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DETERMINANTS OF AGRO-FOOD PRICE DEVELOPMENTS IN SLOVENIA

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QUALITY and price are the critical determinants for consumers in making purchasing decisions. A firm that can provide an appropriate array of goods and services at a lower price than its competitors will have a competitive advantage that should result in an increase in business and enhance financial returns. This article focuses on the consumer food price developments during the Slovenian adjustments towards the European Union membership, and the Euro adoption by the followed increased in consumer prices, and the current economic and financial crises. The empirical analysis on the determinants of the consumer food prices is based on the monthly statistical data, which were obtained from the Statistical Office of the Republic of Slovenia. Agricultural producers' prices during the period examined have increased substantially less than the consumer agro-food prices. During the analyzed period, there has been substantial increase in the energy prices as well as in agricultural wages. By using the principal component analyses, the two common components are identified: 1) general level of prices and wages in agriculture, and 2) the input material prices, funds for agriculture, weather conditions, and output prices of crops in agriculture, but the mitigating role of the Euro adoption. The first common component explains 48.4% of the total variance of the analyzed variables. The second common component additionally explains 13.7% of the total variance. By using the multiple regression analysis we found that the consumer food prices are positively and significantly associated with the agricultural wages, with the agricultural producer prices, with the prices of municipal services, energy prices, and the prices of inputs for agriculture. We also found that the Euro adoption had only the short-term impact on the consumer food prices, but not on the medium-term. By using the linear trend analysis on the time-series data we confirm that during the time of the high food prices from April 2007 to May 2008, the consumer food prices were overshooting above its average level. The highest growth in the consumer food prices was in September 2007. The consumer food price increases were statistically significant between February 2008 and May 2008. During this period the average value of the consumer food price index was 100.45. The economic recession in Slovenia since October 2008 has caused the stabilization and later decline in the consumer food prices. This decline has been significant between February and May 2009. During this period the average value of the consumer food price index was 99.75. This result and the later developments imply that the economic recession has caused the significant decline in the consumer food prices since October 2008. The lowest level in the consumer food price index is recorded by June 2009. During the economic recession the level of productivity (output) and the demand for most goods and services, including the food industry, have declined.

Key Words: Agro-food Chain, Food Prices, Economic Recession, Euro, Slovenia.

Introduction

A key task for the economies that have joined the European Union (EU) (Blanchard, 1997) is a real convergence, the catching up with the per capita income levels of the older more developed members.

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Although some observers have stressed that this process would require extensive investment in physical and human capital (Blanchard, 1997 and Buiter, 2000), the economic growth literature suggests that these are not likely to be the decisive forces leading to the convergence. This literature, from Solow (Solow, 1957) to Prescott (Prescot, 1998) and Hall and Jones (Hall and Jones, 1999), stresses that economic growth as well as inter-country differences in per capita income are largely due to changes or differences in total factor productivity, while the accumulation of physical and human capital plays only a subsidiary role.

The changing conditions in the world economy have caused the ways', sources and participants in the changing global competition. We can talk about competitiveness of enterprises, institutions, branches, and countries. Svetlicic (1996) argues that is necessary to distinguish between competitiveness and competition. The first one is pre-condition for an efficient competition at the market. The competitiveness is not easy to define as it is a subject of different interpretations and misinterpretations. Although competitiveness is defined as an economic term, there are also other factors such as political, natural and cultural characteristics of countries that might cause competitiveness. Porter (1990) distinguishes two kinds of competitive advantages: first, cost, as an enterprise ability to produce and sell cheaper and more efficient than competitors, and second, which is based on product differentiation, as an enterprise ability to supply products of higher quality, specific characteristics, and selling services.

The entry of Slovenia into the EU has caused an additional competition and thus changed the competitiveness relationships between sellers of food. The competitive forces have created pressures for a decline of prices for food and non-alcoholic beverages (agro-food prices) depending on the initial market price levels (Bojnec, 2009). The initial market conditions varied between the new member states of the EU (Bojnec and Ferto, 2009). The increased competition in the food markets, due to the entry of new domestic retail chains as well as the entry of foreign retailers and supermarkets, can explain the increased number of low price agro-food suppliers and the changes in the levels and structures of food prices in the retail market outlets. The borderless trade on the single market, economic growth, Euro adoption and implementation of Common Agricultural Policy (CAP) are some of the important changes for the Slovenian agro-food chains. The transportation of food on long distances is causing high costs, which are not only direct transportation costs, but also indirect costs such as pollution of environment, deterioration of nutritional value of food and similar (Kovac, and Majkovic, 2009). The EU policies are focusing on farm diversification as well as on diversification of economic activities on agricultural areas and in households in rural areas. The farm entrepreneurship and entrepreneurship in agricultural areas and in rural development are seen as efficient tools for promotion of rural economy development and for its sustainable long-term development (Bojnec, 2009a). Slovenian agriculture is relatively less productive due to less favourable natural conditions for agricultural production, historical farm structures, less favourable demographic and educational structures of heads of agricultural households (Knific, 2008). Hocevar (2007) also mention the importance of storages of agro-food products on agro-food markets.

Price stability is one of the key objectives of the macroeconomic policy. Price indices give a weight to prices of goods and services depending on their economic importance (Samuelson and Nordhaus, 1995). Different theories of inflation have been developed in literature. Traditional explanation of inflation was that it is caused by pressures on demand side or pressures on cost side (Hrovatin, 2004). Both causes of inflation are simultaneous, and are merging through inflation expectations. Factors, which usually contribute to inflation (Špiljak, 2006), are increased demands (for example for agricultural produce), increased input costs (for example for means for plant protection), increased prices for non-tradable goods (for example electrical energy), and increased wages in tradable sectors. Gricar and Bojnec (2009) for the catering industry sector show that prices are positively associated with the Euro adoption in Slovenia. The catering industry prices are also positively associated with demands for tourist services, wages and input costs in the catering industry.

On supply side, the pressures for consumer price increases started in 2002 and in mid-2007 due to a considerable increase in oil prices and increases of basic raw materials as well as food at the world markets. This was transmitted into a rapid increase in domestic prices of food and liquid fuels (IMAD, 2008).

Surti (2008) aimed to explain the causes of inflation with the Euro adoption in Slovenia. The Euro adoption was on 1st January 2007. The impact of the Euro adoption to inflation was significant in the first quarter of 2007, but between the second quarter and 2008 by high prices of food. IMAD (2009) estimated that the Euro adoption had the short-term impact on price increases by 0.24 percentage point. Since the second half of 2008 inflation has started to slow-down due to price stabilisation for liquid fuel.

Kozamernik (2009) argues that a part of agro-food price increases in 2007 was transferred from the previous year during the adjustment to the Euro adoption. In general, agro-food price developments are determined by supply-side and demand-side factors. Since mid-2008 the rate of inflation in Slovenia has stabilized due to the liquid fuel price stabilization (IMAD, 2009).

Recent institutional and economic erosions and the rise in state control over energy resources and their use violate the principles of globalization (Novak, 2008 and Quirk, 2008). Financial and economic crisis since the third quarter of 2008 has caused the reduction of economic activity as well as the international economic flows. The decline of the economic activity in the Slovenian main trading partners such as in Germany, France and Italy has reduced the Slovenian exports as well as has had implications for demands for the Slovenian goods and services (Gricar and Bojnec 2009).

The aim of the paper is to investigate factors that are associated with the development of agro-food prices in Slovenia. The monthly data used are obtained from the Statistical Office of the Republic of Slovenia (SORS) for the period from January 2000 to June 2009. We aim to estimate how agro-food prices are associated with the costs of labour in agriculture, prices of energy, communal services and costs for purchases of inputs in agriculture (Blanchard, 1997). We expect that the changes in agro-food prices are positively associated with the Euro adoption during its initial stage of introduction and with producer prices of agricultural products. The economic losses due to an extreme weather conditions might have an additional impact on agro-food prices during the last decades (European Commission 2008). Due to this, we expect association of agro-food prices with the adverse weather conditions, which are measured by the quantity of rains in Slovenia.

Methodology and Data Used

In the empirical analysis we use the principal component method as one of the multivariate methods. We create two new synthetic variables R_k1, and R_k2 (Gricar, 2009) which are a linear combination of the original variables. In the principal component analysis, we use the following ten variables: index of gross wages in agriculture (IGWA), index of quantity of rains (rains), index of prices for food and non-alcoholic beverages (IFB), consumer price index (CPI), dummy variable for the Euro adoption (D1), dummy variable for the period after the Euro adoption (D2), index of communal services for water (ICS), index of input prices in agriculture (IIA), index of energy prices (IEP), and agricultural producers price index (APPI). The two dummy variables D1 and D2 are created arbitrary considering the previous analysis (Bojnec and Gricar, 2009; IMAD, 2008; SORS, 2009 and Surti, 2008). With principal component analysis we find two main principal components, which are used as the synthetic variables (Gricar, 2009).

We also employ multiple regression analysis. With the regression analysis we aim to find function y = f(x), which the best captures the mutual relationships between the analysed variables. We expect positive association between IFB, which is the dependent variable, and IGWA, Rains, CPI, ICS, IIA, IEP, APPI, D1 and D2, respectively, which are used as the explanatory variables in the linear regression equation:

$$IFB = a + b_1*ICS + b_2*IGWA + b_3*rains + b_4*IIA + b_5*APPI + b_6*IEP + b_7*D1 + b_8*D2.$$

With the regression analysis we investigate the intensity, direction and significance of the associations between the analysed variables. We aim to identify main determinants, which are associated with consumer agro-food prices focusing on the costs determinants of inflation and the Euro adoption in Slovenia (Bojnec and Gricar, (2009).

With the variance analysis we test hypothesis about equality of regression coefficients (H_o: $ß_1 = ß_2 = ...$

= $ß_k$ = 0) and with *t* test we test the association between the dependent and the individual explanatory variables (H_o: $ß_i$ = 0). Important is the statistical significance of the obtained empirical results. The acceptable statistical significance is less or equal 5% (a ? 0.05) that we can reject the null hypothesis and to accept the conclusion on the dependence of the dependent variable on the individual explanatory variables (Košmelj, 1987). For the multiple regression analysis it is important to estimate statistical significance of the regression coefficient ßi and the determination coefficient R^2 for the explanation of the regression by the specified explanatory variables. The $ß_i$ tells for how many units increases (or decreases) the dependent variables yi, if the value for the explanatory variable xi increases for one unit. R^2 tells the share of variance of the dependent variable, which is explained by the linear combination of the explanatory variables.

The price statistics monitor and collect prices in different stages of production or sale according to the methodological basis for monitoring and processing of price data18. The empirical regression results and results obtained by the principal component analysis are conducted on the data obtained from the SORS from January 2000 to June 2009. The variables are recalculated into the indices with the base period in January 2000 (January 2000=100).

We also use the trend analysis of time-series data for the investigated variable IFB and its developments over time. We aim to clarify the dynamics of the time-series data. With the regression analysis we estimate the trend equation. Time variable is transformed into the technical time, which the sum is equal to zero. The IFB is in current prices from the SORS data for the period from January 2000 to September 2009.

Empirical Results

Developments of Prices and Wages

The summary statistics of the main data used for the analysed variables are presented in Table 1. Between January 2000 and June 2009 the greatest cumulative increase is found for the index of energy prices by 96.5% and for the index of gross wages in agriculture by 80.6%. The lowest cumulative increase is found for agricultural producer prices by 25.4%.

Principal Component Analysis

With the principal component analysis we aim to find statistically significant the common principal components, which explain the greatest possible variance and thus distribution of the analysed variables. The scree plot (Figure 1) confirms the model with the three common factors. The KMO statistics 0.671, which is greater than 0.5, implies that the data is suitable for the principal component analysis. With the estimated communalities (Table 2) with the principle component analysis we find the highest weights of the explained variance of the common components for the CPI, IGWA, ICS, IIA, APPI, IEP and D2. With the principal component method, we identify two common components, which explain 62.1% of variance of the analysed variables (Table 3).

The first common component captures general price level and wages in agriculture. The second common component captures input prices for materials and means for agriculture, weather conditions, agricultural producer prices and a negative weight for the variable D2.

Table 1: Price Indices and Index of Wages, January 2000 = 100

Year/Month	CPI	IFB	ICS	APPI	IIA	IEP	IGWA
2000/January	100	100	100	100	100	100	100
2009/June	156.50	151.1	187.4	125.4	187.8	196.5	180.6

Source: SORS (2008)29 and Own Calculations.

Note: *CPI – consumer price index; IFB – index of consumer prices for food and non-alcoholic beverages; ICS – index of communal services – water; APPI – agricultural producers price index; IIA – index of input prices in agriculture; IEP – index of energy prices; IGWA – index of gross wages in agriculture.*

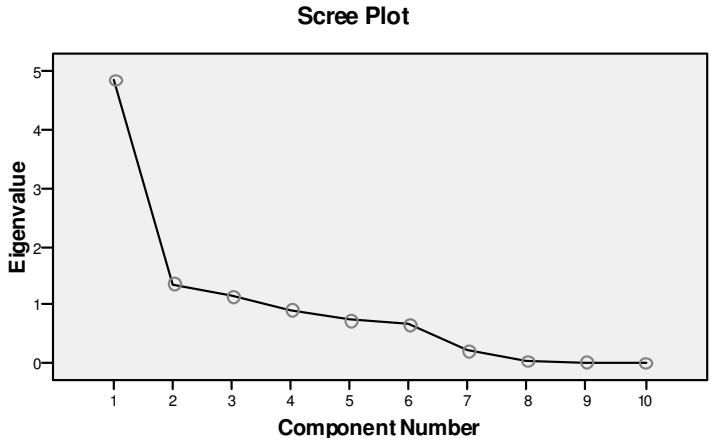

Figure 1: Scree Plot

Table 2: Estimated Communalities for Determinants of Consumer Agro–food Prices, Slovenia, 2000-2009 (monthly data), January 2000=100

Principal Component Analysis		
Variables	**Baseline**	**Extraction**
CPI	1.000	0.984
IFB	1.000	0.971
IGWA	1.000	0.932
IEP	1.000	0.904
ICS	1.000	0.791
IIA	1.000	0.641
APPI	1.000	0.590
Rains	1.000	0.542
D1	1.000	0.680
D2	1.000	0.324

Note: *CPI – consumer price index; IFB – index of consumer prices for food and non-alcoholic beverages; ICS – index of communal services – water; APPI – agricultural producers price index; IIA – index of input prices in agriculture; IEP – index of energy prices; IGWA – index of gross wages in agriculture; D1 – dummy variable for the Euro adoption (D1 = 1 between December 2006 and February 2007, and zero otherwise); D2 – dummy variable for the Euro price stabilization (D2 = 1 between March 2007 and December 2007, and zero otherwise); N=114.*

The robustness of the results is tested by different rotations. Although the total explained variance remained unchanged, the value of explained variance by the individual common component has changed (Gorsuch, 1974). The empirical results of the factor weights are presented in Table 4 for the principal component method. The estimated weights with the principal component method without and with rotations remained similar. This implies that the obtained results are rather stable.

Regression Analysis

With the multiple regression analysis we investigate the association between the dependent variable IFB and the explanatory variables IGWA, Rains, ICS, IIA, APPI, IEP, D1, and D2, respectively. It is assumed that the dependent variable IFB is normally distributed random variable (Romih and Bojnec, 2008). In Table 5, F-test is greater or at least equal from the theoretical value for F distribution m1=k and m2=n-k-1 at degree of freedom a=0.005. This implies that the results are suitable for a further regression analysis.

Table 3: Explanation of Total Variance

	Initial Values			Final Values			Final Values after Maximum Likelihood – Varimax with Kaiser Normalisation		
Components	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
1	4.840	48.400	48.400	4.840	48.400	48.400	4.709	47.900	47.900
2	1.369	13.685	62.085	1.369	13.685	62.085	1.419	14.185	62.085
3	1.151	11.508	73.593						
4	0.923	9.229	82.822						
5	0.741	7.407	90.229						
6	0.664	6.642	96.871						
7	0.220	2.197	99.068						
8	0.061	0.605	99.673						
9	0.030	0.296	99.696						
10	0.003	0.031	100.000						

Note: *Principal component method. (1) own value, (2) % of explained variance, and (3) cumulative share (%) of explained variance.*

Table 4: Component Matrices

Estimated Factor Weights of Variables for the Consumer Prices for Food and Non-alcoholic Beverages in Slovenia, January 2000 – June 2009 (monthly data)						
Principal Component Analysis						
	Without factor rotation		Maximum likelihood – Oblimin with Kaiser Normalisation		Maximum likelihood – Varimax with Kaiser Normalisation	
	Components		Components		Components	
Variables	1	2	1	2	1	2
CPI	0.988	-0.088	0.992	0.044	0.991	0.031
IFB	0.979	0.109	0.964	0.238	0.958	0.226
IGWA	0.964	-0.043	0.964	0.085	0.963	0.079
IEP	0.950	-0.027	0.949	0.099	0.947	0.087
ICS	0.837	-0.286	0.860	-0.172	0.865	-0.183
IIA	0.208	0.723	0.141	0.745	0.114	0.743
APPI	0.466	0.603	0.407	0.659	0.391	0.743
rains	-0.009	-0.406	0.028	-0.403	0.040	-0.404
D1	0.091	-0.002	0.091	0.011	0.091	0.051
D2	0.322	-0.462	0.141	-0.415	0.390	-0.420

Note: *CPI – consumer price index; IFB – index of consumer prices for food and non-alcoholic beverages; ICS – index of communal services – water; APPI – agricultural producers price index; IIA – index of input prices in agriculture; IEP – index of energy prices; IGWA – index of gross wages in agriculture; D1 – dummy variable for the Euro adoption (D1 = 1 between December 2006 and February 2007, and zero otherwise); D2 – dummy variable for the Euro price stabilization (D2 = 1 between March 2007 and December 2007, and zero otherwise); N=114.*

The regression model 1 in Table 5 explains 95.5% of variance of the IFB with the linear association with the ICS, IGWA, Rains, IIA, APPI, IEP, D1, and D2, respectively. The rains and D1 are not statistically significant. When we exclude them, the re-estimated model has not changed a lot (column 3 in Table 5). In this case, we can argue that the partial regression coefficients are significantly associated with the IFB. The regression equation gives associations for the IGWA, ICS, IIA, APPI, IEP, and D2, respectively, with the IFB (column 3):

IFB =-14.276+0.146*ICS+0.1*IGWA+0.033*IIA+0.625*APPI+0.21*IEP+2.366*D2.

The IFB is positively associated with each of the explanatory variables: ICS, IGWA, IIA, APPI, IEP, and D2. The regression parameter, which is pertained to the APPI indicates that an increase in agricultural producer prices (APPI) by one increases consumer food prices (IFB) by 0.63 ceteris paribus. The regression parameter for the D1 variable is significant in regression (2) in Table 5. This result implies that the IFB was significant with the Euro adoption only for the short period of the Euro adoption into the operation system, but not on the short- to medium-term (regression (1) in Table 5). This indicates that the Euro adoption has not caused the significant increase in consumer agro-food prices on the short-term. This is also confirmed by the regression coefficient pertaining to the D2 variable.

Table 5: Regression Functions for the Index of Consumer Prices for Food and Non-alcoholic Beverages

	IFB		
	(1)	(2)	(3)
Constant	-14.276 (-2.762)***	27.196 (5.614)***	-14.276 (-2.762)***
ICS	0.146 (8.283)***	0.225 (15.890)***	0.146 (8.283)***
IGWA	0.100 (2.568)***	0.103 (4.066)***	0.100 (2.568)***
Rains	-0.018 (0.961)	-0.007 (-0.297)	
IIA	0.033 (2.936)***	-0.002 (-0.088)	0.033 (2.936)***
APPI	0.625 (12.681)***	0.388 (10.021)***	0.625 (12.681)***
IEP	0.210 (7.111)***	0.037 (0.618)	0.210 (7.111)***
D1	-0.019 (-0.911)	3.055 (2.288)***	
D2	2.366 (2.061)***	9.328 (9.293)***	2.366 (2.061)***
N	114	96	114
R^2	0.955	0.958	0.955
F test	393.243	427.699	393.243

Note: *IFB – index of consumer prices for food and non-alcoholic beverages; ICS – index of communal services – water; APPI – agricultural producers price index; IIA – index of input prices in agriculture; IEP – index of energy prices; IGWA – index of gross wages in agriculture; D1 – dummy variable for the Euro adoption (D1 = 1 between December 2006 and February 2007, and zero otherwise); D2 – dummy variable for the Euro price stabilization (D2 = 1 between March 2007 and December 2007, and zero otherwise); R2 – adjusted determination coefficient; *** – statistical significant at 1%; ** –*

*statistically significant at 5%; * – statistically significant at 10%; a – excluded variables; t – statistics in the brackets. Headings of columns: (1), (3) – multiple regression functions January 2000 – June 2009, N=114; (2) – multiple regression functions January 2000 – December 2007, N=96.*

Our findings are consistent with some previous analysis. Kozamernik (2009) argues a neutral impact of the Euro adoption on prices in the medium-term. SORS (2008) and IMAD, and Bojnec and Gricar (2009a) show that the short-term catering industry price increase was associated with the roughling of prices by the Euro adoption in Slovenia. However, Gricar and Bojnec (2009) shows that the catering industry prices are associated with inputs costs of food and beverages, wages in the catering industry, demands for tourist services and the short-term roughling of prices with the Euro adoption. Gricar (2009) finds that the catering industry prices are also associated by inflation developments and not only by specific costs and demand factors.

Linear Trend Analysis for the IFB during the High Food Prices and the Economic-Financial Crisis

The linear trend analysis considers features of the technical time and the regression constant a, which is explained as the arithmetic mean of the variable in the analysed time period, while the regression coefficient ß indicates the average change of the explanatory variable on the time unit. The estimated regression parameters are obtained by the least square method (Bojnec and Gricar 2009a). We use data from the SORS for the period from January 2000 to September 2009 in the current prices.

With the linear trend analysis of time series data we find that during the period of high food prices the IFB was the most significant (at 1.6% significance level) between February and May 2008. The high correlation coefficient 0.97 implies strong positive association between the IFB and technical linear time. The regression equation presents the association between the IFB and technical linear time T for the period from February to May 2008: IFB=100.45+0.66T (Figure 2). This implies that the consumer agro-food prices increased on average by 0.66 percentage point per a month (see also Table 6).

Table 6: Linear Trend Analysis for the IFB

Dependent Variable IFB			
	February-May 2008	**February-May 2009**	**October 08-September 2009**
Constant	100.45 (20.401)***	99.75 (45.809)***	99.98 (26.587)***
T (time)	0.66 (7.778)***	0.260 (7.506)***	-0.146 (-1.885)**
R2	0.952	0.966	0.203
F test	60.500	56.333	3.552
D-W	2.62	2.23	2.95

Source: SORS (2008)29 and own calculations, linear trend monthly data, current prices, period at the January 2000 to September 2009; in the brackets are t statistics.

The similar analysis shows that during the economic-financial crisis in Slovenia the IFB was the most significant (at 1.7% significance level) between February and May 2009. The relatively high correlation coefficient 0.98 confirms strong positive association between the IFB and linear technical time during the economic-financial crisis. Since October 2008, the IFB in Slovenia has had the lowest value in June 2009. The regression equation presents the association between the IFB and technical linear time T for the period from February to May 2009: IFB=99.75+0.26T (Figure 3). This implies that the consumer agro-food prices increased on average by 0.26 percentage point per month. However, during the deepest economic-financial crisis between October 2008 and September 2009 the consumer agro-food prices declined by 0.146 percentage point per month: IFB=99.98-

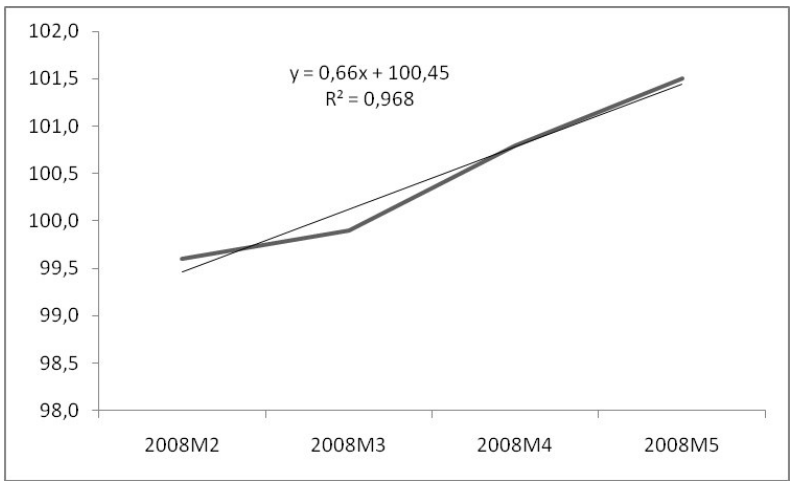

Figure 2: Development of Consumer Agro-food Prices During High Food Prices

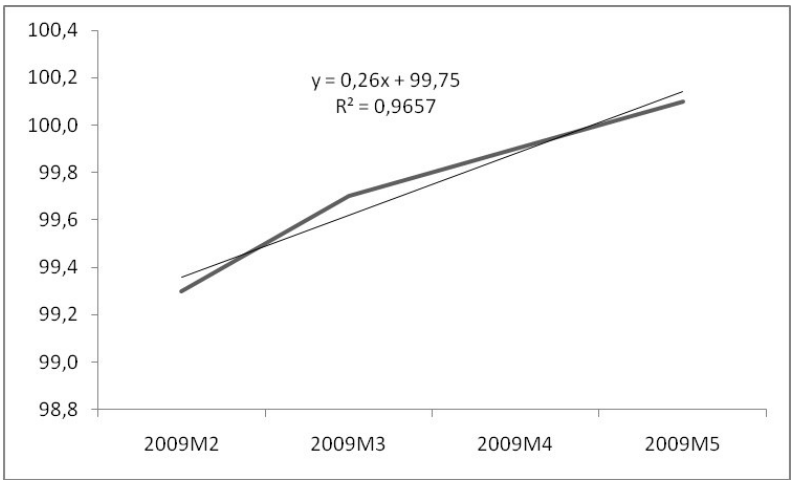

Figure 3: Development of Consumer Agro-food Prices During Economic Recession

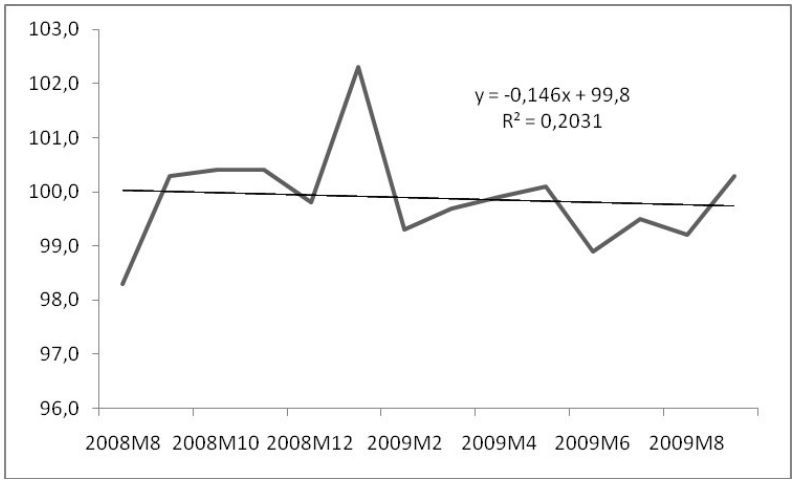

Figure 4: Development of Consumer Agro-food Prices During Economic Recession

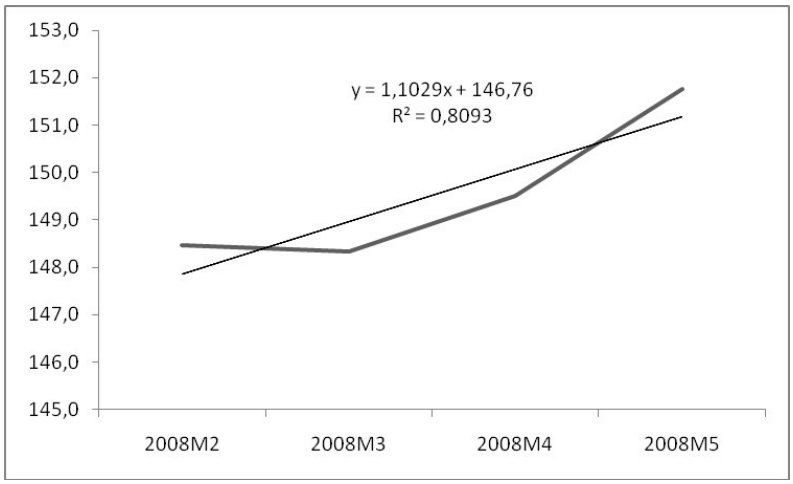

Figure 5: Growth of Consumer Agro-food Prices During High Food Prices

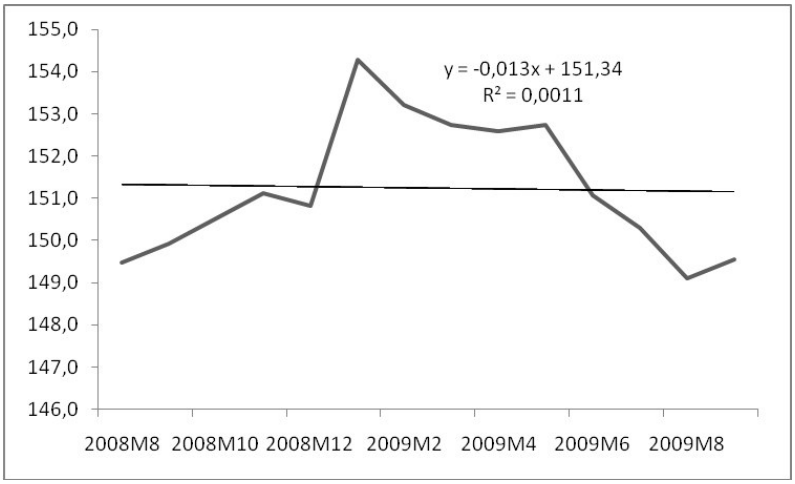

Figure 6: Growth of Consumer Agro-food Prices During Economic Recession

Conclusion

The consumer agro-food prices are analysed within theoretical framework and empirical approaches of determinants and causes of inflation, the Euro adoption, and economic-financial crisis in the Slovenian economy. The impact of the Euro adoption, except on the short-term, on consumer agro-food prices was modest. This is confirmed by the time series data analysis using the principal component analysis, the regression analysis, and the linear trend analysis. These approaches, particularly combining the principal component analysis and the regression analysis, have allowed that several determinants of the consumer agro-food prices are included in the analysis, which has been so far rare.

With the principal component method we identify two common components. The first one is pertained to general price level and wages in agriculture, and the second one to input prices for materials, adverse weather conditions for agriculture, and the Euro adverse.

With the multiple regression analysis we find association of consumer agro-food prices with costs for wages, energy, communal services and input prices for agriculture. As expected, the positive and significant association is revealed between consumer agro-food prices and agricultural producer prices. The Euro adoption is not found as a significant determinant for the consumer agro-food prices increases on the short-term.

The linear trend analysis confirms the significant association between the consumer agro-food prices and the linear technical time during the high food prices and the economic growth (positive association) on one hand, and during the economic-financial recession (negative association).

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