Model Consumption and CPI

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1 Model and data

The data set is monthly CPI all items and total expenditure for the UK from March 1997 to November 2019. We ignore the data after December 2019 since it is impacted by the Covid effect in 2020 Q1.

One of the significant differences between this model and the previous one is that we use total consumption as the demand variable for the overall CPI rate. This model for monthly data not only assumes inflation depends on 12 lagged inflation, dummies variables of each month, three VAT change announcements, and the great $D_{recession}$, but also Consumption C.

$$\begin{aligned} CPI_t = & Constant + \text{ Trend}_t + \beta_1 D_{Jan} + ... + \beta_{11} D_{Dec} + \beta_{12} D_{\text{recesion}} + \\ & \beta_{13} D_{VAT_1} + \beta_{14} D_{VAT_2} + \beta_{15} D_{TAT_3} + \sum_{j=1}^{12} \alpha_j C_{t-j} + \sum_{i=1}^{12} \lambda_i CPI_{t-i} + \sigma_t \end{aligned}$$

Where CPI is the inflation for CPI all itmes, 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. $\sum_{j=1}^{12} \alpha_j C_{t-j}$ is the sum of 12 monthly lags consumption growth rate. $\sum_{i=1}^{12} \lambda_i CPI_{t-i}$ represents the sum of twelve months lags of the inflation rate of CPI ALL ITEMS.

2 stepwise function

To further discover the independent variables that have a more significant influence on inflation and remove less critical coefficients, we introduce stepwise regression. In our simplified process, we apply backward elimination selection based on P-value criteria. For CPI all items, we go through a systematic procedure to

simplify the lag structure: Omit the least significant independent variable and rerun until all variables are significant at 5% or 1%. In this process, we always leave the dummy variables in (VAT, monthly, crisis etc.) in regression, even if insignificant.

3 Results

3.1 The original results

```
##
## ================================================
##                          Dependent variable:
##                      ---------------------------
##                              COPY[, 1]
##                            CPI ALL ITEMS
## ------------------------------------------------
## Constant                     0.52**
## lag1                          0.11
## lag2                          -0.01
## lag3                          0.10
## lag4                          0.02
## lag5                          -0.01
## lag6                          0.06
## lag7                          0.04
## lag8                          0.04
## lag9                          0.02
## lag10                        -0.001
## lag11                         0.02
## lag12                        0.17**
## time_Aug                      -0.56
## time_Dec                     -0.61*
## time_Apr                      -0.44
## time_Jan                     -1.07**
## time_Jul                     -0.96**
## time_Jun                     -0.66**
## time_Mar                      -0.37
## time_May                      -0.36
## time_Nov                     -0.65*
## time_Oct                      -0.40
## time_Sep                      -0.31
## VAT1                         -0.94**
## VAT2                          0.51*
## VAT3                          0.48*
## Recession                     0.17*
## Trend                        0.0002
## growth lag1                   0.18*
## growth lag2                   -0.12
## growth lag3                   0.01
## growth lag4                   0.08
## growth lag5                   -0.01
## growth lag6                   -0.05
## growth lag7                   0.03
## growth lag8                   -0.05
```

```
## growth lag9                        0.14
## growth lag10                       0.02
## growth lag11                      -0.14
## growth lag12                       0.06
## ------------------------------------------------
## Observations                        273
## R2                                 0.76
## Adjusted R2                        0.72
## Residual Std. Error                0.19
## F Statistic                      18.37**
## ================================================
## Note:               *p<0.05; **p<0.01; ***p<[0.***]
```

3.2 The simplified result

```
##
## ================================================
##                           Dependent variable:
##                       ---------------------------
##                                 COPY[, 1]
##                              CPI ALL ITEMS
## ------------------------------------------------
## Constant                        0.39**
## lag3                             0.12*
## lag12                           0.19**
## time_Aug                        -0.26*
## time_Dec                        -0.44**
## time_Apr                         -0.15
## time_Jan                        -1.06**
## time_Jul                        -0.75**
## time_Jun                        -0.52**
## time_Mar                        -0.13*
## time_May                        -0.36**
## time_Nov                        -0.39**
## time_Oct                         -0.17
## time_Sep                         -0.11
## VAT1                            -0.92**
## VAT2                            0.57**
## VAT3                            0.56**
## Recession                       0.18**
## Trend                           0.0002
## growth lag2                      0.09*
## growth lag10                    0.11**
## growth lag12                    -0.07*
## ------------------------------------------------
## Observations                      273
## R2                               0.75
## Adjusted R2                      0.73
## Residual Std. Error              0.18
## F Statistic                     35.24**
## ================================================
## Note:               *p<0.05; **p<0.01; ***p<[0.***]
```