The stock return–inflation puzzle revisited

- Liam A. Gallagher , Mark P. Taylor

Puzzle?

- Fishers model (1930)

 - nominal asset returns move one on one with inflation

Correlation Observed in post war data for US

- Negative : inflation and real stock returns

Hence the name “stock return – inflation” puzzle

Data

- Inflation, CPI
- GDP
- Real stock price index (deflated by CPI)

Range used in paper : 1957Q1 through 1997Q4

Range used in replication: 1951Q1 through 2019Q3

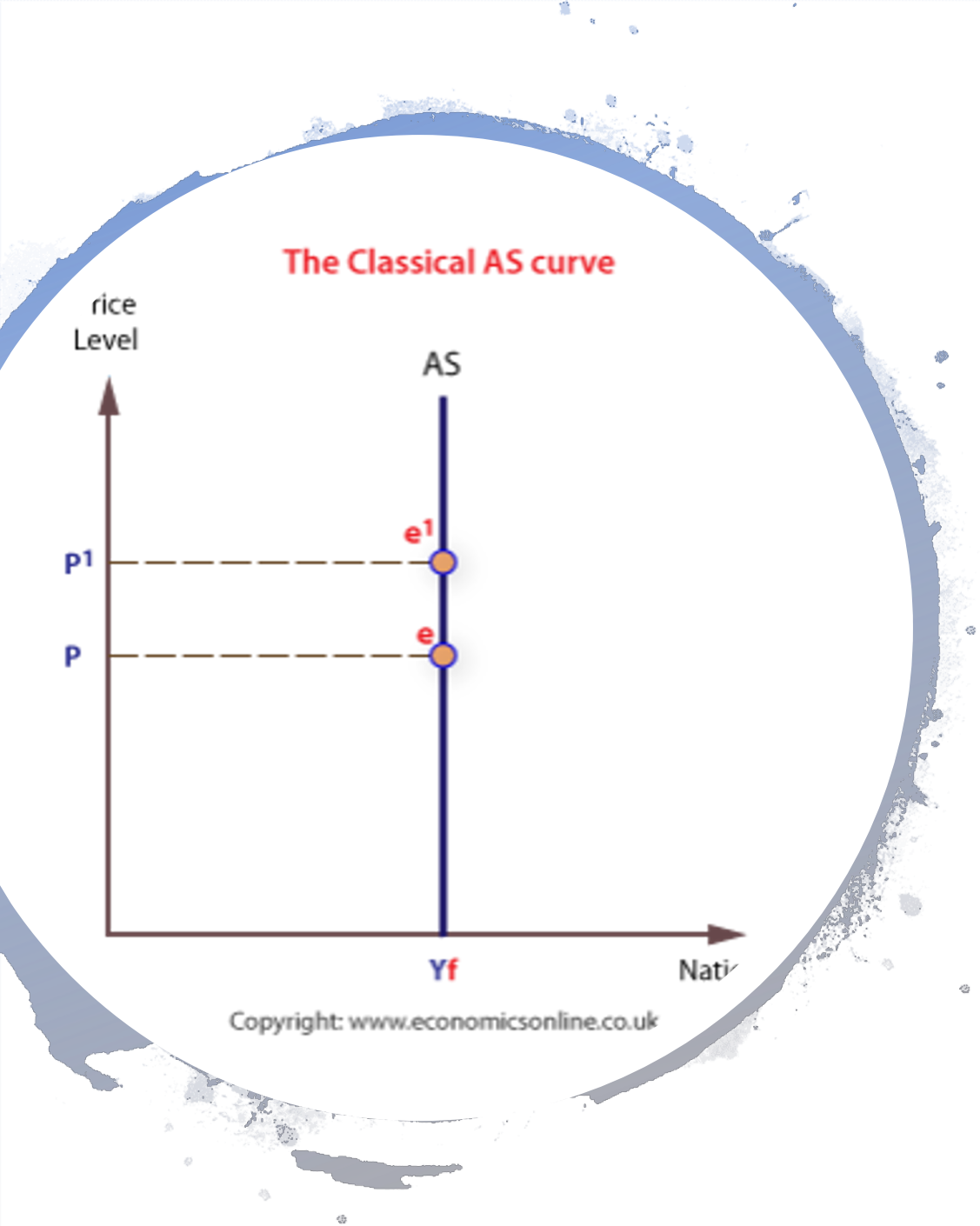
Regressing stock returns on inflation

- Paper results

$$\Delta q_t = \text{seasonals} - 2.88^{*}\Delta p_t \quad R^2 = 0.17$$
$$(0.60) \qquad \text{S.E.} = 0.06$$

- Replication results

	Dependent variable:
	realdcpi
inflation	-2.712***
	(0.344)
Constant	12.407***
	(0.404)
Observations	279
R2	0.183



Fama (1981)

- ‘Proxy hypothesis’
- Supply shocks – effects the output more
- Only Inflation due to supply as proxy
- Fama’s hypothesis predicts only the supply component is significant and negatively correlated with stock returns

Intuition behind

- Stock prices → current + expected future dividends → real output
- Demand shocks → just temporary effects → real output
  → expected future dividends → real stock returns → small

- Though there is short run effect of demand shocks on stock returns
  uncorrelated with any inflation movements
- Negative correlations (inflation and real stock returns)
  largely due to inflationary supply side shocks

Blanchard and Quah(1989)

- Econometric technique to isolate permanent and temporary shocks using Vector Auto regressive systems(multivariate decomposition)
- Permanent – supply shocks
- Temporary – demand shocks

$$2\times 1 \text{ vector of macroeconomic time series } x_t = [\Delta y_t \ \ \Delta p_t]'$$

- Where y = Gdp (output)

  p = inflation

$$x_t = \sum_{j=0}^{\infty} L^j \begin{bmatrix} \psi_{11i} & \psi_{12i} \\ \psi_{21i} & \psi_{22i} \end{bmatrix} \begin{bmatrix} e_{d,t} \\ e_{s,t} \end{bmatrix}$$

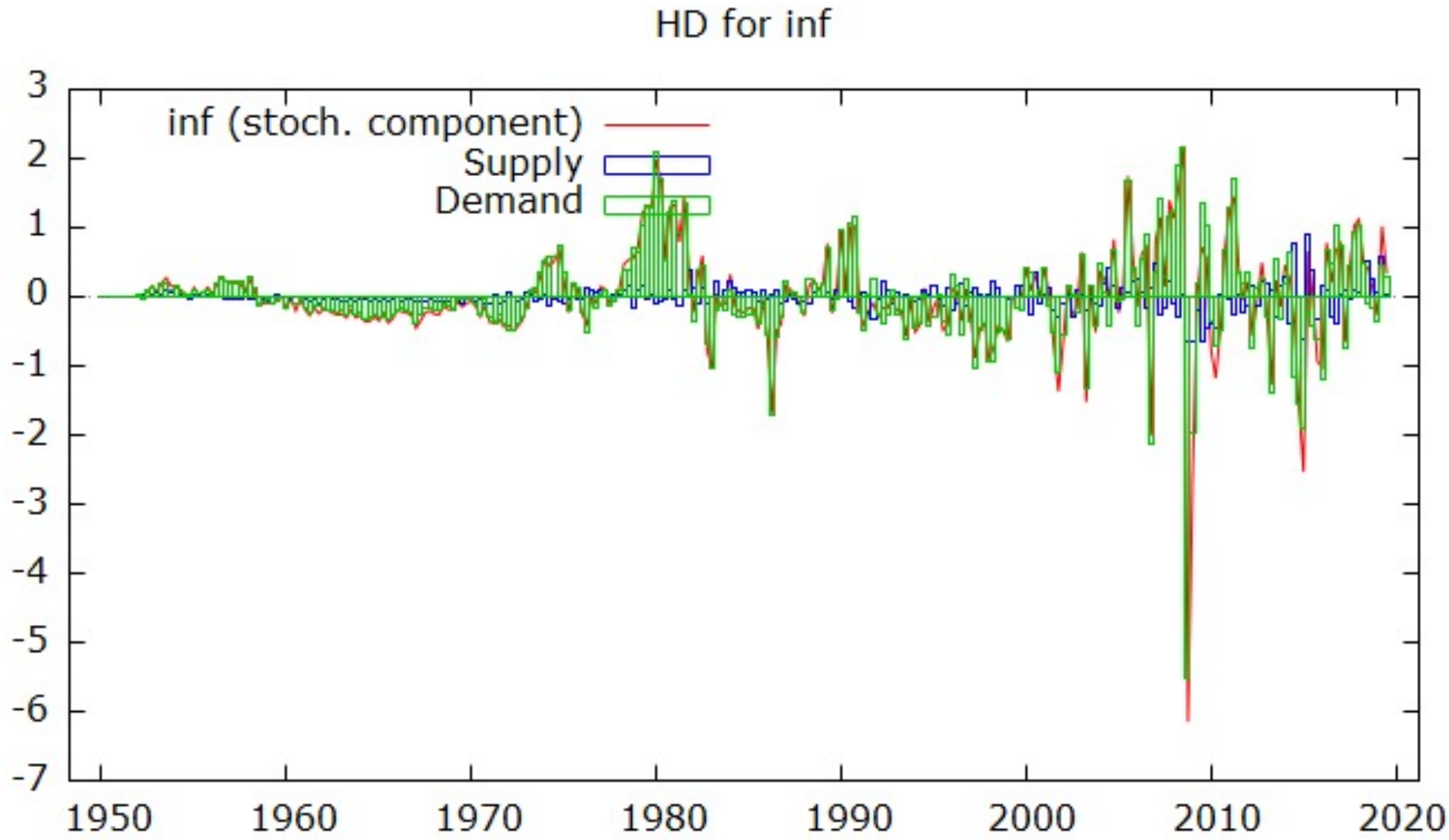
```
Estimated long-run matrix (restricted)
longrun (2 x 2)

     -40353. -6.1846e-011
      5.8009       1.2601
```

Multivariate decomposition

- ψ_{jki} represents the parameters of multivariate moving average representation
- Where $e_{d,t}$ –represents demand innovations

  $e_{s,t}$ – represents supply innovations
- By imposing restrictions on the coefficients in the equation, we can identify inflation due to demand and supply shocks


HD for inf
inf (stoch. component)
Supply
Demand
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
1950
1960
1970
1980
1990
2000
2010
2020

- Paper Results:

$$\Delta q_t = \text{seasonals} - 1.38\Delta^d p_t - 3.48 * \Delta^s p_t \quad R^2 = 0.17$$
$$(1.19) \quad (0.89) \quad \text{S.E.} = 0.06$$

- Replication results

	Dependent variable:
	realdcpi
hd_inf_gdp	-0.790
	(1.652)
p	-2.898***
	(0.359)
Constant	12.667***
	(0.423)
Observations	271
R2	0.197

Long Horizon test

- Boudoukh and Richardson (1993) found stronger empirical support to the hypothesis when longer horizon is considered.

- We investigate the data for the annual frequency to check the robustness of the results

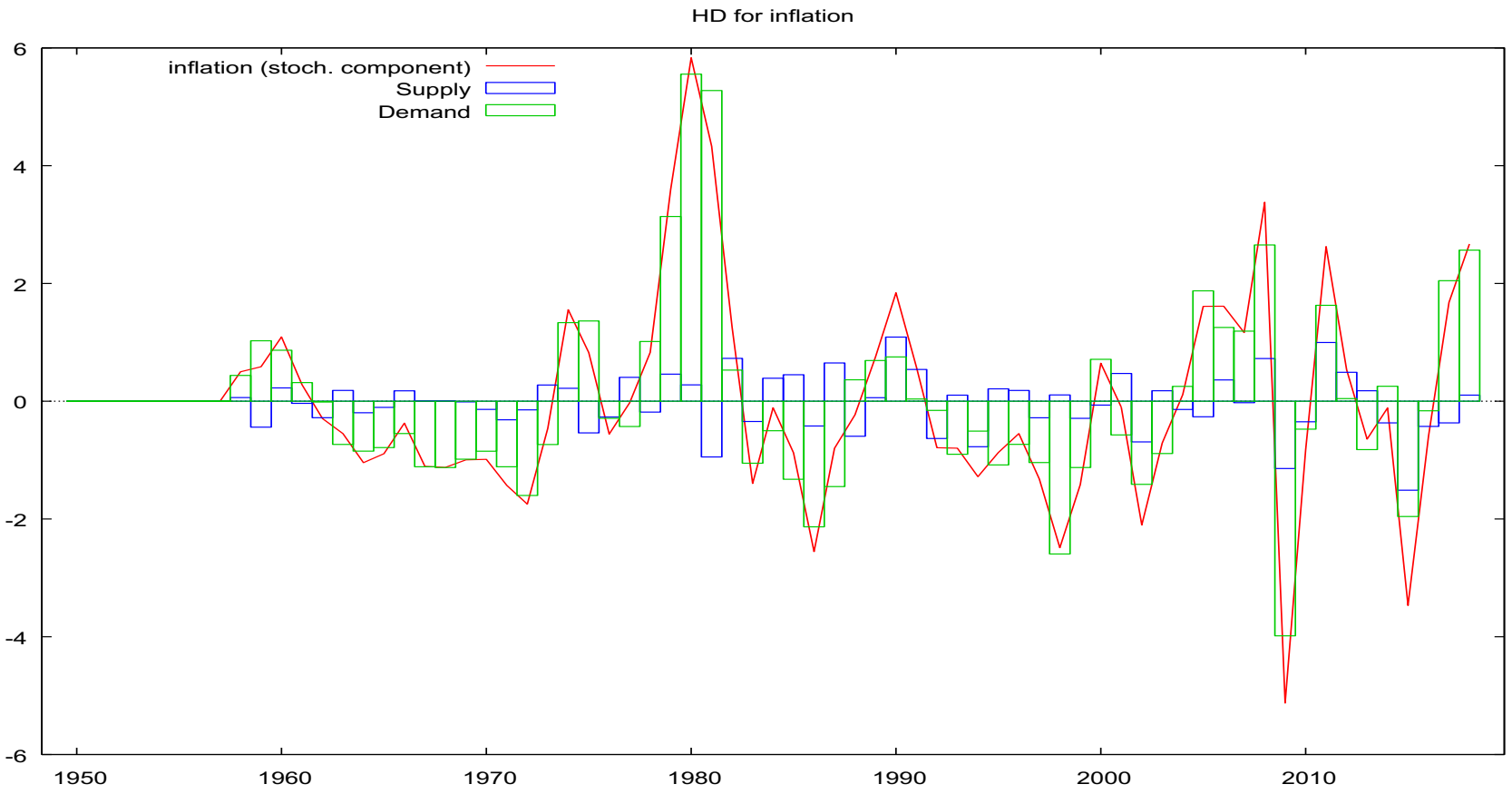
	Dependent variable:	
	realdcpi	realdcpi
	(1)	(2)
inflation	-1.393***	
	(0.208)	
hd_inflation_Supply		0.614
		(1.077)
demand		-1.792***
		(0.239)
Constant	14.719***	16.605***
	(0.844)	(1.024)
Observations	69	61
R2	0.402	0.494
Adjusted R2	0.393	0.477
Residual Std. Error	4.108 (df = 67)	3.966 (df = 58)
F Statistic	45.030*** (df = 1; 67)	28.333*** (df = 2; 58)
Note:		*p<0.1; **p<0.05; ***p<0.01

- Separate Var estimated for annual data

```
Estimated long-run matrix (restricted)
longrun (2 x 2)

     -35049. -1.8554e-010
      21.095       1.6871
```

Decomposition graph for annual data



Kaul's Hypothesis (Interest rate regime 1961Q1 to 1979Q4)

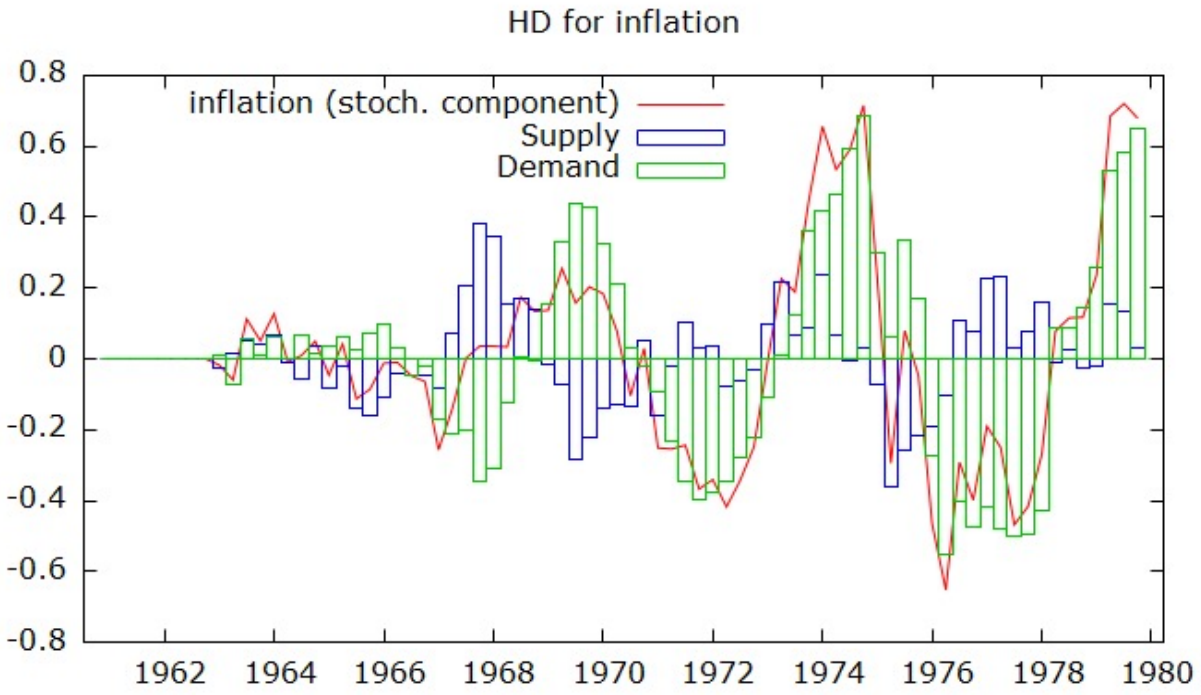
```
> stargazer(k1fm2,type="text")

================================================
                         Dependent variable:
                     ---------------------------
                                realdcpi
------------------------------------------------
hd_inflation_Demand             -4.000***
                                (1.118)

supply                          -11.284***
                                (0.702)

Constant                        22.121***
                                (0.579)

------------------------------------------------
Observations                        68
R2                                  0.802
Adjusted R2                         0.796
Residual Std. Error           2.810 (df = 65)
F Statistic                131.800*** (df = 2; 65)
================================================
Note:                *p<0.1; **p<0.05; ***p<0.01
```



$$\Delta q_t = \underset{(2.42)}{\text{dum}} + \underset{(1.48)}{2.62\Delta^d p_t} - 4.22 * \Delta^s p_t \qquad 0.23 \qquad 0.06$$

Kaul's hypothesis (Money supply regime 1979 to 1997)

```
> stargazer(k2fm1,type="text")

================================================
                         Dependent variable:
                     ---------------------------
                               realdcpi
------------------------------------------------
hd_inflation_Supply            -2.248***
                               (0.463)

demand                          0.697**
                               (0.339)

Constant                       3.935***
                               (0.444)

------------------------------------------------
Observations                      65
R2                               0.345
Adjusted R2                      0.324
Residual Std. Error         1.055 (df = 62)
F Statistic           16.317*** (df = 2; 62)
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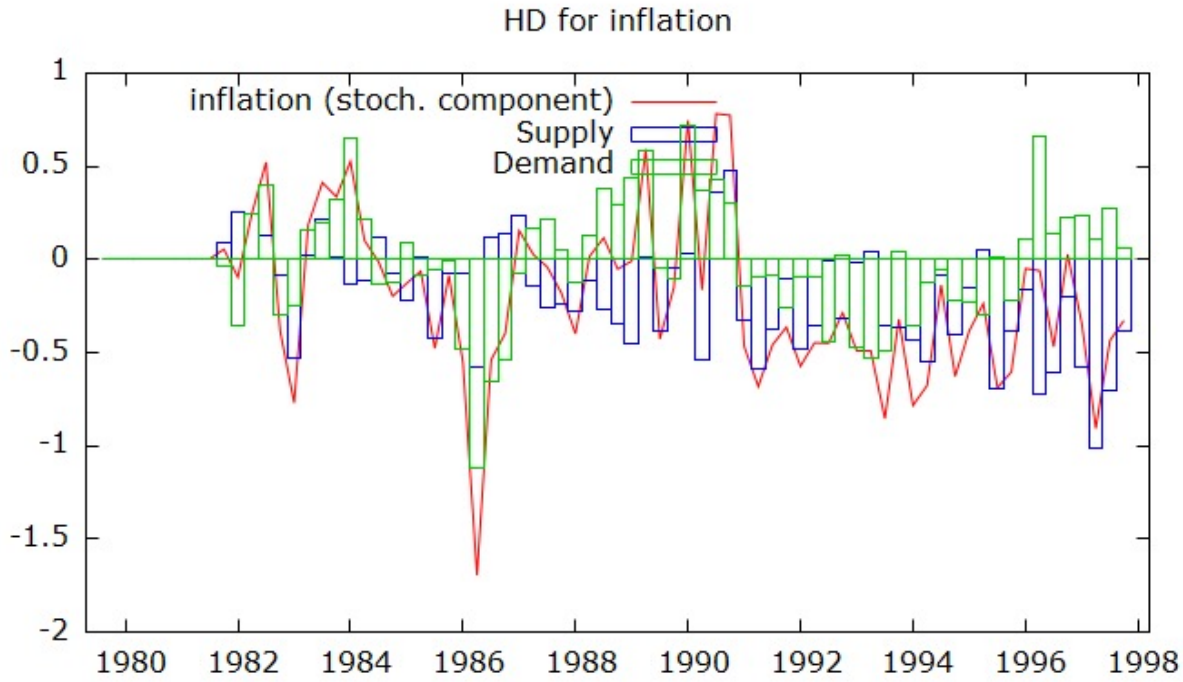

$$\Delta q_t = \underset{(2.26)}{\text{dum}} - \underset{(2.15)}{3.25\Delta^d p_t} - 4.85 * \Delta^s p_t \qquad 0.24 \qquad 0.06$$

Conclusion

US real stock returns vs Inflation vs Real output growth

Real stock returns were found to be

Insignificantly correlated – inflation due to demand innovations

Significantly negatively correlated – inflation due to Supply innovations

- The results are robust to varying data frequency and sub periods