On the predictive content of the PPI on CPI inflation: the case of UK

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Contents

1 Changes in the persistence of the CPI and the PPI

The data set is Consumer price inflation (CPI) all items and Producer price inflation(PPI) for the UK from March 1997 to November 2019. Figure 1 and 2 plot the UK annual and monthly CPI and PPI. To analyze persistent changes in CPI and PPI, the first step is to determine their basic time series properties. Determining the sequence of data integration is of particular importance. That is, evaluating whether the PPI and CPI inflation rates are I (0) processes. If the inflation rate is a non-stationary I(1) process, then the price level will be an I(2) process, so the analysis to determine the pass-through of producer price shocks to consumer prices will be more complex.

Another test we can conduct is the Augmented Dickey–Fuller (ADF) t-statistic test to find if the series has a unit root (a series with a trend line will have a unit root and result in a large p-value). ADF tests reject the null of non-stationarity of both PPI and CPI. The test identifies all stationary periods within the sample. The period identified as I(0) can be analysed according to the timing and operating rules of monetary policy.

```
##
##  Augmented Dickey-Fuller Test
##
## data:  monthly_ppi_cpi$cpi
## Dickey-Fuller = -5.2699, Lag order = 6, p-value = 0.01
## alternative hypothesis: stationary
```

```
##
##  Augmented Dickey-Fuller Test
##
## data:  monthly_ppi_cpi$ppi
## Dickey-Fuller = -6.1957, Lag order = 6, p-value = 0.01
## alternative hypothesis: stationary
```

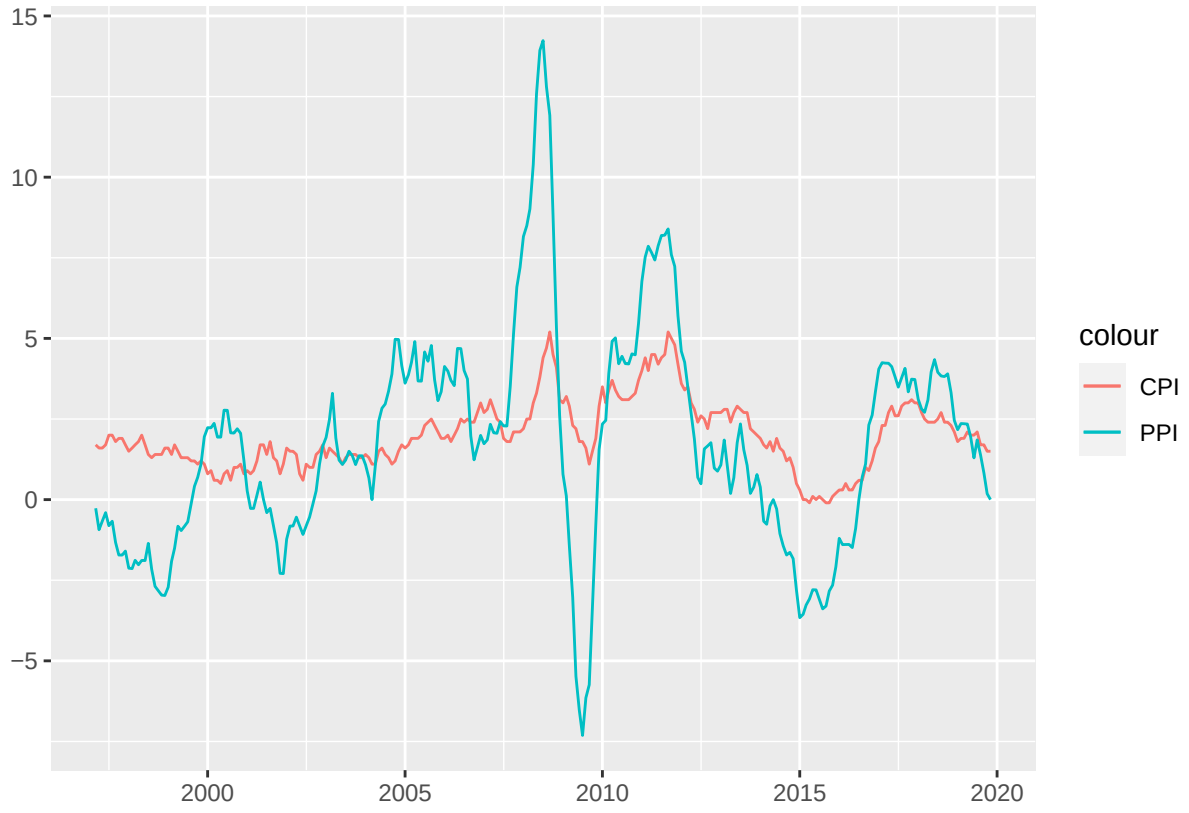

Figure 1: UK Annual inflation: CPI vs PPI

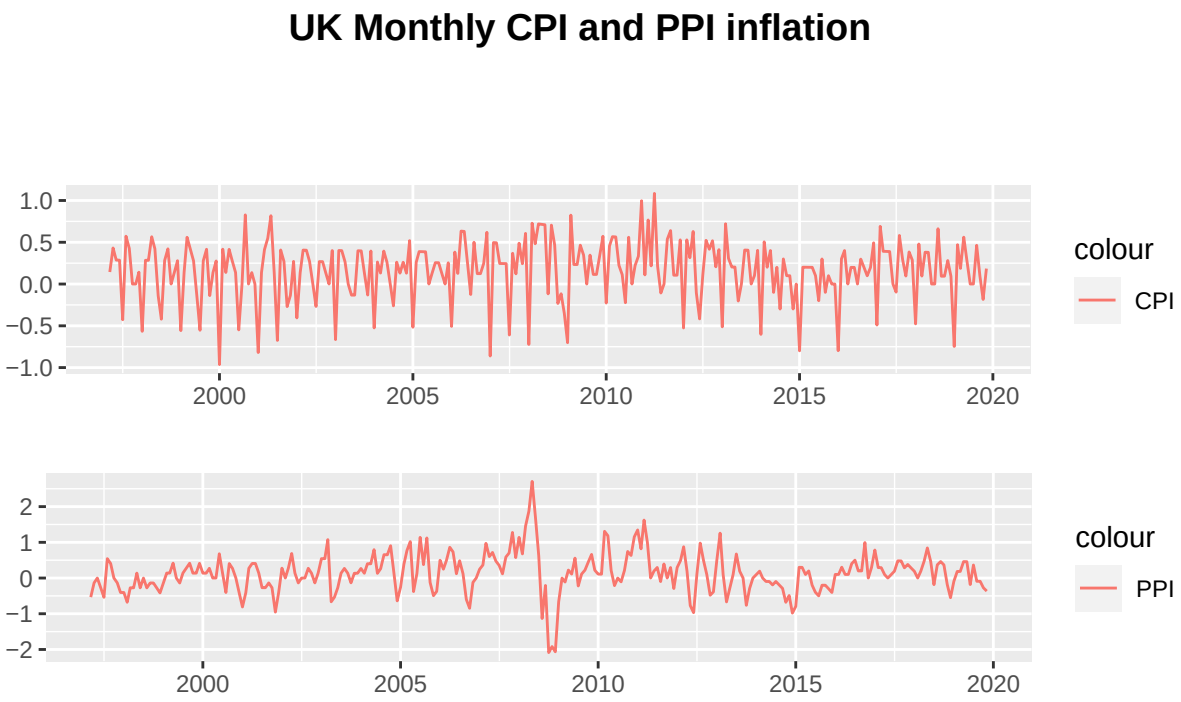

Figure 2: UK Monthly CPI and PPI inflation

2 Methodology to evaluate the predictive content of the PPI for the CPI

Compared with all the previous variables, we used the following formula estimated by Ordinary least squares (OLS). We use Stepwise regression to simplify the results.

$$\pi_t = \pi + \text{Trend}_t + \beta_1 D_{Jan} + ... + \beta_{11} D_{Dec} + \beta_{12} D_{\text{recesion}} +$$
$$\beta_{13} D_{VAT_1} + \beta_{14} D_{VAT_2} + \beta_{15} D_{TAT_3} + \sum_{j=1}^{12} \psi_j U_{t-j} + \sum_{j=1}^{12} \alpha_j \pi_{t-j} + \sum_{j=1}^{12} \lambda_j CPI_{t-j} + \sum_{j=1}^{12} \theta_j C_{t-j} + \sum_{j=1}^{12} \zeta_j \pi_{t-j}^{PPI} + \sigma_t$$

Where π is the inflation for each divisions, D_{JAN} to D_{Dec} are eleven dummy variables for each month. We define February as the base category against which the others are assessed to avoid the dummy variable trap. $D_{recession}$, the great recession that officially began in April 2008 and ended in June 2009, D_{VAT_1} , D_{VAT_2} and D_{VAT_3} are three Value-add ed tax change in the United Kingdom, which were December 2008, January 2010 and January 2011. $\sum_{j=1}^{12} \psi_j U_{t-j}$ describe the unemployment rate. $\sum_{j=1}^{12} \alpha_j \pi_{t-j}$ is the sum of twelve months lagged inflation dependent variables.

$\sum_{i=1}^{12} \lambda_i CPI_{t-i}$ represents the sum of twelve months lags of the inflation rate of CPI ALL ITEMS and $\sum_{k=1}^{12} \theta_k C_{t-k}$ is the sum of 12 monthly lags consumption growth rate. $\sum_{j=1}^{12} \zeta_j \pi_{t-j}^{PPI}$ is PPI inflation.

Please see figure 3 for results.

	Dependent variable:												
	CPI	01FB	02AT	03CF	04HW	05FH	06HL	07TR	08CM	09RC	10ED	11RH	12MS
lag1	-0.02		-0.22**	-0.28**	0.22**	-0.25**	-0.14*	-0.20**		-0.19**		-0.23**	-0.14*
lag2	-0.06			-0.24**		-0.23**	-0.14**						
lag3	0.07			-0.22**									
lag4	0.01			-0.22**									
lag5	-0.04						-0.18**						
lag6	0.02			0.22**		0.22**	-0.13*			0.13*		-0.18**	
lag7	0.01						-0.21**						
lag8	0.02				-0.12*		-0.14**						
lag9	0.04												
lag10	-0.004		0.12*			-0.13**			0.12*				
lag11	0.06												
lag12	0.22**		0.24**	0.30**		0.38**		0.17**		0.20**	0.38**	0.14*	
CPI_lag1												0.13**	0.22*
CPI_lag2							0.27**						
CPI_lag3			0.41*	0.64**				-0.45*	0.66**				
CPI_lag4													
CPI_lag5													
CPI_lag6			0.73**		-0.52**		0.19*	-0.43*					
CPI_lag7						0.64**							
CPI_lag8									0.42*				
CPI_lag9													
CPI_lag10													
CPI_lag11													
CPI_lag12													
growth lag3			0.26*										
growth lag5												0.09**	
growth lag7			0.53**					-0.33*					
growth lag8			-0.30*		0.21*							0.07*	
growth lag9	0.09**							0.67**					
growth lag10								-0.66**			-0.78**		
growth lag11	-0.09**						-0.16**				0.67*		
growth lag12			0.30**										
unemployment lag 1				0.19**									
unemployment lag 3							-0.25**						
unemployment lag 4							0.16**	0.14**					
unemployment lag 5							0.27**						
unemployment lag 6					-0.18*		-0.22**						
unemployment lag 7					0.19**		-0.20**						
unemployment lag 8							0.20**						
unemployment lag 9							0.19**						
unemployment lag 10				-0.07*			-0.35**					0.06**	
unemployment lag 11							0.41**					-0.06**	0.09*
unemployment lag 12							-0.23**	-0.10**					-0.10*
PPI lag 1	0.08**	0.05**					-0.02*	0.46**					
PPI lag 2	-0.07**		-0.12*					-0.38**					
PPI lag 3			0.15*		0.06**				-0.22**	-0.01*			
PPI lag 4								-0.10*	0.22**				
PPI lag 5													0.01*
PPI lag 6												0.03*	
PPI lag 7			-0.21**				0.08**					-0.03*	
PPI lag 8			0.25**				-0.06*		-0.05*				
PPI lag 10			-0.22**	-0.03*									
PPI lag 11			0.15**					0.21**					
PPI lag 12								-0.14*					
time_Aug	-0.03	-0.36*	-0.46	0.91**	0.55*	-0.003	0.17	-0.28	-0.17	-0.11	-0.02	0.003	-0.06
time_Dec	-0.24	0.09	-0.59*	2.06**	0.16	0.88**	-0.46**	-1.16*	-0.39	-0.06	-0.28	-0.23**	-0.33**
time_Apr	0.07	-0.54**	1.18**	1.02*	0.64**	-0.29	0.52**	0.27	0.53*	0.06	0.10	0.13	-0.18
time_Jan	-1.04**	-0.59**	1.20**	-0.52	-0.49*	-1.23**	0.10	-0.88**	-0.25	-0.43**	1.62*	-0.39**	-0.35**
time_Jul	-0.47**	-0.75**	0.65	-0.83	-0.41	-0.40	0.40**	-0.44	-0.29	-0.11	-0.20	0.15	-0.34**
time_Jun	-0.26*	-0.47**	-1.11**	1.28**	-0.04	-0.42	-0.03	0.28	-0.24	-0.11	0.01	0.10	-0.36**
time_Mar	-0.15	-0.61**	-0.34	0.12	-0.21	-0.21	0.40**	0.16	-0.18	-0.02	-0.01	-0.05	-0.27*
time_May	-0.09	0.005	0.27	0.52	-0.33	-0.14	0.06	0.22	-0.34	-0.05	0.01	0.29**	-0.31*
time_Nov	-0.27	-0.06	-1.60**	1.80**	-0.09	-0.60**	-0.41*	-0.73	-0.42*	-0.002	-0.27	-0.16**	-0.25*
time_Oct	0.02	-0.38*	-1.55**	1.71**	0.53	0.04	-0.09	-1.08**	0.18	0.14	0.82	0.02	-0.16
time_Sep	0.08	-0.44**	-0.15	2.84**	0.79**	-0.21	0.31**	-0.97*	0.19	0.10	1.63**	0.03	-0.21
VAT1	-0.75**	-0.42	-0.50	-3.56**	-0.81	-2.92**	-1.02**	1.00	-2.27**	-1.11**	0.12	-0.46**	-0.59
VAT2	0.34	-0.12	1.86**	-1.89**	0.96	0.44	0.59*	-0.60	1.51*	0.62	-0.18	0.39*	0.45
VAT3	0.49*	-0.16	2.49**	-0.56	0.07	1.52**	0.28	1.44*	1.50*	0.26	0.55	1.18**	-0.46
Recession	0.12*	0.33*	0.31	-0.54*	0.08	0.40**	-0.10	-0.11	0.31	0.30**	-0.10	0.04	-0.03
Trend	0.0001	-0.0005	0.0001	0.005**	-0.001	0.0004	-0.001**	0.0005	0.002**	0.001*	-0.0004	-0.0004**	-0.001**
Constant	0.27**	0.48**	0.03	-2.55**	0.09	0.13	0.60**	0.50	-0.24	0.02	0.16	0.31**	0.56**
Observations	273	273	273	273	273	273	273	273	273	273	273	273	273
R^2	0.77	0.29	0.68	0.93	0.36	0.92	0.68	0.71	0.24	0.36	0.60	0.57	0.21
Adjusted R^2	0.74	0.25	0.63	0.93	0.31	0.91	0.63	0.67	0.17	0.30	0.57	0.53	0.14
Residual Std. Error	0.18	0.54	0.56	0.68	0.51	0.46	0.26	0.64	0.60	0.31	1.21	0.15	0.29
F Statistic	25.31**	6.20**	16.19**	135.49**	6.20**	133.10**	13.37**	19.42**	3.59**	6.97**	19.72**	12.77**	3.13**
Note:													*p<0.05; **p<0.01; ***p<[0.***]

Figure 3: predictive content of the PPI for the CPI