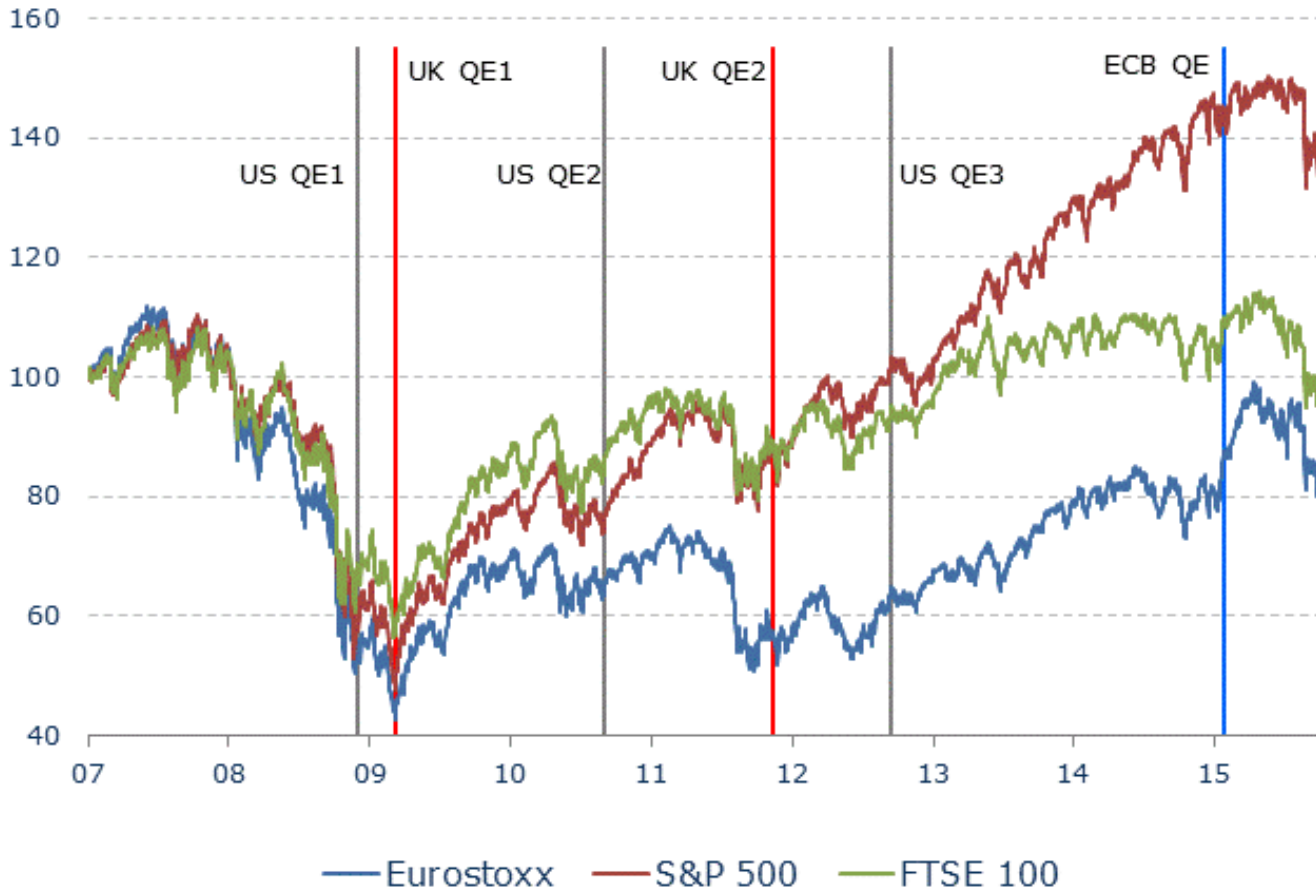


# The signalling content of asset prices for inflation: implications for Quantitative Easing

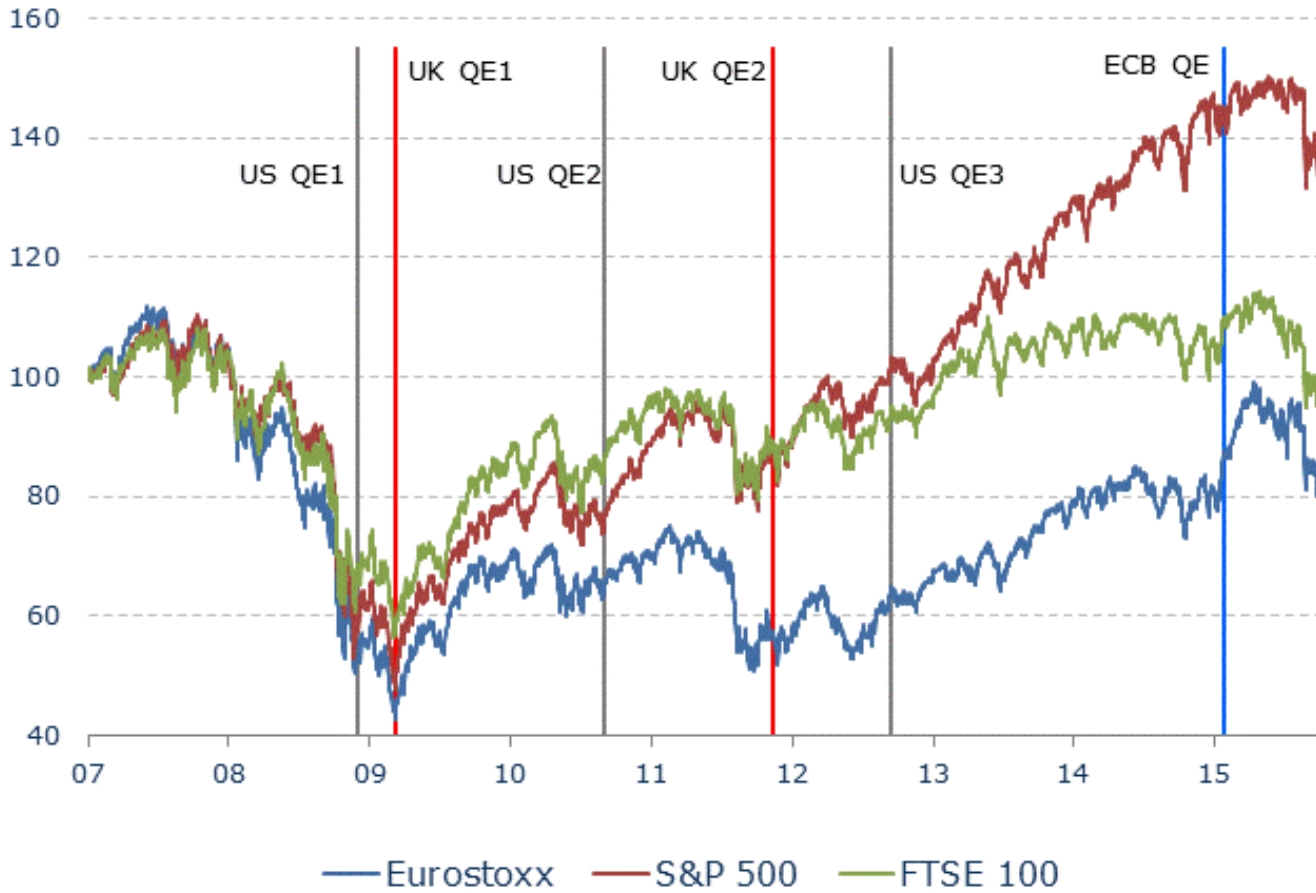
Leo de Haan & Jan Willem van den End

6th NBRM Conference “Central Banking under  
Prolonged Global Uncertainty”, 6 April, 2017, Skopje

# If QE affects asset prices such as stock prices



# Do asset prices signal the future inflationary regime?



# Preview

## Do asset prices signal the future inflationary regime?

- Equity prices, also house prices, bond yields, credit volume
- Two inflationary regimes: very low inflation/deflation, or high inflation
- Methodology: Signalling approach (non-parametric) & discrete choice model (parametric)

## Results

- Financial variables predictors of both high & low inflation
- High asset prices more often signal high inflation than low inflation/deflation
- Sometimes, high asset prices indicate low inflation as well (NL, UK, Japan)
- Transmission of boosted credit volumes or asset prices to very low inflation/deflation may take a long time

## Implications for QE

QE may affect inflation through asset prices, but timing & direction uncertain

# Boom-bust cycles raise deflationary risks

- Reinhart & Reinhart (2010): inflation 4 pp lower after burst asset price bubble
- Alessie & Detken (2011): boom-bust cycles raise deflationary risks

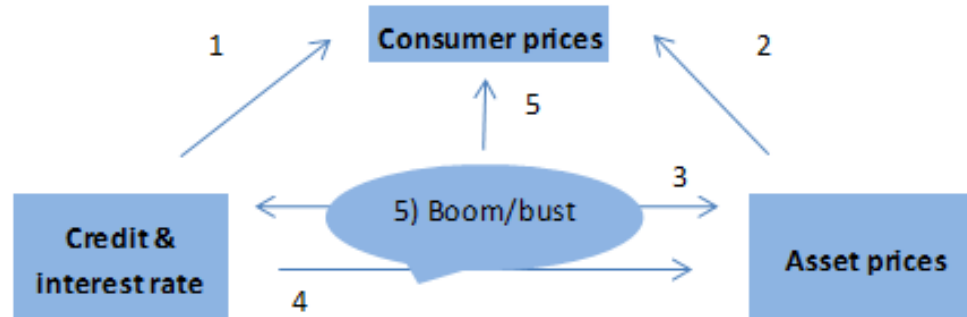
# Transmission channels

1) Cash-in-advance

2) Wealth effects

- a) consumption
- b) investments (Tobin's q)

3) Financial accelerator



4) Risk-taking

Note: Figure is based on Papademos and Stark (2010).

# Definition of inflationary regimes





# Inflation regimes 11 countries

Sample period 1985 – 2014, quarterly data

	Mean inflation (%)	Standard deviation of inflation (%)	Very high inflation (number of obs.)	Very low inflation/ deflation (number of obs.)	Normal inflation (number of obs.)
Germany	1.76	1.19	13	13	90
Norway	2.79	1.99	14	7	95
Sweden	2.52	2.74	15	9	92
Australia	3.53	2.39	23	8	84
United Kingdom	3.51	1.98	12	12	92
United States	2.77	1.27	16	14	86
Japan	0.51	1.29	21	14	80
France	1.90	0.91	23	17	76
Italy	3.26	1.78	26	15	75
Spain	3.66	2.05	18	14	84
Netherlands	1.95	1.05	14	17	85

# Selection of financial market indicators

# Financial indicators

- Credit, Equity and House prices, Bond yields (10 yr sovereign yields & corporate bond rates)
- Quarterly data from 11 countries (US, Japan, UK, Germany, France, Italy, Netherlands, Australia, Norway, Sweden, Spain)
- Sample period 1985Q1 - 2014Q4
- Series have been detrended

# Empirical methodology

## 1. ROC analysis

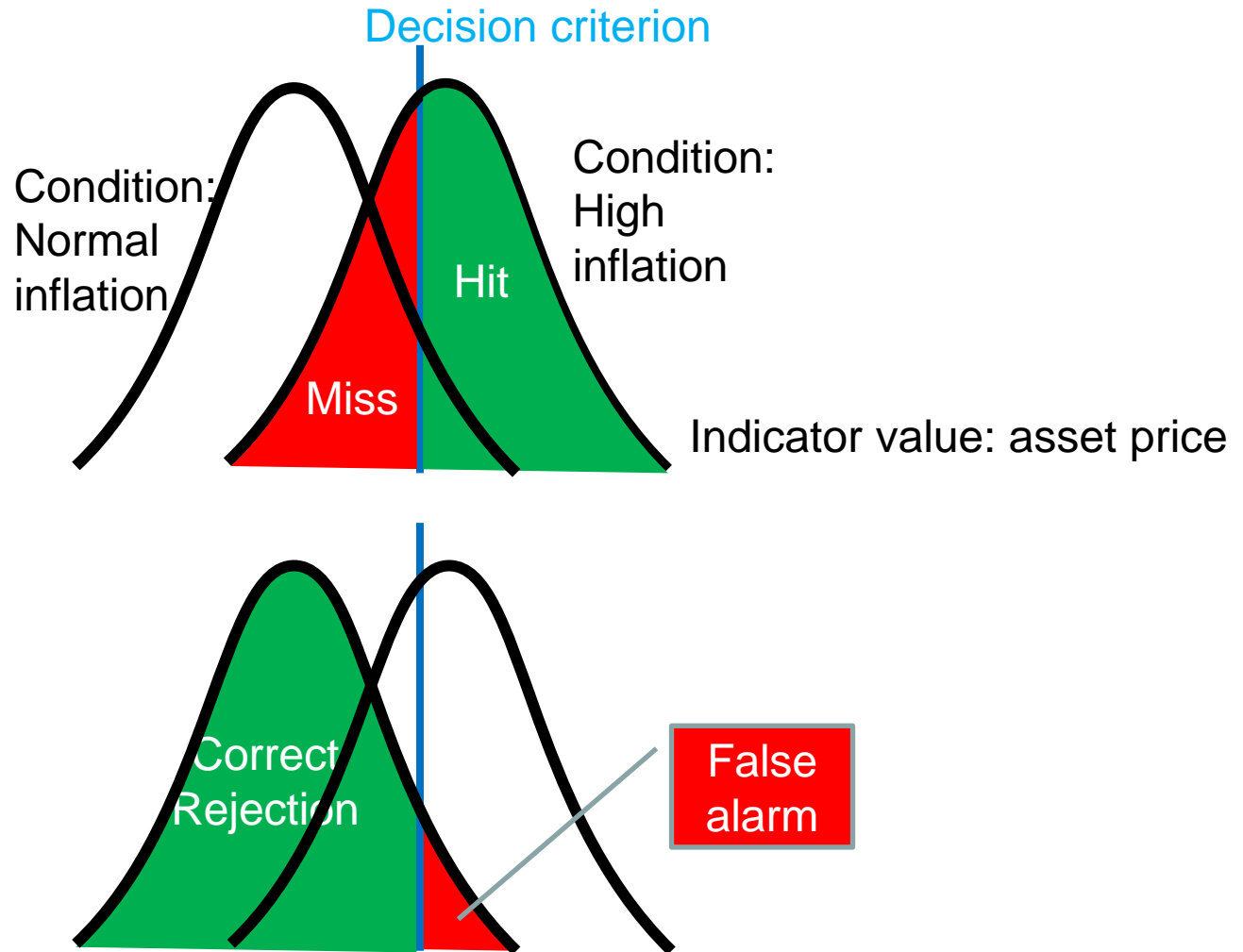
- Non-parametric
- One indicator at a time

## 2. Logit model

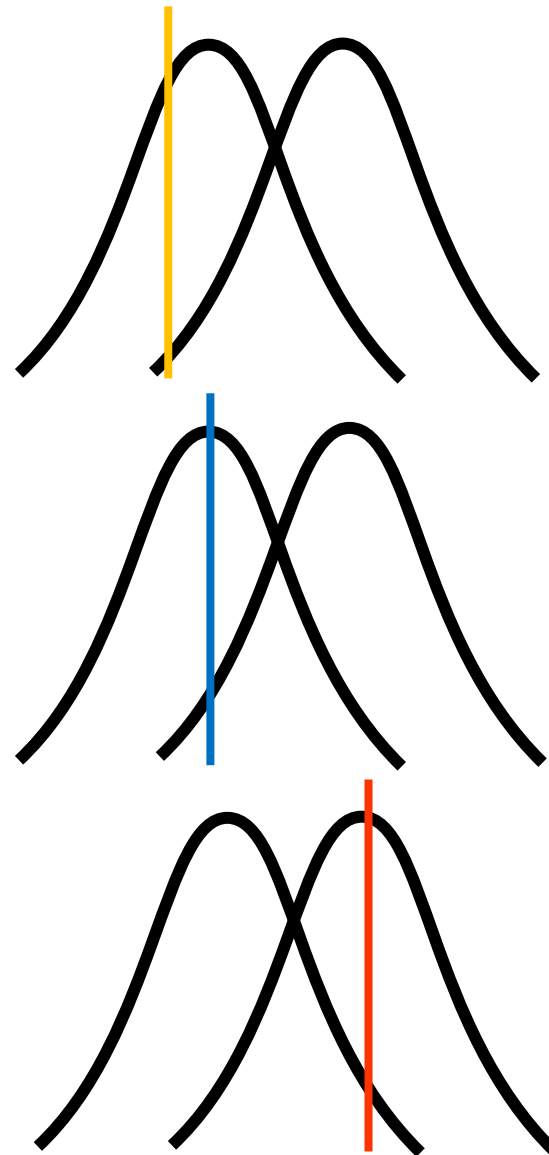
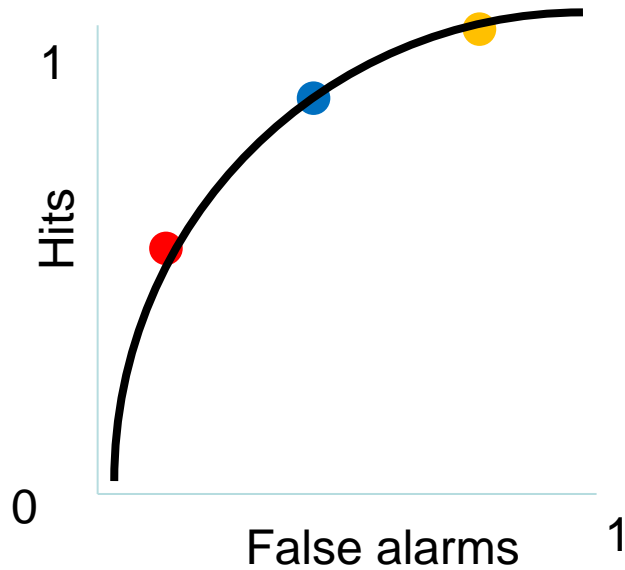
- Parametric
- Several indicators at a time

# ROC analysis

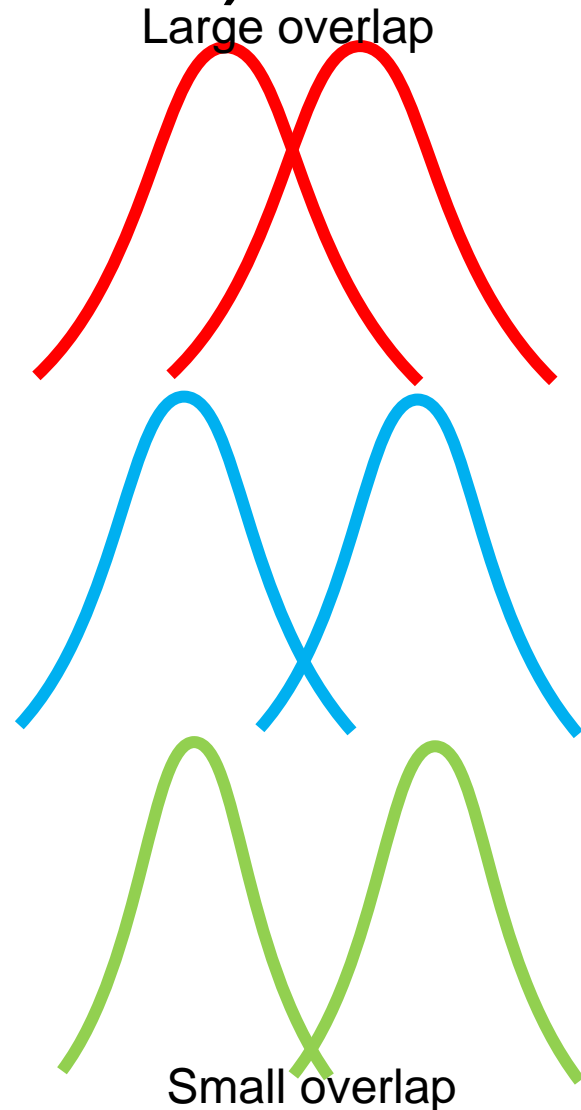
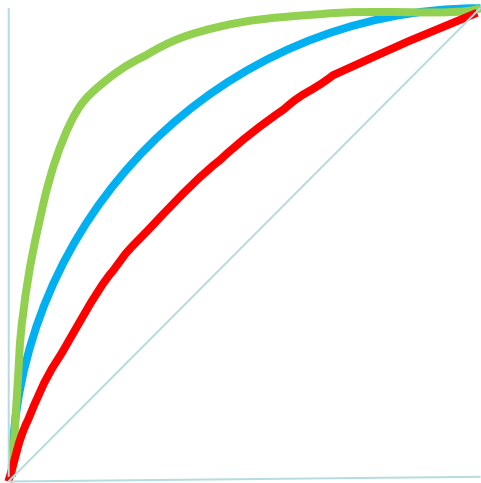
# Hits, misses, false alarms, correct rejections



# ROC curve: different decision criteria



# Area under the ROC curve (AUROC $\geq 0.5$ )





# AUROC results

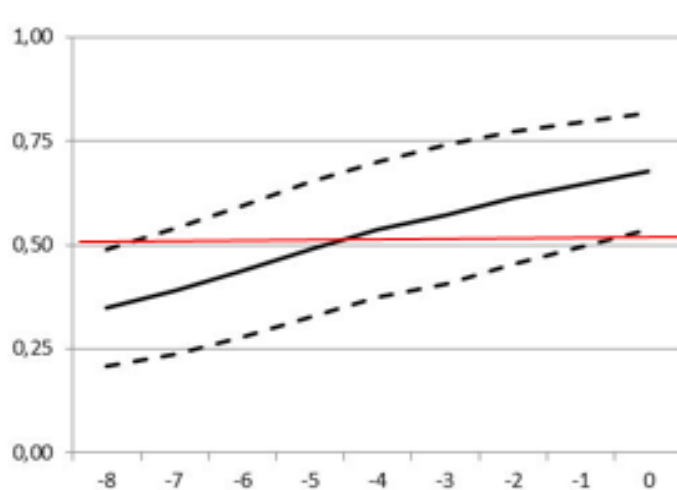
1. Averaged over 11 countries
2. Individual countries

AUROC results averaged over 11 countries

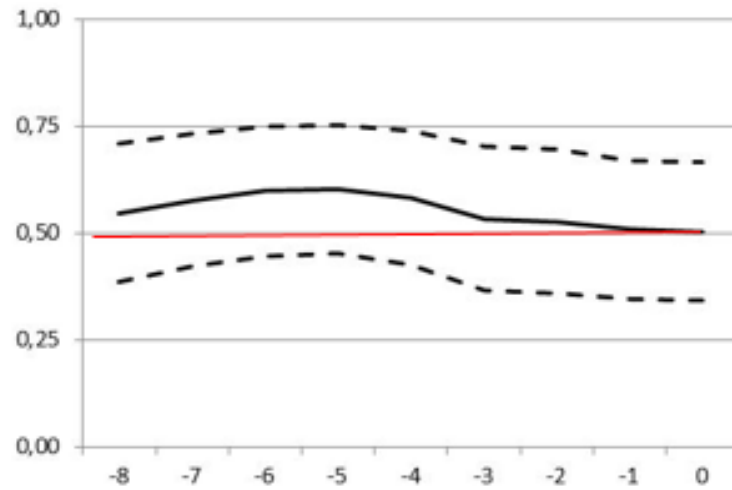
# Averaged results AUROC (1)

AUROC for different leads; averages over 11 countries

**a. Higher credit signalling high inflation**



**b. Higher credit signalling low inflation**

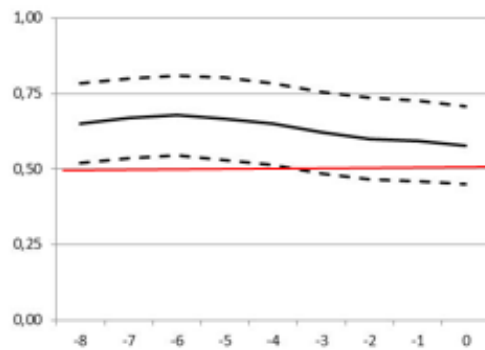


Note: Dotted lines denote 95% confidence bands. Signal is informative if the lower confidence bound > 0.5 (red line).

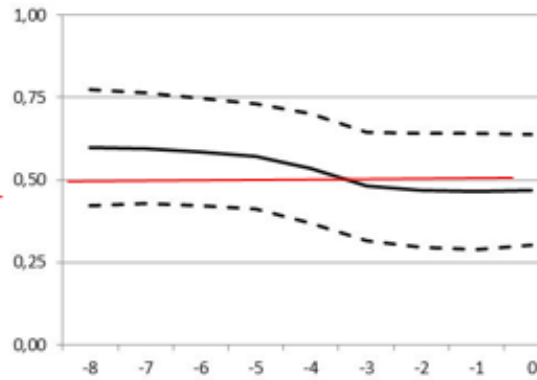
# Averaged results AUROC (2)

AUROC for different leads; averages over 11 countries

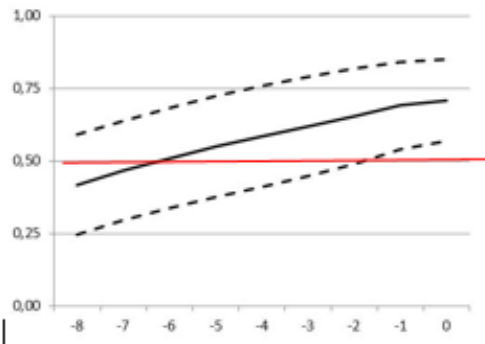
**c. Higher equity price signalling high inflation**



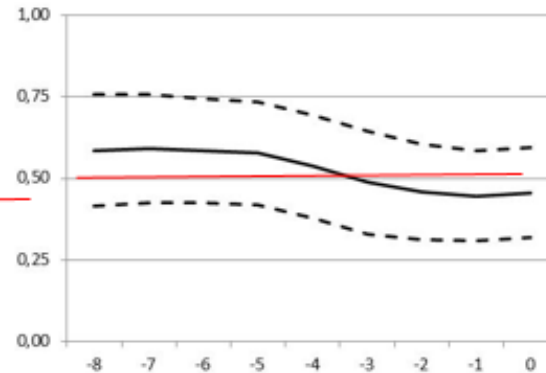
**d. Higher equity price signalling low inflation**



**e. Higher house price signalling high inflation**



**f. Higher house price signalling low inflation**

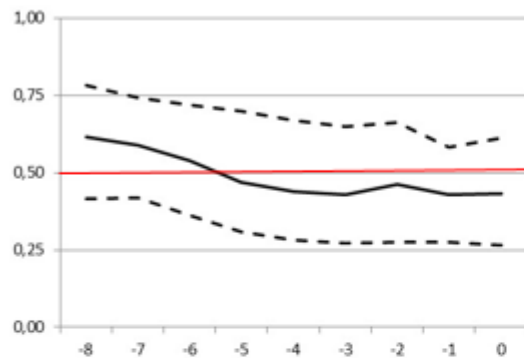


Note: Dotted lines denote 95% confidence bands. Signal is informative if the lower confidence bound > 0.5 (red line).

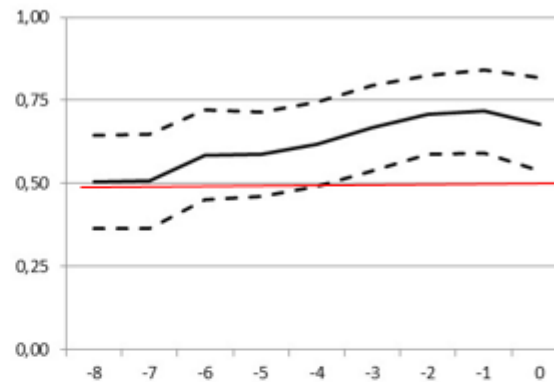
# Averaged results AUROC (3)

1- AUROC for different leads; averages over 11 countries

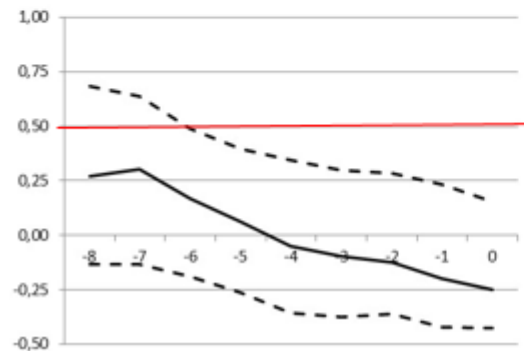
**g. Lower government bond yield signalling high inflation**



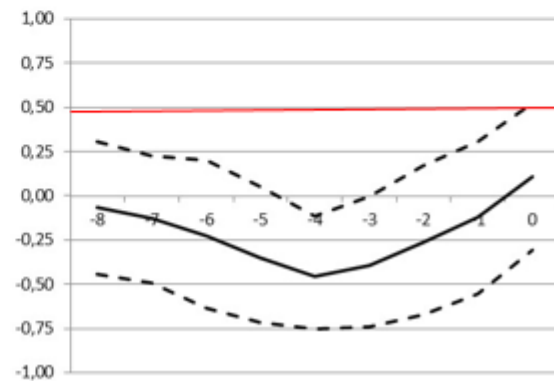
**h. Lower government bond yield signalling low inflation**



**i. Lower corporate bond rate signalling high inflation**



**j. Lower corporate bond rate signalling low inflation**



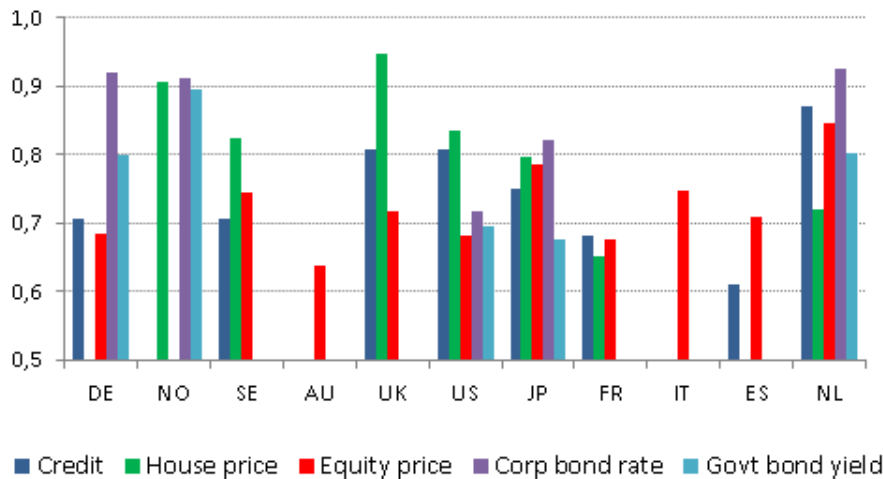
Note: Dotted lines denote 95% confidence bands. Signal is informative if the lower confidence bound > 0.5 (red line).

AUROC results for individual countries

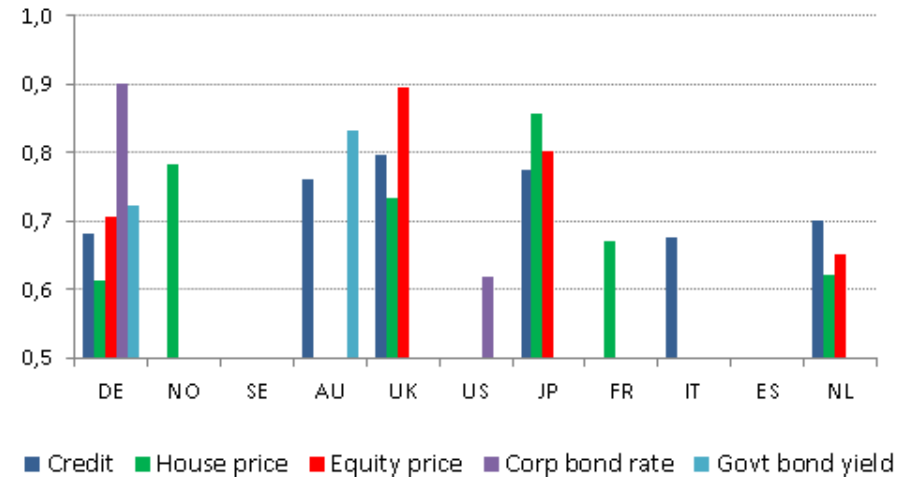
# Country results AUROC (1)

Maximum signalling value (areas under the ROC curve) for lead time 8 to 0 quarters

maximum signal for high inflation



maximum signal for low inflation

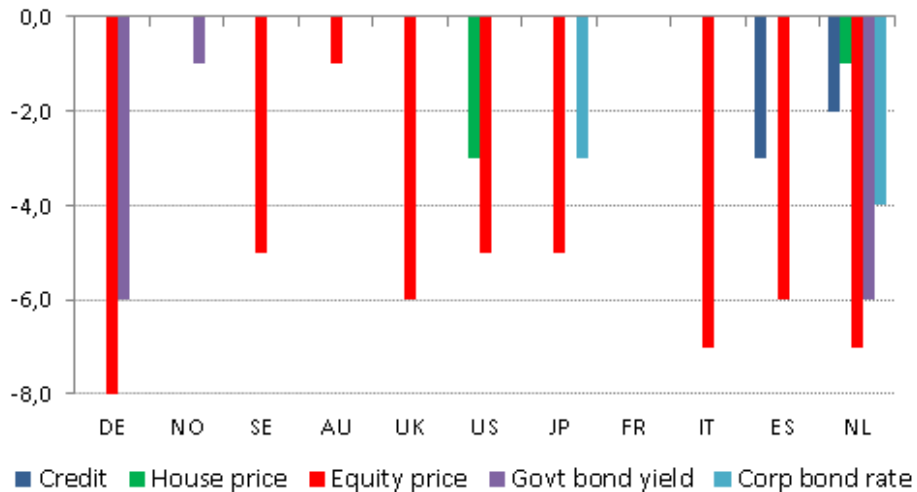


Note: Lead times have been chosen that gives maximum signals (on vertical axis). Significant signalling values extracted from high (above trend) levels of credit, house and equity prices (i.e., lower confidence bound AUROC > 0.5). Significant signalling values extracted from low (vis-à-vis mean) levels of sovereign and corporate bond yields (i.e., lower confidence bound  $[1 - \text{AUROC}] > 0.5$ ). Insignificant AUROC values on vertical axis below 0.5 are not shown.

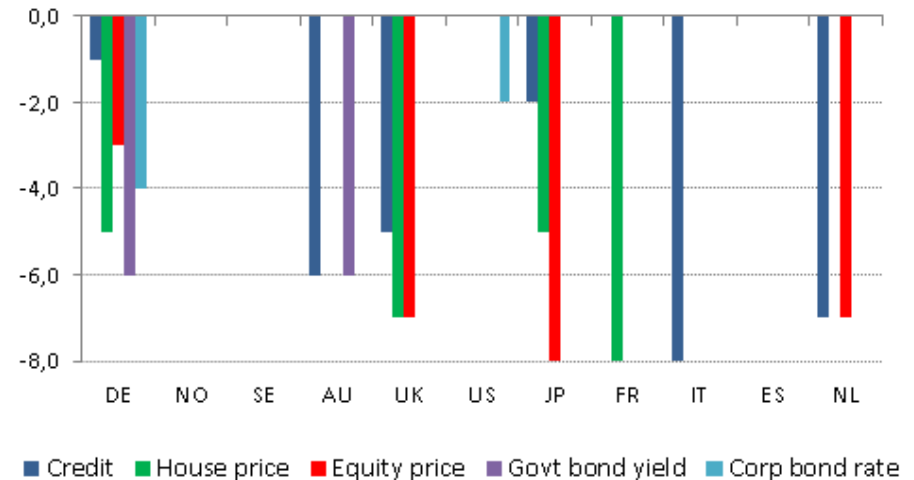
# Country results AUROC (2)

## Lead of maximum signal

### Lead of maximum signal for high inflation



### Lead of maximum signal for low inflation



Note: Lead times have been chosen that gives maximum signals (on vertical axis). Significant signalling values extracted from high (above trend) levels of credit, house and equity prices (i.e., lower confidence bound AUROC > 0.5). Significant signalling values extracted from low (vis-à-vis mean) levels of sovereign and corporate bond yields (i.e., lower confidence bound [1 - AUROC] > 0.5). Insignificant AUROC values on vertical axis below 0.5 are not shown.

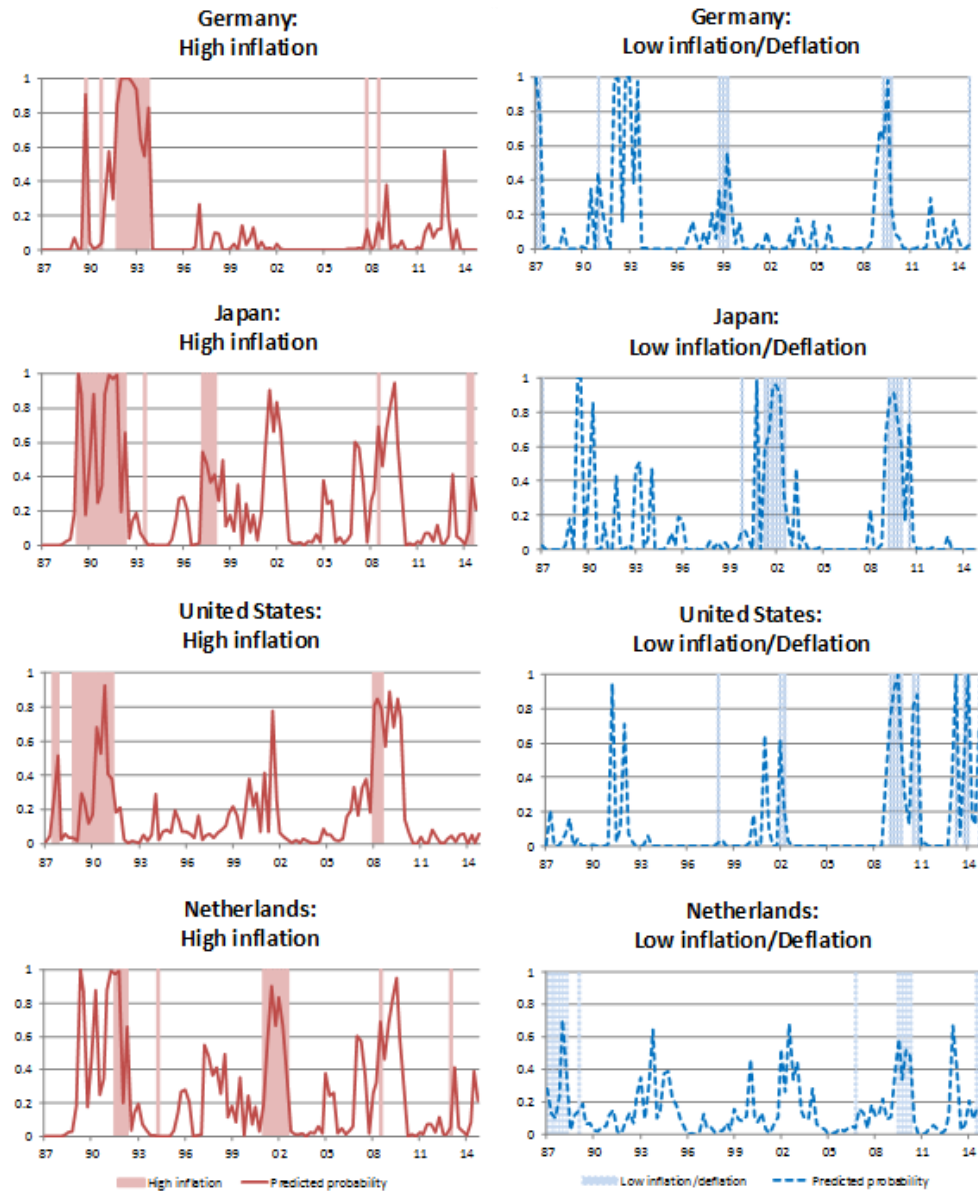


# Logit model

# Logit model

- Parametric method
- Estimates probability of inflationary regime
- Several financial indicators at a time (and business cycle (GDP) for control)

# Results Logit model



# Conclusion

Empirical results (ROC, Logit)  $\Rightarrow$  financial variables are important in predicting high / low inflation regimes

- high asset prices more often signal high inflation than low inflation/deflation
- in some countries, high asset prices indicate low inflation
- lead of high credit & asset prices wrt very low inflation/deflation quite long (up to 8 quarters)
- low government bond yields do not give significant signal for high inflation, while they do for low inflation/deflation

Stimulating asset prices – transmission channel QE - can effectively influence inflation, but ...

... effects are quite uncertain, both in timing and direction