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Components with and without  
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# **A MS-Excel Module to Transform an Integrated Variable into Cumulative Partial Sums for Negative and Positive Components with and without Deterministic Trend Parts.**

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## **Abstract**

Our aim is to describe how a software component called TDICPS can be used. TDICPS is a MS-Excel module developed in VBA (visual basics for applications) by the authors that transforms an integrated variable into cumulative partial sums for positive and negative components along with graphs for a potential sample size of more than one million observations. Several options are available. The variable might have both drift and trend, only drift or no deterministic trend parts. We demonstrate step by step how the stock price index of the US market can be transformed into partial components for positive and negative changes. Any other variable can also be transformed in a similar way. The transformed data can be used for implementing the asymmetric causality tests as developed by Hatemi-J (2012). It can also be used for estimating the asymmetric generalized impulse response functions and the asymmetric variance decompositions as introduced by Hatemi-J (2014). Other options are also possible. The MS-Excel code is available by e-mail from the authors.

***JEL Classifications:*** G15, G11, C32

***Keywords:*** VBA, Software Component, Asymmetry, Causality, Impulses, The US.

## 1. Introduction

It is widely agreed by practitioners that allowing for asymmetric properties in empirical investigations accords well with reality. There is a number of reasons behind this conclusion. For example, it is well-known in the financial literature that people react more to bad news compared to good news. Thus, the impact of a negative change might be different in the absolute terms than the impact of a positive change. Another reason for potential asymmetric effects is the fact that markets with imperfect information exists as is demonstrated by seminal work of Akerlof (1970), Spencer (1973) and Stiglitz (1974). An additional reason for asymmetric affects is the natural limitation on the prices. By that it means that prices of different assets or commodities can increase potentially without any limitation. However, there is a limit for the decrease of prices. In the end the price of any valuable asset or commodity cannot become less than zero in the real world characterized by rationality. Thus, a given level of price increase must have a different consequence than a price decrease by the same amount in the absolute terms. Other facts from markets also confirm the existence of asymmetric effects. For example, by the increase of oil prices, fuel prices increase immediately. Conversely, when oil prices decrease the fuel prices do not adjust immediately. Based on observation we can clearly see that the fuel price adjustment for negative changes takes time and the adjustment is usually partial confirming an asymmetric structure. There are also additional reasons for asymmetric impacts motivated by moral or legal constraints. The econometric methodology has been trying to develop different methods that can take into account asymmetric effects via thresholds, indicator variables or Markov regime switching models. These methods are available within several well-known econometric packages. However, there are recent developments in the literature that suggests transforming the underlying data into partial cumulative sums for negative and positive changes. The transformed data can then be used for implementing asymmetric causality tests. It can also be used for estimating asymmetric impulse response functions. Since these methods are new they are usually not easily available to common practitioners since that appropriate software components are missing. For this reason we have developed a MS-Excel module developed in VBA (visual basics for applications) by that transforms an integrated variable into cumulative partial sums for positive and negative

components along with graphs for a potential sample size of more than one million observations. The goal of this paper is to demonstrate how this software component can be used.

After this introduction the rest of the paper is structured as follows. Section 2 represents the mathematical formulas that are needed for transforming an integrated variable into partial cumulative sums. Sections 3 describes how our module, i.e. TDICPS, can be used for this purpose via a step by step demonstration of a real time series variable. The last section provides conclusions.

## 2. Mathematical Equations

Consider an integrated variable of the first degree, denoted by  $y_t$ , with drift and trend that is generated by the following process:

$$y_t = a + bt + y_{t-1} + \varepsilon_t, \quad (1)$$

where  $t = 1, 2, \dots, T$ . The variable  $\varepsilon_t$  is a white noise disturbance term. The denotations  $a$  and  $b$ , represent constants to be estimated. It can be shown that the solution to equation (1) is as the following by using the recursive method:

$$y_t = at + \frac{t(t+1)}{2}b + y_0 + \sum_{i=1}^t \varepsilon_i, \quad (2)$$

Note that  $y_0$  represents the initial value. Positive and negative changes for the underlying variable can be obtained as the following:

$$y_t^+ = \frac{at + \left[ \frac{t(t+1)}{2} \right] b + y_0}{2} + \sum_{i=1}^t \varepsilon_i^+, \quad (3)$$

and

$$y_t^- = \frac{at + \left[ \frac{t(t+1)}{2} \right] b + y_0}{2} + \sum_{i=1}^t \varepsilon_i^-. \quad (4)$$

Note that the positive and negative shocks are defined as follows:

$\varepsilon_i^+ = \max(\varepsilon_i, 0)$  and  $\varepsilon_i^- = \min(\varepsilon_i, 0)$ . For details and proofs of these results see Hatemi-J (2012, 2014) and Hatemi-J and El-Khatib (2016).

It should be mentioned that the module estimates the parameters  $a$  and  $b$  by using the ordinary least squares (OLS) method. That is, the following solutions are utilized for estimating the underlying parameters:

$$a = \bar{y} - b\bar{t} \quad (5)$$

and

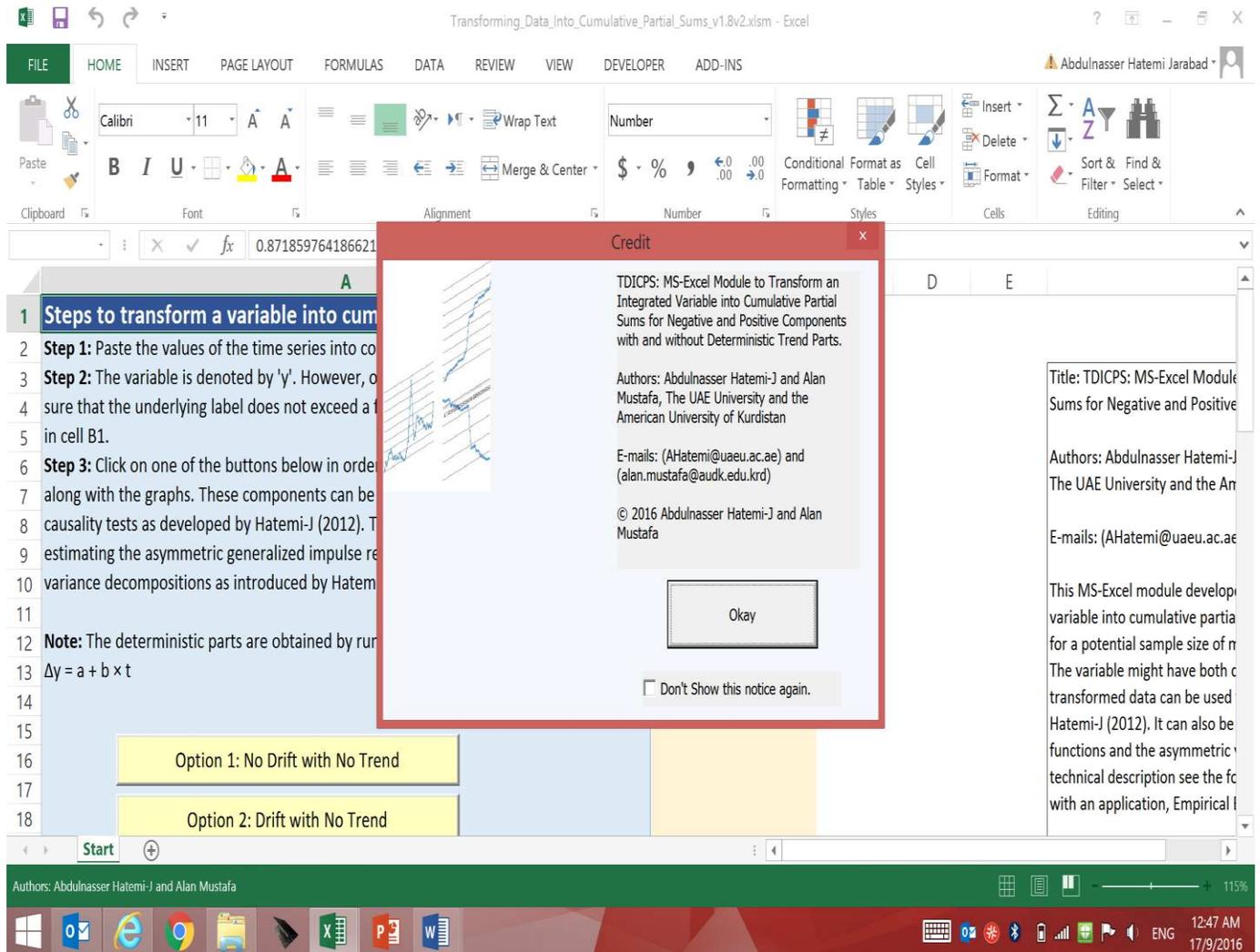
$$b = \frac{\sum_{t=1}^T (y_t - \bar{y})(t - \bar{t})}{\sum_{t=1}^T (t - \bar{t})^2} \quad (6)$$

Where  $\bar{y} = \frac{\sum_{t=1}^T y_t}{T}$  and  $\bar{t} = \frac{\sum_{t=1}^T t}{T}$ .

### 3. The TDICPS

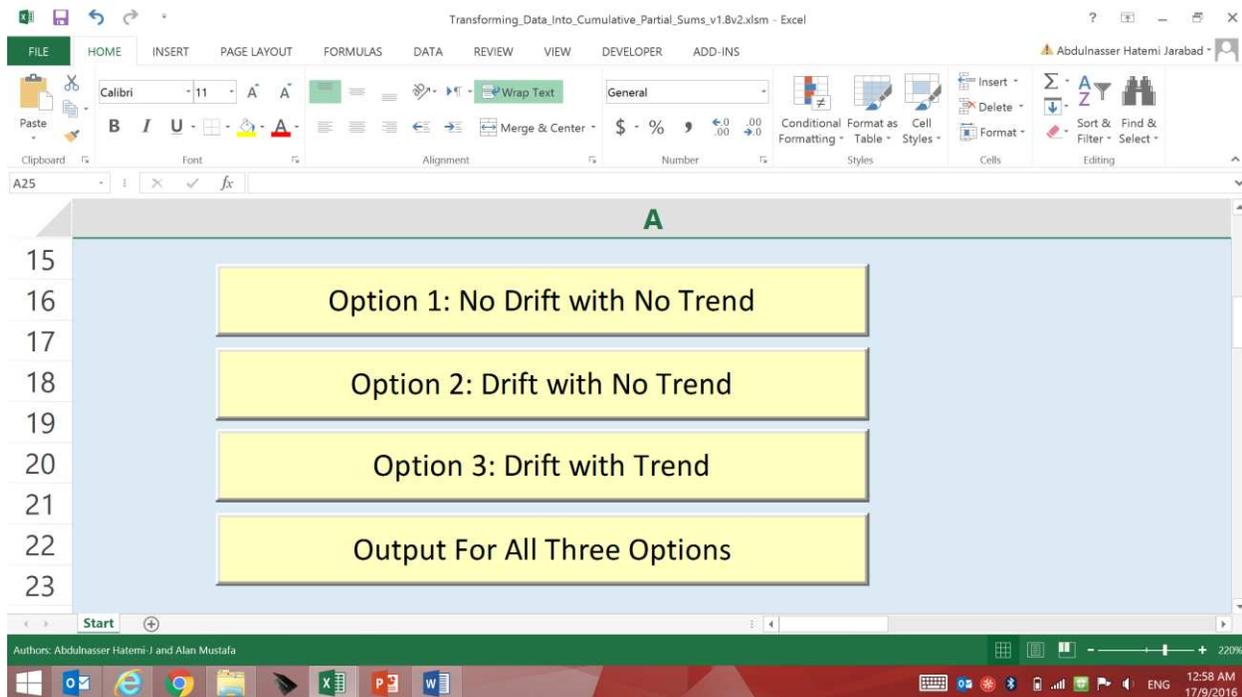
To demonstrate how the TDICPS module works we make use of the stock price index for the US market as an example. This variable covers the period of 1999-2016 on monthly basis. The source is the Federal Reserve Economic Data (FRED) database that is given online by the Federal Reserve Bank of St. Louise.

The first step is to start TDICPS in MS-Excel. Then, the following window opens:



Before using the module we need to click on “Okay” bottom in order to confirm copyright of the authors. Then, you can copy and paste your variable in column B. We denote this column by y.

However if you prefer any other title you can change it. The potential sample size can be more than one million observations. The next step is to choose one of the options that is given on the left side (marked by the yellow color). That is to choose from following options.

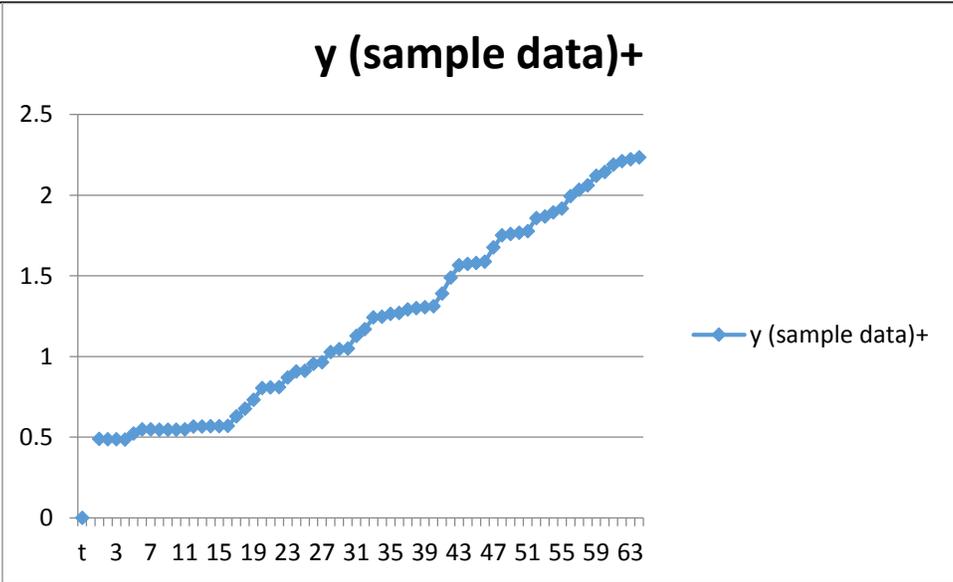
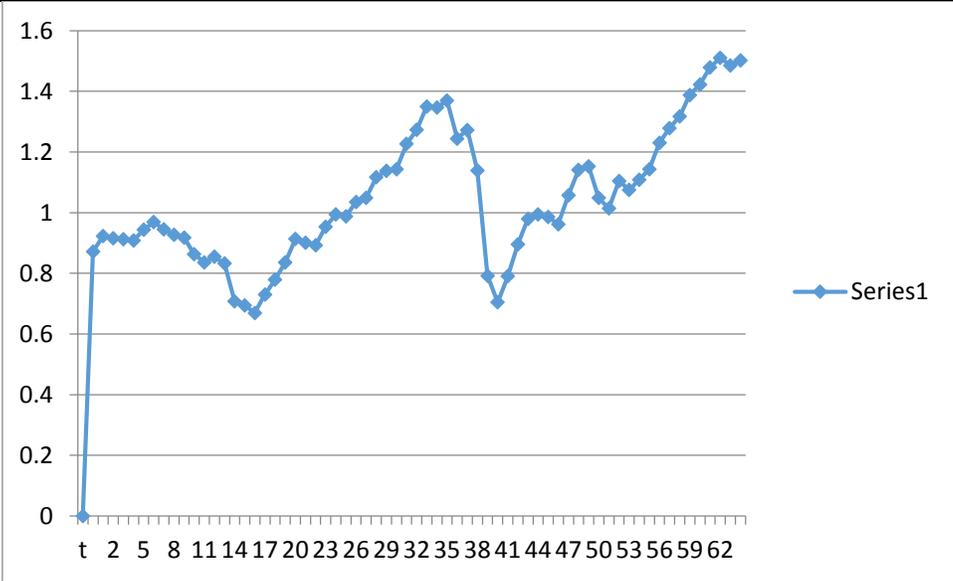


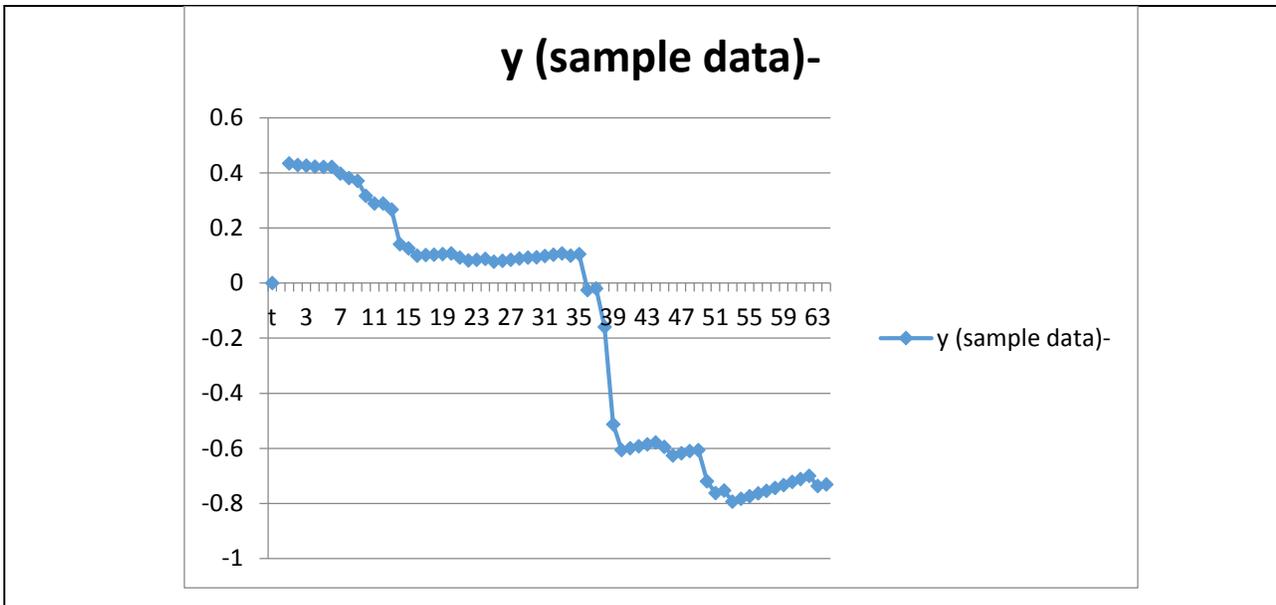
If the first option is selected then there is no drift and trend (i.e.  $a=0$  and  $b=0$ ). If the second option is selected then there is a drift but no trend (i.e.  $a \neq 0$  and  $b=0$ ). If the third option is chosen then there is a drift and trend (i.e.  $a \neq 0$  and  $b \neq 0$ ). By clicking on the chosen option the module provides the transformed data for that option. It is also possible to obtain the results for all three specifications if the “Output For All Three Options” is selected.

In order to demonstrate an example, we select option three and the module provides the following results:

	A	B	C	D
1	<b>Data Transformed with drift and trend</b>			
2				
3	t	y (sample data)	y (sample data)+	y (sample data)-
4	0	0.871859764		
5	1	0.923098318	0.488883197	0.434215128
6	2	0.915700487	0.487379283	0.428321213
7	3	0.912633405	0.48608622	0.426547229
8	4	0.908125484	0.485003978	0.423121542

Column A is the time index and column B is the original data. Column C is the transformed data for positive changes. Column D is the transformed data for negative changes. The module automatically provides graphs for columns B, C and D. For example in this case we obtain the following graphs.





Note that  $y$  represents original data for the US stock price index. Partial cumulative sum for positive changes is denoted by  $y+$ . Partial cumulative sum for negative changes is signified by  $y-$ .

It should be mentioned that the transformed data can be used for implementing asymmetric causality tests as developed by Hatemi-J (2012). It can also be used for estimating the asymmetric generalized impulse response functions as suggested by Hatemi-J (2014). This is straight forward because after transforming the data it can be imported to any consumer friendly econometric package such as EViews, Rats, Stata, PcGive or Microfit among others.

## 4. Conclusions

It is widely agreed in the literature that it is important to allow for potential asymmetric impacts when empirical studies are conducted. Since there is a lack of availability for consumer friendly software components for implanting new developments in the econometric methodology that allows for asymmetric impacts, we have created a module written in VBA language. Although, it is a common practice to develop a prototype of an application using a high level language and then using an alternative environment for application development to work on improving the performance of the execution of that algorithm. This software component is easy to use and it is accessible via MS-Excel.

We have demonstrated here how the stock price index of the US market can be transformed into positive and negative partial cumulative components via this module. After transforming the underlying data, the practitioner can easily implement asymmetric causality tests via any automatic software that provides an option for causality testing. It can also be used for implementing generalized impulse response functions. For technical description of these methods see Hatemi-J (2012, 2014) and Hatemi-J and El-Khatib (2016). It is also possible to use the transformed data to test for hidden cointegration as suggested by Granger and Yoon (2002) or to test for hidden panel cointegration as suggested by Hatemi-J (2011a). Other possibilities are testing for asymmetric panel causality (see Hatemi-J, 2011b) or for implementing the asymmetric GARCH model as recommended by Hatemi-J (2013). The TDICPS software component is available from the authors via e-mail.<sup>1</sup> It is very consumer friendly.

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<sup>1</sup> There is also another module that is written in Octave by Hatemi-J and Mustafa (2016) which can be used to transform the data. However, the Octave module has only one option unlike the MS-Excel one that we provide here, which has three options.

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