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MARKUPS IN THE BRANCHES OF THE POLISH FOOD SECTOR AS BUSINESS CYCLE PREDICTORS

MARŻE W BRANŻACH POLSKIEGO PRZEMYSŁU SPOŻYWCZEGO JAKO PREDYKTORY CYKLU KONIUNKTURALNEGO

Key words: food sector, monopolistic markups, business cycle indicators

Słowa kluczowe: przemysł spożywczy, marże monopolistyczne, wskaźniki koniunktury

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Abstract. The main objective of the paper was to check if and which monopolistic markups of 29 Polish food sector branches can be regarded as potential predictors of business cycle changes. Markups were measured based on a non-overhead labour input margin, whereas the business cycle was considered on the three levels of branch, sector and the whole economy, with following indicators: value of production for the first two, and GDP for the macro cycle. Research methods were panel regressions and cross-correlations. In the analysed period 2000-2013 markups were countercyclical regarding macro cycle and procyclical regarding sectorial and branch cycles. Changes in market structures of 10 Polish food sector branches could be used as predictors for the macro business cycle, and of 6 – for the sectorial business cycle.

Introduction

The Great Recession in world markets, which began in the US in December 2007 has been deemed as the longest recession since World War II [www.federalreservehistory.org/ Events/ DetailView/58]. Countries faced by the crisis launched fiscal stimulus programs with different combinations of government spending and tax cuts. The crisis progressed from banking system crises to sovereign debt crises, when countries elected to bailout their banking systems using taxpayer money. Consequently, global political instability was rising fast. The main problem economists are supposed to address now, apart from analyzing which remedies to choose and why, is to find reliable predictors of an impending crisis.

Arthur Burns and Wesley Mitchell [1946] defined a business cycle as a kind of overall fluctuations of a society activity. They repeat, but without regular intervals, as a length of one cycle is from 1 to 10-12 years. According to Robert Lucas [1995], business cycle fluctuations create the process of repeated, but irregular output oscillations around its long term development path. Consequently, classical and contemporary business cycles were distinguished. The first one shows $_{\text{the}}$ absolute value of economic activity measure, whereas the second – time series without a development path called a trend. Apart from cycles of levels and deviations, because of rare absolute decreases of economic activity indicators after the II World War, the third kind of cycle was enumerated, that is a growth rate cycle. There is also no consensus regarding measures of economic activity. According to Maria Drozdowicz-Bieć [2012] among the most popular ones are: real GDP, industry output value in real terms, real value of retail sales, employment outside agriculture, real wages. Although each business cycle is different from another, some similar paths of changing basic economic variables can be observed. In this context, procyclical (positive correlation with GDP), counteryclical (negative correlation with GDP) and acyclical (no correlation with GDP) variables can be distinguished.

One of the main methods of studying the business cycle, apart from economic tests, econometric methods, and balance and expert method, are barometers [Lubiński, 2004]. Economic barometers take advantage of data from many different sources. Theirs components are normally chosen in a way, that

they can represent different areas of the economy, what decreases the risk of misleading signals. First one was developed by Dorothy Thomas [1926], whereas A. Burns and W. Mitchell [1946] are responsible for distinguishing three different types of business cycle indicators: leading which measures future economic activity, parallel measuring a current level of economic activity, and the least frequency used delayed indicator which measures economic activity with some delay relative to a reference series, which most often is GDP. Geoffrey Moore and Julius Shiskin [1967] specified 6 characteristics of data acting as business cycle barometers: economic significance, statistical adequacy, regularity with respect to turning points, temporality, smoothness, regular and fast data accession.

The leading indicators appear to play the most important role. However, their weakness is that they lack a theoretical background, precisely – there are no causes to observe such plenty of data, and no conclusions regarding rules and causes of particular behavior of data series analyzed. Moreover: it's counterintuitive to assign equal weights to different barometer components, there is an information only about the direction, not the amplitude of fluctuations, it's unable to infer based on historical experience, they are not representative and don't comply formal and statistic requirements [Lubiński 2004]. Consequently, a single predictors of business cycle changes are constantly looked for. Single indicators are also preferable when studying interactions with other variables because of more transparency and simplicity in looking for relationships and mechanisms.

In such a framework, the main research question was if monopolistic markups in the Polish food sector branches can be regarded as potential predictors of business cycle changes. Markups, being a gap between a price and marginal costs, were chosen because one of the leading indicator for the Polish economy is a ratio of price to labor costs [www.biec.org/?display=faq], whereas one of methods of markups calculation implies that a markup can be estimated as an elasticity of output with respect to labor multiplied by inversed labor share. It should be added also that markups are measures of exerted market power, indicating changes in market structures [Kufel 2015]. The food sector was chosen as commonly, not only in Poland, the agro-food sector is regarded as one of the most regulated, traditional one, big and of the strategic importance regarding national food security. In Poland, the food sector is characterized by high shares in employment, exports and GDP. In 2012 17% of employed in the whole manufacturing industry worked in the food sector, a share in sales amounted to 21.4%, and a share in export – 13.1%.

In order to answer the research question, firstly the methodology will be described. In the preliminary analysis the production and markups in the Polish food sector branches in the period 2000-2013 will be briefly characterized and the character of the markups cyclicality will be uncovered.. While studying interactions, panel regressions and cross-correlations will be performed. Identification of food sector branches whose structural changes preceded changes in the business cycle should lead to better decisions regarding both stabilization and competition policies.

Research material and methodology

Markups were calculated with a method that uses a labor input margin to estimate marginal cost. Under assumption of a Cobb-Douglas production function and excluding overhead labor as not increasing with the number of working hours and therefore not influencing markups, we have [Nekarda, Ramey 2013]:

$$\mu = \frac{P}{MC} = \frac{P \cdot MPL}{W_A} = \frac{P \cdot \frac{Y}{hN - \overline{hN}}\alpha}{W_A} = \frac{\alpha}{s'}$$

where: P – price, MC – marginal cost, MPL – marginal productivity of labor, W_A – average wage, Y – production, h – hours per worker, N – number of workers, $\bar{h}\,\bar{N}$ – overhead hours, α – elasticity of output with respect to labor, s' – non-overhead labor share.

In order to depict the relationship between business cycle and markups, only natural logarithms of an inversed labor share were calculated, as the labor elasticity of production was assumed to

remain fixed over time. Firstly, the costs of wages and salaries were multiplied by the ratio of all costs minus costs of management and sales to the whole costs. Afterwards, a value of production was divided by such a cost of non-overhead labor.

Data used for markups measurement are annual covering the period 2000-2013 and regard to the answers of companies hiring above 9 workers put in the SP and Z-O6 forms delivered by the Central Statistical Office (CSO). Data were aggregated for the following 29 Polish food sector branches separated depending on the data availability on a four or three digit level of Polish Economic Activity Specifications (PKD 2007): Processing and preservation of meat, excluding poultry (1); Processing and preservation of poultry (2); Production of meat preserves, including products of poultry (3); Processing and preserving of fish, crustaceans and molluscs (4); Processing and preservation of potatoes (5); Production of fruit and vegetable juices (6); Other processing and preservation of fruits and vegetables (7); Oils and fats production (8); Milk processing and production of cheese (9); Ice cream production (10); Manufacture of grinding cereal products (11); Production of starch and starch products (12); Production of bakery products, fresh confectionary goods and cakes (13); Production of crackers and biscuits, preserved confectionary goods and cakes (14); Production of noodles, dumplings, couscous and similar floury products (15); Sugar production (16); Production of cocoa, chocolate and confectionery products (17); Processing of tea and coffee (18); Spices production (19); Production of homogenised groceries and dietary food (20); Production of other groceries not classified elsewhere (21); Production of ready feed for animals and domestic animals (22); Distilling, rectification and mixing of alcohols (23); Production of cider and other wines (24); Production of beer (25); Malt production (26); Production of non-alcoholic beverages, mineral waters and other bottled waters (27); Production of grape wines and other non-distilled fermented beverages, mineral water and other bottled waters (28); Production of tobacco (29).

A business cycle, after Michał Gradzewicz and Jan Hagemejer [2007] was considered on both sectorial and macroeconomic levels. Additionally, a branch level was incorporated. As a reference series on the macro level – real GDP, whereas on the sectorial and branch levels – real production value (prices from 2000) calculated with an inflation ratio, were chosen. Macro data come from the CSO statistics, while two other variables were calculated taking advantage of databases on Polish food sector branches delivered by CSO. Also data on the business cycle were on a yearly basis.

Regarding methods of studying interactions, panel regressions and cross-correlations were utilized. Trends were eliminated with the Hodrick-Prescott (HP) filter. The panel regressions were estimated with a generalized least squares method, but because a standard procedure didn't give satisfying results, as regardless a type of effects a constant appeared to be statistically not significant, a groupwise weighted least squares procedure was computed, in which weights based on per-unit error variances for the units in the sample are utilized. Both, the time and the branch effects were taken into consideration. Consequently, the analyzed equation was as follows:

$$\mu_{it} = \alpha_i + \alpha_t + \beta Y_{it} + \varepsilon_{it}$$

where μ is a natural logarithm of markup, Y_{it} is a natural logarithm of a business cycle indicator, α_i is a branch effect and α_t is a time effect. 29 branches in 14 years were analysed, what gave 406 observations.

The panel was balanced. Taking into considerations three levels of business cycle measurement, in 7 specifications the following business cycle levels were considered: branch (1); sectorial (2); macro (3); macro and sectorial (4); macro and branch (5); sectorial and branch (6); macro, sectorial and branch (7).

Research results

In the period analyzed, the production of majority of branches, especially because of entering the EU, improved. In 2013 the following three were extremely well: 9 (20.80 bln PLN in 2013), 1 (15.59 bln PLN), 3 (17.97 bln PLN). On the next places in 2013 found branches: 22 (11.67 bln PLN), 17 (8.12 bln PLN), 2 (8.06 bln PLN), what confirms Polish food industry newest areas of specializa-

tion. Interestingly, only in 2013 branch 3 outstripped the production value of branch 1. In fact, as its production from 2000 increased 2.37 times, it was one of the fastest growing branches. Moreover, high growths was noticed in branches 19 (3.81 times), 12 (3.26 times) and 4 (2.04 times). While the correlation of the whole Polish food sector production with real GDP in the period 2001-2013 (growth rates) amounted to 0.593, 12 branches were procyclical (2, 4, 7, 8, 9, 11, 13, 17, 18, 21, 22, 23), three – countercyclical (5, 24, 28), while the rest 14 branches – acyclical, being in the range <–0.25, 0.25>. Regarding markups, a coefficient of variation in the period analyzed was generally low, as its mean across branches amounted to 0.05. It was the highest in branch 16 (0.15). As the increases happened in the pre-accession period and while great recession effects were observable in Poland (2009), markups seem to behaved countercyclical in regards to the macro business cycle.

In order to evaluate markups cyclicality, panel regressions were utilized (Tab. 1). Estimations taking advantage of a weighted least square method without a constant gave significant coefficients. It turns out that markups in the Polish food sector branches seem to behave procyclical in regards to branch and sectorial cycles and countercyclical regarding the macro cycle, what is in accordance with the results obtained by M. Gradzewicz and J. Hagemejer [2007] for the Polish manufacturing industry and by Justyna Kufel [2014] for the EU members food sectors. Interestingly, markups are more connected with the sectorial than the branch cycle. The specification with business cycle expressed on three levels gained the highest R^2, which amounted to 0.375. A 1% increase of GDP was accompanied by a 1.234% decrease, a 1% increase of sectorial production – by a 0.681% increase, and a 1% increase of branch production – by a 0.282% increase of markups.

Table 1. Results of panel regression (coefficient, standard error)
Tabela 1. Wyniki regresji panelowych (współczynnik, błąd standardowy)

Cykl/ *Cycle*	Specyfikacje/*Specifications*						
	1	2	3	4	5	6	7
Branch/*Branżowy*	0.30*** 0.03	-	-	-	0.31*** 0.02	0.28*** 0.03	0.28*** 0.02
Sectorial/*Sektorowy*	-	0.68*** 0.10	-	0.95*** 0.10	-	0.39*** 0.10	0.68*** 0.09
Macro/*Makro*	-	-	-0.61*** 0.18	-1.22*** 0.17	-0.81*** 0.16	-	-1,23*** 0.16
R^2	0.25	0.10	0.03	0.20	0.30	0.27	0.38

*** indicates significance at 1% level/*wskazania na poziomie 1%*
Source: own elaboration based on the CSO data
Źródło: opracowanie własne na podstawie danych GUS

Looking for predictors, cross-correlations between markups and three levels of the business cycle were performed (Tab. 2), where the maximum of an absolute value of a correlation coefficient indicated a delay/lead of a business cycle indicator relative to markups, while a maximum number of lags/leads analyzed was 2 years. Regarding the macro business cycle, in the period 2000-2013 in 10 branches markups proceeded, in 9 – were delayed and in 9 changes were simultaneous. Regarding the sectorial business cycle, markups proceeded in 6 branches, were delayed in 13 and in 8 changes were simultaneous. Regarding branch business cycles, markups mostly changed simultaneously with the business cycle (17 branches), whereas they proceeded in 3, and were delayed in 7 branches. Taking into account up to 2-year delays, in the majority of branches markups were countercyclical regarding macro business cycle (24 branches), as well as procyclical regarding branch business cycle (20 branches). In case of sectorial business cycle, markups were half pro- and half countercyclical (12 against 15 branches). These justifies the results obtained with panel regressions.

Table 2. Results of cross-correlations
Tabela 2. Wyniki korelacji krzyżowych

Branch/ *Branża*	Correlations of markups with the cycle/*Korelacje marż z cyklem*					
	macro/*makro*		sectorial/*sektorowym*		branch/*branżowy*	
	years/*lata*	sign/*znak*	years/*lata*	sign/*znak*	years/*lata*	sign/*znak*
1	0	-	-2	+	+2	-
2	+2	-	0	+	acyclical/*acykliczne*	
3	0	-	+2	-	-1	+
4	+2	-	-1	+	+2	-
5	-2	-	-2	-	0	-
6	acyclical/*acykliczne*		+2	-	-1	-
7	+1	-	+1	+	+2	-
8	0	+	+2	+	+1	+
9	+2	-	0	+	0	+
10	0	-	acyclical/*acykliczne*		0	+
11	-2	-	-2	-	0	+
12	-2	-	-2	-	-1	-
13	+2	-	0	+	+2	-
14	-2	-	0	+	0	+
15	-1	-	+1	-	0	+
16	-1	-	+2	-	0	+
17	+2	-	0	+	0	+
18	0	-	+2	-	+1	+
19	-1	-	0	-	0	+
20	-1	-	+2	-	0	+
21	+2	-	0	+	+2	-
22	-1	-	+2	-	0	+
23	0	+	0	+	0	+
24	+2	-	+2	-	+2	+
25	0	+	+2	+	0	+
26	-1	-	+2	-	0	+
27	0	-	acyclical/*acykliczne*		0	+
28	0	-	+1	-	0	+
29	+2	+	-1	-	0	+
Sector/Sektor	2	-	0	+	no results/*brak danych*	

Notes: leads (+)/lags (-) with maximal absolute value of correlation coefficient/wyprzedzenia (+)/opóźnienia (-) o maksymalnej wartości absolutnej współczynnika korelacji
Source: own elaboration based on the CSO data
Źródło: opracowanie własne na podstawie danych GUS

Summary and conclusion

Markups in the Polish food sector branches appeared to be procyclical regarding the branch and sectorial business cycles and countercyclical regarding the macro business cycle. Taking into account the relationship between real GDP and markups, it may be concluded that markups in the Polish food sector, as well markups of some of its branches, could be utilised as leading indicators of business cycle in Poland, where a change in markups is a sign of an opposite change in real GDP. Ten branches with the highest correlation between markups and delayed business cycle: 20 (-0.581); 19 (-0.550); 15 (-0.539); 14 (-0.533); 12 (-0,522); 22 (-0.455); 16 (-0.446); 26 (-0.442); 11 (-0,379); 5 (-0,267). Regarding sectorial business cycle, markups in the 6 following branches may be treated

as potential leading indicators, where the sign of interaction differs among branches: 29 (-0.630); 5 (-0.576); 4 (0.548); 1 (0.475); 12 (0.448); 11 (0.436). Finally, only in two following branches markups were leading indicators for the branch business cycles – 3 (0.778) and 12 (-0.472).

To the main limitations of the study include the low frequency of data, as well as the short period of the analysis, so drawing long-term conclusions is rather limited. Future research areas should concern a further analysis of the indicated potential predictors taking advantage of characteristics of barometers specified by G. Moore and J. Shiskin [1967], and then looking for the mechanisms behind the proven interactions. Markups as potential predictors may prevent the downturns by influencing decisions from the areas of monetary and government policies. The attractive future research question is if influencing market structures through competition policy affects fluctuations in economic activity.

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Streszczenie

Głównym celem artykułu jest sprawdzenie, czy i które marże w 29 branżach polskiego przemysłu przetwórczego mogą być potencjalnymi predyktorami zmian koniunktury. Wybrano sposób liczenia marż bazujący na marżach pracy produkcyjnej, a cykl koniunkturalny rozważono na 3 poziomach – branży i sektora (wartość produkcji) oraz całej gospodarki (PKB). Metodami badawczymi były regresje panelowe i korelacje krzyżowe. W analizowanym okresie 2000-2013 marże zachowywały się antycyklicznie w odniesieniu do cyklu makroekonomicznego i procyklicznie w odniesieniu do cykli sektorowego i branżowego. Zmiany struktur rynkowych w 10 branżach polskiego przemysłu spożywczego mogłyby być predyktorami zmian cyklu ogólnogospodarczego, natomiast w 6 – cyklu sektorowego.

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