

# Empirical Study of Real Retail Trade Turnover

J. Arneric, E. Jurun, and L. Kordic

**Abstract**—This paper deals with econometric analysis of real retail trade turnover. It is a part of an extensive scientific research about modern trends in Croatian national economy. At the end of the period of transition economy, Croatia confronts with challenges and problems of high consumption society. In such environment as crucial economic variables: real retail trade turnover, average monthly real wages and household loans are chosen for consequence analysis. For the purpose of complete procedure of multiple econometric analysis data base adjustment has been provided. Namely, it has been necessary to deflate original national statistics data of retail trade turnover using consumer price indices, as well as provide process of seasonally adjustment of its contemporary behavior. In model establishment it has been necessary to involve the overcoming procedure for the autocorrelation and colinearity problems. Moreover, for case of time-series shift a specific appropriate econometric instrument has been applied. It would be emphasize that the whole methodology procedure is based on the real Croatian national economy time-series.

**Keywords**—Consumption society, multiple econometric model, real retail trade turnover, second order autocorrelation.

## I. INTRODUCTION

DEVELOPEMENT on the Croatian loan market in the last decade can be divided in three phases [1]. The first lending boom started early in 1996, reaching its maximum in February 1998, with annual credit growth rate of 45.4%.

In late 1999 and early 2000 Croatian banking sector entered a new phase becoming in majority foreign own. Foreign banks in Croatia, as in other Central and Eastern European countries, brought further lowering of interest rates, stronger competition and improved governance. They also brought strong capital inflows leading not only to the significant lending pick-up, but the increase in foreign debt. The economy emerged from the recession and resumed economic growth.

The recovery of lending started in the second half of 2000. By mid-2001 total loans reached annual growth of near 20%, what can be characterized as the beginning of the second lending boom, accelerating up to 30% at the end of the year. Declining interest rates on one side and GDP growth on the other fuelled by the strong growth of personal consumption and net exports and contributed to the increase of credit demand.

In period from 2001 to 2005 in Croatia the significant increase of total loans percentage to GDP has been perceived.

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In 2001 it amounts 39.6%, and in 2005 already 66.3%, which enriched Croatia to the new members of European Union countries (65.3% in 2004), whereas it is still lower than MU12 (117% in 2004) [2].

In Croatia is evident decreasing trend of corporate loans in favor to household loans. Furthermore, this phenomena in short period from 2001 to 2005 is much more expressed in Croatia in comparison to USA and EU. If we compare household loans versus corporate loans there is no significant difference between EU and Croatia. Namely, in observed period in EU 46% of total loans has been given to households and 37.4% to corporate. In Croatia this ration is 50.7% towards 40.1%.

By analyzing the structure of household loans in Croatia it is evident low portion of housing loans (36% in 2005, which is less than half portion of the same loans in USA or EU). Nondedicated household loans, loans for motor vehicles, credits on credit cards and other credits for finance final consumption enrich amount of 62.2% bank credits to Croatian citizens. This unfavorable credit structure encourages unproductive consumption and import goods and services for final consumption. These flows have very negative influence on national balance and stability of national economy in general.

Therefore, it was necessary to begin scientific research about the influence of average monthly real wages and household loans to real retail trade turnover. Moreover, the average monthly real wages are indicator of standard of living, which is crucial for social and economic development in Croatia.

The structure of the paper is organized as follows. In the second section behavioral pattern of observed data is explored. In the third section interpretation of empirical findings is presented, while the fourth section summarizes the results of the research and provides conclusion remarks.

## II. BEHAVIORAL PATTERN OF OBSERVED DATA

It is necessary to emphasize that real retail trade turnover is computed using consumer price indices with base in year 2000. The Consumer Price Index is calculated and published on the basis of about 590 representative goods and services according to the modified Laspeyres formula. Each month over 27000 prices are collected in a fixed panel of outlets on nine geographical locations. All data are observed in period from January 1997 to May 2006.

According to Fig. 1 real retail trade turnover approves strong periodic behavior on monthly basis. Therefore, time-series of real retail trade turnover is seasonally adjusted using multiplicative moving average method.

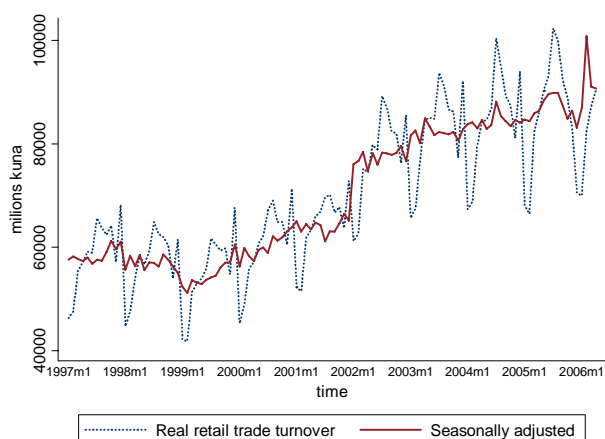


Fig. 1 Observed and seasonally adjusted real retail trade turnover

The bottoms of dotted line on Fig. 1 present real retail trade turnover in Januarys and the tops of dotted line presents the July's real retail trade turnover.

TABLE I  
 SEASONALLY FACTORS OF REAL RETAIL TRADE TURNOVER

Month	Seasonally factor	Percentage change
January	0.804073	-19.59%
February	0.817244	-18.27%
March	0.958139	-4.18%
April	0.996517	-0.35%
May	1.020366	2.04%
June	1.038480	3.85%
July	1.139187	13.92%
August	1.111603	11.16%
September	1.057892	5.79%
October	1.048287	4.82%
November	0.958475	-4.15%
December	1.117478	11.75%

In Table I obtained seasonally factors are presented within each month of the year. It can be notice that major seasonally effects exist in December-January and July-August periods. In December the retail trade turnover is increased under influence of seasonal effect for 11.75% as a result of pre festive period. Opposite, in January after total spending in previous month retail trade turnover decreases for 19.59% and continues to decrease even in February for relative high percent. In July real trade turnover increases significantly for 13.92% as a result of great tourists inflow in Croatia. This enlargement continues also in August (11.16%).

Fig. 2 shows behavior of average monthly real wages of employs in Croatia. It can be notice that standard of living in Croatia is growing slowly but secure, with stochastic deviations around trend.

A part of 11% of the total population is poor, and the additional 10% of it is close to the poverty line because their consumption exceeds the average level by only 25%.

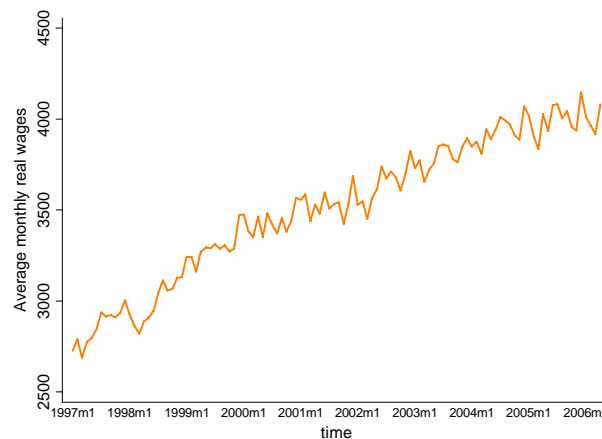


Fig. 2 Observed average monthly real wages

According to the latest surveys of household costs, three quarters of households in Croatia face problems in covering their monthly costs. At the same time, half of their income is spent on meeting the bare necessities of life. This is the cause of rising indebtedness of the population.

From January to December 2007 the total increase in the credit volume to the private sector reached as much as 23%. Moreover, household loans accounted for more than a half of it. Strong positive trend in loans to households is evident in Fig. 3.

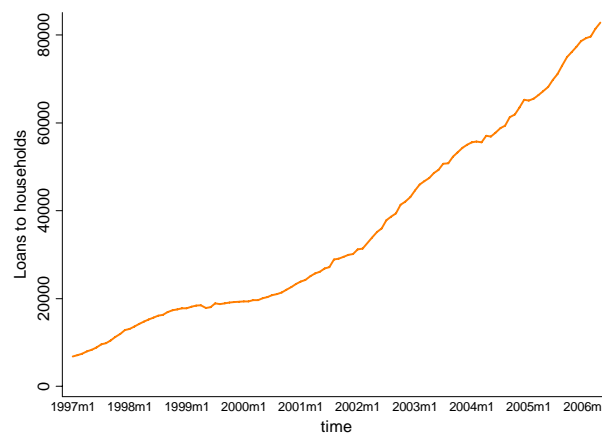


Fig. 3 Household loans

The second important matter for analysis is comparison of GDP per capita in Croatia with that in the European Union. The Croatian economy grew at growth rates higher than those in the EU and GDP per capita in Croatia rose by 55% in the period from 1996 to 2005.

On Fig. 4 all three variables are presented in three dimensional space. To discover all interdependences between them trivariate interpolated surface is mapped across whole region between points observed.

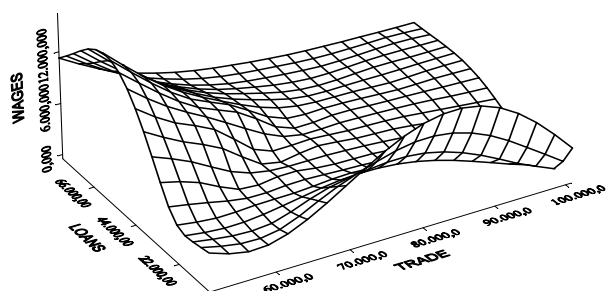


Fig. 4 Trivariate interpolated surface

It is obvious strong relationship between loans to households and retail trade turnover at lower standard of living.

### III. EMPIRICAL FINDINGS

To study how variables affect each other, the multiple linear regression is used. Dependent variable presents seasonally adjusted real retail trade turnover, whereas independent variables are average monthly real wages (measure for standard of living), and household loans. Estimated model with common diagnostics tests are presented in Table II. Estimation procedure is computed using ordinary least square method (OLS) within E-Views software.

According to results in Table II average monthly real wages have no statistically significant effect on real retail trade turnover, whereas 1 millions kuna increase of household loans would also increase real retail trade turnover for 0.52 millions kuna. Perhaps, spurious statistical insignificance of average monthly real wages could be a result of positive residual autocorrelation of order one, according to Durbin-Watson statistic. However, higher order of autocorrelation may exist, which is major property of time-series data. Therefore, coefficients of autocorrelation function and partial autocorrelation function are tested, although adjusted R-squared, F-statistic and relative small standard error of regression (6.24%) are satisfying. On Fig. 5 correlogram of residuals for 15 time lags, with associated Ljung-Box tests (Q-statistics) are presented.

TABLE II  
 ESTIMATED MODEL WITH COMMON DIAGNOSTIC TESTS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INTERCEPT	43184.52	7730.462	5.586279	0.0000
WAGES	2.381673	2.626468	0.906797	0.3665
LOANS	0.520627	0.046763	11.13340	0.0000
R-squared	0.888226	Mean dependent var		70259.33
Adjusted R-squared	0.886175	S.D. dependent var		12996.05
S.E. of regression	4384.593	Akaike info criterion		19.63600
Sum squared resid	2.10E+09	Schwarz criterion		19.70882
Log likelihood	-1096.616	F-statistic		433.0926
Durbin-Watson stat	0.399188	Prob(F-statistic)		0.000000

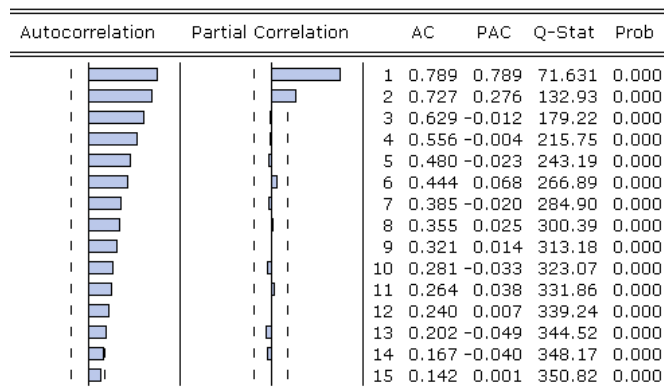


Fig. 5 ACF and PACF coefficients

According to Ljung-Box statistics, statically significance of first 15 autocorrelation coefficients at p-value less than 1% is evident. Namely, the second order autocorrelation is obvious because ACF decays exponentially, and PACF dies out after second time lag. This proves that real retail trade turnover follows autoregression second order process AR(2).

Introducing lag operator  $L^i y_t = y_{t-i}$  autoregression model of second order with two exogenous variables can be defined as lag operator polynomial:

$$(1 - \phi_1 L - \phi_2 L^2) y_t = \beta_0 + \sum_{j=1}^2 \beta_j x_{j,t} + \varepsilon_t \quad (1)$$

Model (1) was extended for third qualitative exogenous variable because the shift in real retail trade turnover in January 2002 was perceived. Therefore, dummy variable is defined as:

$$d_t = \begin{cases} 0 & \text{to December 2001} \\ 1 & \text{from January 2002} \end{cases} \quad (2)$$

Estimated model in (1) with dummy variable defined in (2) is given in Table 3, and can be written as:

$$(1 - 0.4645L - 0.2278L^2) y_t = 58020.5 - 1.6984x_{1,t} + 0.348x_{2,t} + 11994.1d_t \quad (3)$$

According to estimation results all variables are statistically significant except average real monthly wages ( $x_{2,t}$ ). Moreover, negative sign of estimated coefficient is not affirmative within economic theory. Parameter associated to dummy variable indicates that real retail trade turnover from January 2002 has shifted up for 11994.1 millions kuna in comparison to previous period, i.e. near to 20%. If we compare estimated models in Table II and Table III, Akaike and Schwarz information criteria's show that model (3) is better fitted. It is necessary to emphasize the increase of adjusted R-squared value with DW around 2, indicating no

autocorrelation left.

Because of high colinearity between average real monthly wages and household loans the variable average real monthly wages was omitted from the model in the next phase of research. Namely, Pearson correlation coefficient amounts 0.914, and it is statistically significant at p-value less than 1% (two tailed test).

TABLE III  
 AR(2) MODEL ESTIMATION WITH 3 EXOGENOUS VARIABLES

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INTERCEPT	58020.50	7970.251	7.279633	0.0000
WAGES	-1.698356	2.628775	-0.646064	0.5197
LOANS	0.347999	0.061882	5.623603	0.0000
DUMMY	11994.10	1876.000	6.393443	0.0000
AR(1)	0.464537	0.095836	4.847220	0.0000
AR(2)	0.227793	0.096312	2.365148	0.0199
R-squared	0.971653	Mean dependent var	70483.57	
Adjusted R-squared	0.970290	S.D. dependent var	13005.87	
S.E. of regression	2241.774	Akaike info criterion	18.32092	
Sum squared resid	5.23E+08	Schwarz criterion	18.46822	
Log likelihood	-1001.651	F-statistic	712.9564	
Durbin-Watson stat	2.035625	Prob(F-statistic)	0.000000	
Inverted AR Roots	0.76	-0.30		

The final estimated model without variable average real monthly wages is given in following equation:

$$(1 - 0.4597L - 0.2164L^2)y_t = 52974.4 + 0.3207x_{2,t} + 12111.9d_t \quad (4)$$

In model (4) all statistics remained the same in comparison to model (3) when average real monthly wages was included. Still, it was needed to examine if stationary condition of AR(2) part of model (4) is satisfied. According to estimated results the homogeneous part of second order difference equation has following form:

$$y_t - 0.4597y_{t-1} - 0.2164y_{t-2} = 0 \quad (5)$$

If feasible homogeneous solution has the form  $y_t = \alpha^t$ , by substitution in (5) yields:

$$\alpha^t - 0.4597\alpha^{t-1} - 0.2164\alpha^{t-2} = 0 \quad (6)$$

Dividing (6) by  $\alpha^{t-2}$  we obtain characteristic equation:

$$\alpha^2 - 0.4597\alpha - 0.2164 = 0 \quad (7)$$

In (7) solutions are two characteristic roots  $\alpha_1 = 0.75$  and  $\alpha_2 = -0.29$ . Namely, in this case characteristic roots are two distinct real numbers, whose absolute values do not exceed

unity. For any two arbitrary constants  $A_1$  and  $A_2$  the linear combination  $A_1\alpha_1^t + A_2\alpha_2^t$  also solves (5). First homogeneous solution  $A_1 0.75^t$  converges directly because  $0 < \alpha_1 < 1$ , while second homogeneous solution  $A_2 (-0.29)^t$  converges oscillatory because  $-1 < \alpha_2 < 0$ . These solutions satisfy stationary condition of AR(2) model, i.e. inverted roots of AR(2) lag polynomial lie inside the unit circle.

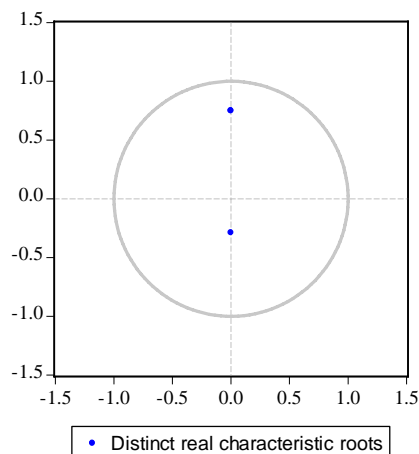


Fig. 6 Inverse roots of AR(2) Polynomial

Actual and fitted values of real retail trade turnover with residuals according to estimated model in (4) are presented in Fig. 7.

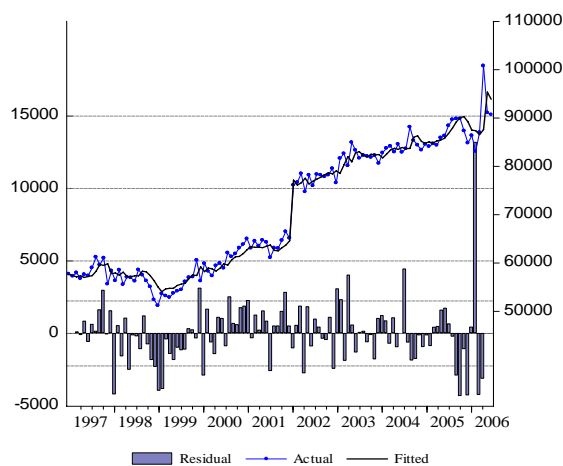


Fig. 7 Comparison of actual and fitted values of real retail trade turnover with residual deviations

#### IV. CONCLUSION REMARKS

This paper is an extraction on the parts of extensive on-going research related to contemporary trends in Croatian national economy. Leaving from the period of transition economy Croatia deals with challenges and difficulties of high consumption society. In modeling process modern instruments

of multiple econometric analysis have confirmed all the theoretical assumptions that authors have set up at the beginning. Namely, the paper provides the evidence of stronger relationship between household loans and retail trade turnover at lower standard of living. Moreover, in the case of rising indebtedness of population, Croatian citizens spend almost entire income on meeting the bare necessities of life.

Nondedicated household loans, loans for motor vehicles, credits on credit cards and other credits for finance final consumption enrich amount of 70% bank credits to Croatian citizens. This unfavorable credit structure encourages unproductive consumption and import goods and services for final consumption. Even more, Croatian banking sector nowadays is more then 90% owned by foreign banks. That's way household loans increase foreign debt and national balance instability. These flows have very negative influence on Croatian national economy in general.

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