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The Level of Personal Consumption Expenditures Conditional on Economic Structural Change – (An Empirical Study in the USA Economy 1960-2013)

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Abstract: *Determining the Level of personal consumption expenditures is the general idea of this paper. Traditionally, we do that by testing the effects of some factors on the level of personal consumption expenditures, and it seems to be like just a list of determinants! In fact, the main focus of this paper is not just investigating about the relation between some factors and the levels of personal consumption expenditures. However, it is to find the change of this relation conditional on an economic structural change. We will do that using empirical data of the USA economy from 1960 - 2013. This paper has two main parts; the first part has basic literature concepts about the consumption, consumer behavior, and factors affect consumption. The second part has the empirical work including all information about the data, regression model, type of tests, and results' analysis.*

1. INTRODUCTION

Although people around the world are different in their lifestyle, culture, level of stander living and many other differences, they all have to do daily activity which is "Consumption". They all, for example have to eat, wear clothes and use some sorts of energies. Therefore, consumption has become one of the most interesting concepts in Economics because it is related directly with human daily needs. Consumption as an economic concept has a very long history. Economists and Sociologists have been studying this topic since ancient civilizations. However, as a response to our modern life, and the advance system of goods and services that we consumed, this concept has been developing over the time. As a result, this concept has taken more interest especially after the huge increase of population and the limitation of economic resources. Economists faced many difficulties to make a complete theory about consumption because it is hard to test people behavior of choosing what they want to consume. However, they impose some assumptions about consumers' behavior to make this theory. (Fine and Ellen, 1993)

In this paper, I will follow the assumptions of this theory such as the rational behavior of consumers and the budget constraint and the traditional determinants of personal consumption expenditures like prices and income. My main goal of this paper is to test the effects of economic structural change which is the rebirth of stock markets in the USA economy at 2000 on the level of personal consumption expenditures in this economy. That means testing the change in relation between the level of personal consumption expenditures and its determinants conditional on that change. In addition, analyze the importance of doing that test for such king of economic relations.

Doing that may lead to more understanding about the impacts of an economic structural change on this relation, and this will be a good guide for economic agents to maximize their utilities and for governments to design efficiently their economic policies(Burk, 1968).

Personal consumption expenditures could be affected by many factors; some of them are public (i.e. they could affect the rational consumers in the same way with slight differences) while the others are personal. For example, the economic factors like income and prices may have same effects on the rational consumer behavior; however, psychological factors like motivation and habits might have different effects on the rational consumer behavior. Furthermore, there may be many other factors such as cultural and sociological factors that could affect the rational consumer behavior. All of these factors together can determine the level of personal consumption expenditures (Kardes, 2002).

Many studies and researches tested the effect of these factors on personal consumption expenditures, so this will not be the point of interest. In this paper I will try to make a comparison between these factors' effects on personal consumption expenditures before and after the economic structural change. For that, this paper will test the effects of some significant factors on personal consumption expender before and after 2000. The date at which the big change happened when the stock markets waked up, and this gave the consumer the opportunity to invest some of their income or wealth in these markets and have gain or loss (Markham and jerry, 2006).This obviously could change the behavior of rational consumer and, at the end, affect the level of personal consumption expenditures.

2. THE MODEL

This paper directly deals with consumption theory. This theory explains how rational consumers behave to choose what they need for consumption conditional on some economic limitations (Snyder and Nicolson, 2012). In particular, it attempts to explain the determinants of personal consumption expenditures such as income, wealth, taxes, and prices. The model used in this estimation is a simple OLS model that tests the relationship between the level of personal consumption expenditures and some economic factors in the USA economy. A mathematical representation of the model is as follows:

$$CON_t = B_1+B_2INC_t+B_3PCI_t+B_4SAV_t+B_5WLT_t+B_6TAX_t+B_7GDP_t+\delta_1D_t+\delta_2(D_t*INC_t)+\delta_3(D_t*PCI_t)+\delta_4(D_t* SAV_t)+\delta_5(D_t*WLT_t)+\varepsilon_t$$

The dependent variable of this model is the level of personal consumption expenditures in real terms; it is denoted by (CON). The first independent variable is the real disposable personal Income (INC).This is one of the important factors that restrict CON; it is expected to be a positive relation between the income and the level of consumption. It comes down to the fact that the increase in personal income will lead to increase of purchasing power and then to high level of consumption and vice versa (Snyder and Nicolson, 2012).

The second independent variable is consumer prices (PCI). The concrete relation between consumer prices and CON is very clear because consumer prices with income represent the consumer budget constraint that determines the maximum level of CON. The positive relation between consumer prices and CON is more likely (Snyder and Nicolson, 2012).

The third independent variable is the personal saving (SAV). Since total income is the sum of consumption and saving, SAV is the part of personal income that is not using for consumption. The expected sign is negative; that means when the saving increases, the CON decrease. Choosing this variable is necessary for this model since this factor has important impact on CON.

The next independent variable is personal wealth (WLT). Wealth represents the level of personal's total currency, deposits including money market fund shares and assets. This factor has positive effect on CON. It is important to include this factor in our model because of its relation with the structural test that we want to do in this paper. For example having a level of wealth may make a consumer think about investing this wealth especially in stock markets. As a result, this will affect CON.

Another independent variable of this model is taxes (TAX). Taxes are a specific amount of money that cut from personal's income and wealth. Government imposes people to pay taxes to provide public services. Since taxes in general reduce personal's income and wealth even they are small amounts, this will reduce the purchasing power and then reduce CON. Therefore, the relation between CON and TAX is negative.

The last independent variable of this model is real gross domestic product (GDP). This variable is important to our model because it represents the state of the economy. High GDP refers to good state which certainly affects wages or income and prices; such changes will affect CON. We expect positive relation between CON and real GDP.

This model has on dummy variable (D) that refers to the breakpoint when the structural change happened as we indicated before. D has value of one for all data before 2000, and zero for all data after 2000. The other variables of the model [i.e. (D*INC), (D* PCI), (D* SAV), and (D* WLT)] are the interaction between D and INC, PCI, SAV, and WLT. Having these interactions will provide clear explanations about the effect of the structural change on the relations between these variables and CON. Finally, the model has ε which denoted the errors.

3. DATA

The data that used in the regression model are time series data. All the data are for the United States of America. All the date is taken from FRED (Federal Reserve Economic Data – Bank of St. Louis). The date used in this paper has quarterly frequency and the period of date is from 1960 to 2013.

The data for CON is in real terms and its unit is billions of chained 2009 dollars. The source of this data is U.S. Department of Commerce: Bureau of Economic Analysis. The BEA Account Code is DPCERX1.

The data for INC is in real terms and its unit is billions of chained 2009 dollars. The source of this data is U.S. Department of Commerce: Bureau of Economic Analysis. The BEA Account Code is A067RX1.

The unit of PCI data is Index 1982-84=100. The source of this data is U.S. Department of Labor: Bureau of Labor Statistics.

The unit of SAV data is billions of dollars. The source of this data is U.S. Department of Commerce: Bureau of Economic Analysis. The BEA Account Code is A071RC1.

The unit of WLT is billions of chained 2009 dollars. The source of this data is Board of Governors of the Federal Reserve System; and the source series id is FL154000025.Q.

The unit of TAX data is millions of dollars. The source of this data is Board of Governors of the Federal Reserve System, and the source ID is FA156220001.Q.

The data for GDP is in real terms and its unit is billions of chained 2009 dollars. The source of this data is U.S. Department of Commerce: Bureau of Economic Analysis. The BEA Account Code is A191RX1.

4. EMPIRICAL RESULTS

To show the effects of structural change of the US economy on the coefficients' magnitude and signs of the model's independent variables, I did divide my work into two parts, each part has some regression processes using STATA program. In the first part, the model that used was without dummy variables and for the same period (1960-2013). However, in the second part regression the model that used was with all variables described in this paper including the dummy variable, and for the same period (1960-2013). Doing that, we can compare the relationship between CON and the regressors of the two models. This will provide a clear explanation about how taking care of the structural change in the USA economy could affect the relationship between CON and the regressors. In other words it explains the adjustments of consumer behavior as a response to this change.

4.1. Part I

The firs regression model (Model (1)) is:

$$CON_t = B_1+B_2INC_t+B_3PCI_t+B_4SAV_t+B_5WLT_t+B_6TAX_t+B_7GDP_t+ \varepsilon_t$$

The coefficients and the stander errors are as shown in the below table:

Table1. *The coefficients and the stander errors for model (1)*

Independent variables	intercept	INC	PCI	SAV	WLT	TAX	GDP
Coefficient	-168.606	0.710	0.357	-0.899	0.068	0.000	0.147
Stander error	(18.734)	(0.035)	(0.394)	(0.057)	(0.006)	(0.000)	(0.027)

Looking at the direction of the relationship between the CON and the regressors in Model (1), we can see that the sign of intercept is negative which is not expected. The income, wealth, and GDP have positive signs and saving has negative sign which all are expected. However, we got positive signs of tax and prices which are unexpected because they should be negative, but we can see that these regressors are not significant to this model.

To interpret the coefficients in table (1), we can see that B1 (the intercept) which is the expected value of CON when the all regressors in this model equal to zero. This value is (-168.606), it must be positive because the consumption value must be positive and that may be interpreted due to outside sample data. We can interpret the other coefficients as the expected change in CON when the specific

regressor is changed and the direction of the change depends on the sign of this regressor. For example, if personal saving increase by billion dollars, the CON will decrease by 0.899billion dollars, and we can do same analysis for the other regressors.

The results of the regression of model (1) showed that the income, personal saving, wealth, and GDP are all highly significant for this model. That is because any change in the income, wealth and saving can increase or decrease the purchasing power and then impact the level of consumption. In addition, the GDP represents measure to the economy's state, so any change in GDP will impact the level of consumption by affecting the wages and prices inside the economy. However, consumer prices and taxes are not significant. It comes down to the fact that we used data in real terms, so the prices will not be significant in this model. Furthermore, the taxes have no big impact on consumer behavior because they may be very small amounts.

According to the results, the F-test [F (6, 209)] showed that the regression has overall significant explanatory power since we reject H_o: All B's equal to zero. In addition, the adjustment $R^2 = 0.999$ and that means 99% of variation in the CON can be explained by the variation of the INC, PCI, SAV, WLT, TAX, and GDP.

The Durbin – Watson test for serial correlation of Model (1) showed that d-statistic (6, 216) = 0.2308 which is less than dL (6, 216) = 1.707 (hint: all values of Durbin – Watson are taken from Durbin – Watson significant table at 5% level of significant), so for the hypothesis test H_o: $\varrho = 0$ against Ho: $\varrho > 0$, we reject H_1: $\varrho = 0$. That means we have autocorrelation problem in this model. Even though the LS estimator still unbiased, there will be some consequences when we have autocorrelation problem. One of them is reducing the efficiency of the estimator and the other is we have different variances among errors over time (not stationary). As a result, we cannot trust this model because the inference will be incorrect and we have to solve this problem to get appropriate results.

After using the correction process to solve the autocorrelation problem in model (1), the Durbin – Watson test for serial correlation showed that d-statistic (6, 216) = 2.373 which is greater than dU (6, 216) = 1.84. That means we fail to reject Ho: $\varrho = 0$ and there is no autocorrelation in the correction model.

$$CON_t = B_1+B_2INC_t+B_3PCI_t+B_4SAV_t+B_5WLT_t+B_6TAX_t+B_7GDP_t+ \xi_t$$

The coefficients and the stander errors after correction model (1) are as shown in the below table:

Table2. *The coefficients and the stander errors for corrected model (1)*

Independent variables	intercept	INC	PCI	SAV	WLT	TAX	GDP
Coefficient	-231.451	0.790	1.145	-0.861	0.037	0.000	0.097
Stander error	(42.121)	(0.031)	(0.751)	(0.038)	(0.012)	(0.000)	(0.021)

Looking at the direction of the relationship between the CON and the regressors in the corrected model (1), we can see that the sign of intercept is negative which is not expected. The income, wealth, and GDP have positive signs and saving has negative sign which all are expected. However, we got positive signs of tax and prices which are unexpected signs because they should be negative, but we can see that these regressors are not significant to this model. The results of the regression of corrected model (1) showed that the income, personal saving, wealth, and GDP are all highly significant for this model. However, consumer prices and taxes are not significant.

4.2. Part II

The second regression model is (Model (2)). This model has also autocorrelation problem, so we did the appropriate correction ad we got the coefficients and the stander errors that are shown below:

$$CON_t = B_1+B_2INC_t+B_3PCI_t+B_4SAV_t+B_5WLT_t+B_6TAX_t+B_7GDP_t+\delta_1D_t+\delta_2(D_t*INC_t)+\delta_3(D_t*PCI_t)+\delta_4(D_t*SAV_t)+\delta_5(D_t*WLT_t)+ \xi_t$$

The Durbin – Watson test for serial correlation of model (2) showed that d-statistic (11, 216) = 0.4082 which is less than dL (11, 216) = 1.654, so for the hypothesis test Ho: $\varrho = 0$ against H_1: $\varrho > 0$, we reject Ho: $\varrho = 0$. That means we have autocorrelation problem in this model. After using the correction process to solve the autocorrelation problem in model (2), the Durbin – Watson test for serial correlation showed that d-statistic (11, 216) = 2.205 which is greater than dU (11, 216)= 1.885. That means we fail to reject Ho: $\varrho = 0$ and there is no autocorrelation in the correction model.

Table3. *The coefficients and the stander errors for the corrected model (2) and model (1)*

regressors	Coefficient	Stander error	Coefficient + δ	Coefficient Model (1)
Intercept	-139.32	(38.3473)	-308.6702	-231.4517
INC	0.7821	(0.0268)	0.8409	0.7901
PCI	3.8080	(0.8019)	0.9509	1.1457
SAV	-1.4082	(0.0552)	-0.8353	-0.8619
WLT	0.0229	(0.0235)	0.0203	0.0376
TAX	0.00005	(0.00002)		
GDP	0.0761	(0.0170)		
D	-169.3502	(166.7786)		
DINC	0.0588	(0.0321)		
DPCI	-2.8571	(1.4102)		
DSAV	0.5729	(0.0580)		
DWLT	-0.0026	(0.0265)		

Looking at the direction of the relationship between the CON and the regressors in the corrected model (2), we can see that the signs of all coefficients are the same as in the corrected model (1). The sign of the intercept is negative which is not expected. The income, wealth, and GDP have positive signs and saving has negative sign which all are expected. However, we got positive signs of tax and prices which are unexpected because they should be negative.

The results of the corrected regression of model (2) showed that the income, personal saving, consumer prices, tax, DINC, DSAV, DPCI and GDP are all significant for this model. However, wealth, D, and DWLT are not significant for this model.

According to the results, the F-test [F (11, 203)] showed that the equation has highly overall significant since we reject H_o: All B's equal to zero. In addition, the adjustment $R^2 = 0.998$ and that means 99% of variation in the CON can be explained by the variation of the regressors of model (2).

By comparing the results from the two models we can infer that the structural change in the US economy changed the level of personal consumption expenditures. The awakening of stock markets that happened in the US economy in 2000 has had impact on CON. We can confirm that by looking at table (3) where we can see that the coefficient of intercept, wealth and consumer prices were decreased. On the other hand, the coefficient of income and saving were increased. That means people have tended to invest in stock market more than spending on personal consumption. These results provide important reason why we should do structural test in consumption models.

At the end we omitted the insignificant regressors from model (2), re-estimated it, tested for serial correlation, and got the final results as below:

The final regression model is (Model (3)):

$$CON_t = B_1+B_2INC_t+B_3PCI_t+B_4SAV_t+B_5TAX_t+B_6GDP_t+\delta_1(D_t*PCI_t)+\delta_2(D_t* SAV_t)+\varepsilon_t$$

The coefficients and the stander errors after correction model (3) are as shown in the below table:

Table4. *The coefficients and the stander errors for corrected model (3)*

Independent variables	intercept	INC	PCI	SAV	TAX	GDP
Coefficient	-211.600	0.824	2.599	-0.810	0.00007	0.065
Stander error	(32.662)	(0.024)	(0.593)	(0.054)	(0.00003)	(0.016)

In the corrected model (4) all regressors are highly significant. The Durbin – Watson test for serial correlation of model (4) showed that d-statistic (7, 216) = 0.2678 which is less than dL (7, 216) = 1.697, so for the hypothesis test Ho: ϱ = 0 against H1: ϱ > 0, we reject Ho: ϱ = 0. That means we have autocorrelation problem in this model. After using the correction process to solve the autocorrelation problem in model (4), the Durbin – Watson test for serial correlation showed that d-statistic (7, 216) = 2.255 which is greater than dU (7, 216) = 1.841. That means we fail to reject Ho: ϱ = 0 and there is no autocorrelation in the correction model.

5. CONCLUSION

This paper attempted to test the change of the relation between the level of personal consumption expenditures and its determinants conditional on an economic structural change. The study used data

from the USA economy from 1960 to 2013. The economic structural change was rebirth of stock markets in the USA economy at 2000. The importance of this study is to provide more understanding about how an economic structural change affects this relation over time, and this will be useful for economic agents to maximize their utilities and for governments to design efficiently their economic policies. The results of this paper showed that this economic structural change has affected this relation, so it is important to do such a test. That is because the traditional test could not provide appropriate results. At the end, we can see that the regressors that remained in the final model are the most significant ones for our model. They are personal income, consumer prices, taxes, GDP, and personal saving.

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