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# Modeling Real Private Consumption Expenditure in Bulgaria after the Currency Board Implementation (1997-2005)

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May 9, 2015

## Abstract

In this paper, an econometric model of consumption in Bulgaria for the period 1997-2005 is constructed. The Error-Correction Model (ECM) approach is employed and long-run relationship between household consumption and income was found. The primary purpose of this empirical paper is to get a better understanding of the factors driving household consumption in Bulgaria and to estimate a consumption function to be used for medium-term forecasting. It is shown that all households behave in a Keynesian way, basing their consumption decisions on current income.

**Keywords:** Keynesian consumption function, Permanent Income Hypothesis, Error Correction Model

*JEL Classification:* E21, E27

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# 1 Introduction

This paper models consumption behavior of households in Bulgaria after the financial crisis in 1996-7. The hyperinflation, and the currency board implemented later in 1997, were structural breaks for the economy. Consumer behavior changed dramatically - most of the people lost the savings they kept for a rainy day and found their real incomes reduced. Households had to form new consumption paths, consistent with the new economic environment. Thus any study that uses data before the financial crisis is subject to the Lucas critique (Lucas 1976): all parameters of the consumption function, estimated with pre-97 data will be conditional on the economic conjecture at that time and will give bad forecasts. Luckily, there are enough quarterly observations for the period after the currency board was implemented for an econometrically sensible study to be pursued.

Private consumption expenditure is the largest component of the Gross Domestic product (GDP) in Bulgaria. That makes it an extremely important component of the aggregate demand, not only because it influences economic growth, but also for business cycle considerations. In this respect, the study of consumption is relevant. In this paper, an econometric model of consumption in Bulgaria for the period 1997- 2005 will be constructed. The Error-Correction Model (ECM) approach will be employed and time-series data will be used in the regression. The primary purpose of this empirical paper will be to get a better understanding of the factors driving household consumption in Bulgaria and to estimate a consumption function to be used for medium-term forecasting.

Aggregate consumption will be expressed as a function of explanatory variables such as income, wealth and others that will capture income uncertainty and intertemporal substitution effects. This kind of studies are common in developed countries, but are a rare event in small countries such as Bulgaria, due to short time series especially for the period after the financial and banking crisis of 1996-97. The studies using household-level data for Bulgaria are by Petrova et al. (1996) and Skoufias (2004). However, both use survey data from 1992-95 and 1994, respectively, which is before the period of interest. A more modern treatments, though with a different focus, can be found in Chukalev (2010) and Genchev (2012).

The paper is organized as follows: Section 2 presents the literature review. Sections 3 describes the data used, the econometric methodology applied and discusses the results ob-

tained from the estimation. Section 4 summarizes the contribution and concludes.

## 2 Literature Review

There is a long list of empirical literature on consumption.<sup>1</sup> Consumption is a feature of macroeconomic models since Keynes (1936) and is especially important for growth in transitional and EU accession countries, e.g. Bredin and Cuthbertson's (2001) paper on Czech Republic. Keynes is the first to postulate the relationship between consumption and disposable income. According to his view, consumers spend a fixed proportion of their current-period after-tax income. Those agents are regarded as "myopic" by Campbell and Mankiw (1991) because their consumption pattern is not consistent with intertemporal optimization. That is why the competing Life-Cycle Hypothesis (LCH) was developed by Modigliani and Brumberg (1954) and the Permanent Income Hypothesis (PIH) was laid out in Friedman (1957).<sup>2</sup> LCH takes the individual lifespan as the planning horizon, while the PIH assumes a setup with infinitely-living agents (or dynasties). Both LCH and PIH allow for the income to vary across the planning horizon, and savings may be used to smooth consumption, as agents base their decision not on current-period income but on their permanent (lifetime) income. That is consistent with reality because people are net debtors when young, net savers during their years of maturity, and net dis-savers during their retirement period. Thus LCH is influenced not only by income, but also by all assets held by the household.

PIH emphasizes the distinction between temporary and permanent changes in income. If the change in income is temporary, this will have only a small effect on the consumption behavior, as households would like to maintain a smooth consumption pattern. It is only when the change in income is permanent that consumers change their consumption by a sizable amount. According to this theory, households look at their discounted future streams of income, which is known in the literature their permanent income. Thus Friedman (1957) claims that consumption is influenced by this aggregate rather than by the current income alone: changes in income will affect consumption with a lag.

Hall (1978) extended the LCH by adding rational expectations (RE). RE means that house-

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<sup>1</sup>For a recent treatment on the subject, see the overview in Muellbauer and Lattimore (1999), and the references therein, and Yoldas (2006) on the UK consumption function.

<sup>2</sup>Another good treatment on the subject is Deaton (1992).

holds behave as if they know the stochastic process that income follows. Consumers will not change their consumption plan unless new information makes them revise their expectations about the future income. According to Hall (1978), if consumers' utility function is quadratic, both consumption and income follow a random walk (RW). If Hall's (1978) hypothesis is right, all lagged variables are in the households' information set as of the current period, so they should not be statistically significant. However, variables used by Hall (1978) are non-stationary and that leads to spurious ("nonsense") regression.

Flavin (1990) tests Hall's hypothesis in a structural framework. She finds that consumption reacts to predictable changes in income, something that goes against both PIH and LCH. That phenomenon is known in the literature as "excess sensitivity" of consumption. In another paper she finds that consumption is extraordinary smooth to unpredictable changes in income, again in conflict with PIH/LCH idea, which she calls "excess smoothness" of consumption.

Campbell and Mankiw's (1991) study encompasses both the Keynesian and PIH/LCH hypotheses, much in the Hendry's (1993) "general-to-specific" methodology. In their model, some of the households are myopic, while the others follow PIH/LCH. The result they obtain violates the PIH - half of the US population bases its consumption pattern on current income. The reason behind that may be some liquidity constraints: a households acting according to PIH may be prevented to do so if it is unable to borrow when needed in order to smooth consumption. That may be proxied by the lending rate on consumption loans, for example.

Another approach to modeling consumption is the ECM approach that of Davidson *et al.* (1978). The authors present a dynamic time-series model of consumption, based on a long-run equilibrium relationship between consumption and income. They assume there is a long-run relationship between income and consumption. There is a steady-state and households are making short-run corrections to the equilibrium. If consumption exceeds long-run consumption, next period consumption will be decreased. Thus the EC term is expected to have a negative sign, and its coefficient to be less than one in absolute terms. This will show how much of the gap from the previous period will be closed in the next period.

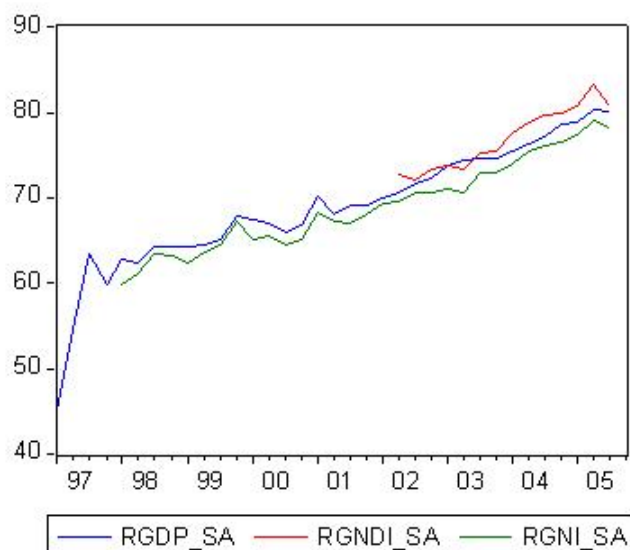
After presenting the literature review, the paper proceeds to describe the data used in

the study and discusses stationarity of the series. The section then presents the economic methodology that will be used to model the Bulgarian consumption function.

### 3 Data Description and Econometric Methodology

For the empirical analysis, quarterly time series data from 1997:2 to 2005:4 will be used. The data was obtained from the IMF International Financial Statistics (IFS) on-line database. All variables are measured in real terms, seasonally adjusted, and deflated by the Consumer Price Index. Natural logs of the variables were taken to handle their magnitude and to express the coefficients of the variables as elasticities. Due to the very short series available for disposable income of households ( $rgndi_{sa}$ ) and gross national income ( $rgni_{sa}$ ), we use gross domestic product ( $rgdp_{sa}$ ) series, which tracks the behavior of gni very closely, as seen from Fig. 1 below:

Figure 1: Aggregate output and income in Bulgaria



*Data source: IFS (2005)*

Before passing to estimation, we investigate the order of integration and trending behavior of all the variables using the Augmented Dickey-Fuller (ADF) test, as described in Dickey and Fuller (1981) and Said and Dickey (1984), and another popular alternative, the KPSS test, as in Kwiatkowski *et al.* (1992). ADF test was used with a constant but without a deterministic trend because usually economic time series have a stochastic trend. Phillips-Perron (1988) specification was not used because it uses a non-parametric correction for

serial correlation, which in a sample of 34 observations has low power because its asymptotic properties are very weak. Our results are summarized in Table 1 below:

Table 1: Data description and stationarity

Name of the variable	Notation	ADF	KPSS
Natural Log of Real household consumption(s.a)	$Lrcons_{sa}$	I(1)	I(1)
Natural Log of Real Gross Domestic Product(s.a)	$Lrgdp_{sa}$	I(1)	I(1)

Since both variables are integrated of order 1, we transform them by taking first differences, in order to make them stationary. Indeed, the first difference are integrated of order zero. After that we proceed with testing for the presence of cointegration between real consumption and income (in natural logarithms). The long-run relation between consumption and income was estimated using the Engle-Granger (1987) two-step procedure. Johansen's (1991) Vector Error Correction estimation was not used because of the short time series available it estimates too many parameters, too many unnecessary coefficients, which result in imprecise estimates of the coefficients of the relevant variables: with 34 observations it is simply too much to ask from the data.

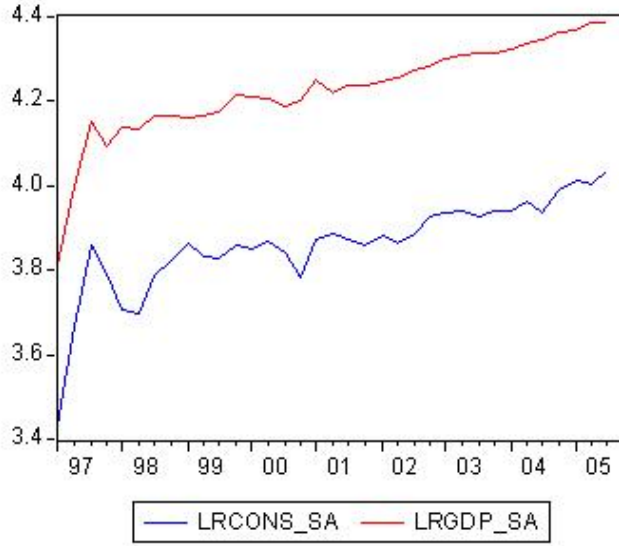
The long-run relation between consumption and income was estimated using Ordinary Least Squares (OLS). It turns out that there is evidence in favor of cointegration, and we are can reject the null hypothesis of the presence of a unit root in the residuals of the co-integrating relationship, using the cointegration ADF test as proposed by Engle and Yoo (1987). The results of the regression, with standard errors reported below the point estimates are as follows:

$$\begin{aligned}
 LRC\hat{O}NS_{SA} &= 0.12 + 0.89 * LRG\hat{D}P_{SA} & (1) \\
 & (0.27) \quad (0.06) \\
 R_{adj}^2 &= 0.86, SEE = 0.03, N = 34
 \end{aligned}$$

Next, we save the residuals from the equation and test for unit root (no cointegration) using ADF test. Note that since this is an estimated series, we have to use the critical value from Engle and Yoo (1987). For 2 variables in the cointegrating relationship and sample size of 34 observations, for 5 % level of significance the critical value of the ADF statistic is -3.29. We safely reject the hypothesis of the presence of a unit root in the residuals and conclude

that there is a stable cointegrating relationship, and we will refer the variable in what is to follow as the "Error-Correction-Term." For robustness check we also use the cointegration Durbin-Watson (DW) test statistic, as suggested by Engle and Granger (1987). Since the DW test statistic exceeds the critical value ( $1.36 > 0.78$ ), we can again reject the presence of a unit root and show there is a long-run relationship between consumption and income. This relationship can be also seen with a naked eye in Fig. 2 below:

Figure 2: Behavior of consumption and output in Bulgaria



*Data source: IFS (2005)*

Next, we investigate the short-run dynamics of consumption using an all encompassing regression in first differences: thus,  $diflrcons_{sa}$  and  $diflrgdp_{sa}$  are the first difference of the seasonally adjusted and logged series of aggregate real consumption and output. Because the total number of observations is only 34, we limit our starting lag length to 4. Proceeding in line with the "from general to simple" econometric principle, we drop the redundant lags from the regression, controlling for their joint significance. The final model is presented below, where "Lx." in front of a variable denotes the "x"-th lag of the respective variable:

$$\begin{aligned} DIFLR\hat{CONS}_{SA} = & 0.0065 - 0.773 * L1.DIFLR\hat{CONS}_{SA} - 0.727 * L2.DIFLR\hat{CONS}_{SA} \\ & - 0.230 * L3.DIFLR\hat{CONS}_{SA} + 0.957 * DIFLR\hat{GDP}_{SA} + 0.572 * L1.DIFLR\hat{GDP}_{SA} \\ & + 0.160 * L4.DIFLR\hat{GDP}_{SA} + 1.197 * L1.\hat{ECT} - 0.629 * L4.\hat{ECT} \quad (2) \end{aligned}$$

All explanatory variables, aside from the constant, are individually statistically significant at 1%. The constant is individually marginally significant at 5%. All variables are jointly



significant at 1%, as indicated by the F-statistic (F-stat=52.42), and  $R_{adj}^2 = 0.93$ . The additional tests performed for autocorrelation in residuals, their normality, functional form of the model and stability of coefficients suggest the validity of the above model. It is apparent that Bulgarian consumers demonstrated a purely Keynesian attitude after the crisis: after the introduction of the currency board in 1997 they were adjusting their consumption to changes in current income within 2 periods. The last proposition merits further investigation within the framework of Campbell and Mankiw (1991) model, which requires running a simple OLS of  $diflrcons_{sa}$  on  $diflrgdp_{sa}$ , and obtained the following results (again, standard errors are reported below the point estimates):

$$\begin{aligned} DIFLR\hat{CONS}_{SA} &= -0.002 + 1.13 * DIFLR\hat{GDP}_{SA} & (3) \\ & (0.007) \quad (0.15) \\ R_{adj}^2 &= 0.63, SEE = 0.034, N = 34 \end{aligned}$$

A potential problem that might arise from the regression above is that there may be some endogenous relationship between the two variables, in which case OLS will give biased and inconsistent estimates. Thus we conduct the Hausman test of the Mankiw-Campbell equation to determine whether OLS introduces a bias in the estimates of coefficients. We choose the 4 lags of  $diflrcons_{sa}$  as instruments, and regress income on them to get the residuals, which will be then used for the Hausman test diagnostics. More specifically, the residuals are going to be included in the Mankiw-Campbell equation as an additional control, and we will check for their individual significance. As seen from the results below, it turns out that the OLS produces consistent estimates of the income elasticity of consumption, since the coefficient in front of the residual term (RESID) is not statistically different from zero, while the other point estimates and their standard errors (not reported) do not change significantly.

$$\begin{aligned} DIFLR\hat{CONS}_{SA} &= -0.002 + 1.18 * DIFLR\hat{GDP}_{SA} + 0.48 * RESID & (4) \\ & (0.61) \end{aligned}$$

$$R_{adj}^2 = 0.65, SEE = 0.039, N = 29$$

In addition, the coefficient in front of  $diflrgdp_{sa}$  is not statistically different from 1. Therefore, as Mankiw-Campbell's model suggests, we cannot reject the hypothesis that all Bulgarian consumers behave in a myopic way. The consumption-to-output is stationary and is stabilizing at 0.7, meaning that households in Bulgaria spend 70 % of their current disposable (after-tax) income. Such a behavior is very different from the models based on intertemporal optimization used to model households' behavior in Western economies.

## 4 Summary and Conclusions

In this paper, an econometric model of consumption in Bulgaria for the period 1997- 2005 was constructed. The Error-Correction Model (ECM) approach was employed and long-run relationship between household consumption and income was found. The primary purpose of this empirical paper was to get a better understanding of the factors driving household consumption in Bulgaria and to estimate a consumption function to be used for medium-term forecasting. It was shown that all households behave in a Keynesian way, basing their consumption decisions on current income. After all, private consumption expenditure is the largest component of the Gross Domestic product (GDP) in Bulgaria and an extremely important component of the aggregate demand. That is not only because it influences economic growth, but also for business cycle considerations. In this respect, the study of consumption is relevant, because it suggests that macroeconomists working on theoretical models on Bulgarian economy within the dynamic stochastic general equilibrium framework maybe should model households' behavior in the Keynesian tradition as hand-to-mouth and myopic, instead of being represented as agents that smooth their consumption over time, as the former is a better approximation of reality.

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