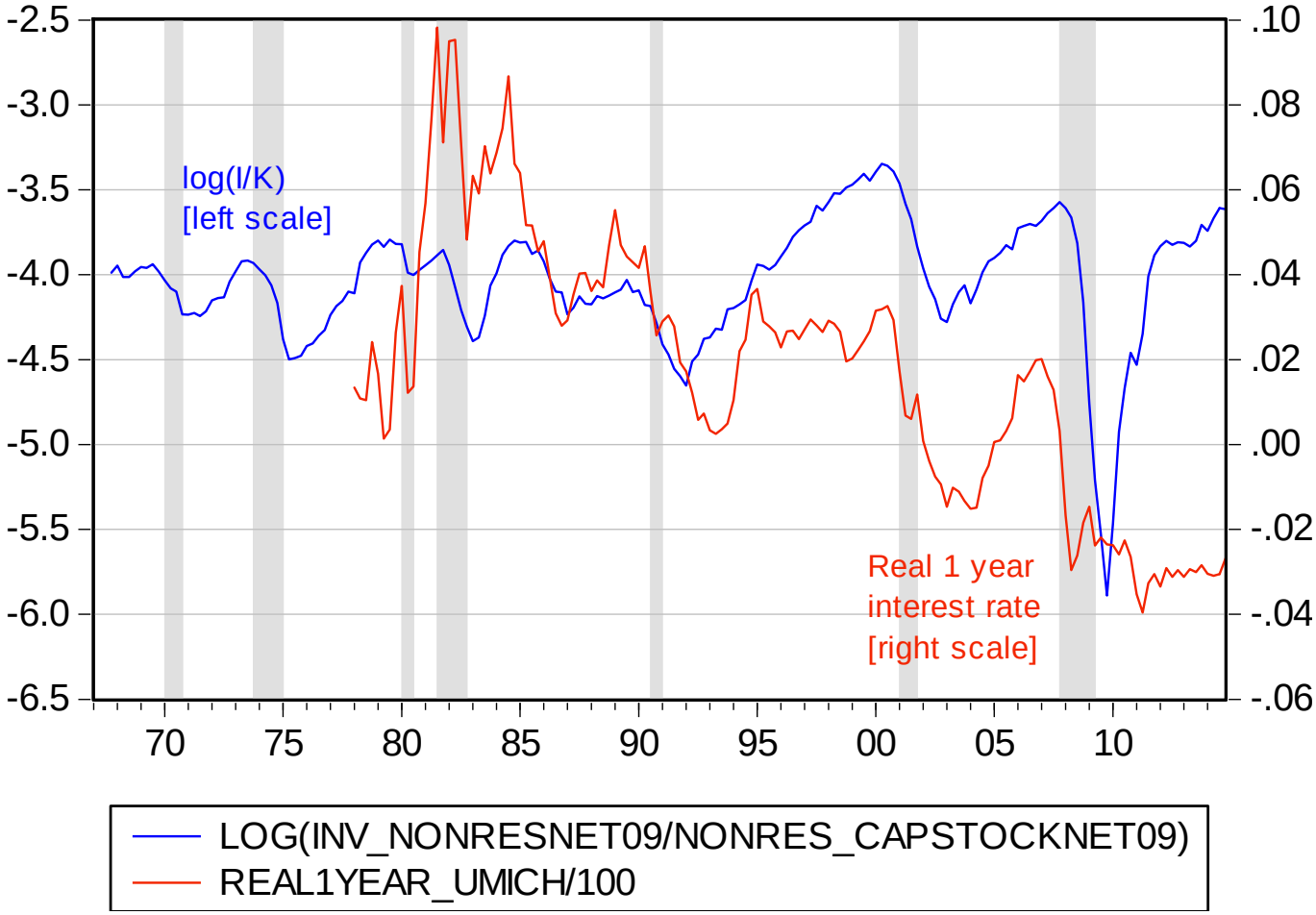
Logs, Relative to GDP



Logs, Relative to Capital



Log(I/K) and r


-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-5.5
-6.0
-6.5
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.06
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-.04
-.06
log(I/K)
[left scale]
Real 1 year
interest rate
[right scale]
70
75
80
85
90
95
00
05
10
LOG(INV_NONRESNET09/NONRES_CAPSTOCKNET09)
REAL1YEAR_UMICH/100

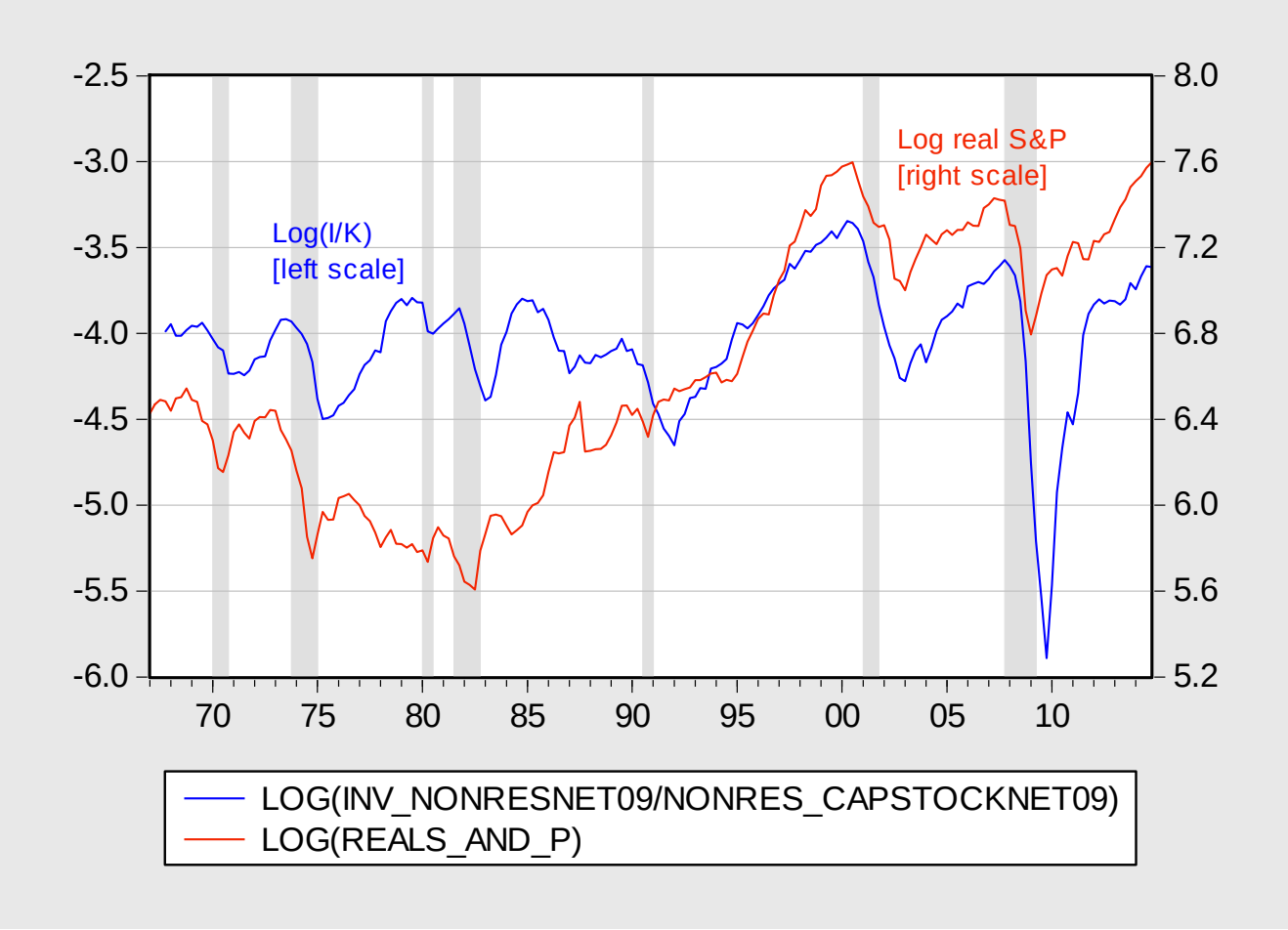
Regression on GDP growth, r

Dependent Variable: LOG(INV_NONRESNET09/NONRES_CAPSTOCKNET09)
Method: Least Squares
Date: 03/25/15 Time: 15:39
Sample (adjusted): 1978Q1 2014Q4
Included observations: 148 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.207268	0.127812	-32.91754	0.0000
D(LOG(GDP09),0,4)	7.009185	2.779121	2.522087	0.0127
REAL1YEAR_UMICH/1...	0.760280	1.828193	0.415864	0.6781

R-squared	0.150812	Mean dependent var	-4.004735
Adjusted R-squared	0.139099	S.D. dependent var	0.398638
S.E. of regression	0.369875	Akaike info criterion	0.868761
Sum squared resid	19.83713	Schwarz criterion	0.929515
Log likelihood	-61.28830	Hannan-Quinn criter.	0.893445
F-statistic	12.87571	Durbin-Watson stat	0.125411
Prob(F-statistic)	0.000007	Wald F-statistic	3.251665
Prob(Wald F-statistic)	0.041550		

Log(I/K) and Stock Market



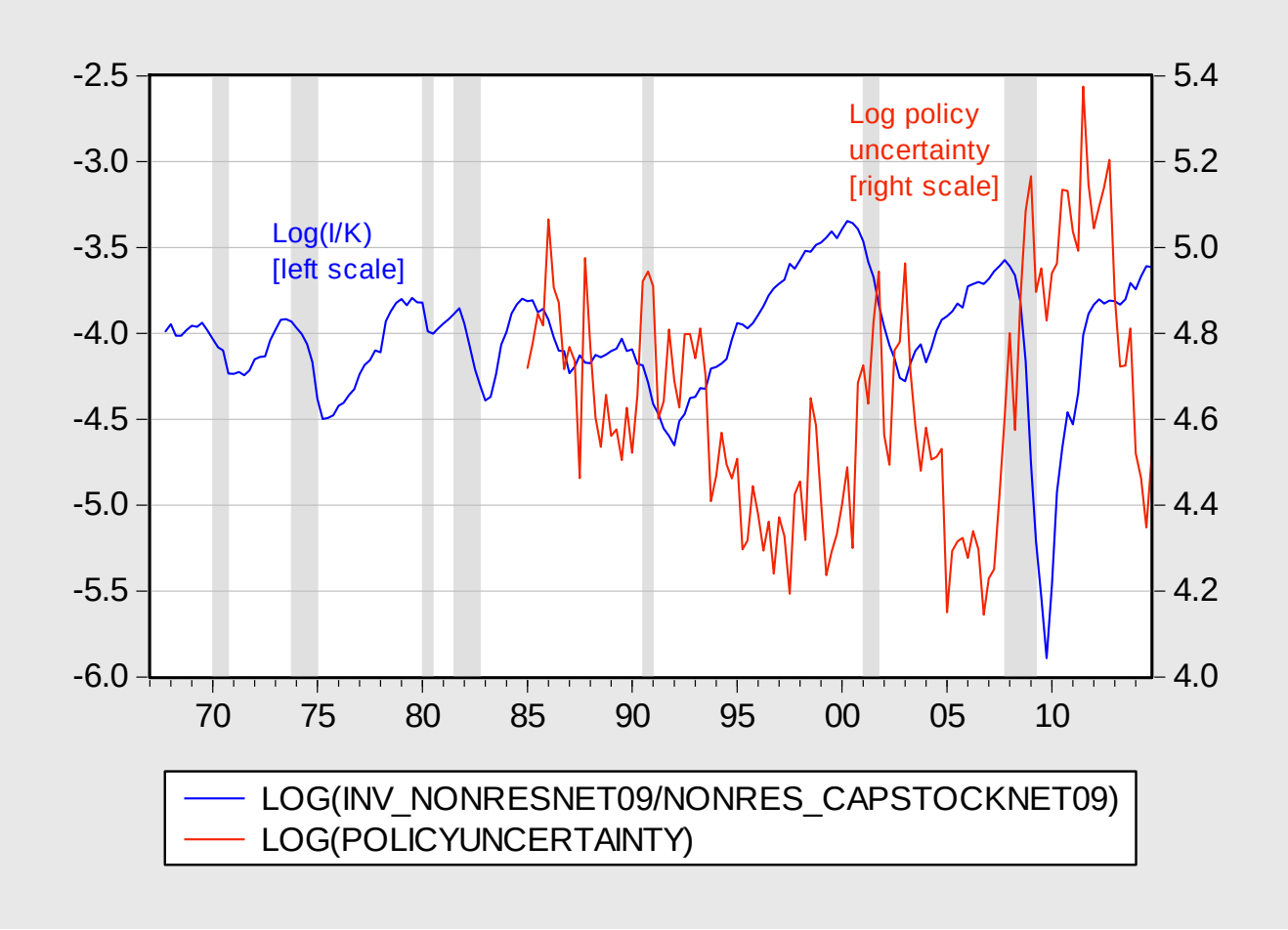
Regression on GDP, Stock Market

Dependent Variable: LOG(INV_NONRESNET09/NONRES_CAPSTOCKNET09)
Method: Least Squares
Date: 03/25/15 Time: 15:42
Sample (adjusted): 1968Q1 2014Q4
Included observations: 188 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.469733	0.524210	-10.43424	0.0000
D(LOG(GDP09),0,4)	5.592260	2.532982	2.207777	0.0285
LOG(REALS_AND_P)	0.193252	0.081649	2.366850	0.0190

R-squared	0.203574	Mean dependent var	-4.033500
Adjusted R-squared	0.194964	S.D. dependent var	0.366513
S.E. of regression	0.328850	Akaike info criterion	0.629397
Sum squared resid	20.00630	Schwarz criterion	0.681043
Log likelihood	-56.16334	Hannan-Quinn criter.	0.650322
F-statistic	23.64386	Durbin-Watson stat	0.134206
Prob(F-statistic)	0.000000	Wald F-statistic	6.178305
Prob(Wald F-statistic)	0.002527		

Log(I/K) and Policy Uncertainty



Regression on GDP, Policy Uncertainty

Dependent Variable: LOG(INV_NONRESNET09/NONRES_CAPSTOCKNET09)
Method: Least Squares
Date: 03/25/15 Time: 15:48
Sample (adjusted): 1985Q1 2014Q4
Included observations: 120 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.887578	0.961460	-1.963241	0.0520
D(LOG(GDP09),0,4)	8.541476	3.945985	2.164599	0.0324
LOG(POLICYUNCERTAINT...	-0.506003	0.207088	-2.443422	0.0160

R-squared	0.306644	Mean dependent var	-4.010318
Adjusted R-squared	0.294792	S.D. dependent var	0.434687
S.E. of regression	0.365036	Akaike info criterion	0.847040
Sum squared resid	15.59039	Schwarz criterion	0.916727
Log likelihood	-47.82239	Hannan-Quinn criter.	0.875340
F-statistic	25.87225	Durbin-Watson stat	0.200999
Prob(F-statistic)	0.000000	Wald F-statistic	6.266819
Prob(Wald F-statistic)	0.002597		

Regression on Determinants

Dependent Variable: LOG(INV_NONRESNET09/NONRES_CAPSTOCKNET09)
Method: Least Squares
Date: 03/25/15 Time: 15:49
Sample (adjusted): 1985Q1 2014Q4
Included observations: 120 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.757367	1.450487	-3.969265	0.0001
D(LOG(GDP09),0,4)	10.92071	3.377149	3.233707	0.0016
LOG(POLICYUNCERTAINT...	-0.271835	0.214765	-1.265734	0.2081
LOG(REALS_AND_P)	0.391195	0.106834	3.661712	0.0004

R-squared	0.455384	Mean dependent var	-4.010318
Adjusted R-squared	0.441299	S.D. dependent var	0.434687
S.E. of regression	0.324912	Akaike info criterion	0.622243
Sum squared resid	12.24590	Schwarz criterion	0.715160
Log likelihood	-33.33460	Hannan-Quinn criter.	0.659977
F-statistic	32.33141	Durbin-Watson stat	0.238104
Prob(F-statistic)	0.000000	Wald F-statistic	15.87951
Prob(Wald F-statistic)	0.000000		

Adding in a Time Trend

Dependent Variable: LOG(INV_NONRESNET09/NONRES_CAPSTOCKNET09)
Method: Least Squares
Date: 03/25/15 Time: 15:50
Sample (adjusted): 1985Q1 2014Q4
Included observations: 120 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-9.233901	1.338200	-6.900242	0.0000
D(LOG(GDP09),0,4)	7.853457	3.218049	2.440440	0.0162
LOG(POLICYUNCERTAINT...	-0.029101	0.170229	-0.170950	0.8646
LOG(REALS_AND_P)	0.878540	0.197300	4.452815	0.0000
@TREND	-0.007280	0.003297	-2.208250	0.0292

R-squared	0.512061	Mean dependent var	-4.010318
Adjusted R-squared	0.495089	S.D. dependent var	0.434687
S.E. of regression	0.308876	Akaike info criterion	0.529021
Sum squared resid	10.97151	Schwarz criterion	0.645166
Log likelihood	-26.74125	Hannan-Quinn criter.	0.576188
F-statistic	30.17125	Durbin-Watson stat	0.224484
Prob(F-statistic)	0.000000	Wald F-statistic	13.09179
Prob(Wald F-statistic)	0.000000		

Fitted Values (no trend)