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Global Challenges and Prospects of the Modern Economic Development

HUMAN CAPITAL AND RAF MATERIAL DEPENDENCE ELIMINATION

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Abstract

Much attention has been paid to the development of human capital and the passage of structural changes in the economy in current scientific publications. At the same time, there are few studies that quantitatively analyze the relationship between the accumulation of human capital in a country, the structural transformation of its economy, overcoming existing structural imbalances. The possession of large reserves of mineral resources is able to exert both positive and negative effects on the national economy, which largely depends on the size and quality of the country's human potential, the effectiveness of its use in practice. The paper studies structural dynamics of economies of two oil and gas extracting countries in the 2000s in the framework of a three-component model “primary-secondary-tertiary sectors”. This paper contributes to a rather limited strand of the literature investigating the link between human capital of a country and structural shifts. The aim is to justify the process of human capital accumulation as a leading factor in overcoming resource addiction. Data from the Russian Federal State Statistics Service and the Norwegian statistics bureau were used for developing a three-sector macroeconomic model similar to the Clark-Fisher model of economic structure. Cross-country comparison identified that intersectoral changes in Norwegian economy are superior in intensity and positive direction, notwithstanding that it still remains far more resource based than the Russian. The analysis pointed out inverse relationship between dynamics of primary and tertiary sector shares determining the process of intersectoral shifts.

Keywords: Dutch disease, human capital, intersectoral shifts, resource curse

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1. Introduction

Explanations concerning deviations from the post-industrial trend of sectoral development are often given in terms of Rybczynski's (1955) theorem, which states that there is a direct relation between the growth of production factors in one parts of an economy and depression or even recession in others due to limited resources. Bhagwati (1958) termed the case when positive results from production expansion and increase in exports in one sector or branch are less significant than negative consequences for the economy as a whole as "immiserizing growth". Description of a partial deindustrialization in the Netherlands coupled with the increase in natural gas extraction first made by Ellman (1981) and amended by other authors was afterwards referred to in the literature as "Dutch disease" (Kojo, 2015; Krasilshchikov, 2016; Palatnik et al., 2019). At the same time, many scientists (Perepelkin & Perepelkina, 2017) consider the "Dutch disease", which causes real exchange rate increase and makes "non-resource" sectors less competitive as a less widespread phenomenon in comparison with the resource curse. Along with the structural imbalance in form of deindustrialization, resource curse manifests itself in economic growth deceleration and its high instability that is determined by dependence on the conjuncture of prices on international raw material markets; in weaknesses of an institutional environment (government corruption in the environmental field in particular); in exaggerated attention to minerals extraction at the expense of other kinds of economic activity; in reduction of social liabilities by the government (Joya, 2016; Oreiro et al., 2020; Sadovskaya & Shmat, 2017). Thus, many countries need to develop and test a model for improving the structure of the national economy, allowing it to weaken its dependence on the export of raw materials. The role of the leading factor of structural development in the presented study is assigned to human capital as the main resource of the post-industrial economy.

2. Problem Statement

Structural shifts in the economy are an attribute of its development. However, their strength and speed of passage depend not only on economic factors. In particular, the presence of rich mineral deposits and significant human capital, which are not purely economic resources, has a strong structure-forming influence. Moreover, this influence is often multidirectional. On the one hand, excessive concentration on the exploitation of natural reserves of mineral raw materials can slow down economic development. On the other hand, the accumulation of human capital is usually accompanied by progressive changes in the economy. The contradiction arising in this connection is manifested in the competition for resources between the raw materials and knowledge-intensive sectors of the economy, which in some cases can have a negative impact not only on them, but also on the growth and development of the entire economy.

3. Research Questions

The problem of achieving harmonious structural development is multifaceted. It has both theoretical and practical components. Their study required the following research questions to be posed:

- to reveal the existing theoretical foundations of an econometric model describing the relationship between the abundance of natural resources and the accumulation of human capital in the process of structural development of the economy;

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- to assess what happened in the Russian economy in the 2000s shifts between the shares of the primary, secondary and tertiary sectors in gross value added. Compare them with similar data on the Norwegian economy;

- to substantiate the need for the state to conduct a selective structural policy aimed at the expanded reproduction of human capital;

- describe the parameters of the model of structural changes in the Russian and Norwegian economies, interpret the calculated data;

- to propose measures to overcome dependence on the export of raw materials by stimulating activities for the accumulation of human capital.

4. Purpose of the Study

In the modern theory of human capital, learning in practice, which occurs through observation, experimentation, concrete actions, mutual exchange of knowledge, as well as the study of new patterns of behavior, is considered as the main cause of progressive changes in the structure of the economy. Appearance of new sectors and disappearance of old ones is theoretically caused by innovations − production innovations in particular that are supported by the changing consumption structure due to real incomes growth stimulated by technological innovations. The driving force of an innovation-centric economy represents human capital. The relationship between its accumulation and long-term economic growth in countries with different levels of socio-economic development was the subject of the study. The purpose of the study was to substantiate the idea of the accumulation of human capital as a determining factor in overcoming resource dependence. This target setting assumes the disclosure of the content of human capital participation in the passage of structural changes in the context of its transformation into the main resource of economic development. This goal was realized within the framework of the post-industrial paradigm of the development of the economy and society, based on the priority in the production and consumption of services over material goods.

5. Research Methods

Sectoral division “primary-secondary-tertiary” allows for analyzing the structure of a country's economy consistent with the realities of an emerging postindustrial society. The Clark-Fisher model as an economic foundation of postindustrialism defined methodology of the conducted research on gross value added structure in Russia and Norway. Sector shares presented in Table 01 were calculated using gross value added in current prices. This became the methodological basis for grouping the initial data for subsequent research.

The study of the structural dynamics of the Russian and Norwegian economies in the XXI century was carried out using economic and mathematical methods. They included mathematical analysis of time series dynamics and correlation and regression analysis. Factor analysis was carried out both at the sector level and at the intra-sector level. In each sector, the most important economic activities introduced into the production functions of the Russian and Norwegian economies were identified. The obtained calculated data served as an empirical justification for the conclusion about the degree of influence of the accumulation of human capital on the ongoing structural transformation of the studied national economies.

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6. Findings

Table 1. Sectoral structure of gross value added in Russia and Norway, %

Years																			
2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Russia																			
Primary																			
13.05	13.68	12.95	12.88	15.12	16.11	15.44	14.46	13.74	13.21	13.46	13.42	13.14	12.89	13.13	14.21	14.15	14.82	16.97	16.40
Secondary																			
28.30	26.79	26.19	25.95	26.83	26.93	26.31	26.38	26.78	25.11	25.10	24.36	24.36	23.03	23.01	23.14	23.01	23.11	23.56	23.34
Tertiary																			
58.65	59.53	60.86	61.17	58.05	56.96	58.25	59.16	59.48	61.68	61.44	62.22	62.50	64.08	63.86	62.65	62.84	62.07	59.47	60.26
Norway																			
Primary																			
26.83	24.05	20.61	26.61	22.94	26.61	28.32	25.32	28.99	20.58	22.70	24.70	25.25	23.68	21.72	17.84	15.32	18.13	20.87	17.04
Secondary																			
15.78	17.30	17.84	16.26	16.65	16.26	17.06	17.32	16.95	16.39	15.98	16.12	15.59	15.16	15.53	16.37	17.26	16.78	16.58	17.10
Tertiary																			
57.39	58.65	61.55	57.13	60.41	57.13	54.62	57.36	54.06	63.03	61.32	59.18	59.16	61.16	62.75	65.79	67.42	65.09	62.55	65.86

Source: authors based on the Rosstat (2005a; 2005b; 2020), Statistics Norway (2020).

Average gross income of a Russian resident (22540 US Dollars) and of a Norwegian citizen (62510 US Dollars) is substantially higher than the global average income (16100 US Dollars) as of year 2016. However, as Table 1 suggests, tertiary sector shares in these countries are remarkably smaller than the world average level (69.05% in 2015). This can be mainly explained by a strong impact of raw materials extraction on the state (especially on exports) of national economies under study, which is reflected in the specificity of their structural dynamics. Furthermore, Russia preserves the Soviet tradition of underestimating importance of the service sector for general economic development. During the 2000s, primary sector share grew by 1.1 percentage points, tertiary sector share increased by 4.19 p.p., while the secondary sector share declined by 5.29 p.p. Under the circumstance when primary as well as service sectors' shares rise at expense of the generally uncompetitive on foreign markets secondary sector, the latter should be perceived as insufficiently mature, and the transition to tertiarization stage might be regarded as untimely. Mean share values in the Russian economy between 2000-2016 were as follows: 13.83% for primary, 25.38% for secondary, 60.79% for tertiary sector.

Changes in the sectoral structure of Norwegian economy were more pronounced. Shares of tertiary and secondary sectors in the gross value added rose by 10.03 p.p. and 1.48 p.p., respectively, whilst the primary sector share was reduced by 11.51 p.p. Tertiarization together with weakening of dependence on industries linked with mineral resources extraction was observed in the course of the studied period. Owing to this, the sectoral structure of Norway experienced an improvement over the 2000s compared to Russia: service sector share reached and subsequently surpassed the Russian level; a twofold gap in secondary sector value went down to one-third towards 2016; primary sector share was halved. Average values of sectoral shares in the Norwegian economy over the considered time period equaled: 23.65% for primary,

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16.46% for secondary, 59.89% for tertiary sector. Mean sectors' shares over 17 years in the economies of both countries display similarity in the case of tertiary sector but largely differ with regard to primary and secondary sectors.

The dynamic point of view presents another picture: discrepancies in tertiary sector shares between the countries gradually increased, attaining 4.58 percentage points in 2016, while disparity between the values of primary and secondary sector shares diminished (1.17 p.p. and 5.75 p.p., respectively). The substance of structural changes in these national economies should be evaluated separately: it was predominantly progressive in Norway, though Russia tended to increase the share of a sector involved in exploitation of natural resources, which is not common even for an industrial development stage. Special procedures of management of state incomes from oil exports in Russia and Norway are adjusting intersectoral shifts. Artificial reduction of aggregate demand by "sterilization" of excessive export revenue in stabilization funds is considered a proven method of preventing inflation and national economy's dependence on fluctuations of conjuncture in the international raw material markets. However, limitation of domestic investment and state expenditures in case of non-monetary nature of inflation may be less effective and cause stagnation in the secondary and tertiary sectors. If the structure of economic growth seems to be weak and of low quality, it might be more rational to use "petrodollars" accumulated in stabilization funds buying shares of promising high-tech national companies, which capitalization does not correlate with the carbohydrates prices dynamics, instead of purchasing highly reliable securities of foreign issuers. Finding and supporting the force that opposes continuing structural degradation, e.g. potentially competitive modern industries that are not technologically integrated into the complex of oil and gas production and exports, yet subsidized by its revenues in the medium term, is a task of utmost importance for the Russian and Norwegian economies. This being so, without improving the mechanisms of incomes distribution and capital mobility, rental payments and taxes related to natural resources will not have a sustainable, economically positive structural effect.

Standard deviation of primary sector shares in Russia being 3.8 times less than in Norway (0.97 against 3.64) during the considered time period acts as an evidence of Russian primary sectors' greater stability with respect to highly volatile prices on international oil and gas markets. The Russian tertiary sector also had smaller dispersion of its share in the economy (2.14 in contrast to 3.61, i.e., 1.7 times difference). The reverse situation could be observed with respect to the secondary sector: according to the standard deviation indicator, its share dynamics in Russia was less stable (1.66, as opposed to 0.74, i.e., 2.2 times difference). The obtained results allow to assume that in general intersectoral shifts in the Norwegian economy passed more intensively and were predominantly affecting primary and tertiary sectors. Secondary and tertiary sectors proved to be most structurally active in the Russian economy.

A quantitative assessment of sectoral shares changes in the economies permitted to identify two mathematically meaningful relationships. First of all, a strong inverse relation between primary and tertiary sectors was detected: the correlation coefficient of corresponding shares ($r_{I,III}$) amounted to −0.67 in the Russian economy and equaled −0.98 in the Norwegian one. Negative correlation implies that growing values of one indicator are associated with decrease in values of a related indicator on average. Therefore primary sector share growth is highly probably accompanied by tertiary sector share shrinkage and vice versa. This powerful correlation link suggests the relationship between the mentioned sectors to have a

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dominating influence on the economy's structural development. Secondly, the Russian economy displayed a strong inverse relation between the shares of secondary and tertiary sectors ($r_{II,III} = -0.90$), while such dependence was not observable in Norway ($r_{II,III} = -0.07$). Consequently, expansion of services may be viewed as a reason for deindustrialization in Russia, whereas the Norwegian economy exhibited no signs of industrialization inhibition due to tertiary sector share enlargement. Thirdly, correlation between primary and secondary sector shares was positive and weak ($r_{I,II} = 0.29$) in Russia, while being absent ($r_{I,II} = -0.14$) in Norway.

Mutual relationships between sector shares are expressed by means of the standardized multiple regression equation $\hat{y} = \hat{b}_{II}\hat{x}_{II} + \hat{b}_{III}\hat{x}_{III}$, where $\hat{y}$ is a standardized primary sector share, $\hat{b}_{II}$ and $\hat{b}_{III}$ are standardized regression coefficients for secondary and tertiary sectors, $\hat{x}_{II}$ and $\hat{x}_{III}$ are standardized variables reflecting the shares of respective sectors. For instance, the coefficient $\hat{b}_{III}$ in front of $\hat{x}_{III}$ shows an average change in primary sector share when the tertiary sector share alters by one standard deviation (δ_{III}) and the mean secondary sector share remains constant.

An equation for Russia has the following form: $\hat{y} = -1.71 \cdot \hat{x}_{II} - 2.22 \cdot \hat{x}_{III}$. Since $r_{I,III}$ is substantially greater than $r_{I,II}$ in absolute terms, the absolute standardized coefficient in front of $\hat{x}_{III}$ exceeds the absolute standardized coefficient of $\hat{x}_{II}$. The equation above suggests that increase in tertiary sector share by 1 standard deviation (δ_{III}) is likely to cause reduction of primary sector share by $2.22\,\delta_I$ on average (constancy of mean secondary sector share provided). In case of Norway, an equation takes the form: $\hat{y} = -0.20 \cdot \hat{x}_{II} - 0.99 \cdot \hat{x}_{III}$. Here linear correlation between primary and tertiary sectors is much stronger than between primary and secondary ones, so that an increase in tertiary sector share by 1 standard deviation would lead to an average decrease in primary sector share by $0.99\,\delta_I$ (while the secondary sector share would not change on average). A less pronounced reaction of the primary sector share on changes in tertiary sector share in the Norwegian economy could be explained by a larger share (as compared to the Russian economy) of primary sector, which reduces the value of coefficient $\hat{b}_{III}$. An impact of secondary sector share changes on the primary sector share is negligible.

Table 2. Structure of gross value added by kinds of economic activity in Russia and Norway, %

Years																		
2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Russia																			
Oil and gas extraction																			
4.05	4.23	4.92	5.24	7.69	9.37	9.45	8.56	7.58	7.09	7.73	7.87	8.02	8.05	7.91	8.39	8.04	9.25	13.21	12.55
Processing industries																			
18.8	17.1	17.2	16.3	17.4	18.3	17.9	17.6	17.5	14.8	14.8	13.40	13.63	12.96	13.33	13.77	13.72	13.64	14.51	14.60
Wholesale and retail trade; maintenance of vehicles, motorcycles, household appliances and articles of personal use																			

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22.9	21.7	22.9	22.1	20.3	19.5	20.3	20.2	20.3	17.9	20	17.43	16.79	16.19	16.21	16.41	15.99	14.11	13.79	13.74
Professional, scientific, technical activities and education																			
5.95	6.96	7.05	7.52	6.83	6.82	6.72	7.53	7.61	8.20	7.67	6.57	6.41	6.92	6.97	6.93	7.21	7.71	7.21	7.56
Norway																			
Oil and gas extraction																			
24.5	21.9	18.6	18.8	22.4	25	26.6	23.8	27.6	19.6	20.6	23.82	23.62	22.01	19.93	15.86	12.68	16.65	19.31	15.51
Processing industries																			
9.83	10.8	10.8	10.8	10.3	9.79	9.98	10.2	9.48	8.23	8.08	7.55	7.38	7.39	7.61	8.03	7.94	6.63	6.09	6.45
Wholesale and retail trade; maintenance of vehicles, motorcycles, household appliances and articles of personal use																			
8.87	8.93	9.13	8.85	8.51	8.14	7.98	8.88	7.72	7.8	7.84	7.33	7.3	7.05	7.45	7.73	7.86	7.93	7.67	7.95
Professional, scientific, technical activities and education																			
7.39	7.74	8.23	8.48	8.3	8.05	7.75	8.33	8.07	9.36	9.24	8.86	9.08	9.34	9.51	9.94	10.42	9.85	9.73	10.31

Source: authors based on the Rosstat (2005a; 2005b; 2020), Statistics Norway (2020).

The four kinds of economic activity presented in Table 02 are considered as determinants of structural shifts in gross value added on intra- and intersectoral levels. Oil and gas extraction is crucial for primary sector while processing industries form a basis of secondary sector dynamics, as the shares of both mentioned kinds of economic activity in gross value added of corresponding sectors surpass 50%. Wholesale and retail trade; maintenance of vehicles, motorcycles, household appliances and articles of personal use is a kind of economic activity having the largest share in the structure of Russian tertiary sector. On the other hand, the Norwegian tertiary sector is dominated by professional, scientific, technical activities and education, with generation and diffusion of human capital being the main objective of the latter in a postindustrial economy.

The analysis of shares of sectors and economic activity kinds in Table 01 and Table 02 allows to conclude:

– a threefold increase in oil and gas extraction share (from 4.05% to 12.55% or by 8.55 p.p.) was a driver of primary sector share growth (by 3.35 p.p.) in Russia. The reverse process of a reduction of this sector's share in the Norwegian economy (from 26.83% to 17.04% or by 9.79 p.p.) was caused by a decrease in oil and gas extraction share of about the same magnitude (from 24.5% to 15.51% or by 8.99 p.p.);

– contraction of the secondary sector share by 4.96 p.p. observed in Russia was a consequence of processing industries share dropping by 4.2 p.p. The latter share diminished in the Norwegian economy (by 3.38 p.p.) as well, however, the share of its secondary sector grew by 1.32 p.p. due to rapidly expanding construction (the share of construction increased by 2.72 p.p. thus equaling 6.64% in 2019). Summing up, the signs of deindustrialization were identified in both economies but in the Norwegian one they were less noticeable;

– the most evident structural shift in both economies was a shift in favor of tertiary sector. It appeared to have a larger magnitude in Norway because of an outstripping expansion of services that represent the basis of human capital reproduction. Growth rate of the Norwegian tertiary sector share reached 14.75% over 19 years, while the share of professional, scientific, technical activities and education attained a 39.51% rate. Considering the Russian economy, note that during this period the share of tertiary sector demonstrated a smaller growth rate of 2.74%, and share of the mentioned kind of economic activity exhibited a 27.05% rate;

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– movement of the share, which corresponds to traditional types of economic activity with a relatively low labor productivity (namely, wholesale and retail trade along with a number of related services), was characterized by negative values in both economies. This share grew smaller by 9.16 p.p. in Russia and by 0.92 p.p. in Norway, with the respective negative growth rates of 40% and 10.38%. Such progressive intrasectoral structural shifts are able to serve the further expansion of service sector in the future.

Correlation analysis of time series presented in Table 2 allowed to identify presence of a statistically significant link between the shares of primary sector and oil and gas extraction in the structure of a Russian gross value added (correlation coefficient $r_{I,1} = 0.59$). The regression equation of primary sector share on the share of oil and gas extraction in Russia takes the form: $y_I = a + bx_1 = 11.31 + 0.34x_1$. Significance of the equation is corroborated by the value of determination coefficient ($R^2 = 0.35$) and the Fisher's test statistic that equals 8.11, thus exceeding the critical value at the significance level $\alpha = 0.05$ ($F_{fact} > F_{table}$, $F_{table} = 4.54$). Statistical significance of regression coefficients follows from the exceedance of actual t-test values ($t_a = 12.52$; $t_b = 2.85$) of the critical value ($t_{table} = 2.13$) at the same significance level. According to the elasticity coefficient $\overline{Э}_{y_I x_1} = b\frac{\overline{x}_1}{\overline{y}_I} = 0.34\frac{7.31}{13.83} = 0.18$, the deviation of oil and gas extraction share from its mean by 1% would cause primary sector share to deviate from its average by about 0.18%.

Linear relationship between the secondary sector share and the share of processing industries in the structure of Russian gross value added was stronger than the one studied previously (correlation coefficient $r_{II,2} = 0.95 > 0.59$). Regression equation for the given relationship is as follows: $y_{II} = c + dx_2 = 13.29 + 0.77x_2$. The coefficient of determination $R^2 = 0.90$, the value of Fisher's test statistic $F_{fact} = 136.03$, t-test values for regression coefficients $t_c = 12.72$, $t_d = 11.66$ point to statistical significance of this equation and its coefficients. The elasticity coefficient $\overline{Э}_{y_{II} x_2} = d\frac{\overline{x}_2}{\overline{y}_{II}} = 0.77\frac{15.79}{25.39} = 0.48$ shows that processing industries share deviating from its mean by 1% causes secondary sector share to divert from its average by about 0.48%. These facts indicate that dynamics of value added creation in processing industries largely determines structural transformation of the secondary sector in Russia.

Factor analysis of tertiary sector share dynamics required evaluation of the two kinds of economic activity instead of a one. Wholesale and retail trade with some related services as well as professional, scientific, technical activities and education were considered as such. It was not possible to detect any connection between the tertiary sector share and the share of professional, scientific, technical activities and education in case of Russia. However, a rather strong negative correlation was observed between the series of tertiary sector share and the share of wholesale and retail trade $(r_{III,3} = -0.70)$. The corresponding regression equation $y_{III} = e + fx_3 = 72,62 - 0,62x_3$ is statistically significant at 5%

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level. A negative value of elasticity coefficient $\overline{Э}_{y_{III}x_3} = f\dfrac{\overline{x}_3}{\overline{y}_{III}} = -0.62\dfrac{19.24}{60.79} = -0.19$ means that deviation of the share of wholesale and retail trade (with related services) from average by 1% up may affect tertiary sector share such that it would deviate from its mean value downwards by approximately 0.19%.

Finally, the production function of a Russian economy can be described as follows:

$$Y_R = y_I + y_{II} + y_{III} = (a + bx_1) + (\mathrm{c} + dx_2) + (e + fx_3) =$$
$$= (11.31 + 0.34x_1) + (13.29 + 0.77x_2) + (72.62 - 0.62x_3) =$$
$$= 97.22 + 0.34x_1 + 0.77x_2 - 0.62x_3 .$$

Coefficients of the equation variables show a percentage point change in gross value added when the variable changes by 1 p.p. When a variable in the production function equation experiences a 1 p.p. change (provided all other variables remain constant), its coefficient shows a resulting percentage point change in gross value added. For example, an increase in oil and gas extraction share by one percentage point leads to the growth of gross value added by 0.34 p.p. on average. The magnitude of calculated coefficient values suggests that the Russian gross value added alters mostly in response to the dynamics of processing industries share. Correlation and regression analysis of relationships between sector shares and shares of selected economic activity kinds in gross value added was analogously applied with respect to the economy of Norway. Linear regression equations for sector shares in the structure of Norwegian gross value added are statistically significant at the $\alpha = 0.05$ level, as are their coefficients. The major detected difference in contrast to the Russian economy is presence of a connection between tertiary sector share and the share of professional, scientific, technical activities and education.

As a result, the production function of a Norwegian economy looks like this:

$$Y_N = y_I + y_{II} + y_{III} = (a' + b'x_1) + (\mathrm{c}' + d'x_2) + (e' + f'x_4) =$$
$$= (4.88 + 0.87x_1) + (13.21 + 0.36x_2) + (28.25 + 3.63x_4) =$$
$$= 46.34 + 0.87x_1 + 0.36x_2 + 3.63x_4 .$$

Taking into account coefficients in front of the three variables, results of professional, scientific, technical activities and education make the greatest contribution to the growth of gross value added. Impact of oil and gas extraction takes the second place, processing industries are following with an almost triple backlog.

Given a common raw material specialization of exports, the elasticity coefficient of primary sector share with respect to oil and gas extraction share has a far larger value in Norway (0.79) compared with Russia (0.18). High relative sensitivity towards oil and gas extraction coupled with decline in volumes of extraction, which took place during the period of study, adversely affected the value added dynamics of primary sector share in the Norwegian economy. Conversely, Russian volumes of oil and gas extraction moderately increased against the backdrop of greater oil prices volatility, which stabilized the dynamics of cost indicators of primary sector functioning. A gap in levels of socioeconomic development between countries became apparent primarily through the distinct strength of impact of professional, scientific,

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technical activities and education on the tertiary sector share in gross value added: linear correlation in the Norwegian economy was strong but in the Russian one turned out to be negligibly small.

Calculation results prove existence of a possibility of an economically effective substitution of raw material production by a technologically more advanced activity in the tertiary sector that encompasses creation of services with a substantial value added and a positive synergistic effect spilling over on other sectors. An example of Norway, where the abundant financing of science and education expands and intensifies the process of human capital reproduction, demonstrates a realistic approach towards a structurally better balanced economy, national producers of which are sufficiently competitive on the domestic market as well as on international markets of both raw materials and high-tech products. In order to give a justification for the statement above by means of correlation and regression analysis, let us assess an interconnection between human capital reproduction in the tertiary sector and dynamics of product creation in the primary sector. The economy of Norway is characterized by negative correlation ($r_{I,4} = -0,79$) between primary sector share and the share of professional, scientific, technical activities as well as education in gross value added. Thus, growing share of this aggregated kind of economic activity is often accompanied by the reduction in primary sector share. An obtained linear regression equation $y_I = g' + h' x_4 = 53.25 - 3.40 x_4$ is statistically significant at $\alpha = 0.05$ ($F_{fact} = 24.59$). This linear model explains the given data quite well, since $R^2 = 0.62$. Elasticity coefficient calculated as $\overline{Э}_{y_I x_4} = h \frac{\overline{x}_4}{\overline{y}_I} = -3.40 \frac{8.71}{23.65} = -1.25$ implies that deviation of the share of professional, scientific, technical activities and education by 1% up from its mean value causes decline in the average primary sector share by 1.25%. This relationship is not evident in the Russian economy ($r_{I,4} = -0.09$), as confirmed by insignificance of regression equation ($F_{fact} = 0.13 < F_{table} = 4.54$) and a low coefficient of determination. Therefore, while the economy of Norway has an ability to shrink the primary sector share significantly by intensified human capital reproduction in the tertiary sector, the described mechanism in the Russian economy does not allow to expect similar consequences from investment in professional, scientific, technical activities and education because the link is too weak.

7. Conclusion

Analysis of structural development of national economies with a similar exports specialization but different development levels showed presence of common problems and specificity of solutions to these problems. Correlation and regression analysis, together with development of linear models describing interrelations between sector shares in the Russian and Norwegian economies during the 2000s, confirmed presence of adverse consequences from raw material exports specialization. The strongest connection in the intersectoral structure of Russian and Norwegian economies proved to be an inverse relationship between the dynamics of primary and tertiary sector shares. The signs of structural changes leading to tertiarization and deindustrialization were discovered in both national economies. Owing to identification of economic activity kinds that determine dynamics of each sector's share in gross value added, we evaluated strength of their impact and obtained production function equations for Russia and Norway. This

allowed us to prove possibility of overcoming dependence on raw material exports by means of expanded production of services with a substantial value added that are able to exert a positive synergistic influence on the whole economy. Professional, scientific, technical activities and education can be regarded as the source of creation of such services, since this kind of economic activity contributes the most to the expanded reproduction of human capital.

A noticeable decrease in primary sector share due to intensified human capital reproduction in the tertiary sector that was achieved in Norway does not seem feasible in Russia without carrying out profound economic, structural and institutional reforms. Choice of measures of sectoral structure improvement should be based upon the knowledge that the Norwegian economy has to be cured of "Dutch disease" in the first place, while the Russian one – of "resource curse". Statistical data show that deindustrialization is a main indication of the "Dutch disease" in both economies: the share of processing industries in Norwegian gross value added contracted by 3.38 p.p. (from 9.83% in 2000 to 6.45% in 2019), whilst the Russian share decreased by 4.20 p.p. (from 18.8% to 14.6% over the same period of time). The year 2008 turned out to be critical for the share of processing industries: its fall gained momentum due to the world economic crisis accompanied by plummeting oil prices. At that time, the share of oil and gas extraction in the Norwegian economy shrank sharply (from 27.6% in 2008 to 15.51% in 2019, i.e. was reduced by 12.09 p.p.), while it went up in the Russian economy (from 7.58% in 2008 to 12.55% in 2019, i.e. grew by 4.97 p.p.). Similar external economic conditions affected the national economies under consideration in a different manner: substitution of a resource-intense activity by more technologically and ecologically progressive kinds of economic activity took place in the first one, while the other one continued to expand mining of oil and gas. Unequal participation of human capital in the functioning of the national economy (along with a negative "resource curse" effect, which is absent in Norway but present in Russia) should be attributed to reasons for the detected intercountry difference in occurrence of structural shifts.

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