

# THE EXCESS SMOOTHNESS AND SENSITIVITY OF CONSUMPTION IN THE V4 COUNTRIES

Terézia Vančová<sup>1</sup>

<sup>1</sup> Department of Statistics and Operational Analysis, Faculty of Business and Economics, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic

To link to this article: <https://doi.org/10.11118/actaun201967061653>

Received: 21. 8. 2019, Accepted: 23. 10. 2019

To cite this article: VANČOVÁ TERÉZIA. 2019. The Excess Smoothness and Sensitivity of Consumption in the V4 Countries. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 67(6): 1653–1663.

## Abstract

This paper contributes to the debate on the Permanent Income Hypothesis (PIH) and excess consumption smoothness and sensitivity in the context of conditions in the V4 countries. This paper also shows results contrary to the belief of the Permanent Income Hypothesis/Random Walk Hypothesis that the change in consumption is an innovation which is not predictable by lagged saving or lagged income change. The paper tests the implication of the Permanent Income Hypothesis/Random Walk Hypothesis, using quarterly aggregate data for 1995–2017 in the V4 countries. A vector autoregression for saving and changes in disposable income is used to generate a forecast of declines in disposable income. As a result, when income changes abruptly, the resulting change in consumption is much smoother and conversely, when changes in income are anticipated, consumption responds sensitively. The aggregate consumption is both excessively smooth relative to the new information causing consumers' revision of previous expectations about current and future income, and excessively sensitive to lagged income growth.

Keywords: consumption expenditure, disposable income, excess sensitivity, excess smoothness, savings, VAR model, V4 countries

## INTRODUCTION

Private consumption has played a key role in recent (2013–2018) output growth. The question is how long the current pace of consumption growth can continue and what are the drivers of the recent expansion in private consumption (ECB, 2018). Private consumption has been closely aligned with the development of disposable income and wealth (Fernandez-Corugedo, 2004). A key factor determining how spending responds to changes in income is the marginal propensity to consume, the response of spending to a transitory increase in income. Nevertheless, it has been shown in the empirical literature that interest rate, (income) uncertainty, credit and liquidity constraints, financial deregulation, household debt or demographic factors (e.g. aging) are also important determinants (Rodriguez-Palenzuela and Dees, 2016; Bayar and Mc Morrow, 1999).

The theory of consumption function has evolved over the decades. Theoretical interest has stimulated empirical works and a number of consumption functions have been estimated. Unfortunately, different consumption theories can lead to diverse policy prescriptions. There is no universal consumption theory that can explain consumption behaviour in all economies; economists must therefore investigate what is essential for explaining consumption in their country (Fernandez-Corugedo, 2004). There is no doubt that aggregate consumption is a key variable for policy makers.

The best known and the most widely used theories of the consumption function began with Keynes's General Theory and Absolute Income Hypothesis (1936) followed then by Modigliani and Brumberg's Life-Cycle Hypothesis (1954) and by Friedman's Permanent Income Hypothesis (1957). These theories have brought an influential contribution

to answering the question of how consumption, and thus savings, depends on the development of income. A core statement of the last two hypotheses originates from the basic intuition that individuals generally prefer a relatively steady life-time profile of consumption to a widely fluctuating time profile. Consumption is determined by the value of expected lifetime resources; it is limited by permanent income (Friedman, 2015). Individuals consume a fraction of their permanent income in each period of life and thus the average propensity to consume equals the marginal propensity to consume. We recall that one of the big issues in Keynesian economics was and is what percent of additional income people spend on consumption. Lucas (1976) argued that traditional consumption functions were not useful for evaluating the effects of alternative policies, even though they fit the data well. When an uncertainty about income is incorporated into the model, the specification has to be modified. Only unexpected changes in income would cause the consumption path to shift. The independence of consumption changes from expected changes in income is known as the Random-Walk Hypothesis of consumption, which is not a separate theory but rather an implication of the neoclassical model. The model states that the conditional anticipation of future marginal utility is a function of today's level of consumption alone; all other information is irrelevant (Hall, 1978). Other possible related works for the Permanent Income Hypothesis through rational expectations can be found for example in Bilgili (1997, 2001 and 2003).

The flip side of total consumption is total savings, and the evolution of savings over time in a country is important to its capital formation and business cycles.

According to Friedman's PIH, a positive shock to income should in the short run cause a small increase in consumption. After that permanent income is smoother than measured or current income, so that the theory is consistent with the observation that consumption is smoother than income. Campbell and Deaton (1989) found, contrary to this belief, that an increase in income does not immediately lead to an increase in consumption, permanent income is in fact less smooth than measured income, so that the permanent income theory cannot be satisfactory and adequate explanation for the excess smoothness of consumption. Therefore, consumption growth is said to be excessively smooth relative to income growth.

The response of consumption to changes in permanent income signalled by innovations in the current income and to current income itself is termed the excess sensitivity of consumption to current income (Flavin, 1981). The excess sensitivity of consumption deals with anticipated changes of income and excess smoothness is due

to unanticipated changes of income (Romer, 1996). In other words, consumption may be smoothed to current income, which has an unexpected part, and also sensitive to lagged income, which is known to the consumer (Campbell and Deaton, 1989; Pesaran, 2003; Ludvigson and Michaelides, 2001; Berument and Froyen, 2009; Bilgili, 2006; Blundell, Pistaferri and Preston, 2008; Attanasio and Pavoni, 2011).

The process generating income  $k$  periods ahead can be defined as the sum of current income and  $k$  changes from now to then:

$$(E_t - E_{t-1})y_{t+k} = (E_t - E_{t-1})y_t + \sum_{j=1}^k (E_t - E_{t-1})y_{t+j}. \quad (1)$$

Deaton (1992) has provided estimates of two stochastic processes for labour income on the detrended data and on the first differences. He has based his reflection on the process:

$$\alpha(L)z_t = \beta(L)\varepsilon_t, \quad (2)$$

where  $\alpha(L)$  and  $\beta(L)$  are polynomials in the lag operator  $L$ ,  $z_t$  is the deviation of income from the mean  $\mu_t(z_t = y_t - \mu_t)$  and  $\varepsilon_t$  is a white-noise (serially uncorrelated) process. Both estimations are pure autoregressive processes. For the trend-stationary model, Deaton (1992) estimated the autoregressive polynomial as:

$$\alpha(L) = 1 - 1.42L + 0.45L^2, \quad (3)$$

while for the difference-stationary specification:

$$\alpha(L) = 1 - 1.44L + 0.44L^2. \quad (4)$$

Although these estimations seem to be extremely similar at first glance, their consequences for consumption behaviour are considerably different. Deaton (1992) has used these estimates together with an interest rate of 1% per quarter to calculate the change in permanent income and warranted consumption corresponding to an income innovation. From (2), Deaton (1992) got for the trend-stationary model:

$$\Delta c_t = \Delta y_t^p = 0.28\varepsilon_t, \quad (5)$$

which means that a dollar innovation in income generates only 28 cents of additional permanent income and consumption. Permanent income and consumption are smoother than income. However, the same formula Deaton (1992) has used for the difference-stationary model:

$$\Delta c_t = \Delta y_t^p = 1.77\varepsilon_t, \quad (6)$$

which leads to the contradictory conclusion – innovation in income generates changes in permanent income that are larger than the innovations in income. A dollar innovation in income generates 1.77 dollars of additional permanent income and consumption.

The choice of the model matters because each of them draws a different conclusion from the implication of the Random Walk Hypothesis. Deaton (1992) and others find it hard to believe that income is tied to any non-stochastic function of time and they claim that the accuracy of the forecast naturally decreases with time. According to the deterministic trend model, income cannot stray too far from its fixed trend which appears to be inconsistent with the rational notion. These assessments are in favour of adopting the difference-stationary model of income, or more precisely an integrated process.

The following section introduces an arrangement of used data and methods which brings together Campbell's and Deaton's (1989) and Deaton's (1992) ideas. Section results tries to answer the questions how does the household consumption reply to shifts in income and whether expected income changes have a different consumption effect than abrupt shocks. The final sections of this paper are dedicated to the discussion of the achieved results and the conclusion of the analysis.

## MATERIALS AND METHODS

The structure of the dataset used is inspired by Campbell and Deaton's article (1989). The research is based on a time series analysis using Visegrad Group country data covering the period from the first quarter of 1995 till the last quarter of 2017. Eurostat is the main data source for all time series used. The time series of disposable income is available only at an annual frequency. The quarterly path is estimated on the basis of external quarterly information of a relevant economically related variable. The real gross domestic product as used in this paper is a quarterly indicator series for disaggregation of annual figures to quarterly figures. Because of time consistency, quarterly values have to match annual values (the sum of quarterly values of the GDP must be equal to the annual value). The correlation coefficient between annual time series of real gross domestic product and annual time series of disposable income reaches a value 0.99 in the case of the Czech Republic, 0.98 in Hungary, 0.99 in Poland and 0.99 in Slovakia. The quarterly time series of GDP are aggregated into annual data and then the proportion of each quarter value to annual value is computed. Following these proportional shares, annual values of disposable income can be divided into quarterly values.

The first required time series is the first difference of the logarithm of disposable income subtracting the mean. The time series of disposable income is measured as per capita aggregate in the euro

currency and seasonally adjusted by the TRAMO/SEATS procedure. For acquiring the real terms of disposable income, the GDP implicit deflator is used. The GDP implicit deflator is calculated by dividing aggregated GDP measured in current prices by the same aggregate measured in prices of the year 2010. Furthermore, this form of disposable income is then logarithmized and differenced. In consequence, the first difference of the logarithm of disposable income is considered to be stationary. The last step is to subtract the mean<sup>1</sup> of the rate of growth of disposable income. These operations lead to variable  $\Delta \log y_t - \eta$  used in the VAR model (7).

The second essential time series for the VAR model (7) is a time series for saving. The chosen approach copies the specification in Campbell and Deaton (1989). The ratios of saving to income are related to expectations of the ratios of future to current income. The saving ratio as a share of saving to disposable income subtracting the average saving ratio<sup>2</sup> is used in the VAR model as variable  $s_t/y_t - \sigma$ , where  $s_t = y_t - c_t$ . The quarterly time series of consumption is also expressed in real terms due to the same GDP deflator usage. The time series of consumption expenditures is also measured as a per capita aggregate in the euro currency and seasonally adjusted by the TRAMO/SEATS procedure, which we have performed.

The last necessary data for excess smoothness testing is the interest rate couched in the deposit facility rate. The European Central Bank sets this rate every six weeks as a component of its monetary policy. According to the definition, the deposit facility rate is the interest rate which banks accept for depositing money with the central bank overnight. The average interest rate for the period from 1995 to 2017 is 0.28% per quarter.

The first difference of the logarithm of disposable income and the saving ratio follow a stationary process. The Augmented Dickey Fuller (ADF) unit root test with no intercept was used because of statistically insignificant intercept in the model. A p-value of less than 5% implies rejecting the null hypothesis that there is a unit root (Tab. I).

I: *P-values of ADF test for disposable income and saving in V4 countries*

	disposable income	saving
Czechia	< 0.001	0.0033
Hungary	< 0.001	0.0127
Poland	0.0127	0.0391
Slovakia	< 0.001	0.0428

1  $\mu = 0.0051066$  in the case of Czechia,  $\mu = 0.010028$  in the case of Hungary,  $\mu = 0.0085712$  in the case of Poland and  $\mu = 0.0039147$  in the case of Slovakia

2  $\sigma = 0.10784$  in the case of Czechia,  $\sigma = 0.076706$  in the case of Hungary,  $\sigma = 0.066887$  in the case of Poland and  $\sigma = 0.11310$  in the case of Slovakia

The original version of the VAR model used can be found in Campbell and Deaton (1989). An extended explanation of the model with a more detailed description is included in Deaton (1992). The basic model includes income and savings with the simplest possible case with one lag of each:

$$\begin{pmatrix} \Delta \log y_t - \mu \\ \frac{s_t}{y_t} - \sigma \end{pmatrix} = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \begin{pmatrix} \Delta \log y_{t-1} - \mu \\ \frac{s_{t-1}}{y_{t-1}} - \sigma \end{pmatrix} + \begin{pmatrix} u_{1t} \\ u_{2t} \end{pmatrix}. \tag{7}$$

This basic VAR model can be briefly rewritten into:

$$x_t = Ax_{t-1} + u_t, \tag{8}$$

where  $x_t$  is the vector containing income changes followed by saving ratio and the matrix  $A$  is the two-dimensional matrix of coefficients  $a$ .

A straightforward procedure for testing the excess smoothness is based on the estimation of the vector autoregressive model and testing the two linear cross-equation restrictions on the estimated matrix  $A$ . If restrictions are satisfied, there is no “excess smoothness” of consumption because their form is based on the validity of the Permanent Income Hypothesis. Following Flavin (1981), equation (9) represents the basic permanent income theory:

$$c_t = \frac{r}{1+r} A_t + \frac{r}{1+r} \sum_{k=0}^{\infty} (1+r)^{-k} E_t y_{t+k}. \tag{9}$$

Variable  $c_t$  is the real consumption per capita at time  $t$ ,  $r$  is the interest rate (assumed to be a constant),  $\frac{r}{1+r} A_t$  is the real capital income per capita at the end of period  $t$ ,  $E$  is the expectation operator for expectations formed at  $t$  and  $y$  is the real labour income per capita received at the time  $t$ . Point expectations, a constant real interest rate, and the infinite horizon are all involved.

According to Hall (1978) the change in consumption is the annuity value of the present discounted value of change in the anticipated value of future labour incomes:

$$\Delta c_{t+1} = r \sum_{k=1}^{\infty} (1+r)^{-k} (E_{t+1} - E_t) y_{t+k}. \tag{10}$$

The standard definition of saving is the difference between consumption and total income, including capital income. Then the equation above is recast in the equivalent expression first derived by Campbell (1987).

Campbell’s saving equation (11) simply rewrites the Permanent Income Hypothesis with no change of content:

$$s_t = - \sum_{k=1}^{\infty} (1+r)^{-k} E_t \Delta y_{t+k}. \tag{11}$$

The Permanent Income Hypothesis implies that people save because they rationally expect their labour income to decline; they save “for a rainy day” (Campbell, 1987). According to this, saving is

the discounted present value of expected future declines in labour income (Campbell and Deaton, 1989). The saving is observed by the economist and belongs to his information set. Therefore, the agent’s saving behaviour reveals to him what he needs to know about the agent’s expectations of the discounted present value of future income changes. This information allows him to control for the typical consumer’s (representative agent’s) superior information when he predicts income (Deaton, 1992).

Forecast of the vector  $x$  is formed from equation (8) using:

$$E_t x_{t+k} = A^k x_t, \tag{12}$$

which delivers a prediction of both saving and income change. In order to pick out the individual prediction of income change and saving, these two vectors are used:

$$e_1 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}, e_2 = \begin{pmatrix} 0 \\ 1 \end{pmatrix}. \tag{13}$$

The expectation of future income change is then according to Campbell and Deaton (1989) expressed as:

$$E_t \Delta y_{t+k} = e_1' A^k x_t. \tag{14}$$

Taking the Permanent Income Hypothesis (Friedman, 1957) into account and saving form like  $e_2' x_t$ , the saving equation can be written in the form:

$$-s_t = -e_2' x_t = \sum_{k=1}^{\infty} (1+r)^{-k} E_t \Delta y_{t+k} = \sum_{k=1}^{\infty} (1+r)^{-k} e_1' A^k x_t. \tag{15}$$

After several adjustments the form of equation (15) acquires and gives the two linear restrictions:

$$e_2' = -e_1' \sum_{k=1}^{\infty} \rho^k A^k = \rho (e_2' - e_1') A, \tag{16}$$

where  $\rho = (1+r)^{-1}$ .

For a straightforward understanding, Deaton (1992) recommended looking at the effect of the restrictions on both equations of the vector autoregression, separately on the change in labour income and on saving.

Equation (17) characterizes the change in labour income and parameters  $\alpha$  and  $\beta$  are the elements in the first row of matrix  $A$  ( $a_{11}$  and  $a_{12}$ ).

$$\Delta \log y_t - \mu = \alpha (\Delta \log y_{t-1} - \mu) + \beta \left( \frac{s_{t-1}}{y_{t-1}} - \sigma \right) + u_{1t}. \tag{17}$$

The change in labour income and restrictions (16) imply the form of the saving equation as:

$$\frac{s_t}{y_t} - \sigma = \alpha (\Delta \log y_{t-1} - \mu) + (\beta + 1 + r) \left( \frac{s_{t-1}}{y_{t-1}} - \sigma \right) + u_{2t}, \tag{18}$$

where coefficients  $\alpha$  and  $\beta$  are the elements in the second row of matrix  $A$  ( $a_{21}$  and  $a_{22}$ ).



The excess smoothness test is based on previously derived equations, starting from the estimation of the VAR model (7) from which the estimates of parameters are obtained. Subsequently, the Wald test is used to verify the conformity of the estimated parameters in the VAR with these restrictions:

$$a_{11} = a_{21}, \quad (19)$$

$$a_{22} = a_{12} + 1 + r. \quad (20)$$

If the restrictions on the vector autoregression settled by Campbell and Deaton (1989) hold good, then the change in consumption is precisely the change in permanent income.

Another test is crucial in Hall's (1978) and Sargent's (1978) Permanent Income/Rational Expectation Hypothesis. It analyses the predicted relationship between consumption, lagged consumption and the revision in permanent income, which depends on a lagged information set. Such a response to predictable shifts in current income is what Flavin (1981) called "excess sensitivity". If the Permanent Income/Rational Expectation Hypothesis were true, the correlation between the change in consumption and the lagged change in income would be zero.

In consonance with these ideas, the excess smoothness and excess sensitivity cannot be thought in the separate way. If there is no correlation between the change in consumption and the lagged information, consumption changes cannot be too smooth because they must be equivalent to changes in permanent income. If the change in permanent income and the change in consumption are equal, consumption is described as a random-walk and there is no place for idea of excess sensitivity (Deaton, 1992).

## RESULTS

The following chapter contains the estimates of the VAR model parameters. The analysis is done with the simple first-order vector autoregressive model containing income growth ( $\Delta \log y_t$ ) and the saving ratio ( $s_t/y_t$ ). The first order vector autoregression (7) generates parameter estimates which are presented in Tab. II.

There is a small but statistically significant negative feedback from the lagged saving ratio to changes in income. That confirms Campbell's (1987) and Campbell and Deaton's (1989) prediction which implies that people save because they rationally

II: VAR coefficient estimations for each V4 country

	Czechia	Hungary	Poland	Slovakia
$a_{11}$	0.144	0.040	-0.068	-0.029
$a_{12}$	-0.214	-0.026	0.016	-0.032
$a_{21}$	-0.187	-0.083	-0.159	0.151
$a_{22}$	0.722	0.926	0.949	0.820

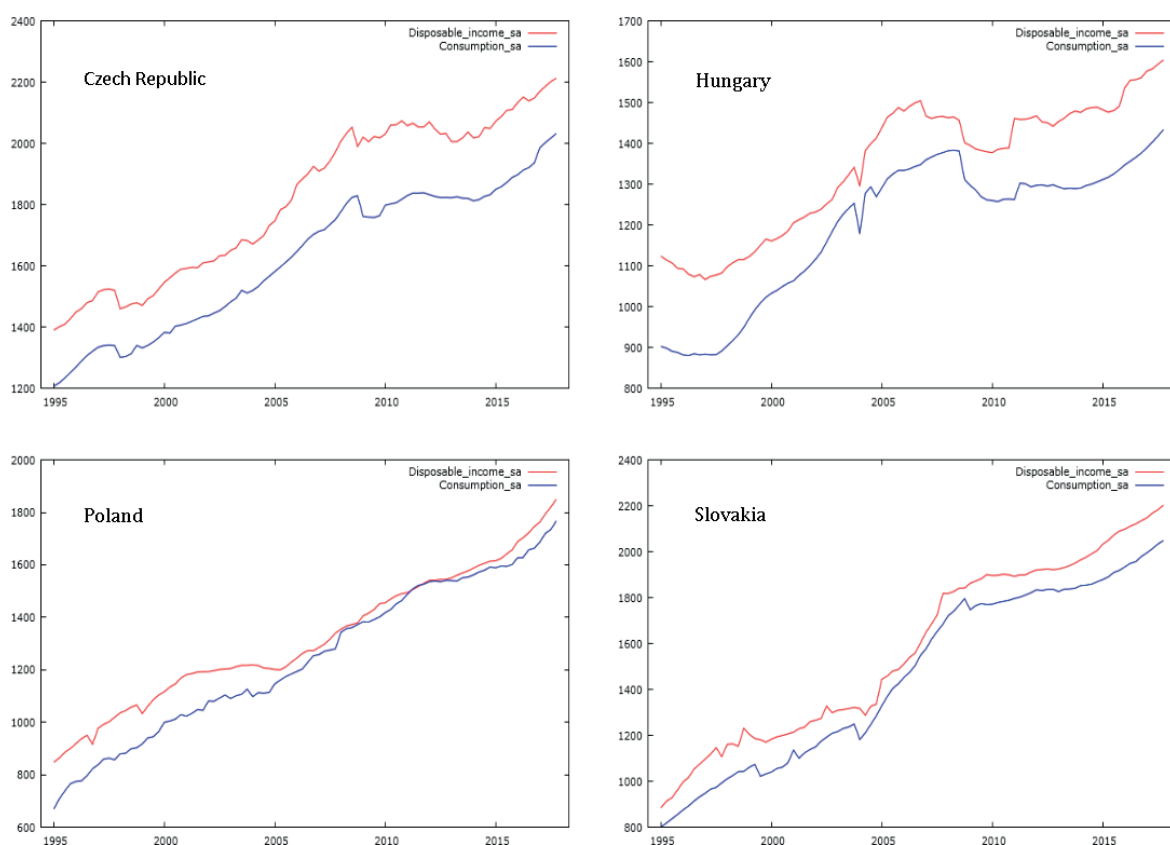
expect their permanent income to decline; they save "for a rainy day". Savings should be a good predictor of declines in labour income, because consumers with promptly notice of income changes will give a sign through their saving behaviour.

The Permanent Income Hypothesis/Random-Walk Hypothesis implies the above-mentioned restriction on the estimated coefficients of the formed VAR model. The Wald test rejects the null hypothesis, restrictions are not satisfied, which leads to a refusal of the Random-Walk Hypothesis and statement that consumption is too smooth but not due to the smoothness of permanent income. Aggregate consumption is smooth relative to unexpected income changes. In other words, consumption may be smoothed to unanticipated part of current income and sensitive to lagged income, which is known by consumer. According to the Permanent Income Hypothesis/Random-Walk Hypothesis, lagged income should not have a predictive ability to current consumption/savings because this information has already been included in past consumption. However, these results suggest that consumption responds to expected income changes.

Figs. 1–4 illustrate the aggregate consumption expenditure and aggregate disposable income of Visegrad Group countries using data covering the period from the first quarter of 1995 till the last quarter of 2017. Both aggregate consumption expenditure and aggregate disposable income trend upwards over time. Deaton (1992) applied consumption expenditure and labour income data from the United States covering the period 1953:2–1984:4 as an example of conformity to the Permanent Income Hypothesis – income fluctuated more about its trend than consumption and the saving ratio was considered to be pro-cyclical; rising in the boom and falling in the slump and consumption was to some extent considered to be protected against business-cycle fluctuation in income.

III: The Wald test of the estimated parameters in the VAR for conformity with the restrictions

	Czech Republic	Hungary	Poland	Slovakia
$a_{11} = a_{21}$	0.144 = -0.187	0.040 = -0.083	-0.068 = -0.159	-0.029 = 0.151
$a_{22} = a_{12} + 1 + r$	0.722 = -0.214 + 1 + 0.282	0.926 = -0.026 + 1 + 0.282	0.949 = 0.016 + 1 + 0.282	0.820 = -0.032 + 1 + 0.282
Wald test (p-value)	< 0.001	< 0.001	< 0.001	< 0.001



1: Consumption expenditure and disposable income: Visegrad Group, 1995:1–2017:4

Development of time series of consumption and disposable income in the Czech Republic reflects this statement by Deaton (1992) made with regard to the Permanent Income Hypothesis. However, this fact is not in any way evident from the development of consumption and disposable income of other V4 countries. In the case of Hungary, consumption expenditure was obviously increasing at a higher rate than disposable income in the period 2000–2004. By contrast, in the crisis period, Hungarian consumption was falling more quickly than disposable income because of faster rising rate of unemployment than in other V4 countries. Consumption expenditure in Poland is rising even at a time of falling disposable income. The Permanent Income Hypothesis has not been approved by the development of time series of Slovakia, too. In 2004–2008, when disposable income was expanding quickly, the same boost was noted in the case of consumption expenditure. An increase in the saving rate was not noted at this time of economic expansion that did not affirm a pronounced upward trend in the saving ratio with economic growth.

Tabs. IV and V present a variety of regressions testing the predictive power of real disposable income per capita, using seasonally adjusted time series with unit root. An augmented Dickey–Fuller (ADF) test have been used to test the hypothesis

of the presence of the unit root in the residuals of created models. The hypothesis has been rejected; residuals are stationary. There exists a stationary linear combination of the set of nonstationary variables, time series are co-integrated.

Hall (1978) showed that a lagged level of disposable income has essentially no predictive value at all. Tab. IV also shows that a single lagged level of disposable income has no predictive value at all in countries of the V4, except for Poland.

Tab. V offers regressions of current consumption on lagged consumption and four lagged values of income. Hall (1978) did not reject the hypothesis that

IV: Equations relating consumption to lagged consumption and lagged disposable income

$c_t = \beta_0 + \beta_1 c_{t-1} + \beta_2 y_{t-1} + \varepsilon_t$				
Country	$\beta_0$	$\beta_1$	$\beta_2$	R <sup>2</sup>
USA 1948–1977	-16.000	1.024**	-0.010	0.999
Czechia	9.518	0.911***	0.079	0.996
Hungary	10.478	0.956***	0.037	0.989
Poland	-4.412	0.927***	0.081*	0.998
Slovakia	18.714*	0.979***	0.016	0.998

\*\*\*Significant regression coefficients at a 1% significance level

\*\*Significant regression coefficients at a 5% significance level

\*Significant regression coefficients at a 10% significance level

V: Equations relating consumption to lagged consumption and past levels of disposable income

$$c_t = \beta_0 + \beta_1 c_{t-1} + \beta_2 y_{t-1} + \beta_3 y_{t-2} + \beta_4 y_{t-3} + \beta_5 y_{t-4} + \varepsilon_t$$

Country	$\beta_0$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$	R <sup>2</sup>
USA 1948–1977	-23.000	1.076**	0.049	-0.051	-0.023	-0.024	0.999
Czechia	5.482	0.999***	0.344***	-0.234**	-0.149	0.039	0.997
Hungary	18.992	0.943***	0.099	-0.024	0.223	-0.259**	0.988
Poland	-5.073	0.953***	0.155*	0.053	-0.142	-0.012	0.998
Slovakia	12.100	0.998***	0.301***	-0.077	-0.254**	0.028	0.998

\*\*\*Significant regression coefficients at a 1% significance level

\*\*Significant regression coefficients at a 5% significance level

\*Significant regression coefficients at a 10% significance level

the coefficients of all four lagged values of income are zero. By contrast to Hall, the tests reported in the V4 countries reveal substantial evidence against the Permanent Income Hypothesis/Random Walk Hypothesis. Lagged income has predictive power beyond that of lagged consumption. The Permanent Income Hypothesis/Random Walk Hypothesis is refuted. Consumers are excessively sensitive to current income or more generally according to Hall (1978) consumers use a non-optimal distributed lag of past income in making consumption decisions.

## DISCUSSION

This paper indicates that consumption is not a random walk but follows both excess smoothness and excess sensitivity of disposable income. The results of this empirical research confirm the excess smoothness of household consumption in the countries of the V4, that is, the model predicts that households should respond more sensitively to unanticipated income changes (income shocks) than is found in the data. The response should depend on the endurance of the shock and on the degree of imperfections in the credit and insurance markets.

The Permanent Income/Life-Cycle Hypothesis is built on sensible implications of basic economic principles but several discrepancies between the model's predictions and aggregate data have been revealed. Deaton (1987), Campbell and Deaton (1989) and Galí (1991) have revealed inconsistencies between the models' predictions and aggregate data and have asserted that aggregate consumption growth is in fact much smoother than aggregate income growth. Deaton (1992) defines excess smoothness as an insufficient responsiveness of consumption to a current income shock.

Deaton (1992), Carroll (1992), Carroll (1997) have argued that the buffer stock paradigm can provide a good description of the consumer's behaviour and can explain the smoothness of aggregate consumption and its correlation with lagged income. Ludvigson and Michaelides (2001) have shown that the standard buffer stock model, which incorporates borrowing restrictions, impatience and

precautionary motives, does not generate a persistent aggregate income shock (excess smoothness) or a robust correlation between consumption growth and lagged income growth (excess sensitivity). Only the incomplete information version of the aggregate buffer stock model is suitable in this case (Ludvigson and Michaelides, 2001).

Hryshko (2011) has found an excess smoothness of household consumption in an estimated model with self-insurance. He has suggested that households are certainly better informed about income components than econometricians, which means that the structure of the income process observed by the econometrician may differ from an accurate income structure. Hryshko (2014) has examined the excess smoothness of consumption in the standard life-cycle model with self-insurance calibrated to US data and uncovered a negative correlation between the permanent and transitory shocks. His model with negatively correlated permanent and transitory income shocks may provide some perspective for an explanation of excess smoothness of consumption as well as excess sensitivity to current income. The possible key of this evidence is the situation when a negative or a positive permanent shock is partially smoothed by a transitory shock of the opposite sign (Hryshko, 2014).

Blundell and Pistaferri (2003), Krueger and Perri (2006), Blundell *et al.* (2008), Attanasio *et al.* (2008), Luengo-Prado and Sørensen (2008), Attanasio and Pavoni (2011), Kaplan and Violante (2010) and Heathcote *et al.* (2009) have found a significant degree of consumption smoothing against income shocks, including highly persistent ones. The consumption smoothness noted in the data is associated to the extent to which households are capable of insuring against permanent and transitory shocks.

Luo *et al.* (2009) have brought to our attention a different possible reason for explaining both excess sensitivity and partially excess smoothness, which is the spirit of capitalism. In Luo *et al.* (2009) a dependence of expected consumption growth on expected income growth is demonstrated, responding exactly to the theory prediction in the presence of the spirit of capitalism.

Regressions using aggregate data of the V4 countries consistently return an estimate significantly larger than 0 when current growth in consumption is regressed on lagged aggregate income growth. This is the so-called 'excess sensitivity' phenomenon pointed out by Flavin (1981). She reacted to Hall's (1978) conclusion that the coefficients of lagged income growth were not statistically different from zero. Seater and Mariano (1985) have found that consumption shows sensitivity to transitory income due to liquidity constraints. Campbell and Mankiw (1989) have attributed excess sensitivity to the presence of "rule of thumb" consumers. Attanasio and Weber (1993) have warned that excess sensitivity tests which rely on macroeconomic data were biased. Souleles (1999 and 2002) has studied the anticipated income increase and analysed how consumption responds to the widely preannounced tax cuts of the Reagan administration era. Souleles (2002) has employed micro data and he has found that consumption is excessively sensitive to tax-cuts. Wilcox (1989) has examined the responses of aggregate consumption to preannounced increases in social security benefits and has found that consumption increases when the income increase is actually implemented and not when it is announced. Shapiro and Slemrod (2009) have suggested that even a temporary tax change could be moderately effective in increasing household spending. Kueng's paper (2015) has found significant evidence of consumption excess sensitivity in response to salient, predetermined and nominally large cash flows. These findings are also in line with Broda and Parker's research (2014) that estimate the spending reactions to the smaller

economic stimulus payments in 2008. Parker (2017) has written that the economic stimulus payments of 2008 were widely anticipated and their arrival caused significant spending increases. According to Luo, Smith and Zou (2009), the spirit of capitalism is not only an explanation of excess smoothness but also of excess sensitivity of consumption to current income.

In contrast to these papers stand Browning and Collado (2001) who have used Spanish micro data to examine the consumer response to the payment of institutionalized extra wage payments to full-time workers. They have detected no evidence of excess sensitivity and have considered bounded rationality as a reason why have earlier researchers found a large response of consumption to predicted income changes. Consumers actually tend to smooth consumption and do not respond when the changes in income are small and the costs of adjusting consumption are not inconsequential (Browning and Collado, 2001). Limosani and Millemaci (2011) also have not found significant evidence of excess sensitivity of consumption to income, including the case in which we take liquidity constraints into account

Further, Luengo-Prado and Sørensen (2008) have observed that excess sensitivity is higher in states where consumers have to confront the higher income uncertainty. Some of the studies expect stronger reactions of the low-wealth consumers to predictable income changes than of the high-wealth consumers, a finding that is in favour with the existence of liquidity constraints (Jappelli and Pistaferri, 2011).

## CONCLUSION

The purpose of this paper was to revisit the evidence on the excess smoothness of consumption within the V4 countries by using recently available quarterly data. A straightforward Deaton procedure (1992) for testing excess smoothness was adopted. The first-order vector auto-regression generates parameter estimates which enter two linear cross-equation restrictions. The results of the V4 countries are consistent with the supposition that consumption is smoother than it should be according to the Permanent Income Hypothesis. A sudden shock to lifetime income did not seem to cause a similarly large shock to consumption. People do not change their consumption expenditures based on new information about the amount of their lifetime income but rather maintain smooth consumption from one period to another. A possible reason is the nature of people because they are creatures of habit and these take time to change or develop.

The results of this paper also show a positive correlation between a change in consumption and a lagged change in income, a correlation which would be zero if the Permanent Income/Random Walk Hypothesis were true.

The Permanent Income/Random Walk Hypothesis also suggests that the change in consumption is an innovation which is simultaneously the change in permanent income. The "excess sensitivity" of changes in consumption to anticipated changes in income implies that consumption will respond less to unanticipated changes (innovations, shocks) in income. The facts that consumption slowly adjusts to innovations in income and then changes in consumption are related to averages of previous changes, explain both the smoothness and the sensitivity. Excess sensitivity deals with anticipated changes and excess smoothness is due to unanticipated changes, then, it is possible that consumption may follow both (Romer, 1996).



Policies incorporate economic stimulus programs, automatic stabilizers, which have a large predictable component. According to the Permanent Income Hypothesis, households are expected to adjust their spending only to the news about such programs as it affects their permanent income. Thus aggregate consumption is both excessively smooth relative to unpredictable current income growth, which is new information causing a consumers' revision of previous expectations about current and future income, and excessively sensitive to lagged income growth. This paper shows that widely anticipated economic stimulus payments can cause significant spending increases. Significant average responses to expected payments are important for the prediction of economic consumption behaviour and consequently for the revision of adequate economic purpose settings and the effectiveness of such economic stimulus programs.

#### Acknowledgements

Supported by grants No PEF\_DP\_2018030 and No PEF\_DP\_2019034 of the Grant Agency IGA PEF MENDELU.

#### REFERENCES

- ATTANASIO, O. and PAVONI, N. 2011. Risk Sharing in Private Information Models with Asset Accumulation: Explaining the Excess Smoothness of Consumption. *Econometrica*, 79(4): 971–1325.
- ATTANASIO, O. and WEBER, G. 1993. Consumption Growth, the Interest Rate and Aggregation. *Review of Economic Studies*, 60(3): 631–649.
- ATTANASIO, O., GOLDBERG, P. K. and KYRIAZIDOU, E. 2008. Credit constraints in the market for consumer durables: evidence from micro data on car loans. *International Economic Review*, 49(2): 401–436.
- BAYAR, A. and MC MORROW, K. 1999. *Determinants of private consumption*. European Economy, Economic Papers 1997–2001, No. 135. Brussels: European Commission.
- BERUMENT, H. and FROYEN, R. 2009. Monetary Policy and U.S. Long-term Interest Rates: How close are the linkages? *Journal of Economics and Business*, 61(1): 34–50.
- BILGILI, F. 1997. Testing the Ricardian equivalence theorem in the framework of the permanent income hypothesis. In: *International Conference in Economics I. F27 Macroeconometric Studies I*. East Technical University, Ankara, Turkey, September 19, 1997.
- BILGILI, F. 2001. The Unbiasedness and efficiency tests of the rational expectations hypothesis. In: *International Conference in Economics V. F7 Adjustment Dynamics in Open Economies*. Ankara, Turkey, September 12, 2001.
- BILGILI, F. 2003. Dynamic implications of fiscal policy: Crowding out or crowding in? In: *International Conference in Economics VII. F5 Fiscal Policy, Public and Private Expenditures*. East Technical University, Ankara, Turkey, September 8, 2003.
- BILGILI, F. 2006. Random walk, excess smoothness or excess sensitivity? Evidence from literature and an application for Turkish economy. In: *International Conference on Economics*. Consumption in Turkey, Ankara, Turkey, September 12, 2006.
- BLUNDELL, R. and PISTAFERRI, I. 2003. Special Issue on Income Volatility and Implications for Food Assistance Programs. *The Journal of Human Resources*, 38: 1032–1050.
- BLUNDELL, R. PISTAFERRI L. and PRESTON, I. 2008. Consumption inequality and partial insurance. *American Economic Review*, 98(5): 1887–1921.
- BRODA, C. and PARKER, J. 2014. The Economic Stimulus Payments of 2008 and the Aggregate Demand for Consumption. *Journal of Monetary Economics*, 68: 20–36.
- BROWNING, M. and COLLADO, M. D. 2001. The response of expenditures to anticipated income changes: panel data estimates. *The American Economic Review*, 91(3): 681–692.
- CAMPBELL, J. Y. 1987. Does saving anticipate declining labor income? An alternative test of the permanent income hypothesis. *Econometrica*, 55(6): 1249–1273.
- CAMPBELL, J. Y. and DEATON, A. 1989. Why Is Consumption So Smooth? *Review of Economic Studies*, 56(3): 357–374.
- CAMPBELL, J. Y. and MANKIW, N. G. 1989. Consumption, Income, and Interest Rates: Reinterpreting the Time Series Evidence. *NBER Macroeconomics Annual*, 4: 185–216.
- CARROLL, C. D. 1992. The Buffer Stock Theory of Saving: Some Macroeconomic Evidence. *Brookings Papers on Economic Activity*, 2: 61–156.
- CARROLL, C. D. 1997. Buffer-Stock Saving and the Life-Cycle/Permanent-Income Hypothesis. *Quarterly Journal of Economics*, 112(1): 1–55.

- DEATON, A. S. 1987. Life-Cycle Models of Consumption: Is the Evidence Consistent with the Theory? In: *Advances in Econometrics. Fifth World Congress*. Cambridge and New York: Cambridge University Press, Vol. II, pp. 121–148.
- DEATON, A. S. 1992. *Understanding Consumption*. 1<sup>st</sup> Edition. New York: Oxford University Press.
- EUROPEAN CENTRAL BANK. 2018. *ECB Economic Bulletin*. Issue 5. ECB.
- EUROSTAT. 2019. GDP and main components (output, expenditure and income). *Eurostat*. [Online]. Available at: [http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama\\_10\\_gdp&dang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_gdp&dang=en) [Accessed: 2019, February 14].
- EUROSTAT. 2019. Final consumption aggregates. *Eurostat*. [Online]. Available at: [http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=namq\\_10\\_fcs&dang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=namq_10_fcs&dang=en) [Accessed: 2019, February 13].
- EUROSTAT. 2019. Population on 1 January by age and sex. *Eurostat*. [Online]. Available at: [http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo\\_pjan&dang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_pjan&dang=en) [Accessed: 2019, February 14].
- FERNANDEZ-CORUGEDO, E. 2004. *Consumption Theory*. 1<sup>st</sup> Edition. London: Bank of England.
- FLAVIN, M. 1981. The Adjustment of Consumption to Changing Expectations about Future Income. *Journal of Political Economy*, 89(5): 974–1009.
- FRIEDMAN, M. 1957. *A Theory of the Consumption Function*. 1<sup>st</sup> Edition. Princeton: Princeton University Press.
- FRIEDMAN, M. 2015. *A theory of Consumption Function*. Reprint of 1957 Edition. Mansfield: Martino Fine Books.
- GALI, J. 1991. Budget constraints and time series evidence on consumption. *American Economic Review*, 81(5): 1238–1253.
- HALL, R. E. 1978. Stochastic Implications of the Life Cycle-Permanent Income Hypothesis: Theory and Evidence. *Journal of Political Economy*, 86(6): 971–987.
- HEATHCOTE, J., STORESLETTEN, K. and VIOLANTE, G. L. 2009. Quantitative Macroeconomics with Heterogeneous Households. *Annual Review of Economics*, 1(1): 319–354.
- HRYSJKO, D. 2011. *Excess Smoothness of Consumption in an Estimated Life Cycle Model*. Working Paper. Alberta: University of Alberta.
- HRYSJKO, D. 2014. Correlated Income Shocks and Excess Smoothness of Consumption. *Journal of Economic Dynamics and Control*, 48(C): 41–62.
- JAPPELLI, T. and PISTAFERRI, L. 2011. The Consumption Response to Income Changes. *Annual Review of Economics*, 2: 479–506.
- KAPLAN, G. and VIOLANTE, G. L. 2010. How Much Consumption Insurance beyond Self-Insurance? *American Economic Journal: Macroeconomics*, 2(4): 53–87.
- KEYNES, J. M. 1936. *The general theory of employment, interest, and money*. United Kingdom: Palgrave Macmillan.
- KRUEGER, D. and PERRI, F. 2006. Does Income Inequality Lead to Consumption Inequality? Evidence and Theory. *The Review of Economic Studies*, 73(1): 163–193.
- KUENG, L. 2018. Excess Sensitivity of High-Income Consumers. *The Quarterly Journal of Economics*, 133(4): 1693–1751.
- LIMOSANI, M. and MILLEMACI, E. 2011. Evidence on excess sensitivity of consumption to predictable income growth. *Research in Economics*, 65(2): 71–77.
- LUCAS, R. 1976. Econometric policy evaluation: A critique. *Carnegie-Rochester Conference Series on Public Policy*, 1(1): 19–46.
- LUDVIGSON, S. C. and MICHAELIDES A. 2001. Does Buffer-Stock Saving Explain the Smoothness and Excess Sensitivity of Consumption? *American Economic Review*, 91(3): 631–647.
- LUENGO-PRADO, M. J. and SØRENSEN, B. E. 2008. What can explain excess smoothness and sensitivity of state-level consumption? *The Review of Economics and Statistics*, 90(1): 65–80.
- LUO, Y., SMITH, W. T. and ZOU, H. 2009. The Spirit of Capitalism and Excess Smoothness. *Annals of Economics and Finance*, 10(2): 281–301.
- MODIGLIANI, F. and BRUMBERG R. 1954. Utility analysis and the consumption function: an interpretation of cross-section data. In: *Post-Keynesians Economics*. KURIHARA, K. (Ed.). New Brunswick: Rutgers University Press, pp. 388–436.
- PARKER, J. 2017. *Why Don't Households Smooth Consumption? Evidence from a 25 Million Dollar Experiment*. NBER Working Paper, No. 21369. NBER.
- PESARAN, M. H. 2003. Aggregation of linear dynamic models: an application to life-cycle consumption models under habit formation. *Economic Modelling*, 20(2): 383–415.
- RODRIGUEZ-PALENZUELA, D. and DEES, S. 2016. Savings and Investment Behaviour in the Euro Area. ECB Occasional Paper, No. 167. ECB.
- ROMER, D. 1996. *Advanced Macroeconomics*. 1<sup>st</sup> Edition. New York: The McGraw-Hill.

- SARGENT, T. J. 1978. *Rational Expectations, Econometric Exogeneity and Consumption*. Staff Report 25. Federal Reserve Bank of Minneapolis.
- SEATER, J. J. and MARIANO, R. S. 1985. New Tests of the Life Cycle and Tax Discounting Hypothesis. *Journal of Monetary Economics*, 15(2): 195–215.
- SHAPIRO, M. D. and SLEMROD, J. 2009. Did the 2008 tax rebates stimulate spending? *American Economic Review*, 99(2): 374–379.
- SOULELES, N. 1999. The Response of Household Consumption to Income Tax Refunds. *American Economic Review*, 89(4): 947–958.
- SOULELES, N. 2002. Consumer Response to the Reagan Tax Cuts. *Journal of Public Economics*, 85(1): 99–120.
- WILCOX, D. 1989. The Sustainability of Government Deficits: Implications of the Present-Value Borrowing Constraint. *Journal of Money, Credit and Banking*, 21(3): 291–306.

Contact information

Terézia Vančová: terezia.vancova@mendelu.cz