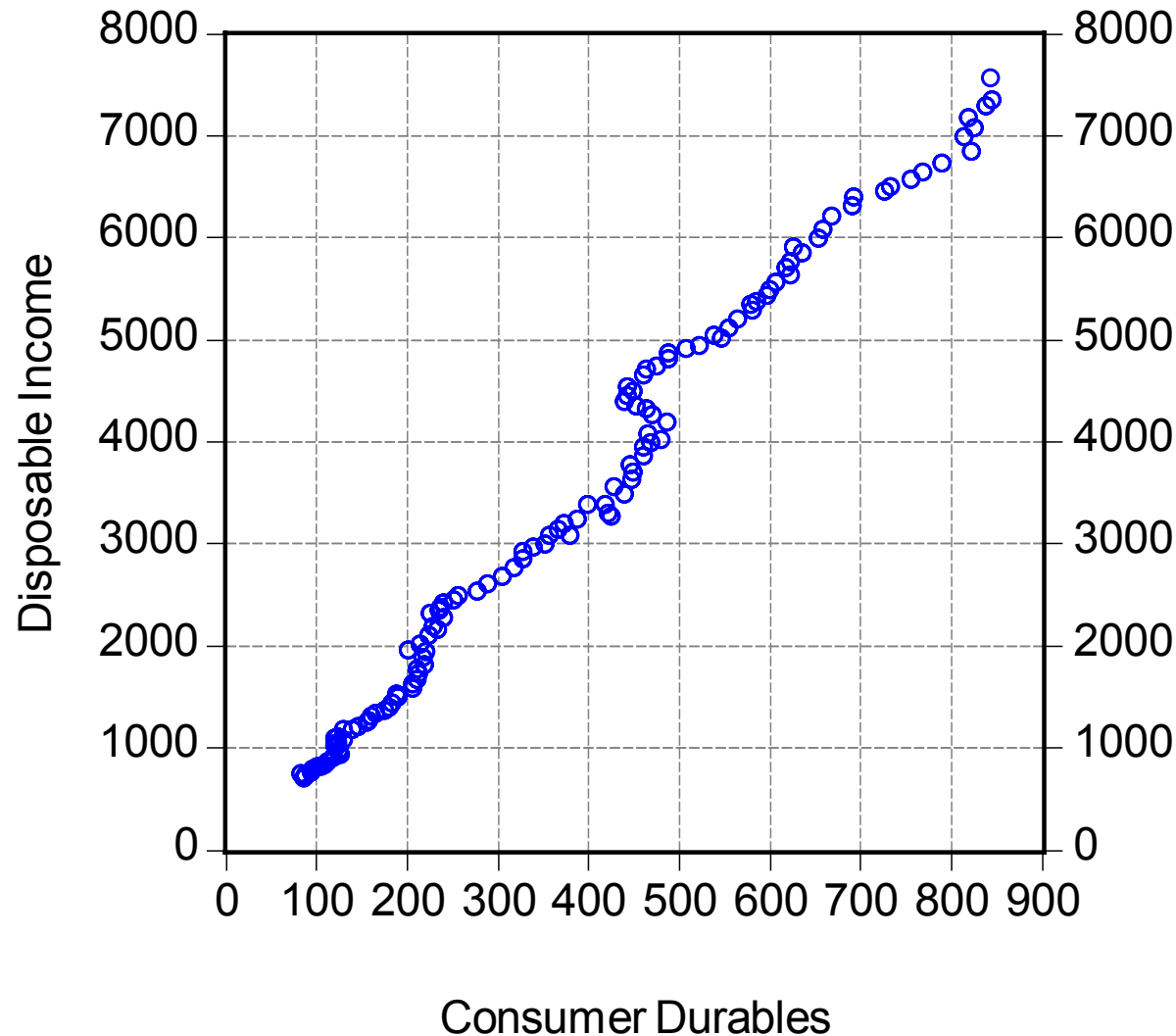


Econometrics

Lecture 7

Econometrics



YD

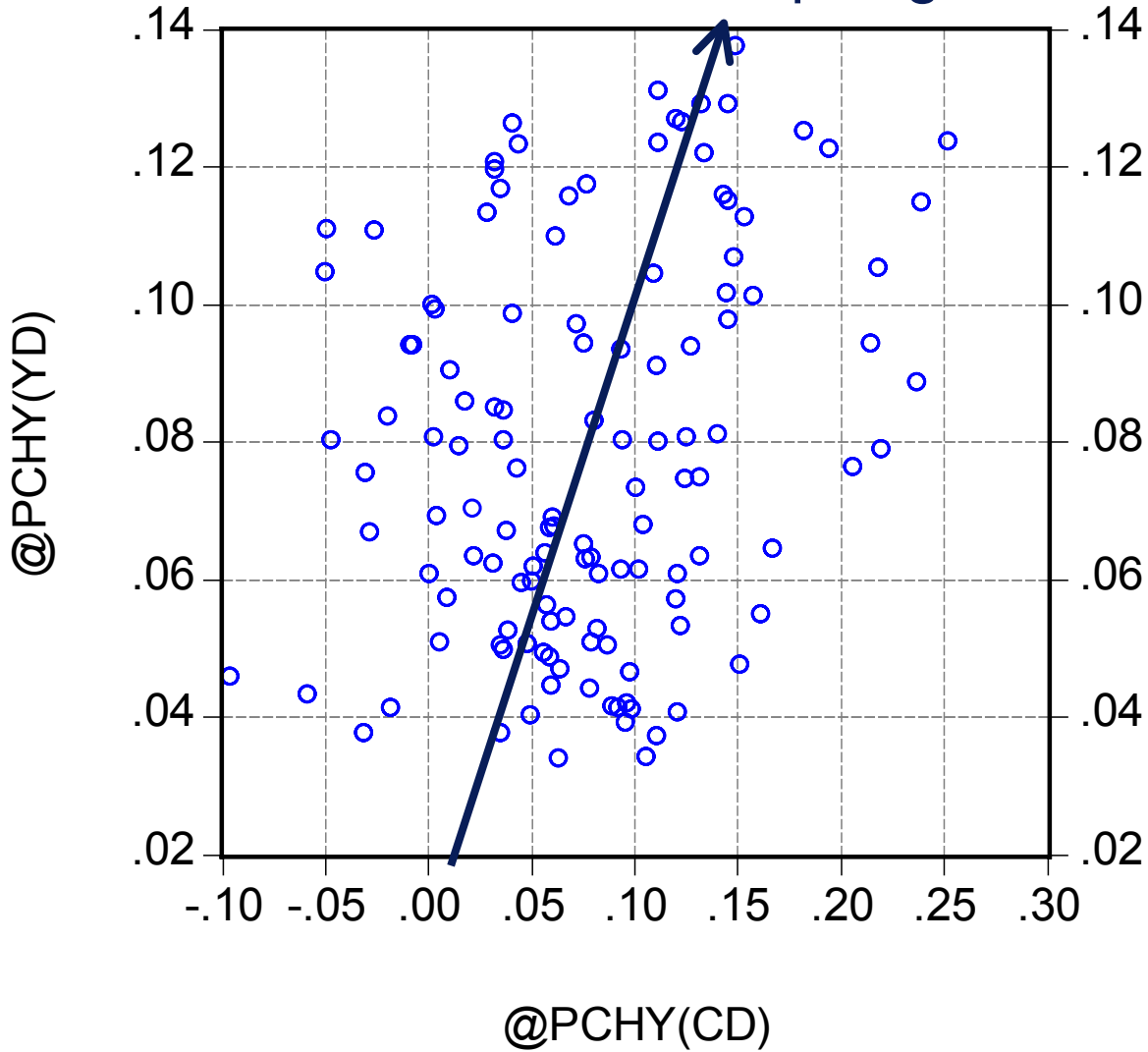
Correlation

CD

0.993222

Econometrics

Arrow = equal growth



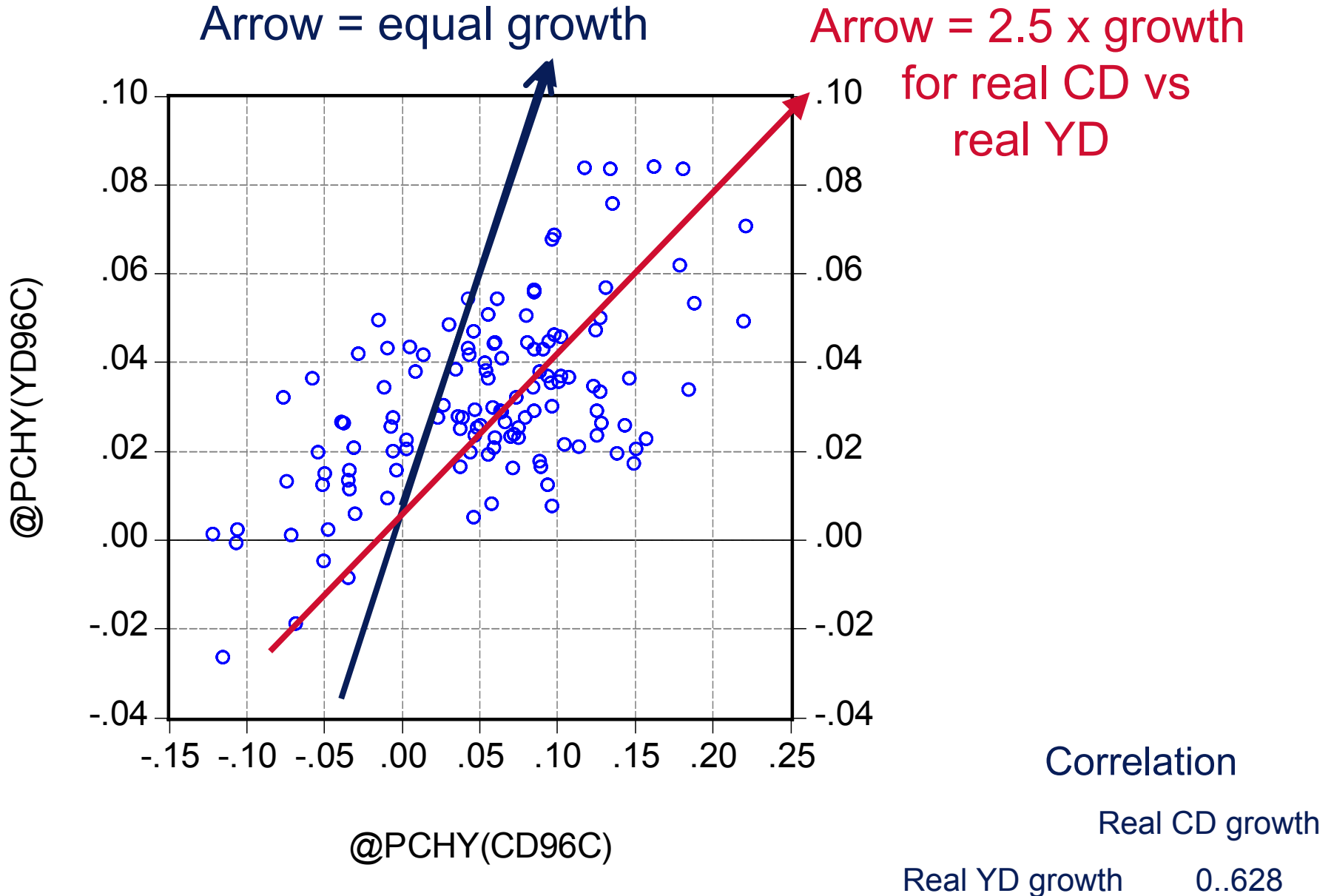
Correlation

CD growth

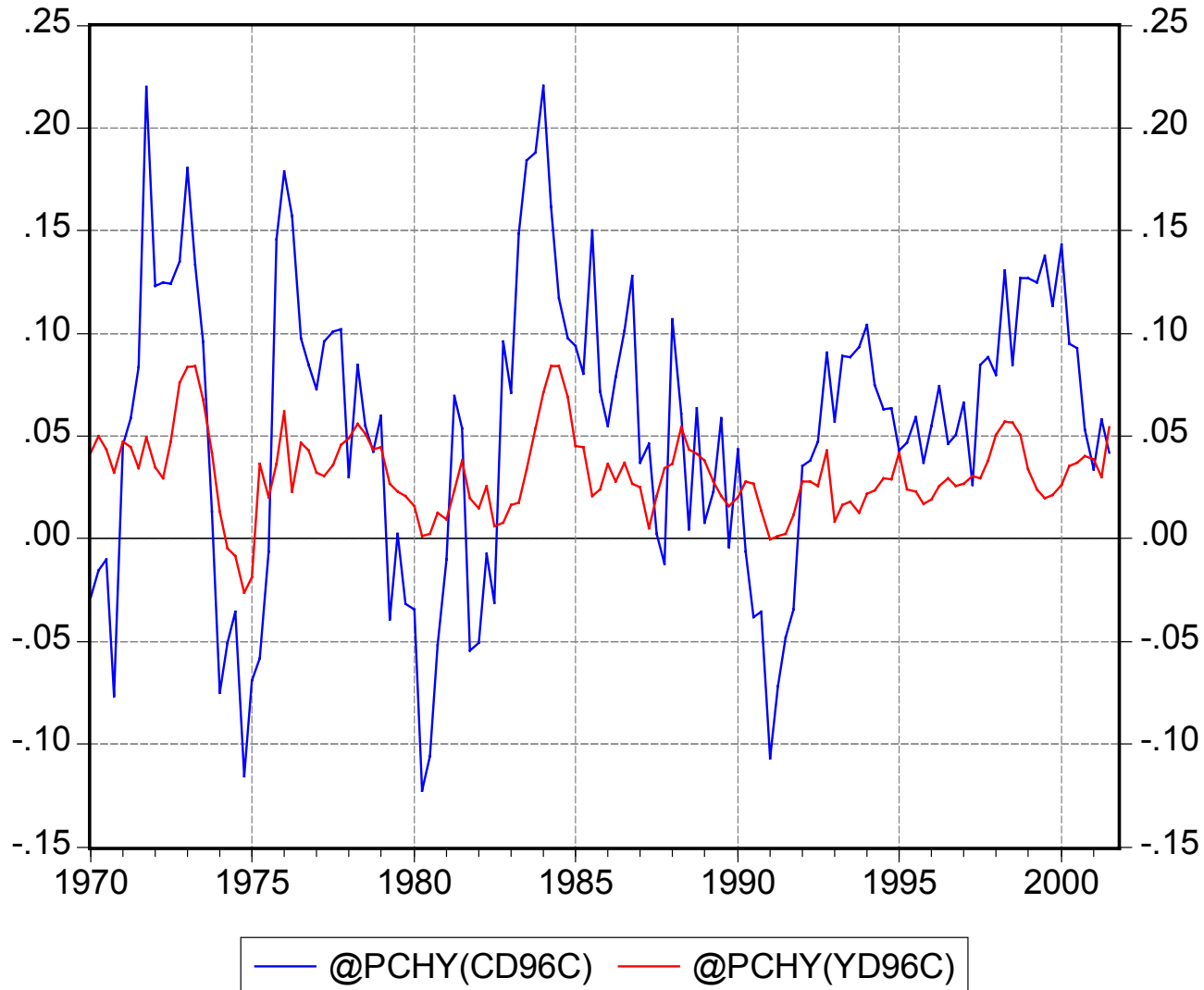
YD growth

0..190

Econometrics



Econometrics



Deriving the OLS (Ordinary Least Squares) estimated coefficients:

$$(1) \quad Y_t = a + bX_t + e_t$$

$$(2) \quad \bar{Y} = a + b\bar{X}$$

$$\therefore Y_t - \bar{Y} = b(X_t - \bar{X}) + e_t$$

$$(3) \quad y_t = bx_t + e_t$$

- the sum of the errors is zero
- a bar (i.e. \bar{X}) over a variable signifies the mean
- subtract the means (2) from each value (1)
- rename the deviations from the mean with lower case letters (3) $e_t = y_t - bx_t$

Goal: find the \hat{b} that minimizes the sum of the squared error terms, $\sum e_t^2$.

$$e_t = y_t - bx_t$$

$$e_t^2 = y_t^2 - 2by_tx_t + b^2x_t^2$$

$$\sum e_t^2 = \sum y_t^2 - 2b \sum y_tx_t + b^2 \sum x_t^2$$

$$\frac{\partial \sum e_t^2}{\partial b} = -2 \sum y_tx_t + 2b \sum x_t^2$$

$$= 0 \Rightarrow \hat{b} = \frac{\sum y_tx_t}{\sum x_t^2}$$

Note that upper-case letters represent the variable and that lower-case letters represent the variable less its mean.

Common Statistical Expressions:

$$\text{Variance of } x: \sigma_x^2 = \frac{\sum x_t^2}{n}$$

$$\text{Variance of } y: \sigma_y^2 = \frac{\sum y_t^2}{n}$$

$$\text{Covariance of } x \text{ and } y: \sigma_{xy}^2 = \frac{\sum x_t y_t}{n}$$

$$\text{Correlation coefficient for } x \text{ and } y: \rho_{xy} = \frac{\sqrt{\sigma_{xy}^2}}{\sqrt{\sigma_x \sigma_y}}$$

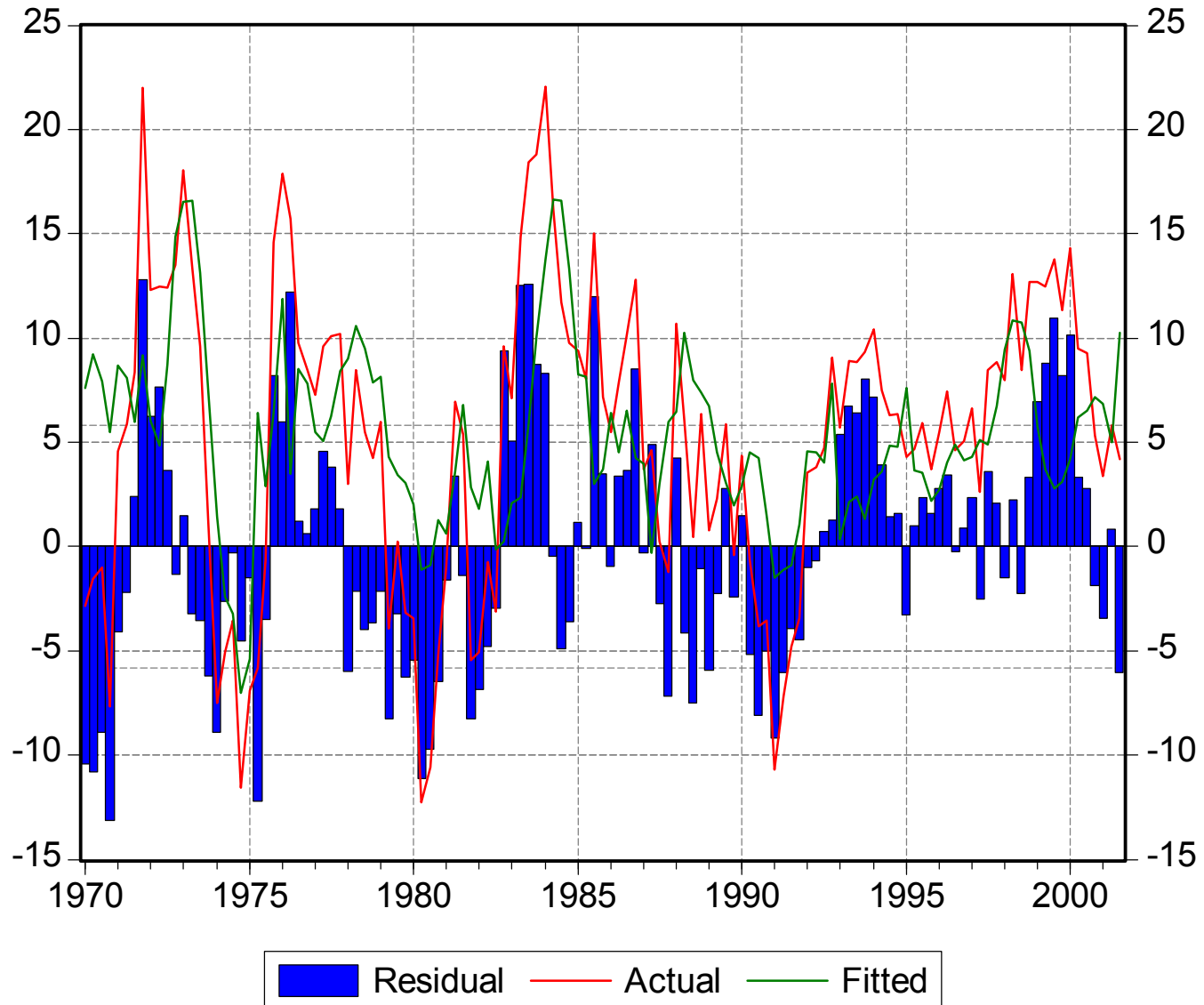
Relating these expressions to the OLS estimated coefficient, \hat{b} :

$$\hat{b} = \frac{\sigma_{xy}^2}{\sigma_x^2} = \frac{\rho^2 \sigma_x \sigma_y}{\sigma_x^2} = \rho^2 \frac{\sigma_y}{\sigma_x}$$

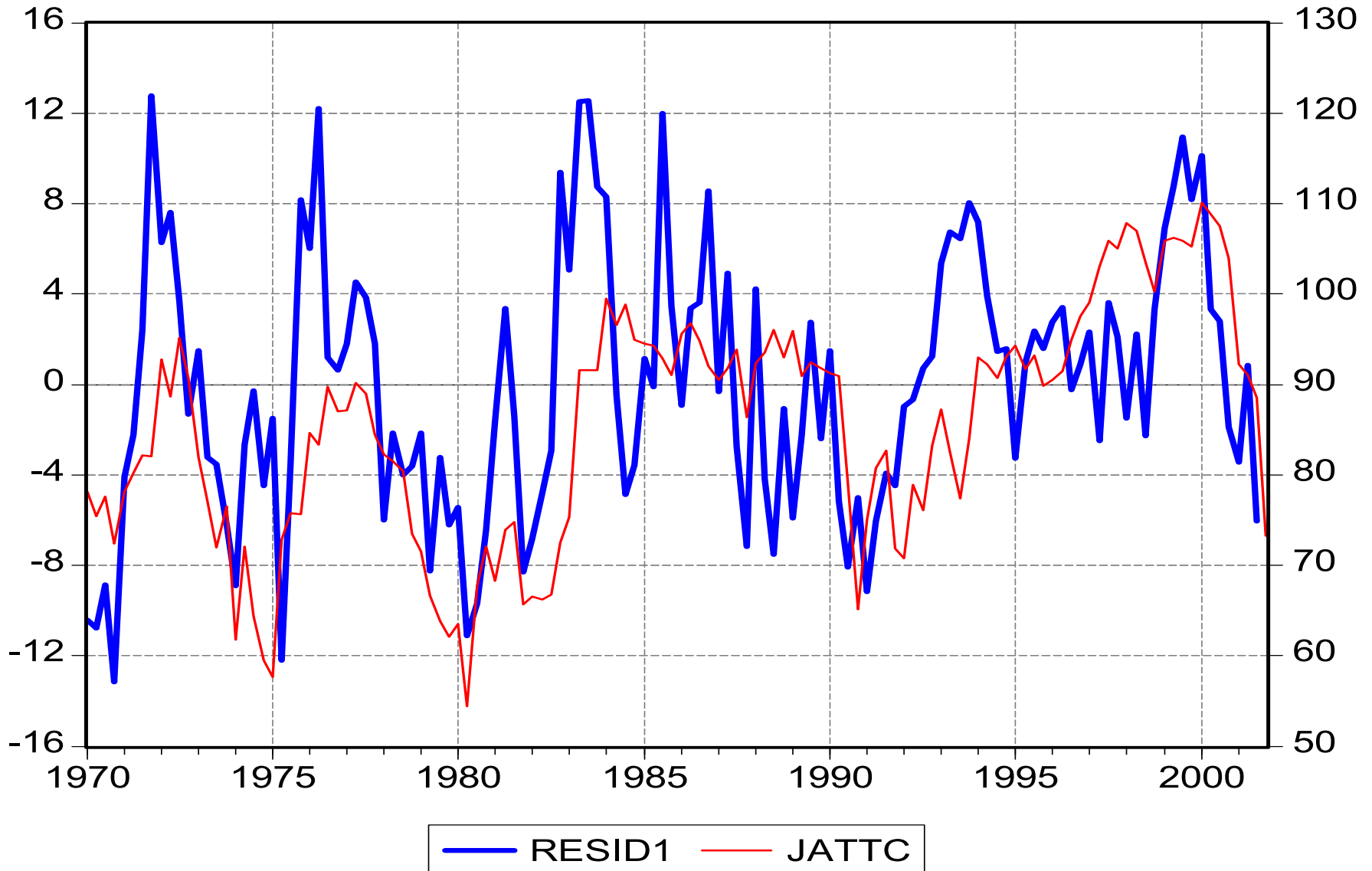
Econometrics

Equation 1				
Dependent Variable: 100*@PCHY(CD96C)				
Method: Least Squares				
Date: 02/23/02 Time: 16:01				
Sample(adjusted): 1970:1 2001:3				
Included observations: 127 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	
C	(1.43)	0.98	(1.45)	
100*@PCHY(YD96C)	2.14	0.26	8.13	
R-squared	0.35	Mean dependent var		5.35
Adjusted R-squared	0.34	S.D. dependent var		7.19
S.E. of regression	5.84			

Econometrics



Econometrics

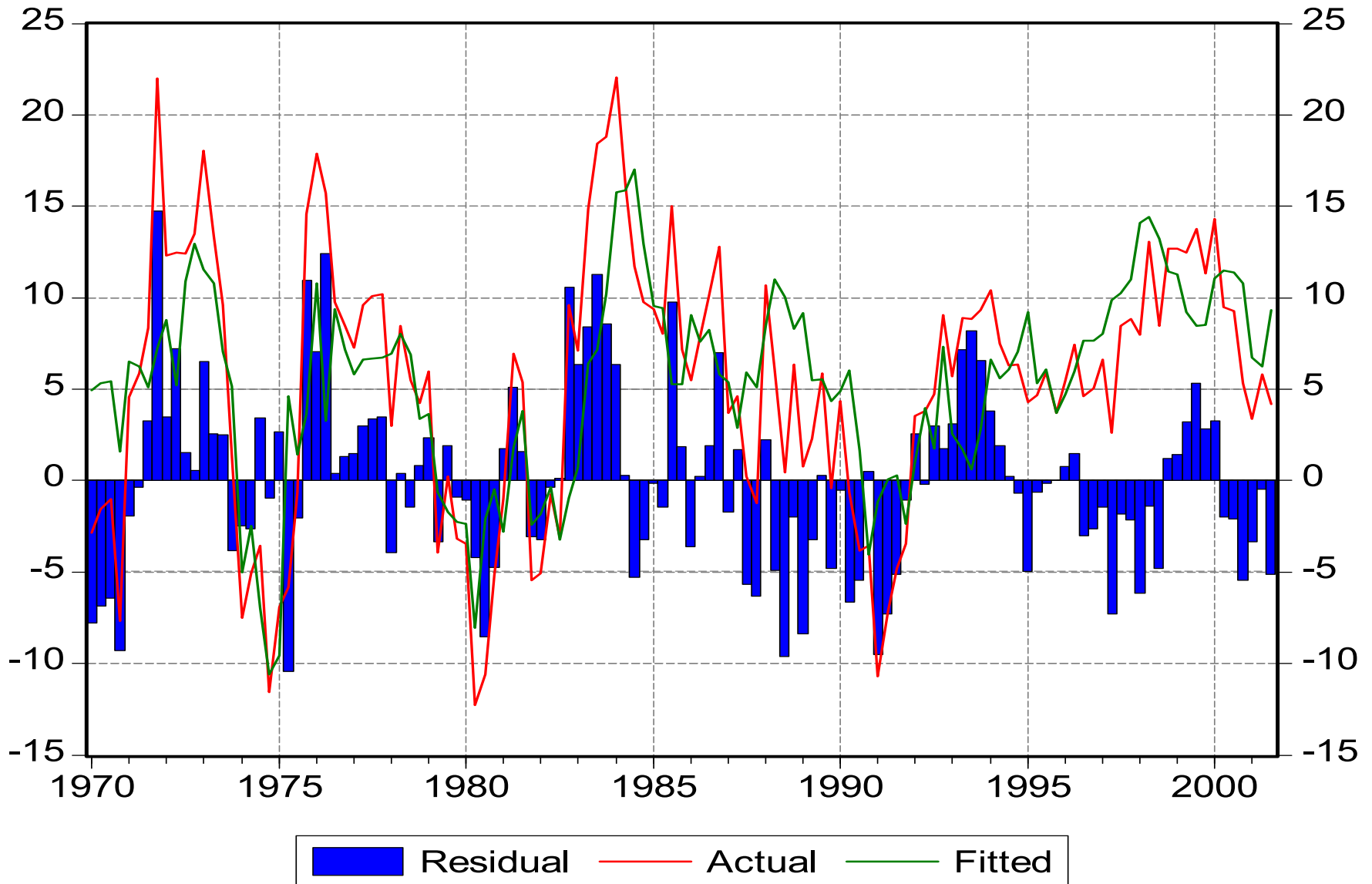


Econometrics

Add Consumer Confidence, Level and Change

Equation 2				
Dependent Variable: 100*@PCHY(CD96C)				
Method: Least Squares				
Date: 02/23/02 Time: 15:59				
Sample(adjusted): 1970:1 2001:3				
Included observations: 127 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	
C	(20.63)	3.13	(6.59)	
100*@PCHY(YD96C)	1.55	0.25	6.29	
JATTC	0.25	0.04	6.32	
JATTC-JATTC(-1)	0.11	0.09	1.29	
R-squared	0.53	Mean dependent var		5.35
Adjusted R-squared	0.52	S.D. dependent var		7.19
S.E. of regression	4.98			

Econometrics



Econometrics

Add the change in the bond interest rate

Equation 3				
Dependent Variable: 100*@PCHY(CD96C)				
Method: Least Squares				
Date: 02/23/02 Time: 16:23				
Sample(adjusted): 1970:1 2001:3				
Included observations: 127 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	
C	(18.39)	3.13	(5.87)	
100*@PCHY(YD96C)	1.70	0.24	6.95	
JATTC	0.21	0.04	5.43	
JATTC-JATTC(-1)	0.11	0.08	1.32	
RMGFCM_10NS-RMGFCM_10NS(-4)	(0.96)	0.33	(2.92)	
R-squared	0.56	Mean dependent var		5.35
Adjusted R-squared	0.55	S.D. dependent var		7.19
S.E. of regression	4.83			

Econometrics

Add the growth of real household net worth

Equation 3A			
Dependent Variable: 100*@PCHY(CD96C)			
Method: Least Squares			
Date: 02/23/02 Time: 16:30			
Sample(adjusted): 1970:1 2001:3			
Included observations: 127 after adjusting endpoints			
Variable	Coefficient	Std. Error	t-Statistic
C	(14.06)	3.31	(4.25)
100*@PCHY(YD96C)	1.62	0.24	6.80
JATTC	0.15	0.04	3.56
JATTC-JATTC(-1)	0.12	0.08	1.50
RMGFCM_10NS-RMGFCM_10NS(-4)	(0.87)	0.32	(2.75)
100*@PCHY(HHNETW96C(-1))	0.34	0.11	3.20
R-squared	0.60	Mean dependent var	5.35
Adjusted R-squared	0.58	S.D. dependent var	7.19
S.E. of regression	4.66		

Econometrics

An alternative approach:

Regress the level of spending on the level of income

Equation 4			
Dependent Variable: CD96C			
Method: Least Squares			
Date: 02/23/02 Time: 16:34			
Sample(adjused): 1970:1 2001:3			
Included observations: 127 after adjusting endpoints			
Variable	Coefficient	Std. Error	t-Statistic
C	(287.40)	16.37	(17.55)
YD96C	0.16	0.00	45.65
R-squared	0.94	Mean dependent var	435.49
Adjusted R-squared	0.94	S.D. dependent var	196.51
S.E. of regression	46.93		

What is the estimated contemporaneous
MPC for consumer durables?
The “elasticity”?

	CD96C	YD96C
Mean	435.5	4432.4
Std. Dev.	196.5	1170.4
Correlation		.972

Econometrics

Explore effects of lagged income.

Note negative coefficient!

Equation 5				
Dependent Variable: CD96C				
Method: Least Squares				
Date: 02/23/02 Time: 16:45				
Sample(adjusted): 1970:1 2001:3				
Included observations: 127 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	
C	(287.55)	15.75	(18.26)	
YD96C	0.42	0.08	5.42	
.25*(YD96C(-1)+YD96C(-2)+YD96C(-3)+	(0.26)	0.08	(3.33)	
R-squared	0.95	Mean dependent var		435.49
Adjusted R-squared	0.95	S.D. dependent var		196.51
S.E. of regression	45.15			

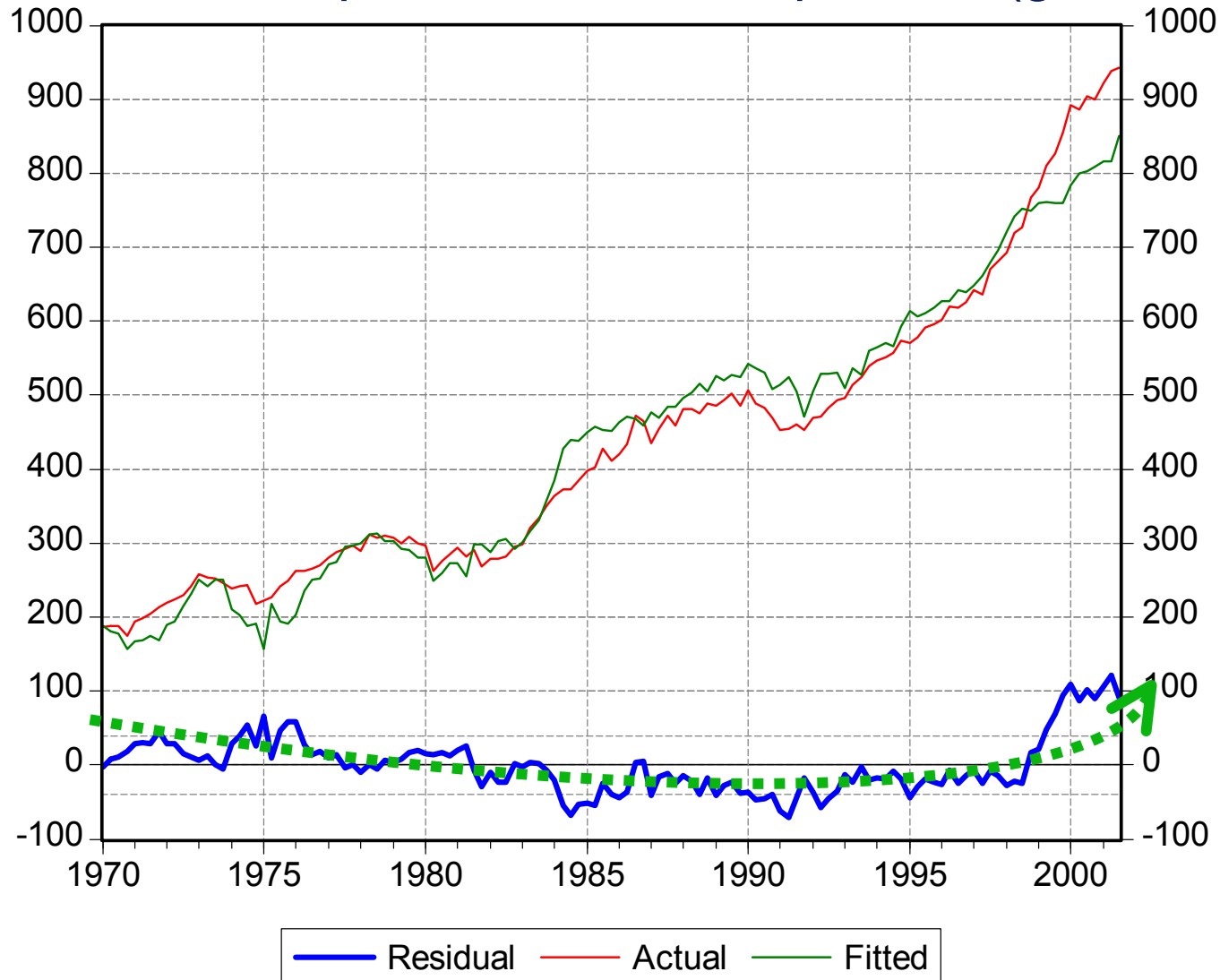
Econometrics

Add consumer confidence. Note Income coefficient changing.

Eauation 6				
Dependent Variable: CD96C				
Method: Least Squares				
Date: 02/23/02 Time: 16:49				
Sample(adjusted): 1970:1 2001:3				
Included observations: 127 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	
C	(441.08)	30.06	(14.67)	
YD96C	0.20	0.08	2.46	
.25*(YD96C(-1)+YD96C(-2)+YD96C(-3)+	(0.06)	0.08	(0.73)	
JATTC	0.75	0.45	1.65	
JATTC(-4)	2.02	0.40	5.04	
R-squared	0.96	Mean dependent var		435.49
Adjusted R-squared	0.96	S.D. dependent var		196.51
S.E. of regression	39.57			

Econometrics

Observe the shape of the residual pattern (green dotted arrow)



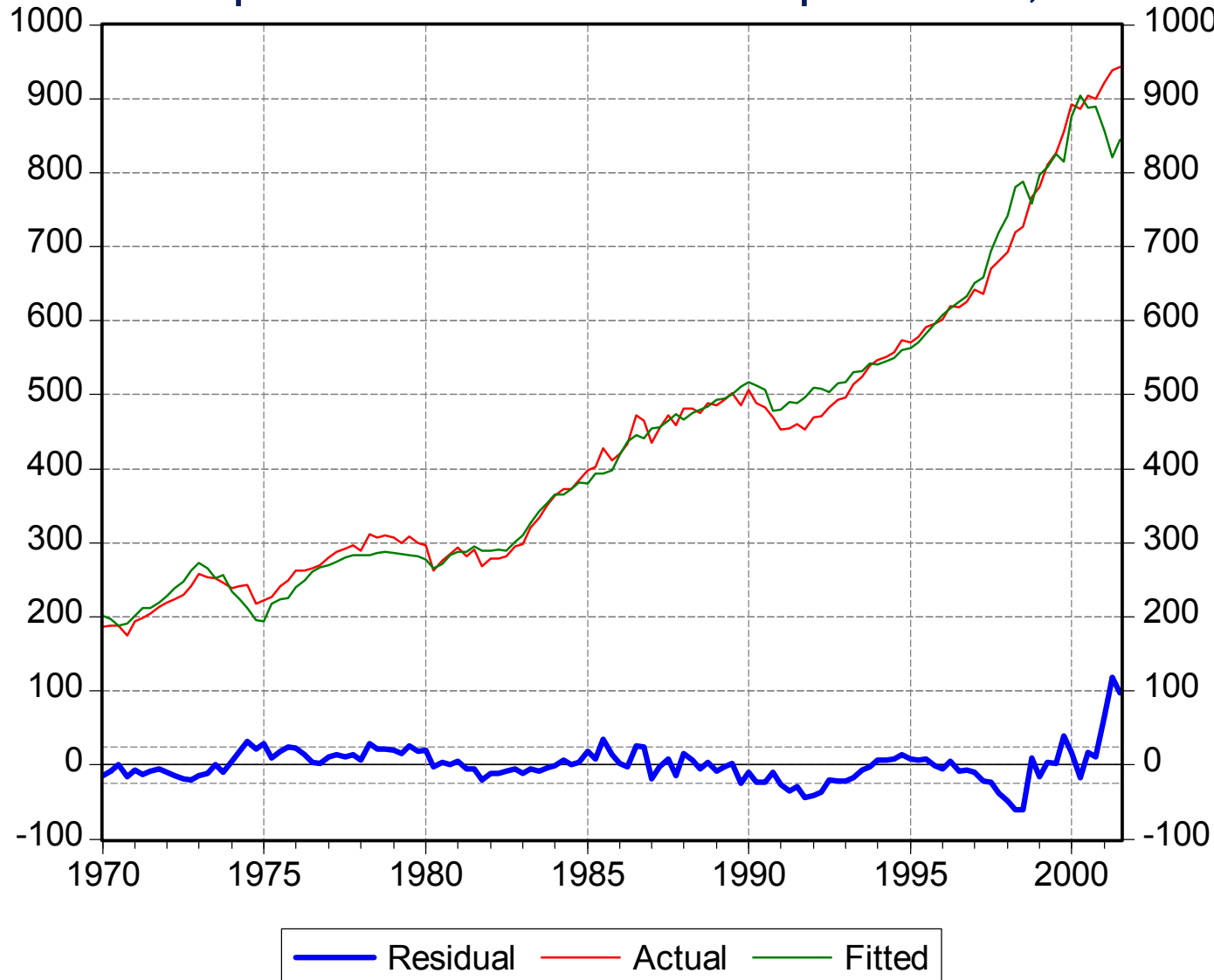
Econometrics

Add the bond rate and household net worth

Equation 7				
Dependent Variable: CD96C				
Method: Least Squares				
Date: 02/23/02 Time: 17:03				
Sample(adjusted): 1970:1 2001:3				
Included observations: 127 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	
C	(195.87)	26.58	(7.37)	
YD96C	0.10	0.05	1.97	
.25*(YD96C(-1)+YD96C(-2)+YD96C(-3)+	(0.07)	0.05	(1.30)	
@MOVAV(JATTC,4)	1.18	0.31	3.75	
RMGFCM_10NS	(2.83)	1.14	(2.48)	
HHNETW96C(-1)	0.02	0.00	13.02	
R-squared	0.99	Mean dependent var		435.49
Adjusted R-squared	0.98	S.D. dependent var		196.51
S.E. of regression	24.25			

Econometrics

Note improvement in 1990s explanation, but still problems



Econometrics

The Need to Use
logarithms illustrated by
using an exact identity:

Spending (CD) =

Price (PIDCD)
times Volume (CD96C)

Linear Version
Produces Silly
Coefficients



Log Version
Produces Exact
Coefficients



Equation 9			
Dependent Variable: CD			
Method: Least Squares			
Date: 02/23/02 Time: 17:43			
Sample(adjusted): 1970:1 2001:3			
Included observations: 127 after adjusting endpoints			
Variable	Coefficient	Std. Error	t-Statistic
C	(235.01)	5.47	(42.98)
PIDCD	261.23	9.11	28.67
CD96C	0.92	0.01	107.85
R-squared	1.00	Mean dependent var	379.00
Adjusted R-squared	1.00	S.D. dependent var	219.40
S.E. of regression	13.04		

Equation 10			
Dependent Variable: LOG(CD)			
Method: Least Squares			
Date: 02/23/02 Time: 17:45			
Sample(adjusted): 1970:1 2001:3			
Included observations: 127 after adjusting endpoints			
Variable	Coefficient	Std. Error	t-Statistic
C	1.77E-13	2.01E-14	8.80
LOG(PIDCD)	1.00	5.36E-15	1.87E+14
LOG(CD96C)	1.00	3.17E-15	3.15E+14
R-squared	1.00	Mean dependent var	5.74
Adjusted R-squared	1.00	S.D. dependent var	0.67
S.E. of regression	8.74E-15		

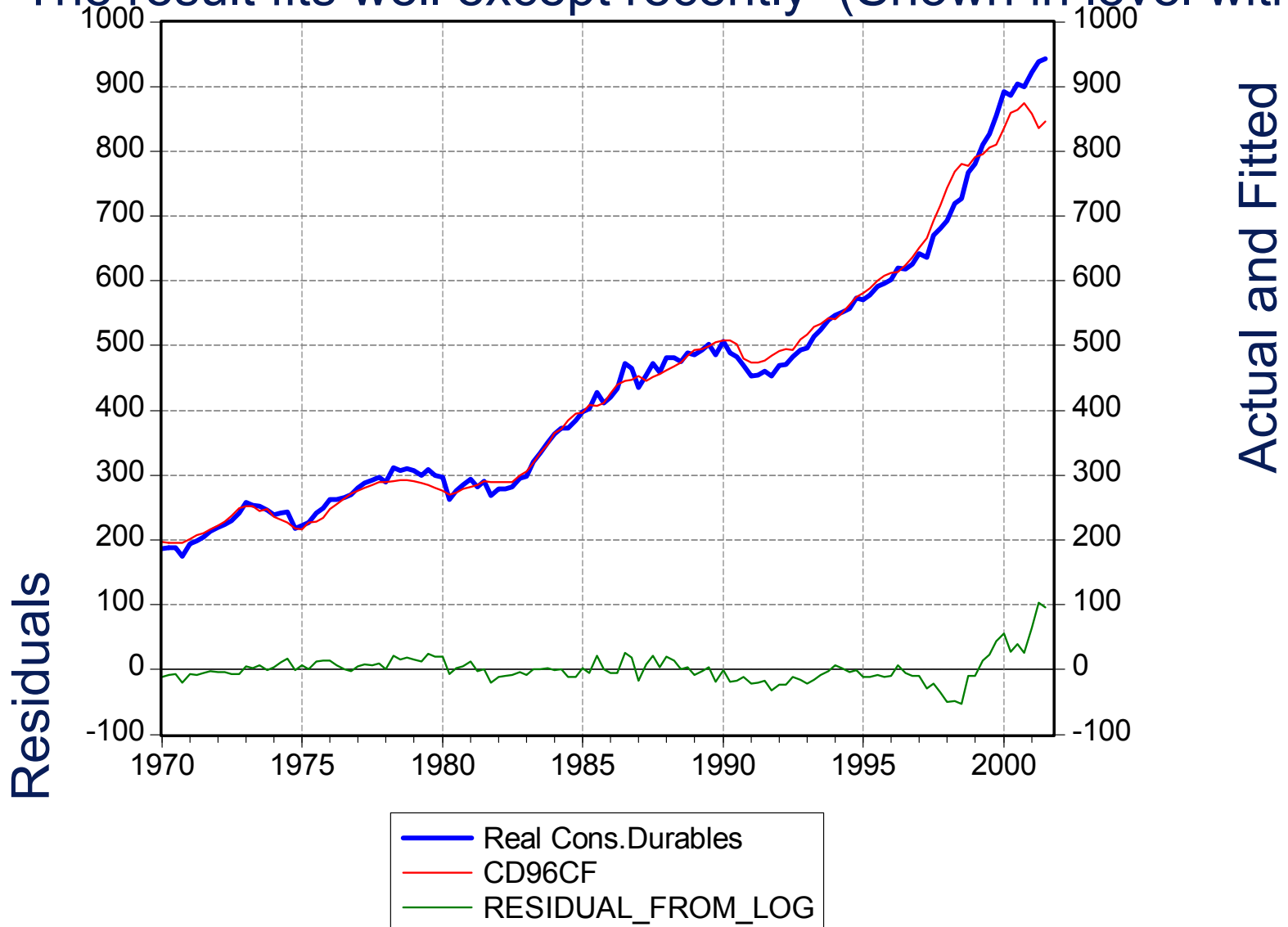
Econometrics

Switch to logarithms of key, exponentially rising variables

Equation 8				
Dependent Variable: LOG(CD96C)				
Method: Least Squares				
Date: 02/23/02 Time: 17:10				
Sample(adjusted): 1970:1 2001:3				
Included observations: 127 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	
C	(6.27)	0.14	(43.68)	
LOG(YD96C)	0.92	0.37	2.51	
LOG(.25*(YD96C(-1)+YD96C(-2)+YD96C(-3)+YD96C(-4)))	0.21	0.36	0.59	
@MOVAV(JATTC,4)	0.00	0.00	8.75	
RMGFCM_10NS	(0.01)	0.00	(4.41)	
LOG(HHNETW96C(-1))	0.25	0.07	3.56	0.00
R-squared	0.99	Mean dependent var		5.98
Adjusted R-squared	0.99	S.D. dependent var		0.44
S.E. of regression	0.04			

Econometrics

The result fits well except recently (Shown in level without log)



Econometrics

The result fits well (Shown in logs)

