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## GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

# On sensitivity of industries and companies to the state of economy

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**Abstract:** Cyclicality in industries and companies is scrutinized in the paper. Cyclical industry/firm is that which parameters (in particular, value added by industry and economic value added) have high correlation with the parameter reflecting economic cycles (in particular, GNP). The theoretic approval for the thesis that *durable goods industries are more cyclical than nondurable ones* is already provided. The aim of the research is to conduct an empirical analysis of cyclicality of Canadian and Russian industries in terms of the aforementioned statement and cyclicality of Russian companies as components of industrial structure. According to the results, the extents of cyclicality of durable and nondurable goods industries in Canada are equal. The theoretical thesis under consideration is correct for the industrial structure of Russia: durable goods industries in Russia are more cyclical than nondurable ones. Moreover, Russian companies also comply with the aforementioned statement. In addition to this, the effect of asymmetrical reaction of industries and companies on expansion and contraction happening in the economy as well as a role of company's management in regulation of the extent of cyclicality of a company are considered in the paper.

**Subjects:** Macroeconomics; Industrial Economics; Econometrics

**Keywords:** cyclicality; cyclical industry; cyclical company

### 1. Introduction

A significant amount of theories pertain to the dynamics of economic cycles. However, not so much attention is put to similar tendencies in industries. If their cyclicality is mainly caused by the fluctuations of the economy, then they are called cyclical. According to the conventional view, durable

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### PUBLIC INTEREST STATEMENT

Cyclicality is not only a distinctive feature of an economy as a whole but also of a particular industries and companies. Despite the fact that cyclicality of a parameters characterizing industries can be caused by different reasons, those of industries which cyclicality comes from changes in the state of economy are called cyclical. Economic fluctuations influence an industry through changes in purchasing power of consumers in other words through changed in demand. As far as demand for durable goods is more elastic than for nondurable goods, the former are supposed to be more cyclical than the latter. As a result of the analysis, it is found that this thesis is appropriate for description of Russian industries and companies; however, durable and nondurable goods industries in Canada are equally sensitive to fluctuations in the economy.

goods industries are much more sensitive to business cycles, whereas nondurable goods industries seem to be more robust to boom-bust tendencies happening in the economy. The former is assumed to be caused by the cyclicity of the demand for durable goods. Petersen and Strongin (1996) mention various “accelerator” models of investment in this type of products; imperfections in financial markets force buyers of durable goods to rely heavily on internal finance, which is highly procyclical; intertemporal substitution among numerous explanations of higher elasticity of the demand for durable products comparing with nondurable ones. The above-named researchers demonstrated that industries producing the first type of goods in the US are three times more cyclical than industries producing the second type. We hypothesize that this principle is correct for the industrial structure in Canada as well. It is suggested by a well-known fact that Canadian economy is rather similar to the US one. Having investigated the industrial structure of Canada, we discovered that cyclicity of Canadian industries does not depend on the kind of goods they produce: durable or nondurable ones. Both of them are equally sensitive to swings in the economy. Another interesting idea is that industries and companies react differently on expansion and contraction tendencies. We also make an attempt to provide some insight into this phenomenon.

The structure of this paper is as follows: in Section 2, stylized facts of cyclicity in industries are presented and terminology is defined; in Section 3, methodology used in this study is described; data and results are discussed in Section 4; and concluding remarks are presented in Section 5.

## 2. Literature review. Stylized facts of cyclicity in industries

Dynamics of a majority of economic variables characterizing households, companies, industries and economies as a whole is generally acknowledged to be cyclical. Such patterns in an industry can be caused either by the industry itself or by fluctuations in the economy. Several vivid examples are to illustrate this statement.

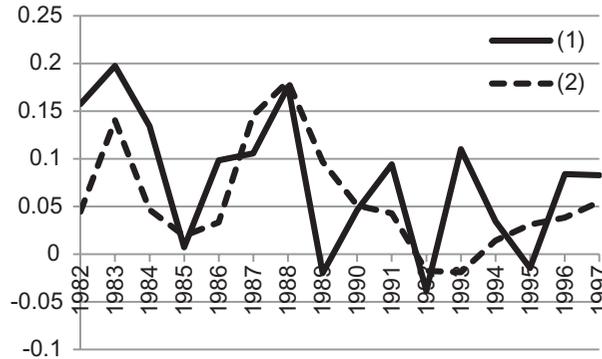
Luxury has always been a cyclical industry but the fluctuations in industry’s value added became even more intensive during the last years (Luxury Goods. Bling Back, 2010). In the early 2000s along with the economic downturn in America the growth rate of the industry lowered. It recovered only in 2004. As the financial crisis hit the economy the global luxury market shrank again by 8%. The luxury’s recovery began toward the end of 2009.

Another example is the US telecom industry. It used to be one of the most sustainable industries during the previous century experiencing growth even in the periods of the GDP decrease except three years of the Great Depression (Noam, 2006). The situation has changed in the 90s along with the growing popularity of mobile wireless access lines influencing negatively wireline ones. It is hypothesized in the article that cyclical fluctuations will probably become an inherent part of the industry. Noam attributes the volatile pattern to the nature of the industry which is characterized as being a network one (Metcalf’s law)<sup>1</sup>.

The luxury good’s cyclicity comes from the fluctuations in the economy whereas the telecom’s one is connected with its structure, thus, is caused by internal factors.

The authors of the (Petersen & Strongin, 1996) research (as well as the authors of the (Domowitz, Hubbard, & Petersen, 1988; Noam, 2006)) distinguish cyclical and noncyclical companies. A cyclical industry (company) is defined as this which state is strongly influenced by state of the economy, a stage of business cycle (Cyclical Company, n.d.). In this paper an industry/company is called *cyclical* if dynamics of parameter of an industry (company)<sup>2</sup> and dynamics of Gross National Product (GNP) are “in phase” (if it is assumed that the dynamics of parameters is cyclical). (An example is canned and preserved fruits and vegetables industry in Canada (Figure 1)) Consequently, the above-mentioned parameters have strong (positive) correlation. If dynamics of the aforementioned parameters are “out of phase”, an industry is called *countercyclical* (correlation is negative). If the parameters are not correlated (weakly correlated, correlation coefficient is not statistically significant) then an industry is assumed to be *noncyclical*.

**Figure 1. The dynamics of the growth rate of real VAD by Canned and preserved fruits and vegetables industry (1) and growth rate of real GNP (Canada) (2).**



### 3. Methodology

The thesis under consideration is the following: durable goods industries are more sensitive to business cycles than nondurable ones. We will analyze cyclicity of Canadian and Russian industries as well as Russian companies and check if the aforementioned thesis is correct in these three cases. This analysis might provide an opportunity to forecast the influence of the economy on company's state.

The analysis of cyclicity will include several steps. First, we will analyze the following regression

$$\Delta VAD_{it} = \alpha_i + \beta_i * \Delta GNP_t + \varepsilon_{it} \quad (1)$$

where  $\Delta VAD_{it}$  is a percent change in real value added by industry;  $\Delta GNP_t$  is real growth rate of GNP. If a  $\beta_i$ —coefficient is statistically significant and a sign of the coefficient is positive the industry is suggested to be cyclical.

*Does an industry react similarly on the expansion and recession tendencies in the economy?* Another form of the regression equation

$$\Delta VAD_{it} = \alpha_i + \beta_i(\Delta GNP_t - \overline{\Delta GNP}) + \gamma_i |\Delta GNP_t - \overline{\Delta GNP}| + \mu_{it} \quad (2)$$

( $\overline{\Delta GNP}$  is an average value of a percent change in real growth rate of GNP for the period chosen for the analysis) has been implemented in order to analyze this aspect.

Coefficient  $\gamma_i$  (if it is significantly different from zero) in Equation (2) characterize asymmetry of reaction of an industry on equal in absolute values positive and negative change in real growth rates of GNP.

We hypothesize that *reaction of an industry on expansion trends is stronger than on recession ones*. We naturally assume that during the period of economic prosperity growth rate of GNP becomes above the average value then in the period of economic slowdown growth rate of GNP turns to be below its average value (can be negative). Thus, the aforementioned hypothesis assume that in the periods of economic prosperity (if growth rate of GNP increase by  $n\%$ ) growth rates of value added by an industry increase stronger (in comparison with the average growth rate of value added by industry) than decrease (in the absolute value) (in comparison with the average value of the growth rate of value added) in the period of economic downturn (if growth rate of GNP decrease by  $n\%$ ).

In order to analyze cyclicity connected with company's structure of financial resources we will use  $\Delta EVA$  (economic value added) as a dependent variable in each of the regression equations.

$$EVA_{it} = NOPAT_{it} - (IC_{it} * WACC_{it}),$$

where  $NOPAT_{it}$ —net profit of a firm  $i$  adjusted for taxes paid for the period  $t$ ;  $WACC_{it}$ —weighted average cost of capital of a firm  $i$  calculated at the end of period  $t$ ;  $IC_{it}$ —invested capital in a firm  $i$  to the end of period  $t$  (Teplova, 2011).

We will estimate the regression equation in the following form:

$$\Delta EVA_{it} = \alpha_i + \beta_i \Delta GNP_t + \mu_{it} \tag{3}$$

where  $\Delta EVA_{it}$  is the real growth rate of economic value added by a firm  $i$  for the period  $t$  (Other notations are consistent with those made in the regression Equation (1)).

Because of the fact that EVA is usually estimated for a particular company (the data for Russian companies for the period 2004–2011 is used (International Laboratory in Economics of Intangible Assets “Scientific Fund NRU HSE”, Grant № 13-05-0021, n.a)) it seems reasonable to use SUR model to take into consideration correlation of stochastic components in regression equations for companies belonging to the same industry.

#### 4. Data and results

Having conducted the regression analysis for the industrial structure of Canada (Standard Industry Classification) for the period 1981–1997 (Statistics Canada. Table 301-0001 Manufacturing Activities, by Standard Industrial Classification, 1980 (SIC), 1981–1997) and the industrial structure of Russia (OKVED classification of industries<sup>3</sup>) (Federal Agency of State Statistics ROSSTAT, 2003–2013) for the period 2003–2013, we pick out cyclical industries according to the aforementioned criteria<sup>4</sup> (Tables 1 and 2).

Further the  $\beta$ -coefficients for durable and nondurable goods industries (that are cyclical) have been compared with the use of the mean comparison test (Tables 7 and 8 in the Appendix 1). It was found that

**Table 1. Cyclical industries in Canada, 8% level of significance**

| #  | Durability | Standard Industrial Classification, 1980 (SIC)                 | Beta  | t-st | Prob. |
|----|------------|--|-------|------|-------|
| 1  | 0          | Canned and preserved fruit and vegetable industry [1031]       | 0.651 | 2.29 | 0.038 |
| 2  | 0          | Other dairy products industries [1049]                         | 1.111 | 2.41 | 0.030 |
| 3  | 0          | Brewery products industry [1131]                               | 0.618 | 2.28 | 0.039 |
| 4  | 0          | Contract textile dyeing and finishing industry [1992]          | 1.542 | 2.46 | 0.027 |
| 5  | 0          | Women’s coat and jacket industry [2441]                        | 0.920 | 2.43 | 0.029 |
| 6  | 0          | Women’s dress industry [2443]                                  | 0.688 | 1.94 | 0.073 |
| 7  | 0          | Other clothing and apparel industries [2499]                   | 0.808 | 2.64 | 0.019 |
| 8  | 1          | Upholstered household furniture industry [2612]                | 1.035 | 1.91 | 0.077 |
| 9  | 0          | Business forms printing industry [2811]                        | 1.008 | 2.93 | 0.011 |
| 10 | 0          | Platemaking, typesetting and bindery industry [2821]           | 1.636 | 2.12 | 0.052 |
| 11 | 0          | Book publishing industry [2831]                                | 1.052 | 4.01 | 0.001 |
| 12 | 1          | Metal closure and container industry [3042]                    | 0.811 | 1.99 | 0.067 |
| 13 | 1          | Metal plumbing fixtures and fittings industry [3091]           | 2.077 | 2.47 | 0.027 |
| 14 | 1          | Electric lamp (bulb and tube) industry [3333]                  | 2.155 | 2.26 | 0.040 |
| 15 | 1          | Other communication and electronic equipment industries [3359] | 0.949 | 2.33 | 0.035 |
| 16 | 1          | Lime industry [3581]   | 0.890 | 2.69 | 0.017 |
| 17 | 1          | Non-metallic mineral insulating materials industry [3594]      | 1.118 | 1.97 | 0.069 |
| 18 | 0          | Paint and varnish industry [3751]                              | 1.255 | 2.48 | 0.026 |
| 19 | 1          | Broom, brush and mop industry [3991]                           | 1.070 | 2.26 | 0.040 |

**Table 2. Cyclical industries in Russia, 8% level of significance**

| #  | Durability | Industry, OKVED  | Beta   | t-st. | Prob. |
|----|------------|--|--------|-------|-------|
| 1  | 0          | Fishing and fish farming   | -0.512 | -3.48 | 0.008 |
| 2  | 1          | Coal, lignite and peat extraction  | 1.847  | 2.85  | 0.021 |
| 3  | 1          | Crude oil and natural gas extraction   | 0.937  | 2.41  | 0.043 |
| 4  | 1          | Metal ore extraction   | 1.081  | 2.73  | 0.026 |
| 5  | 1          | Other minerals' extraction   | 0.632  | 2.41  | 0.043 |
| 6  | 0          | Clothes manufacturing, fur manufacturing and dyeing  | 0.735  | 3.11  | 0.015 |
| 7  | 0          | Leather, leather products and shoes manufacturing  | 0.846  | 2.4   | 0.043 |
| 8  | 1          | Wood, wood products and cork manufacturing, except furniture   | 0.612  | 2.6   | 0.032 |
| 9  | 0          | Publishing industry  | 1.053  | 2.38  | 0.044 |
| 10 | 0          | Printing and other service   | 0.842  | 4.43  | 0.002 |
| 11 | 0          | Coke and petroleum products manufacturing  | 1.203  | 2.42  | 0.042 |
| 12 | 0          | Chemical manufacturing (excluding production of gunpowder and explosive substances) excluding pharmaceutical manufacturing   | 1.468  | 3.67  | 0.006 |
| 13 | 0          | Rubber and Plastic products manufacturing  | 0.725  | 2.77  | 0.024 |
| 14 | 1          | Manufacture of other nonmetallic mineral products  | 1.307  | 4.55  | 0.002 |
| 15 | 1          | Metallurgical industry   | 1.199  | 3.52  | 0.008 |
| 16 | 1          | Fabricated metal products manufacturing  | 0.783  | 5.63  | 0.000 |
| 17 | 1          | Machinery and equipment manufacturing (except weapons and ammunition)  | 0.843  | 4.71  | 0.002 |
| 18 | 1          | Manufacture of electrical machinery and equipment except isolated cables and wires   | 0.768  | 2.88  | 0.021 |
| 19 | 1          | Production of medical devices, including surgical equipment and orthopedic appliances; the production of instruments and tools for measurement, control, testing, navigation and other purposes; production of the instruments of control and regulation | 0.624  | 4.41  | 0.002 |
| 20 | 1          | Production of railroad rolling stock (locomotives, tram motor carriages and other rolling stock); manufacture of motorcycles and bicycles; manufacture of other transport equipment  | 1.264  | 3.04  | 0.016 |
| 21 | 1          | Construction industry  | 0.569  | 3.15  | 0.014 |
| 22 | 1          | Vehicles and motorcycles trade, their maintenance and repair (without motor fuel retail)   | 2.244  | 2.87  | 0.021 |
| 23 | 0          | Wholesale trade and trade with agent's mediation except Vehicles and motorcycles trade   | 0.646  | 2.55  | 0.034 |
| 24 | 0          | Retail trade, except vehicles and motorcycles trade; household furniture repair; retail sale of fuel   | 0.336  | 2.78  | 0.024 |
| 25 | 0          | Hotels and restaurants service   | 0.561  | 3.94  | 0.004 |
| 26 | 0          | Transport service (land transport)   | 0.362  | 2.6   | 0.031 |
| 27 | 0          | Production and distribution of films, radio and broadcasting business  | 0.522  | 2.76  | 0.025 |
| 28 | 0          | Other entertainment business, including news agencies etc  | 0.696  | 3.65  | 0.007 |

- (1) durable and nondurable goods industries in Canada are equally sensitive to business cycles (Average estimated value of coefficient  $\beta_1$ ,  $\hat{\beta}_1$  is equal to 1,1);
- (2) the estimate of the extent of cyclicity of durable goods industries in Russia is 1,5 times higher than that of nondurable goods industries (Average estimated value of coefficient  $\beta_1$ ,  $\hat{\beta}_1$ , for cyclical durable goods industries in Russia is equal to 1,05, for cyclical nondurable goods industries—0,677).

Similar analysis conducted for the US economy (Cyclical Company, n.d.) has established that durable goods industries are 3 times more cyclical than nondurable ones (Average estimated value of coefficient  $\beta_i$ ,  $\hat{\beta}_1$ , for cyclical durable goods industries in the US is equal to 2,953, for cyclical nondurable goods industries—1,108).

*Why do the results for Canada and the US differ despite the fact that their economies seem to be rather close to each other?* At least one reason for this phenomenon to appear can be identified. The research for the US covers the period 1958–1986 while the period of 1981–1997 is investigated for Canada. The point is that some durable goods industries could start producing goods that have shorter lifetime. Because of that durable goods industries could demonstrate lower sensitivity to business cycles so that it is almost equal to the extent of cyclicity of nondurable goods industries.

Another issue to be brought to the foreground is *negative beta-coefficients* that doesn't stay in line with a theoretical explanation of the existence of cyclical industries. The point is that if we change the criteria used to pick out cyclical industries in the way that the  $\beta$ -coefficients should be significant on the 10% level of significance then we will observe three industries in Canada (Metal dies, moulds and patterns industry, Other transportation equipment industries, Other chemical products industries) and one industry in Russia (Fishing and fish farming) that have negative  $\beta$ -coefficient. We singled out several explanations of this phenomenon.

Firstly, durable goods industries might have negative beta-coefficient because in case of economic slowdown people could be willing to buy them as an investment. So that industry value added could demonstrate countercyclical tendency having negative beta-coefficient.

Secondly, nondurable goods industries' parameters could also be countercyclical. This phenomenon could appear for low-quality goods (including Giffen goods) whose consumption usually increases when consumers' income tends to decline.

Thirdly, if the reaction of an industry on changes in the economy is lagging then an industry will also demonstrate countercyclical tendencies.

Fourthly, 10% level of significant implies the 10% probability of error of type I. The latter reflects the situation when the null hypothesis of beta coefficient being equal to zero is rejected but it shouldn't be. Thus for such cases of negative beta-coefficient above-mentioned case could take place with the 10% probability. In other words, these negative beta-coefficients could be stated as significant by mistake with the defined probability.

*Does an industry react similarly on the expansion and recession tendencies in the economy?* Another form of the regression equation

$$\Delta VAD_{it} = \alpha_i + \beta_i(\Delta GNP_t - \overline{\Delta GNP}) + \gamma_i |\Delta GNP_t - \overline{\Delta GNP}| + \mu_{it} \quad (2)$$

( $\overline{\Delta GNP}$  is an average value of a percent change in real growth rate of GNP for the period chosen for the analysis) has been implemented in order to analyze this aspect.

Coefficient  $\gamma_i$  (if it is significantly different from zero) in Equation (2) characterizes the asymmetry of reaction of an industry on equal in absolute values positive and negative change in real growth rates of GNP.

We hypothesize that *reaction of an industry on expansion trends is stronger than on recession ones*. We naturally assume that during the period of economic prosperity growth rate of GNP becomes above the average value then in the period of economic slowdown growth rate of GNP turns to be below its average value (can be negative). Thus, the aforementioned hypothesis assume that in the periods of economic prosperity (if growth rate of GNP increase by  $n\%$ ) growth rates of value added

by an industry increase stronger (in comparison with the average growth rate of value added by industry) than decrease (in the absolute value) (in comparison with the average value of the growth rate of value added) in the period of economic downturn (if growth rate of GNP decrease by  $n\%$ ). The estimates of the regression Equation (2) for several Canadian industries are represented in Table 3.

The analysis of the value of the dependent variable in response to changes in the value of independent variables (Table 4, Figure 2(a)–(d)) proposed three effects:

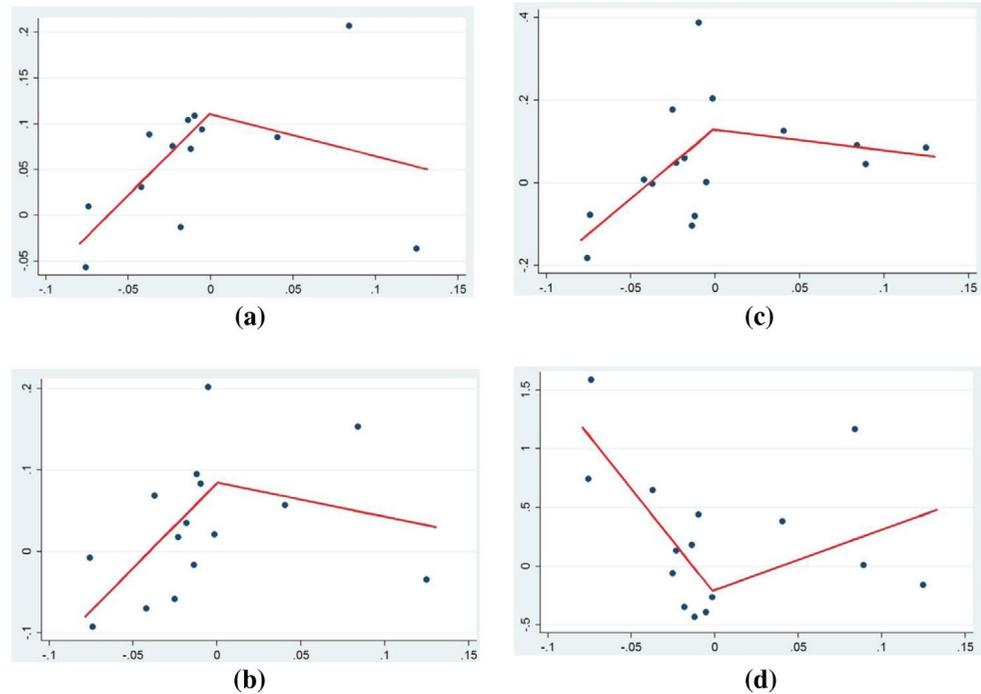
**Table 3. Cyclical industries in Canada (10% level of significance) (regression Equation (2))**

| No. |   | Durability | GNP    | t-st (GNP) | ABS_GNP | t-st (ABS_GNP) | Const. | t-st (const.) |
|-----|---|------------|--------|------------|---------|----------------|--------|---------------|
| 1   | Other food products industries (including malt and malt flour industry, SIC 1094 and 1099 combined) | 0          | 0.669  | 2.297      | -1.142  | -2.515         | 0.112  | 4.731         |
| 2   | Children's clothing industry [2451]   | 0          | 0.824  | 2.224      | -1.233  | -2.134         | 0.083  | 2.768         |
| 3   | Occupational clothing industry [2492]   | 0          | 1.434  | 2.240      | -1.983  | -1.986         | 0.133  | 2.552         |
| 4   | Wafer board industry [2593]   | 1          | -6.279 | -2.615     | 11.647  | 3.111          | -0.232 | -1.190        |

**Table 4. Forecasted values of  $\Delta VAD$  for industries mentioned in Table 3**

| $(\Delta GNP - \overline{\Delta GNP})$ | $\Delta VAD$ (1 industry, Other food products industries (including malt and malt flour industry)) | $\Delta VAD$ (2 industry, children's clothing industry) | $\Delta VAD$ (3 industry, occupational clothing industry) | $\Delta VAD$ (4 industry, wafer board industry) |
|--|--|---|---|---|
| 0.05                                   | 0.088  | 0.063   | 0.105   | 0.268   |
| 0.04                                   | 0.093  | 0.067   | 0.111   | 0.215   |
| 0.03                                   | 0.098  | 0.071   | 0.116   | 0.161   |
| 0.02                                   | 0.102  | 0.075   | 0.122   | 0.107   |
| 0.01                                   | 0.107  | 0.079   | 0.127   | 0.054   |
| 0                                      | 0.112  | 0.083   | 0.133   | 0   |
| -0.01                                  | 0.094  | 0.063   | 0.098   | 0.179   |
| -0.02                                  | 0.076  | 0.042   | 0.064   | 0.359   |
| -0.03                                  | 0.057  | 0.021   | 0.030   | 0.538   |
| -0.04                                  | 0.039  | 0.001   | -0.004  | 0.717   |
| -0.05                                  | 0.021  | -0.020  | -0.038  | 0.896   |
| -0.06                                  | 0.003  | -0.040  | -0.072  | 1.076   |
| -0.07                                  | -0.015   | -0.061  | -0.107  | 1.255   |

**Figure 2. Reaction of industries on change of  $\Delta GNP$  in comparison with its average value. Y-axis— $\Delta VAD_{it}$ , X-axis— $\Delta GNP_t - \overline{\Delta GNP}$  (a) 1 industry; (b) 2 industry; (c) 3 industry; (d) 4 industry.**



- economic prosperity influences an industry stronger than economic downturn ( $\Delta VAD$  is higher when  $\Delta GNP_t - \overline{\Delta GNP}$  increases by  $n\%$  than when  $\Delta GNP_t - \overline{\Delta GNP}$  decreases by  $n\%$ )<sup>5</sup>;
- the tendency of smoothing cyclicity (peaks as well as troughs) is also observed (when growth rate of GNP increases growth rate of value added by industry becomes lower than in the local maximum);
- growth rate of several industries approaches its highest values when growth rate of an economy is constant which means that GNP dynamics is not cyclical but linear and upward.

According to the results of similar analysis conducted for Russian industries, the aforementioned features characterize Russian industries as well as the Canadian ones. Thus, we can conclude that asymmetrical reaction of industries to expansion and recession tendencies is rather common (at least for Canadian and Russian industries); several industries grow at the fastest rates when GNP grows at the constant rate and is not characterized by cyclical patterns.

One can suggest to use  $(\Delta GNP_t - \overline{\Delta GNP})^2$  among regressors in Equation (2) instead of  $|\Delta GNP_t - \overline{\Delta GNP}|$  in order to account for the asymmetry of industry's reaction. It is worth noticing that in this case the estimates of coefficients do not change significantly in comparison with its values in the regression Equation (2).

We implied so far that a degree of cyclicity of an industry is an exogenous parameter. An industry is more or less sensitive to changes in the state of the economy because of peculiarities attributed to an industry and connected with its costs structure (the share of material expenses in total revenue (Petersen & Strongin, 1996)). At the same time, an industry/company can be characterized not only by its cost structure but also by its structure of financial resources.

In order to analyze cyclicity connected with company's structure of financial resources, we will use  $\Delta EVA$  (economic value added) as a dependent variable in each of the regression equations.

$$EVA_{it} = NOPAT_{it} - (IC_{it} * WACC_{it}),$$

where  $NOPAT_{it}$ —net profit of a firm  $i$  adjusted for taxes paid for the period  $t$ ;  $WACC_{it}$ —weighted average cost of capital of a firm  $i$  calculated at the end of period  $t$ ;  $IC_{it}$ —invested capital in a firm  $i$  to the end of period  $t$  (Teplova, 2011).

We will estimate the regression equation in the following form:

$$\Delta EVA_{it} = \alpha_i + \beta_i \Delta GNP_t + \mu_{it} \tag{3}$$

where  $\Delta EVA_{it}$  is the real growth rate of economic value added by a firm  $i$  for the period  $t$  (Other notations are consistent with those made in the regression Equation (1)).

Because of the fact that EVA is usually estimated for a particular company (the data for Russian companies for the period 2004–2011 is used (International Laboratory in Economics of Intangible Assets “Scientific Fund NRU HSE”, Grant № 13-05-0021, n.a)) it seems reasonable to use SUR model to take into consideration correlation of stochastic components in regression equations for companies belonging to the same industry.

The weighted average values of  $\hat{\beta}_1$  for durable and nondurable goods companies are presented in Table 5.<sup>6</sup>

It seems quite evident that durable goods companies in Russia are more cyclical than nondurable ones.

In order to check companies for different reaction on expansion and recession tendencies we will estimate the following regression equation:

$$\Delta EVA_{it} = \alpha_i + \beta_i (\Delta GNP_t - \overline{\Delta GNP}) + \gamma_i |\Delta GNP_t - \overline{\Delta GNP}| + \mu_{it} \tag{4}$$

Notations are consistent with those made in the regression Equations (2) and (3).

We found several companies that are cyclical one of which is Joint stock company Ryazan Plant of the Oil and Chemical Products. The results of the analysis of the reaction of  $\Delta EVA_{it}$  on changes in the values of  $(\Delta GNP_t - \overline{\Delta GNP})$  are presented in Table 6.

It is worth noticing that the values of growth rate of EVA turn from being positive to being negative at the same period as the growth rate of GNP does. This means that the dynamics of this parameters is in phase, thus, this company can be classified as cyclical. Moreover, the thesis about different reaction of industries and companies on expansion and recession trends in the economy is suggested to be correct. Probably, company’s management attempts to decrease the influence of economic downturn on the company and to expand during the period of economic prosperity.

One would assume to account for endogeneity in the regression Equation (1) modifying it in this way:

$$\Delta VAD_{it} = \alpha_i + \beta_i * (\Delta GNP_t - \Delta VAD_{it}) + \varepsilon_{it} \tag{5}$$

However the estimates of the coefficients, which are of the primary importance in our analysis of the extent of industries’ cyclicity, do not change significantly.

**Table 5. Average value of the beta-coefficient (regression Equation (3))**

|                            | Weighted average value of $\hat{\beta}_1$ |
|----------------------------|---|
| Durable goods companies    | 5.698                                     |
| Nondurable goods companies | 0.774                                     |

**Table 6. Reaction of joint stock company ryazan plant of the oil and chemical products on the change of values of independent variable**

| $(\Delta GNP - \overline{\Delta GNP})$ | $\Delta EVA$ |
|--|--------------|
| 0.05                                   | 3.318        |
| 0.04                                   | 2.654        |
| 0.03                                   | 1.991        |
| 0.02                                   | 1.327        |
| 0.01                                   | 0.664        |
| 0                                      | 0            |
| -0.01                                  | -0.034       |
| -0.02                                  | -0.068       |
| -0.03                                  | -0.102       |
| -0.04                                  | -0.135       |
| -0.05                                  | -0.169       |
| -0.06                                  | -0.203       |
| -0.07                                  | -0.237       |

### 5. Concluding remarks

It is necessary to take into account that the use of OKVED classifier for the analysis of cyclicity of durable and nondurable goods industries and companies in Russia can result in biased estimates. The point is that OKVED code is given according to the type of business activity that a company declares at the beginning of its operations and this code in many cases does not change over time but the type of business activity can change. Thus, we can consider a company producing durable goods but it changed its profile and actually is producing nondurable ones.

In addition to this estimates in the regression Equations (3) and (4) are biased<sup>7</sup> as far as there are omitted variables among which are refinancing rate and others.

The analysis of cyclicity (based on the use of the parameter of value added by industry) proposed several results:

- Durable goods industries and nondurable goods industries in Canada are equally sensitive to business cycle. The first type of industries in Russia is 1,5 times more cyclical than the second type of industries.
- Asymmetrical reaction on the expansion and recession tendencies in the economy is rather common for Canadian and Russian industries.
- Some industries grow at the highest rates when GNP growth at the constant rate.

The results of the analysis of cyclicity (based on the usage of the parameter of economic value added) are the following:

- The average estimated value of the degree of cyclicity is higher for durable goods companies in Russia than for nondurable ones.
- Company managers tend to eliminate cyclical sensitivity of a company.

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### Notes

- As far as quantity of factors (labor, capital) increase the output grows (proportionally to the elasticity of scale). The increase in usage of a product leads to the growth in the value of a good and the increase in demand. It results in the increase in sales and as a consequence increase in the real wages paid which stimulates workers and their productivity increases. However, since the market has saturated the demand decreases as long as consumers reassess the value of a product.
- Value added by industry (VAD) and Economic value added (EVA) are considered.
- Industries in Russia were divided by the authors into durable goods industries and nondurable goods industries according to the classification published by Statistics Canada. Industries which specialize on services were classified as nondurable goods industries because services are consumed instantaneously as far as they are produced.

- The data for GNP of Russia and Canada is collected with the use of (World Bank Group, 1981–1997).
- Industry 4 is countercyclical.
- Companies were divided into industries according to their OKVED.
- Moreover, the estimates are probably inconsistent.

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## Appendix 1.

Table 7. Mean-comparison test for the estimates of beta-coefficients for cyclical durable and cyclical nondurable goods industries in Canada

| Variable                 | Obs | Mean                     | Std.err. | Std.dev.              | [95% conf. interval] |       |
|--------------------------|-----|--------------------------|----------|-----------------------|----------------------|-------|
| Beta0 <sup>a</sup>       | 11  | 1.026                    | 0.104    | 0.343                 | 0.796                | 1.257 |
| Beta1 <sup>b</sup>       | 8   | 1.263                    | 0.189    | 0.536                 | 0.815                | 1.711 |
| Combined                 | 19  | 1.126                    | 0.100    | 0.438                 | 0.915                | 1.337 |
| Diff <sup>c</sup>        |     | -0.237                   | 0.201    |                       | -0.661               | 0.187 |
| H0: Diff = 0; t = -1.177 |     |                          |          |                       |                      |       |
| Ha: Diff < 0             |     | Ha: Diff! = 0            |          | Ha: Diff > 0          |                      |       |
| Prob. (T < t) = 0.128    |     | Prob ( T  >  t ) = 0.256 |          | Prob. (T > t) = 0.872 |                      |       |

<sup>a</sup>Beta0 is the coefficient in the regression for cyclical durable goods industries in Canada.

<sup>b</sup>Beta1 is the coefficient in the regression for cyclical nondurable goods industries in Canada.

<sup>c</sup>Diff = mean(Beta0) – mean(Beta1).

Table 8. Mean-comparison test for the estimates of beta-coefficients for cyclical durable and cyclical nondurable goods industries in Russia

| Variable                   | Obs | Mean                      | Std.err. | Std.dev. | [95% conf. interval]  |       |
|----------------------------|-----|---------------------------|----------|----------|-----------------------|-------|
| Beta0_R <sup>a</sup>       | 14  | 0.677                     | 0.123    | 0.461    | 0.411                 | 0.944 |
| Beta1_R <sup>b</sup>       | 14  | 1.051                     | 0.132    | 0.495    | 0.765                 | 1.336 |
| Diff_R <sup>c</sup>        | 14  | -0.373                    | 0.203    | 0.758    | -0.811                | 0.064 |
| H0: Diff_R = 0; t = -1.843 |     |                           |          |          |                       |       |
| Ha: Diff_R < 0             |     | Ha: Diff_R! = 0           |          |          | Ha: Diff_R > 0        |       |
| Prob. (T < t) = 0.044      |     | Prob. ( T  >  t ) = 0.088 |          |          | Prob. (T > t) = 0.956 |       |

<sup>a</sup>Beta0\_R is the coefficient in the regression for cyclical durable goods industries in Russia.

<sup>b</sup>Beta1\_R is the coefficient in the regression for cyclical nondurable goods industries in Russia.

<sup>c</sup>Diff\_R = mean(Beta0\_R) - mean(Beta1\_R).



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