# Expense items: test on items generating inflation

Hassen, Ben Naceur

Université Tunis El Manar, Faculté des Sciences Economiques et de Gestion de Tunis, Tunisia

September 2014

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 8 No. 2 Sep. 2014, pp. 291-298

http://www.ijisr.issr-journals.org/

# Expense items: test on items generating inflation

***Hassen Ben Naceur***

Université Tunis El Manar,
Faculté des Sciences Economiques et de Gestion de Tunis, Tunisia



**ABSTRACT:** This study aims to spot the inflation – generating expenses. The expenses items are represented by series of prices statistical indexes. We are going to determine the series of gaps on these prices indexes. We will afterwards study the data- generating process in the context of the ARCH model and the V-GARCH model. We will find out the following items (food, clothes and transports) as inflation- generating items.

**KEYWORDS:** White noise, ARCH model, V-GARCH process, generator, inflation, statistical index.

## 1 INTRODUCTION

We will study the series of prices statistical indexes in the category of expenses items. The test, achieved on these series, enables us to spot inflation-generating items.

## 2 CHOICE OF THE MODEL

We will study the series of prices statistical indexes within the expenses items. These series may bring out temporal or instantaneous dependencies. Therefore, we will study these series of observations in the context of a V-GARCH model. The expenses items studied are the following:

| Expenses items | item i |
|---|---|
| Food | 1 |
| Housing | 2 |
| Clothes | 3 |
| Health care | 4 |
| Transport | 5 |
| Leisure and education | 6 |

In the category of expenses items, we will determine series of gaps of prices statistical indexes:

$y_t = p_{t,i} - p_{t,m}$ .

m=o, i.

- $p_{t,i}$ indicates the price index in the expenses item i.

- $p_{t,0}$ represents the consumption prices index.

The variations of the new series, $y_t$ , enable us to compare the trajectories of both series,

$$p_{t,i} \text{ and } p_{t,0}$$

The series $y_t$ is submitted, in terms of values and signs, to an instantaneous variability.

In this context, the series studied, varies in risky way, at the proximity of fixed parameter:

$$y_t = b_i + \mathrm{e}_t$$

i=1, 2,…, 6.

$$\mathrm{E}[\mathrm{y}_t] = b_i$$

The inflation-generating process is described by these gaps between

$$p_{t,j} \text{ and } p_{t,m}$$

In another way, the series $y_t$ is not following the normal distribution.

The skewness and kurtosis coefficients do not indeed belong to the proximity of the reference values:

$$\begin{cases} s^* = 0 \\ k^* = 3 \end{cases}$$

If

$$X \sim N(m, \sigma^2) : \begin{cases} s^* = 0 \\ k^* = 3 \end{cases}$$

Because

$$\mu_i = E\left[(X-m)^i\right]$$

$$= \begin{cases} \sigma^{2s} \prod_{j=1}^{s} (2j-1) & \text{si} \quad i = 2s \\ 0 & \text{otherwise} \end{cases}$$

$$s^* = \frac{\mu_3}{\left[\mu_2^3\right]^{0,5}}$$

$$k^* = \frac{\mu_4}{\mu_2^2}$$

Then:

The series represents:

- Leptokurtic aspect,
- A quite high asymmetry coefficient, which is a sign of non-linearity.

As a matter of fact:

| Expenses items | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| $s^*$ | 0.25 | -1.08 | 0.58 | 1.05 | 0.94 | -0.14 |
| $k^*$ | 2.32 | 4.52 | 3.64 | 9.32 | 3.52 | 2.16 |

We will take these series of gaps between $p_{t,j}$ and $p_{t,m}$ as patterns in the category of the six expenses items.

Then, we will study in the context of ARCH pattern, the series of observations, $y_t$ :

$$\begin{cases} y_t = b_i + e_t \\ V\left[e_t / e_s \ , \ s < t\right] = c_0 + \sum_{i=1}^{q} c_i e_{t-i}^2 \\ \qquad\qquad = \mathrm{h}_\mathrm{t} \ . \end{cases}$$

The parameters $c_i$ explain the weight of the past in the conditional variance of disturbances.
The model enables us to spot the inflation-generating items. We will, here, realize the ARCH test:

$$\mathrm{H}_0 : c_1 = ... = c_q = 0$$

$$H_a = H_0^c \quad .$$

$H_0^c$ indicates the complementary of $H_0$ .

We will, afterwards, realize the following test:

$$\mathrm{H}_0^\mathrm{i} : b_i = 0$$

$$H_a^i : b_i \neq 0$$

i=1, 2,…, 6.
This means to test:

$$\mathrm{H}_0^\mathrm{i} : y_t = e_t$$

$$H_a^i : y_t = b_i + e_t \quad .$$

Then, under $\mathrm{H}_0^\mathrm{i} : b_i = 0$ , the series $y_t$ is following a process of white noise.

It is then the chocks symmetry hypothesis in the prices series.
This hypothesis comes out to spot the series following a process of white noise in the category of expenses items.
The alternative hypothesis enables us to spot the inflation-generating expenses if:

- $b_i \succ 0$

- $b_i$ is significantly different of zero.

As a matter of fact, this model enables us to spot the inflation-generating items thanks to the sign and significance on the parameter, $b_i$.

We will, afterwards, that study these series of gaps in the context of the V-GARCH model.

$$y_t^* = p_{t,j} - p_{t,0}$$

$$y_t^{**} = p_{t,j} - p_{t,i}$$

The series available may bring out temporal or instantaneous dependencies.

$$\begin{cases} y_t = b_0 + e_t \\ V\left[e_t / e_s \ , \ s < t\right] = H_t \end{cases} \quad .$$

$$y_\mathrm{t} = \begin{bmatrix} y_t \, * \\ y_t \ ** \end{bmatrix} \quad .$$

$$b_0 = \begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix}$$

$$e_t = \begin{bmatrix} e_t * \\ e_t ** \end{bmatrix}.$$

The choice of the V-GARCH model is dictated by the two first conditional moments of the process studies:

$$E\left[e_t / e_s, s\langle t\right] = 0$$

$$V\left[e_t / e_s, s\langle t\right] = E\left[e_t e_t^{'} / e_s, s\langle t\right]$$

$$= H_t$$

$\mathrm{H_t}$ is a square matrix of order N. It is the matrix of the conditional covariances of the disturbances.

We will here study the signs of the parameters $b_{10}$ and $b_{20}$ .

The expenses item j is an inflation-generating item if :

- $b_{10} \succ 0$
- The parameter $b_{10}$ is significantly different from zero.

In this context, we will spot the item j as an inflation-generating item:

- $b_{10} \succ 0 : p_{t,j} \geq p_{t,0}$
- $\begin{cases} b_{20}\langle 0 : p_{t,j} \leq p_{t,i} \\ b_{20}\rangle 0 : p_{t,j} \geq p_{t,i} \end{cases}$

As a matter of fact, the expenses item j can be a first or a second- class inflation generator.

We will then realize the test of significance on the parameters $b_{10}$ and $b_{20}$ :

$$H_0^s : b_{s0} = 0$$

$$H_a^s : b_{s0} \neq 0$$

s=1, 2.

## 3 ESTIMATIONS

We will approach the data- generating process with a whole class of models:

### 3.1 ARCH(Q) MODEL

$$\begin{cases} y_t = b_i + e_t \\ e_t^2 = \mathrm{c}_0 + \sum_{i=1}^{q} c_i e_{t-i}^2 + \omega_t \end{cases} .$$

We will here achieve the test:

$$\mathrm{H}_0 : c_1 = ... = c_q = 0$$

$$H_a = H_0^c$$

The disturbances are here following a process ARCH(1).

| Expenses items | $\hat{b}_i$ |
|---|---|
| 1 | 2,11<br>(10,50) |
| 2 | -9,07<br>(-47,42) |
| 3 | 1,84<br>(4,14) |
| 4 | -0,37<br>(-1,47) |
| 5 | 0,92<br>(3,28) |
| 6 | -1,98<br>(-9,96) |

The numbers in brackets are the t of Student.

The estimations are achieved on quarterly frequencies data corresponding to a period of observations between [1974 :1, 2011 :4].

$\hat{b}_i \succ 0$ :

The expenses item i is an inflation-generating item.

Thus, the inflation – generating items are the following items: food, clothes and transport.

The series available are then described in terms of increase rate.

The gap between the two rates is interpreted as the gap between the rate in the expenses items i ( $p_{t,i}*$ ) and the inflation rate ( $p_{t,0}*$ ):

$$y_t = p_{t,i}* - p_{t,o}*$$

i=1, 2,…,6 .

$$p_{t,m}* = Log\left(\frac{p_{t,m}}{p_{t-1,m}}\right)$$

m=0, i.

The data-generating process is a conditionally heteroskedastic white noise process:

$$\begin{cases} y_t = e_t \\ e_t^2 = c_0 + \sum_{i=1}^{q} c_i e_{t-i}^2 + \omega_t \end{cases} .$$

### 3.2 V-GARCH MODEL

We will study, in the context of the V-GARCH model, the series of observations:

$$\begin{cases} y_t = b_0 + e_t \\ V\left[e_t / e_s \ , \ s < t\right] = H_t \end{cases} .$$

The vector of the dependent variables is then:

$$y_{\mathrm{t}} = \begin{bmatrix} y_t^* \\ y_t^{**} \end{bmatrix} \quad .$$

$$y_t^* = b_{10} + e_t^*$$
$$y_t^{**} = b_{20} + e_t^{**} \quad .$$

$$b_0 = \begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix} \quad .$$

-Test of significance:

We will here realize the test:

$$\mathrm{H}_0 : b_{10} = 0$$

$$\mathrm{H}_{\mathrm{a}} = H_0^c$$

The parameter $b_{10}$ is significantly different from zero.

-Signs of parameter $b_{10}$ and $b_{20}$

The expenses item j is an inflation- generating item if the parameter $b_{10}$ has a positive sign.

The price index in the expense items j, which is $p_{t,j}$ , is compared to the price index of the expense item i ( $p_{t,i}$ ) and to the consumption prices index ( $p_{t,0}$ ).

a. Let us assume that: $b_{20} \leq 0$

$$\begin{cases} \hat{b}_{10} > 0 \\ \hat{b}_{20} < 0 \end{cases}$$

The signs of the two parameters studied lead us to a double liaison:

$$\begin{cases} p_{t,j} - p_{t,0} \geq 0 \\ p_{t,j} - p_{t,i} \leq 0 \end{cases} .$$

Then :

$$p_{t,0} \leq p_{t,j} \leq p_{t,i} \quad .$$

The expenses items $j$ is a second-class inflation-generating item.

b. $b_{20} \geq 0$

If $b_{20} \geq 0$ : $p_{t,0} \leq p_{t,i} \leq p_{t,j}$ .

The expenses item $j$ is a first-class inflation-generating.

This model enables us to spot food, clothes and transport as inflation-generating.

The choice of estimations is dictated by the signs of parameters $b_{10}$ and $b_{20}$.

The observations on the two interest variables, $y_t^*$ and $y_t^{**}$, are conditionally the values of these parameters:

$$y_t^* = p_{t,j} - p_{t,0}$$

$$y_t^{**} = p_{t,j} - p_{t,i}$$

| Expenses items | | j | |
|---|---|---|---|
| | | **3** | **5** |
| **i** | **1** | $\hat{b}_{10} = 1.61$ $(3.54)$ $\hat{b}_{20} = -1.55$ $(-2.28)$ | $\hat{b}_{10} = 4.10$ $(9.47)$ $\hat{b}_{20} = 0.45$ $(1.00)$ |
| | **3** | | $\hat{b}_{10} = 1.78$ $(4.05)$ $\hat{b}_{10} = 1.78$ $(4.05)$ $\hat{b}_{20} = 1.54$ $(2.00)$ |

The numbers in the brackets are the t Student.

The results enable us to spot the first of the second-class inflation-generating expenses items.

(*) $p_{t,0} \le p_{t,j} \le p_{t,i}$ .

$$(**) \quad \begin{cases} p_{t,0} \le p_{t,1} \le p_{t,5} \\ p_{t,0} \le p_{t,3} \le p_{t,5} \end{cases}$$

The item 5 is a first-class inflation-generating item.

## 4 CONCLUSION

We have hence realized series of gaps between series of prices statistical indexes in the category of expenses items. Then we have studied the data-generating process in the context of ARCH and V-GARCH models. The test on these series of observations enables us to spot food, clothes and transport as inflation-generating items. These items can be a first or a second-class inflation generating items.

**REFERENCES**


[1] Bakhshi H. [2002] : "Inflation and relative price variability". Economics letters, 76, p. 27-33.

[2] Basrak B.,Davis R. A. et T. Mikosch [ 2002] « Regular variation of Garch models, stochastic processes and their applications,99,p.95-115.

[3] Bauwens L.,Laurent S. et J.V.K. Rombouts[ 2006] : "multivariate Garch models : a survey", Journal of Applied Econometrics, 21, p.79-109.

[4] Bernard A. et Durlauf S. [1996] : "Interpreting tests of the convergence hypothesis". Journal of Eonomics, 71, p. 161 - 173.

[5] Bollerslev T., Engle R.F. et J.Wooldridge [ 1988 ]: "a capital asset pricing model with time varying covariances", Journal of political economy, 96, p.116-131.

[6] Bollerslev T. [1986]: "Generalized autoregressive conditional heteroskedasticity". Journal of Econometrics, 31, p. 307 - 327.

[7] Bollerslev T. et Wooldridge J. M. [1992]: "Quasi –Maximum Likelihood estimation and inference in dynamic models with time –varying covariances". Econometric Reviews, 11, p. 143 -179.

[8] Engle R. F. [1982]: "Autoregressive conditional heteroscedasticity with estimates of the variance of U. K inflation". Econometrica, 50, p. 987 -1007.

[9] Engle R. F. [2002a]: "New frontiers for ARCH models". Journal of Applied Econometrics", 17, p. 425 –446.

[10] Engle R. F. [2002b]: "Dynamic conditional correlation: A simple class of multivariate GARCH models". Journal of Business and Economic statistics, 20, p. 339 -350.

[11] Engle R. F. et Bollerslev T. [1986] : "Modeling the persistence of conditional variances". Econometric Reviews, 5, p. 1 - 50.

[12] Fielding D. et Mizen P. [2000]: "Relative price and inflation in Europe" Economica.

[13] Florens J. P., Marimoutou V. et Peguin A. [2004] : « Econométrie : Modélisation et inférence ».

[14] Francq C. et Zakoian J. M. [2009] : « Modèles GARCH : inférence statistique et applications financières » Economica – Paris.

[15] Tse Y.K. et A. Tsui [2002] : " A multivariate Garch model with varying correlations", Journal of businessand statistics, 20,p.351-362.

[16] Weiss A.A.[1988]: "ARMA models with ARCH errors", Journal of time series analysis, 5, p.129-143.