

## Inflation targeting in practice

- Legislation
  - Central bank law with targets
  - Independence
  - Ultimate or specific targets
- Dependence on
  - Parliament
  - Government
- Interpretation of law
- Policy
  - Forward-looking  $\Leftrightarrow$  forecasting the economy
- Evaluation
- Accountability

## Legislation

- Ultimate and/or specific law
  - USA ultimate
  - UK ultimate + parliament
  - ECB ultimate target and specific target set by governing council
  - Sweden ultimate specific by board
- Interpretation of law
  - 2% target
  - Flexible
  - Not in law but in preparatory works
    - Lexicographic ordering

## Independence

The independence of the Executive Board is also emphasized in the Sveriges Riksbank Act, which states that the members of the Executive Board may neither seek nor take instructions when fulfilling their monetary policy duties.

## Legislation

Price stability remains the overriding objective for monetary policy under the flexible exchange rate.

The Riksbank will, through monetary policy, defend the results achieved in the struggle against inflation. The Riksbank specifies that the objective of monetary policy is to limit the annual increase in the consumer price index in 1995 and onwards to 2 per cent, with a degree of tolerance of  $\pm 1$  per cent.

This objective corresponds to the current underlying rate of inflation.

## also said

Price stability is a prerequisite for sustained economic growth as well as full employment and it prevents an arbitrary redistribution of income and wealth.

## Law & CB July 2008

The statutory objective of monetary policy is to maintain price stability.

Monetary policy acts with a lag and is normally focused on achieving the inflation target within a two-year period. The two-year time horizon also provides scope for taking fluctuations in the real economy into consideration.

The Riksbank routinely takes into consideration changes in asset prices and other financial variables (exchange rates, house prices, share prices, household and corporate indebtedness, etc.) in monetary policy decisions.

## Flexibility

- The two-year horizon can be interpreted as a restriction as to how much consideration can normally be given to real economic developments, a restriction which – like the specified inflation target – the Riksbank has imposed on itself to make the target of maintaining price stability credible

## and...

The Riksbank's forecasts are based on the assumption that the repo rate (the Riksbank's policy rate) will develop in such a way that monetary policy can be regarded as well-balanced. Normally, a well-balanced monetary policy means that inflation is close to the inflation target within two years while inflation and the real economy are not showing excessive fluctuations.

## 1993 & 2008

Price stability is a prerequisite for sustained economic growth as well as full employment and it prevents an arbitrary redistribution of income and wealth.

Also, monetary policy does not have the task of, and cannot be used for, achieving lasting higher employment or growth. What monetary policy can achieve, however, is to ensure an inflation rate which over a number of years is well in line with the inflation target and to contribute to dampening the fluctuations in the real economy. In this way, monetary policy can create good conditions for an efficiently functioning economy and a favourable, stable macroeconomic development.

## Evaluation

- Who?
- How?
- Targets? Outcome?
- Time perspective
- Consequences?

## Accountability

- Consequences
- Failure => ?
- Ex post / ex ante
  
- Time perspective

## Forecasting the economy

- Policy is forward-looking
  
- Forecasts

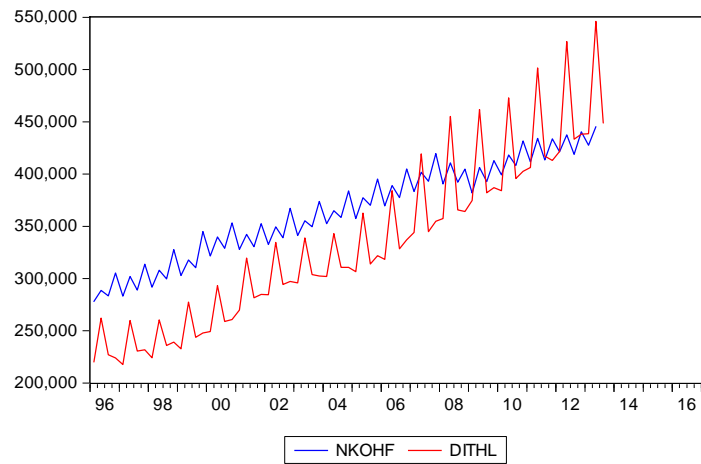
## Data

- CPI no revisions
- GDP large revisions
- Evaluate with real time data
  
- Data non-stationary

## Explain the data

- Models for non-stationary data
  
- Theory
  - Often not explicit on dynamics
  - Example consumption and income
  
- Short-run / Long-run

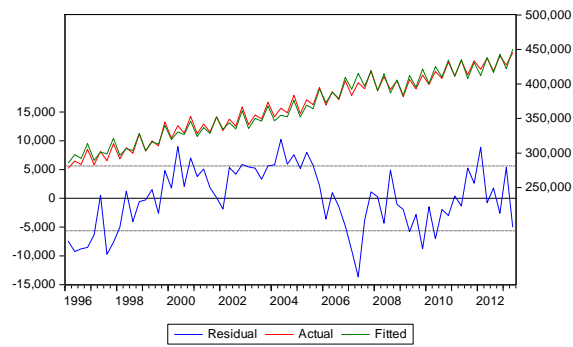
## Consumption and income



Dependent Variable: NKOHF  
 Method: Least Squares  
 Date: 12/12/13 Time: 00:03  
 Sample (adjusted): 1996Q1 2013Q2  
 Included observations: 70 after adjustments

Variable	Coefficien...	Std. Error	t-Statistic	Prob.
C	174756.6	7694.671	22.71138	0.0000
S1	-23463.97	1909.012	-12.29115	0.0000
S2	-31071.67	3004.951	-10.34016	0.0000
S3	-21753.00	1928.022	-11.28255	0.0000
DITHL./NKOHP	0.354353	0.037281	9.505017	0.0000
(HUSMV_NEW+NETTO)/NKOH...	0.012095	0.000966	12.52631	0.0000
R-squared	0.986334	Mean dependent var	365418.8	
Adjusted R-squared	0.985266	S.D. dependent var	46295.82	
S.E. of regression	5619.562	Akaike info criterion	20.18771	
Sum squared resid	2.02E+09	Schwarz criterion	20.38044	
Log likelihood	-700.5699	Hannan-Quinn criter.	20.26427	
F-statistic	923.8076	Durbin-Watson stat	0.776401	
Prob(F-statistic)	0.000000			





## Error correction model

$y$  and  $x$  nonstationary

$\Delta \ln y$  and  $\Delta \ln x$  stationary

$\ln y - \beta \ln x$  stationary

$$\Delta \ln y_t = \alpha_0 + \alpha_1 \Delta \ln y_{t-1} + \gamma_1 \Delta \ln x_t + \delta (\ln y_{t-1} - \beta_0 - \beta_1 \ln x_{t-1}) + \varepsilon_t$$

Long run solution:  $\ln y = \text{constant} + \beta \ln x$

## Can be written

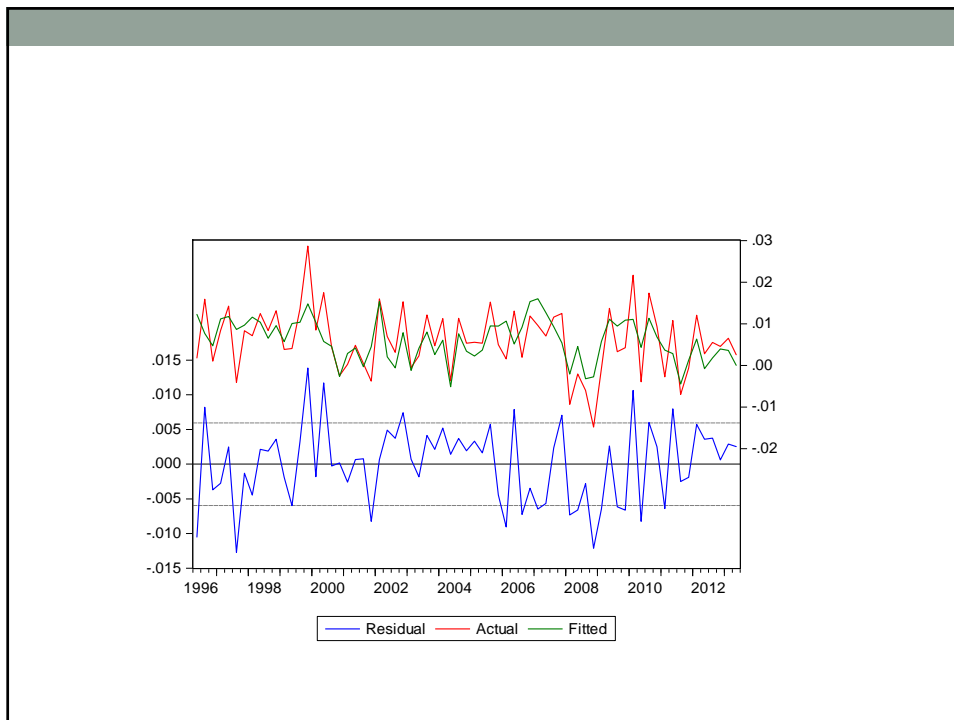
$$\Delta \ln y_t = (\alpha_0 - \delta\beta_0) + \alpha_1 \Delta \ln y_{t-1} + \gamma_1 \Delta \ln x_t + \delta \ln y_{t-1} - \delta\beta_1 \ln x_{t-1} + \varepsilon_t$$

- Very common econometric model in practice

## Error correction model example

Dependent Variable: DLOG(NKOHFS)  
 Method: Least Squares  
 Date: 12/12/13 Time: 08:12  
 Sample (adjusted): 1996Q2 2013Q2  
 Included observations: 69 after adjustments

Variable	Coefficien...	Std. Error	t-Statistic	Prob.
C	1.589464	0.401940	3.954480	0.0002
DLOG(DITHL_D11/NKOHF)	0.155406	0.050261	3.091954	0.0030
DLOG((HUSMV_NEW+NETTO)/N...	0.108703	0.022647	4.799893	0.0000
LOG(NKOHFS(-1))	-0.291537	0.080198	-3.635206	0.0006
LOG(DITHL_D11(-1)/NKOHF(-1))	0.089022	0.036812	2.418332	0.0185
LOG((HUSMV_NEW(-1)+NETTO(-1...	0.064375	0.016853	3.819874	0.0003
R-squared	0.436036	Mean dependent var	0.006073	
Adjusted R-squared	0.391277	S.D. dependent var	0.007631	
S.E. of regression	0.005954	Akaike info criterion	-7.326630	
Sum squared resid	0.002233	Schwarz criterion	-7.132360	
Log likelihood	258.7687	Hannan-Quinn criter.	-7.249557	
F-statistic	9.741837	Durbin-Watson stat	2.108370	
Prob(F-statistic)	0.000001			



## Econometrics and calibration

- Neo-Keynesian models not fully microfounded but mainly based on estimated model
- New Keynesian models "fully" microfounded, estimated and calibrated
- Simulate model to get data
- Compare simulated data with actual data

## Models

- NK style models
- Time series models
  - Univariate simple models
  - VAR models
- Structural models used by sectoral experts
  - Consumption functions
  - Wage equations
  - And more...

## Forecast evaluation

- Post-sample evaluation
- Accuracy
  - RMSE
- Bias
  - ME
- Horizon
  - Nowcasting
  - 1 quarter
  - 2 years
  - > 2 years

## Ex post forecast evaluation

- Forecast
  - Shocks during forecast horizon
  - CB cannot counteract the shocks
  - Ex post failure could be good policy
- 
- Forecast
  - Shocks during forecast horizon
  - Ex post success could be best policy

Table 1: RMSE for quarterly forecasts 2000-2006, variables expressed as quarterly or annual per cent growth

Variable	FC	Forecast horizon (quarter)							
		1	2	3	4	5	6	7	8
Policy rate	RB	0.06	0.27	0.45	0.60	0.66	0.80	0.98	1.10
	NIER	2.17	0.80	0.70	0.78	1.06	1.12	1.17	1.31
	AR	4.24	1.68	1.38	1.25	1.23	1.13	1.08	1.04
	StD	0.95							
UND1X (quarterly rate)	RB	0.14	0.40	0.38	0.40	0.42	0.44	0.33	0.33
	AR	2.95	1.05	1.11	1.07	1.07	1.06	1.28	1.32
	StD	0.58							
	StD SA	0.38							
UND1X (annual rate)	RB	0.10	0.49	0.54	0.50	0.47	0.53	0.62	0.76
	NIER	1.09	0.84	1.05	1.26	1.43	1.11	1.00	0.90
	StD	0.80							
CPI (quarterly rate)	RB	0.10	0.38	0.37	0.41	0.45	0.51	0.41	0.41
	AR	4.37	1.17	1.13	1.05	1.04	0.93	0.97	1.04
	StD	0.53							
CPI (annual rate)	RB	0.11	0.46	0.51	0.53	0.67	0.87	1.05	1.19
	NIER	0.73	0.91	1.09	1.18	1.11	1.03	1.01	1.04
	StD	0.90							
GDP	RB	0.30	0.31	0.28	0.28	0.36	0.37	0.34	0.31
	NIER	0.99	1.06	0.98	1.09	1.01	1.06	1.33	1.22
	AR	0.75	1.05	1.29	1.32	0.98	0.92	1.02	1.07
	StD	0.35							
Employment	RB	0.35	0.32	0.36	0.36	0.38	0.40	0.38	0.37
	NIER	0.94	1.03	0.87	0.97	1.00	1.04	1.09	1.09
	AR	0.95	1.14	1.07	1.13	1.09	1.05	1.13	1.15
	StD	0.41							
GDP/employment	RB	0.41	0.49	0.40	0.49	0.43	0.45	0.37	0.42
	AR	0.88	0.71	0.86	0.88	0.96	0.91	1.06	0.97
	StD	0.50							

## Forecast performance

Table 2. Forecast errors for different variables and horizons 2000Q1 – 2006Q3. Bias (ME) and size (RMSE). Data as annual changes. The p values for the no-bias hypothesis are in parentheses under Bias and the standard deviation for each variable in parentheses under Size. Data for PPI and distribution margin are for 2004Q2–2006Q3.

Horizon	Bias (ME)			Size (RMSE)		
	1	2-5	6-9	1	2-5	6-9
UNDIMPX	0,039 (0,292)	-0,054 (0,559)	-0,208 (0,053)	0,187 (1,761)	0,932 (1,776)	0,999 (1,744)
UNDINHX	0,028 (0,226)	0,114 (0,005)	-0,042 (0,335)	0,119 (0,561)	0,403 (0,627)	0,380 (0,508)
UND1X	0,024 (0,209)	0,059 (0,149)	-0,096 (0,022)	0,095 (0,564)	0,414 (0,572)	0,376 (0,533)
TCW index	0,185 (0,466)	0,891 (0,000)	0,033 (0,845)	1,221 (1,840)	1,847 (1,828)	1,559 (1,615)
Residual price	-0,146 (0,565)	-0,963 (0,000)	-0,287 (0,089)	1,228 (2,462)	1,756 (2,414)	1,517 (2,233)
PPI	0,224 (0,875)	0,106 (0,715)	0,586 (0,001)	4,358 (3,858)	1,036 (3,685)	0,566 (3,751)
Distrib. margin	-0,100 (0,952)	-0,839 (0,050)	-0,532 (0,145)	4,815 (5,447)	1,990 (5,273)	1,091 (5,180)

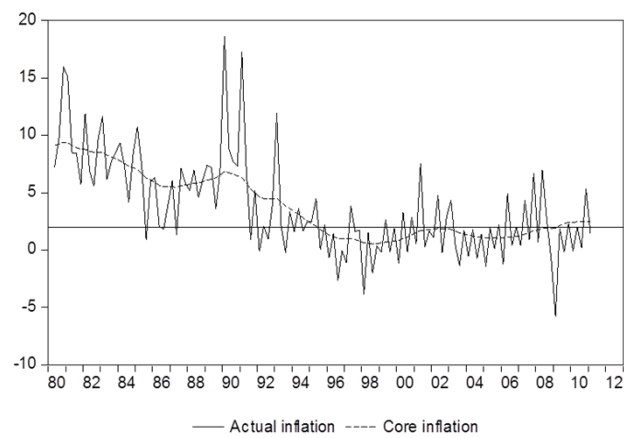
## Failure for a long time period

- A sequence of shocks
- Bad forecasts
- Bad policy
  
- How to evaluate?
- Compare central banks
  - Compare with business evaluations, compare with competitors

## Swedish case of bad policy

$$L = \frac{1}{2} E_0 \sum_{t=0}^{\infty} \beta^t \left( \phi_{yy} \tilde{y}_t^2 - \phi_y \tilde{y}_t + \phi_{\pi} (\pi_t - \pi^T)^2 + \phi_i i_t \right)$$

## Core inflation



## Simulation

- What would the interest rate had been to have inflation around the target?
- On average 0.8 p.u. lower
- Implications for real variables
  - Employment +50 000
- Huge welfare improvement in terms of the loss function
  
- Svensson
  - Unemployment -40 000

## Targets and tradeoffs

- Ultimate target
  - Stable prices
- 2% inflation
  
- Flexibility
  - Real targets
    - Output gap, unemployment
  - Housing prices
  - Household debt



## Inflation targeting era

- The great moderation
- Inflation low
- Inflation less volatile
- Output growth high
- Output volatility lower
- Does this depend on inflation targeting?
  - Compare countries
    - Denmark vs Sweden

## Alternative theories

- Hysteresis models
  - Temporary shocks -> Permanent effects
  - Insider-outsider
- Near-rational expectations
  - Akerlof's Phillips curve
  - Mankiw/Reis inattentive agents
- Friedman's rule - zero interest rate
- Inflation tax

## The financial crisis 2008

