International Journal of Sustainable Development and Planning
Vol. 17, No. 2, April, 2022, pp. 497-505
Journal homepage: http://iieta.org/journals/ijsdp

Assessing the Policy of Attracting Investments in the Main Sectors of the Economy in the Context of Introducing Aspects of Industry 4.0

Uliana Nikonenko[1*], Tetiana Shtets[2], Andrii Kalinin[3], Iryna Dorosh[4], Larysa Sokolik[5]

[1] Department of Financial and Economic Security, Accounting and Taxation, Ukrainian Academy of Printing, Lviv 79000, Ukraine
[2] Department of Finance and Accounting, Robert Elworthy Institute of Economics and Technology, Kropyvnytskyi 25000, Ukraine
[3] Department of Economics and Personnel Management, Central Ukrainian Institute of PJSC "Interregional Academy of Personnel Management", Kropyvnytskyi 03039, Ukraine
[4] Department of Administrative and Financial Management, Lviv Polytechnic National University, Lviv 79000, Ukraine
[5] Department of Public administration and regional studies, Odessa Polytechnic National University, Odessa 65044, Ukraine

Corresponding Author Email: nikonenko.uliana.uad@gmail.com

https://doi.org/10.18280/ijsdp.170214

Received: 29 January 2022
Accepted: 8 April 2022

Keywords:
economy, investments, sectors of the economy, assessing, industry 4.0

ABSTRACT

The purpose of this work is to study and evaluate the impact of world commodity prices on the dynamics of investment in exporting countries of natural resources using the developed methodology under the influence of industry 4.0 aspects. Modern economic activity is accompanied not only by the impact of COVID-19, but also by the impact of the first manifestations of industry 4.0. This applies not only to export-import operations but also to the very need for them due to the cost of new technologies. Using mathematical methods, we investigate the impact of world commodity price indices, in particular, the general commodity price index, the agricultural commodity price index, the food price index, the metal price index, and the crude oil price index, on the dynamics of investment in commodity-type economies in both dimensions – level and volatility. The innovativeness of the study lies in determining the significance of the impact of world commodity prices on the dynamics of foreign direct investment (FDI) of raw material exporting countries (on the example of three groups of countries with different levels of economic development). The proposed methodology makes it possible to empirically evaluate the mechanisms of the macroeconomic impact of commodity prices on investment dynamics.

1. INTRODUCTION

When we talk about industry 4.0, we forget that the industrial sector depends primarily on technologies related to the supply of raw materials and export-import operations. It is there that investments should be directed to bring it to a proper modern level.

The emergence of industry 4.0 is accompanied by the formation of a new era of the industrial sphere and the world order, characterized by the development of global industrial networks, as well as the implementation of the principles of intelligent production, the use of cyber-physical systems, and machine-machine interaction. Any technology innovation must be provided with appropriate resources. The key role in the industrial sector is played by primary and non-primary products, respectively. That is why today it is so active to invest in the primary and non-primary sectors of the economy with the aim of their active innovation and technological development and bringing them to a new level. In order to provide a new level of industry and ensure the safety of their operations in the new industrial era, the very policy of export and import of raw and non-commodity products should first be improved.

The mechanisms of a commodity boom, characterized by a significant increase in prices and an increase in earnings from the export of raw materials above some equilibrium trend, provide for changes in the structure of income and their intertemporal dynamics. First of all, we are talking about the redistribution of resources in favor of the commodity sector. At the same time, a decrease in aggregate investment can be expected from such accompanying phenomena as trade protectionism, macroeconomic instability, the spread of corruption, and the preference for short-term solutions in economic policy.

The mechanisms of the commodity boom anticipate changes in the structure of income. First of all, we are talking about the redistribution of resources in favor of the commodity sector. At the same time, a decrease in aggregate investment can be expected from such accompanying phenomena as trade protectionism, macroeconomic instability, the spread of corruption and the preference for short-term solutions in economic policy. At the same time, the case of Norway, Australia, Canada, New Zealand and, among low-income countries, Chile, demonstrates that the availability of raw materials in general and commodity booms in particular are not necessarily accompanied by a decrease in investment and a slowdown in economic growth if income from raw material exports are used for productive investment.

Most theoretical models suggest that the relationship between macroeconomic instability and investment depends not only on the marginal return on capital but also on the uncertainty factor. This dependence is not always unfavorable, but the probability of obtaining a negative effect increases in the case of "irreversible" investments in the development of natural resources, imperfect competition, and the absence of advantages from the scale of production. The absence of a negative impact of rising volatility on investment is seen as a sign of the effectiveness of such alternative mechanisms for influencing income as the efficiency of factors of production or technological progress.

The instability of prices for raw materials can be one of the instrumental factors not only in the investment process but also in private consumption. Transfers to the poorest segments of the population and increased government investment can be conducive to increasing employment in non-primary sectors, which prevents deindustrialization.

In the event of an unfavorable decline in commodity prices, which is predominantly the root cause of a cyclical downturn in production, better redistribution of income allows the phase of economic recovery to continue in time between two successive commodity booms. First of all, it concerns the countries of Latin America and Africa.

In our study, two dimensions of the commodity boom should be distinguished, namely: 1) the effect of an increase in the general price level and 2) the consequences of volatility in world commodity prices. As noted by Cavalcanti et al. [1], the negative effect of the instability of world prices for raw materials can prevail over the gain from the increase in price indices, and the negative impact of price instability is primarily due to a decrease in investment in physical capital. Accordingly, it is of practical interest to compare both effects - from changes in the general price level and their volatility. If the commodity boom is associated primarily with increased volatility in world prices for raw materials, which, in fact, becomes a source of macroeconomic shocks, these are more serious challenges for stabilization policy than in the case of "linear" price dynamics.

The structural aspects of the commodity boom are no less important than the impact on GDP and industrial production in the new conditions of development and the industrial revolution because investments determine the long-term dynamics of income and the path to new progress. Moreover, there is no evidence in the economic literature that there are any significant differences in this aspect between high- and low-income resource-based economies. Another thing is private consumption, which usually affects economic growth through the mechanisms of income redistribution through the state budget and intertemporal smoothing of private household expenditures.

One explanation for the lack of effectiveness of foreign direct investment (FDI) as a means of increasing GDP and non-commodity exports may be the attraction of FDI in economies with weak institutional frameworks. For example, the orientation of FDI towards the development of industry can be expected in economies with a developed financial market. This facilitates financing and other aspects of the functioning of enterprises, but in most commodity-exporting countries, banks are relatively small and have fewer contacts with private business. Since financial market maturity implies openness to capital flows, this can be accompanied by excessive exchange rate volatility in case of insufficient price and wage flexibility. For its part, such instability leads to a slowdown in GDP growth, which on the surface looks like a consequence of attracting FDI.

Another problem is the neglect of balance of payments constraints, which can also be caused by FDI inflows. Turkey sample 2002-2008 was an example of successfully attracting FDI as a means of consolidating financial stabilization and diversifying exports, but later proved to be a limitation of the balance of payments. Over time, a significant negative current account balance appeared, which was not given due attention. Obviously, the reason for Turkey's increased vulnerability to crisis phenomena, despite the high rate of economic growth, was the inability to implement the countercyclical restriction of aggregate demand with the help of fiscal and monetary policy instruments.

For reasons of stabilization policy, the situation is simpler when the influence of price dynamics and price index volatility coincide. In this case, for example, the natural response to a price boom is to improve the budget balance and limit the money supply as a means of preventing inflationary "overheating" of the economy. It is more difficult to imagine the stabilization policy tools if the impact of the price index and its volatility is asymmetric. In principle, the effects of both components of price dynamics can cancel each other out, but in fact, it is more realistic to assume that individual components of income will react differently to a commodity boom.

If we assume an asymmetric effect of the components of the price boom in commodity markets on individual components of income, it becomes possible to rationally explain such, at first glance, phenomena, when at the height of high prices for raw materials there is no expected increase in investment, as was noted for the metallurgy of 2003-2008 as a sample. This situation can be easily explained by the negative impact of the volatility of world metal prices, which is observed against the backdrop of an upward trend in the price index. In this interpretation, the paradoxical lack of investment is the result of a negative reaction to volatility and lays the groundwork for the future stagnation of one or another commodity sector. All this only stops the possibility of reaching a new level in the industrial sector and the development of industry 4.0.

The assessment of the significance of the impact of world commodity prices on the dynamics of FDI is based on the use of statistical data of a wide time range.

To study the influence of volatility and the level of world prices for raw materials, a two-step least squares method was used, improved in this paper, which allows simultaneously determining the impact of these two parameters on FDI dynamics, which can be considered an innovation in this study.

The purpose of this work is to study and evaluate the impact of world commodity prices on the dynamics of investment in exporting countries of natural resources using the developed methodology under the influence of industry 4.0 aspects.

2. LITERATURE REVIEW

As Hegerty notes [2], the first decade of the new century was reflected in the significant instability of world prices for raw materials, and most of all on the eve of and after the global financial crisis of 2008-2009, which led to an increase in the instability of the stock market, many "emerging" markets were reflected in high volatility of the movement of capital and all this at the end of the third industrial revolution.

In general, the greater instability of capital flows for

developing countries (by 80% on average) is explained by three characteristics: 1) increased vulnerability of investors to "crisis" information; 2) the "contagion" effect when events in one country cause capital outflows in neighboring countries and, most importantly, 3) the duration of shocks to the financial account of the balance of payments, which are much higher than the corresponding indicator for industrial countries [3-5]. Such differences between the two groups of countries cannot be explained by weaker macroeconomic "underpinnings" like budget balances, but rather by other factors: underdevelopment of financial markets, weak institutions, low per capita income.

According to Carrière-Swallow and Cespedes [6], based on data from 20 industrial and 20 developing countries, there are significant differences between countries regarding the response to the uncertainty of financial markets. Compared with the United States and other industrialized countries, in developing countries, the immediate response to the uncertainty of capital flows is a decrease in investment and private consumption, while in favorable periods there is a "jump" of both indicators towards overestimation. The dynamics of investment and consumption correlate with the depth of financial markets, and the negative impact of uncertainty may be weakened by fiscal discipline and prudent monetary policy.

Fiscal discipline, through the stabilization of budget revenues, allows smoothing of private consumption after the end of the commodity boom [7]. To this end, it is important to strengthen control over the use of export proceeds from raw materials and to avoid cost increases when commodity prices are high. Finally, fiscal policy must create incentives for economic diversification. Both directions - diversification and industrialization - are considered by experts as a reliable way to reduce vulnerability to the instability of world prices for raw materials.

Charnavoki and Dolado [8] explain the instability of world prices for raw materials mainly by the effect of global shocks from aggregate demand and global shocks in commodity markets, while aggregate supply shocks in non-commodity markets have a relatively subordinate significance. From other results, it is obtained that: a) the balance of exports and imports of countries exporting raw materials is predominantly positively correlated with an improvement in the terms of trade; b) RER depends on raw material prices; c) improvement in TOT is accompanied by an increase in private consumption, investment and government spending, d) the phenomenon of "Dutch disease" affects the loss of price competitiveness and a decrease in output in the non-primary export sector.

Houseman et al. [9] showed that RER instability is three times higher in developing countries than in industrial countries. At the same time, we are talking not only about countries exporting raw materials but also about low-income countries in general. Bodart et al. [10] is based on data from 68 countries for the period 1988-2008. obtained that RER significantly depends on commodity prices if their share in exports exceeds 20%. Later study for 33 small developing countries over the period 1980-2012. found that the long-term correlation between RER and world commodity prices depends on the exchange rate system and openness to foreign trade and capital flows, while the nomenclature of commodity exports does not.

It should be noted that the dependence of RER on the terms of trade remains significant even for the G7 countries. For example, for Canada, it was found that the dependence of RER on the terms of trade is more significant than on monetary factors [11-13]. For the United States, it was found that commodity price shocks are the second most important factor of macroeconomic instability after technological shocks, primarily in terms of the impact on inflation. A recent study found that RER was dependent on commodity prices for the UK, Germany, and Japan, and these countries can already be said to have moved to a new level of the industry.

Using annual data for 1970-2007, Cavalcanti et al. [1] found that the negative effect of the instability of world prices for raw materials prevails the gain from the commodity boom; at the same time, the diversification of commodity-exporting countries is favorable for economic growth. Accordingly, it was concluded that, in fact, it is not raw materials, but the instability of their prices that creates the phenomenon of the "raw material curse" (the negative impact of price instability is primarily due to a decrease in investment in physical capital).

Not surprisingly, the commodity price volatility of the past decade's pattern has drawn additional attention to the implications of TOT's volatility. In particular, in the post-crisis 2010-2011. (the period of the third industrial revolution) research focuses on assessing the nature of price changes - permanent or temporary, as well as the impact on RER and international competitiveness. Like other aspects of the impact of commodity market instability, there is a dependence of macroeconomic effects on institutional factors. Using data from 158 countries over the period 1970–2007, Arezki and Gylfason [14] found that commodity price volatility contributes to the growth of the non-commodity sector in democratic countries, but this effect does not exist in countries with autocratic rule. The explanation is that in democracies, commodity price volatility leads to increased savings, while the opposite occurs in autocratic countries.

The conducted analysis of the literature does not give positive conclusions, but it gives a positive effect of the fact that the topic is quite relevant for the study. In this section, we conducted a detailed analysis of the literature in order to establish how relevant the topic is in the scientific community. A review of the literature was necessary to review the current state of research on the problem. As for the review of our vision of the problem, it will be presented in the following parts of the study.

At the same time, in theoretical and applied studies of the impact of world commodity prices on the dynamics of investments in commodity-based economies, there is a lack of methodology for economic and statistical analysis of the functional dependencies of a commodity-based economy, which implies simultaneous consideration of the dynamics of world commodity prices and their volatility and makes it possible to empirically evaluate the mechanisms macroeconomic impact. on the dynamics of investment in the context of the emergence of industry 4.0.

3. METHODOLOGY

To assess the impact of world commodity prices on the investments of individual countries, the following statistical model was used (1):

$$\Delta \ln INV_t = \alpha_0 + \sum_{i=1}^{n} \alpha_i \Delta \ln INV_{t-i} + \beta_1 \ln P_t + \beta_2 pvar_t + \gamma_1 \Delta \ln RER_{t-1} + \varepsilon_t, \qquad (1)$$

where, INV_t is an investment (index, 2010=100), P_t is one of

the world commodity price indices (index, 2005=100), $pvar_t$ is the conditional variance of the selected world commodity price index, RER_{t-1} is the exchange rate, α_0 is a constant, α_i is the lag of the selected macroeconomic indicator with the i-th lag, β_1 is the assessment of the impact of the commodity price index, β_2 is the assessment of the impact of volatility (instability) of the commodity price index, γ_1 is the assessment of the exchange rate impact, ε_t is the stochastic factor.

It is assumed that the first differences in the logarithms of the investment index depend on their own lag values, the values of one of the world price indices for raw materials and its volatility, and the exchange rate (1). Although the use of the terms of trade indicator (TOT - "term of trade") prevails in empirical studies, the use of commodity indices has significant advantages, because there is no vulnerability to various biases in the statistical assessment of influence (biases) and possible endogeneity [15].

The use of several commodity indices is justified from the point of view of the different dependence of individual macroeconomic indicators on changes in the price of various commodities. For example, the world price of metal can determine the dynamics of GDP, while the prices of agricultural raw materials can determine the volume of private consumption. This involves taking into account the cost of several commodities.

Using mathematical methods, we investigate the impact of world commodity price indices, in particular, the general commodity price index, the agricultural commodity price index, the food price index, the metal price index, and the crude oil price index, on the dynamics of investment in commodity-type economies in both dimensions – level and volatility.

The methodology of empirical research includes methods of grouping, abstraction, comparison, theoretical generalization, and regression analysis. Our study was conducted using quarterly data for the period 1980-2020.

The portfolio model of sectoral equilibrium we developed (i.e., sectors with different returns (commodity and non-commodity)) made it possible to substantiate that the resource nature of the Ukrainian economy may be a consequence of a higher current return on investment in human and physical capital in the resource sector, even despite the higher equilibrium (long-term) the value of GDP dynamics with an increase in the share of the non-primary sector. That is, the economy is in a kind of "raw material trap". If you do not resort to preferences in favor of activities in the non-primary sector or strengthening the monetary unit or attracting foreign direct investment, there are objective prerequisites for a long stay in a macroeconomic state with a lower economic growth rate compared to the potential of the economy. This feature explains at first glance the paradoxical fact of the preservation of the raw material orientation of the Ukrainian economy against the backdrop of a fairly developed industrial sector.

Thus, the research structure consists of the analysis of quarterly data for a certain period of time. To conduct an empirical test of the most important functional relationships using the 2SLS assessment. As a result, an assessment of the impact of the volatility of world commodity prices on the dynamics of investments is presented.

4. DATA AND MODEL SPECIFICATION

The analysis was carried out using quarterly data for the period 1980-2020. in the context of several indicators (That is, covers the periods of the third and fourth industrial revolution (industry 4.0)): $PCOM_t$ – general commodity price index (2005=100), $PRAW_t$ – agricultural commodity price index (2005=100), $PFOOD_t$ – food price index (2005=100), $PMETAL_t$ – metal price index (2005=100), $POIL_t$ crude oil price index (2005=100) using two-step least squares (2SLS).

The 2SLS estimates for an unbalanced spatiotemporal sample of 18 years of data from countries in Latin America, Southeast Asia, and the former Soviet Union (plus Turkey and South Africa) were used to empirically test the most important functional relationships. All data are obtained from the World Bank database [440]. Due to the availability of the relevant time series, data for some countries are used for a rather long period of 1972-2020. (Mexico, Chile, Uruguay, Indonesia, Thailand, Turkey), 1980-2020 the period is limited to 1990-2020. (Argentina), 1996-2020 (Malaysia), 1999-2020 (Colombia, Ukraine), 1994-2020 (Belarus), 1997-2020 Moldova). As you can see, the raw and non-primary sectors of the economy of many countries still remain at a low level of development and cannot reach the so-called Industry 4.0. It is very interesting to explore the dynamics of investing in such countries.

5. RESULTS OF RESEARCH AND DISCUSSION

At first glance, the availability of natural resources makes it possible to do without foreign capital and finance the development of infrastructure and the accumulation of human capital at its own expense, as was observed in the United States at the end of the 19th century, or relatively recently in Norway or Great Britain after the discovery of oil and gas deposits on the shelf of the North Sea during the periods of the second and third fishing revolutions. However, the "resource curse" phenomenon demonstrates that the export of raw materials in most cases creates a short-term increase in income, which is changed by the stagnation of production in the long term and reaches the level of industry 4.0. Diversification of the production structure makes it possible not only to avoid dependence on unstable world prices for raw materials but, above all, to increase the long-term rate of economic growth; at the same time, there is a growing consensus that the proceeds from the export of raw materials do not necessarily become a "curse" for the economy. Raw capital must be complementary to spending on infrastructure and human development. In addition to Malaysia, neighboring Indonesia is another example. In the 1970s, oil and natural gas export revenues were used to increase the production of mineral fertilizers, which made it possible to increase the volume of agricultural products, thus making living in cities cheaper and moving to the production of labor-intensive industrial products. This process was accompanied by an improvement in the budget balance and attraction of foreign direct investment.

Diversification of production structures will make it possible to reduce dependence on unstable world prices for raw materials and, in the medium and long term, to move towards sustainable economic growth.

The key task in this case is to strengthen the national currency and reduce the dollarization of the economy. A corresponding change in the price ratios between the primary and non-primary sectors (in favor of the non-primary, i.e. technological) will prevent the increase in primary exports, and at the same time, incentives will arise for the use of raw materials in the domestic market - both for the production of

export goods with a higher added value, and limited import substitution.

An assessment of the dependence of investments of individual countries exporting raw materials on the volatility (instability) of world prices for raw materials is presented in Table 1.

Table 1. An assessment of the impact of the volatility of world commodity prices on the dynamics of investment in raw material exporting countries (Industrialized countries, already practically in industry 4.0)

	$pcom_t$			$praw_t$		
	β_1	β_2	γ_1	β_1	β_2	γ_1
Australia	–0.015 (–0.48)	–0.001 (–0.01)	–0.156 (–1.77*)	–0.058 (–1.25)	1.367 (1.67*)	–0.166 (–2.12**)
Canada	–0.033 (–2.06**)	–0.189 (–2.63***)	–0.107 (–1.75*)	–0.037 (–1.37)	–0.175 (–0.22)	–0.198 (–3.34***)
South Korea	–0.040 (–2.21**)	–0.153 (–2.42**)	0.115 (1.98*)	—	—	—
Portugal	–0.017 (–0.58)	–0.012 (–0.10)	0.267 (0.63)	0.044 (0.88)	–1.937 (–1.99*)	0.280 (0.65)
New Zealand	0.015 (0.51)	–0.035 (–0.26)	–0.164 (–1.66*)	0.011 (0.23)	–3.018 (–1.26)	–0.208 (–2.20**)

	$pfood_t$			$pmetal_t$			$poil_t$		
	β_1	β_2	γ_1	β_1	β_2	γ_1	β_1	β_2	γ_1
Australia	0.018 (0.38)	0.617 (0.79)	–0.112 (–1.43)	–0.058 (–1.25)	1.367 (1.67*)	–0.166 (–2.12**)	–0.014 (–0.78)	0.013 (0.29)	–0.169 (–2.07**)
Canada	–0.014 (–0.50)	0.173 (0.59)	–0.222 (–4.3***)	–0.007 (–0.41)	–0.047 (–0.51)	–0.218 (–4.18***)	–0.015 (–1.87*)	–0.038 (–2.12**)	–0.20 (–3.87***)
South Korea	—	—	—	–0.039 (–1.87*)	–0.129 (–0.94)	0.140 (0.77)	–0.023 (–1.93*)	–0.057 (–1.92*)	0.098 (1.70*)
Portugal	–0.047 (–0.94)	–0.061 (–0.07)	0.250 (0.60)	—	—	—	–0.009 (–0.50)	–0.030 (–0.59)	0.303 (0.70)
New Zealand	0.011 (0.24)	–2.648 (–1.95*)	–0.201 (–2.24**)	—	—	—	0.011 (0.56)	0.073 (0.33)	–0.031 (–2.83***)

*Note: t-statistics are shown in parentheses; *. **. *** means statistical significance at the 10%, 5% and 1% levels, respectively*

Table 2. An assessment of the impact of world commodity price volatility on investment dynamics in raw material exporting countries (low-income countries (third industrial revolution))

	$pcom_t$			$praw_t$		
	β_1	β_2	γ_1	β_1	β_2	γ_1
Argentina	0.058 (1.36)	–0.324 (–1.95*)	0.022 (0.45)	0.168 (2.68***)	–0.251 (–0.28)	0.013 (0.29)
Brazil	0.066 (2.08**)	–0.177 (–1.48)	–0.029 (–0.61)	0.148 (2.71***)	–0.150 (–0.16)	–0.022 (–0.48)
Mexico	–0.063 (–2.65**)	–0.219 (–2.41**)	0.048 (0.54)	–0.121 (–2.62**)	0.685 (0.21)	–0.075 (–0.92)
Chile	–0.053 (–1.26)	–0.345 (–2.37**)	–0.281 (–2.08**)	–0.120 (–1.65*)	–0.432 (–0.38)	–0.348 (–2.59***)
Indonesia	–0.004 (–0.19)	0.254 (2.88***)	–0.035 (–0.72)	–0.053 (–1.24)	1.363 (1.69*)	–0.016 (–0.20)
Thailand	0.007 (0.71)	–2.845 (–6.70***)	–0.404 (–0.92)	0.007 (0.71)	–2.845 (–6.7***)	–0.404 (–0.92)
Malaysia	–0.072 (–2.32**)	0.217 (2.0**)	–0.103 (–0.53)	–0.119 (–2.03**)	1.236 (1.28)	–0.084 (–0.47)
South Africa	–0.165 (–1.70*)	–0.050 (–4.35***)	–1.258 (–1.54)	–0.046 (–0.41)	–2.440 (–1.45)	–1.206 (–1.58)
Turkey	0.059 (1.29)	–0.107 (–0.57)	–0.286 (–4.4***)	0.012 (0.16)	1.317 (0.98)	–0.274 (–4.18***)

	$pfood_t$			$pmetal_t$			$poil_t$		
	β_1	β_2	γ_1	β_1	β_2	γ_1	β_1	β_2	γ_1
Argentina	0.168 (2.68***)	–0.251 (–0.28)	0.013 (0.29)	—	—	—	0.027 (1.04)	–0.168 (–1.82*)	0.035 (0.78)
Brazil	0.099 (1.80*)	–0.147 (–0.18)	–0.048 (–1.10)	0.039 (1.06)	0.056 (0.20)	–0.046 (–0.94)	0.036 (1.88*)	–0.122 (–1.60)	–0.031 (–0.65)
Mexico	–0.057 (–1.37)	–0.153 (–1.27)	–0.078 (–0.95)	–0.049 (–1.91*)	–0.045 (–0.94)	–0.095 (–1.23)	–0.039 (–2.44**)	–0.104 (–1.87*)	0.021 (0.23)
Chile	–0.042 (–0.50)	–0.940 (–0.92)	–0.305 (–2.27**)	–0.136 (–2.9***)	–0.169 (–0.52)	–0.349 (–2.77**)	–0.024 (–0.95)	–0.142 (–1.50)	–0.285 (–2.1**)
Indonesia	0.014 (0.34)	1.525 (2.19**)	–0.006 (–0.11)	—	—	—	–0.053 (–1.23)	0.114 (2.84***)	–0.034 (–0.88)
Thailand	–0.149 (–0.65)	–2.919 (–0.69)	–0.794 (–1.39)	—	—	—	–0.013 (–0.18)	–1.090 (–5.48***)	–0.528 (–1.13)
Malaysia	–0.119 (–2.03**)	1.236 (1.28)	–0.084 (–0.47)	—	—	—	–0.037 (–1.77*)	1.140 (1.84*)	–0.094 (–0.52)
South Africa	0.166 (1.25)	–4.335 (–1.67*)	0.254 (1.85*)	0.020 (0.31)	–1.423 (–2.36**)	0.196 (0.50)	–0.020 (–0.60)	–0.289 (–2.09**)	0.180 (1.44)
Turkey	0.175 (2.39**)	0.312 (0.25)	–0.283 (–4.45***)	0.065 (1.29)	0.200 (0.49)	–0.282 (–4.3***)	0.024 (0.88)	–0.052 (–0.62)	–0.287 (–4.5***)

*Note: t-statistics are shown in parentheses; *. **. *** means statistical significance at the 10%, 5% and 1% levels, respectively*

In Table 1 indicator $pcom_t$ is a general commodity price index, further information is provided in the context of individual indices, in particular, price indices for agricultural raw materials ($praw_t$), food products ($pfood_t$), metals ($pmetal_t$) and crude oil ($poil_t$), respectively.

An assessment of the impact of world commodity price volatility on investment dynamics in raw material exporting countries (low-income countries (third industrial revolution)) is presented in Table 2.

An assessment of the impact of the volatility of world commodity prices on the dynamics of investment in the countries-exporters of raw materials for the countries of the former Soviet Union (third industrial revolution) is presented in Table 3.

One of the ways to overcome the "Dutch disease" involves increasing investment, and on this basis - increasing labor productivity. Such exploitation of the benefits of openness has been observed in successful Asian countries, but the Chilean experience is no less successful. A direct (and significant) relationship between the improvement of TOT and investment for countries exporting raw materials has been empirically confirmed. However, some researchers, based on the argument about the greater capital intensity of industrial sectors, argue that the commodity boom leads to a decrease in capital funds. Empirical studies mainly show the negative impact of uncertainty in general and price volatility in particular on investments, but there is less evidence of a negative dependence on the level of commodity prices. In one of the earlier studies, it was found that TOT volatility is not an important factor in the investment process in developing countries, so the negative impact on GDP is carried out in other ways, for example, due to a decrease in the efficiency of the economy or insufficient use of technology. However, there is no other evidence of the independence of investment from the instability of commodity prices. In general, it can be assumed that the impact of the level of commodity prices on investment is uncertain, and their volatility is negative β_1<>0, β_2<0.

The standard argument for an inverse relationship between RER decline and investment is dependent on imports of investment goods (γ_1<0). However, the relationship can be reversed if machine building is more capital intensive than the raw materials sector or if the country has a significant excess labor force.

The greatest obstacle to the development of non-primary industries is usually considered to be an increase in the exchange rate due to the rise in the cost of raw materials in world markets. This is true in commodity economies (especially in the transition to the new level of industry 4.0), but does not apply to the volatility of world commodity prices and, more importantly, does not have the expected negative impact on investment for most low-income countries, except for Chile and Turkey. This feature contrasts with the much stronger direct negative dependence of investment on world commodity prices and their instability. Especially since the appreciation of the exchange rate in Chile encourages investment, like most industrial countries and Turkey. Only in South Africa, and South Korea, there is a negative impact on the appreciation of the exchange rate for investment, which can be explained by less dependence on imported investment goods due to the presence of their own production base. But if for South Korea the raw material orientation is relatively insignificant and concerns mineral raw materials and metallurgical products, then in South Africa it is about the mining and oil extracting industries that operate on their own outdated industrial potential.

In general, we can conclude that the exchange rate mechanism cannot be a universal factor in reducing investment in poorer commodity-exporting countries, and, accordingly, in increasing non-commodity exports in general and high-tech exports in particular. There is no direct reason to assert the importance of one of the most important mechanisms of the "Dutch disease" because usually an increase in the exchange rate is accompanied by the stagnation of investments (against the background of their redistribution in favor of the commodity sector) and hypertrophied consumption in the public and private sectors. The symptoms of Dutch disease only occur when resource boom proceeds are used to finance private consumption.

Table 3. An assessment of the impact of the volatility of world commodity prices on the dynamics of investment in the countries-exporters of raw materials for the countries of the former Soviet Union (third industrial revolution)

	$pcom_t$			$praw_t$		
	β_1	β_2	γ_1	β_1	β_2	γ_1
Belarus	–0.085 (–1.02)	0.238 (0.79)	–0.097 (–0.91)	–0.175 (–1.18)	–0.146 (–0.06)	–0.067 (–0.81)
Georgia	–0.149 (–1.34)	–1.051 (–2.66***)	0.194 (0.45)	–0.211 (–1.03)	1.022 (0.29)	0.367 (0.86)
Moldova	–0.191 (–1.58)	–2.526 (–5.19***)	0.208 (0.76)	–0.238 (–0.95)	1.028 (0.23)	0.509 (1.56)
Kazakhstan	0.177 (1.44)	0.504 (1.22)	0.123 (0.61)	0.349 (1.67*)	–0.711 (–0.20)	0.078 (0.37)
Ukraine	–0.024 (–0.40)	–0.540 (–3.06***)	0.055 (0.41)	–0.140 (–1.41)	–5.753 (–1.25)	0.088 (0.63)

	$pfood_t$			$pmetal_t$			$poil_t$		
	β_1	β_2	γ_1	β_1	β_2	γ_1	β_1	β_2	γ_1
Belarus	–0.157 (–1.01)	1.029 (0.47)	–0.119 (–1.05)	—	—	—	–0.052 (–0.98)	0.001 (0.47)	–0.097 (–0.90)
Georgia	–0.125 (–0.61)	–1.862 (–0.63)	0.330 (0.72)	—	—	—	–0.092 (–1.29)	–0.421 (–2.28**)	0.158 (0.36)
Moldova	–0.260 (–1.08)	–4.722 (–1.13)	0.359 (1.15)	—	—	—	–0.116 (–1.56)	–0.926 (–4.20**)	0.295 (1.04)
Kazakhstan	0.215 (1.03)	–0.089 (–0.03)	0.152 (0.75)	0.242 (1.77*)	–0.463 (–0.48)	0.105 (0.53)	0.085 (1.12)	0.192 (1.02)	0.125 (0.61)
Ukraine	–0.056 (–0.57)	–6.278 (–2.86***)	0.075 (0.56)	0.105 (1.67*)	–1.607 (–2.68***)	–0.018 (–0.14)	–0.019 (–0.48)	–0.313 (–2.88***)	0.041 (0.36)

*Note: t-statistics are shown in parentheses; *. **. *** means statistical significance at the 10%, 5% and 1% levels, respectively*

The policy of attracting investments in the non-primary sector has three main dimensions: 1) macroeconomic, 2) institutional and 3) production. Macroeconomic conditions influenced by the exchange rate, the nature of the stabilization policy, and confidence in the economy, which determines the features of price and monetary stability and investor preferences. Institutional factors are important as a way of stimulating the investment process, orderly balancing the balance of payments, and consolidating confidence in the economy. The production aspects concern the infrastructure and the quality of the labor force, which are directly related to the nature of government spending and the institutional environment. In the ideal case, the desired flow of resources from the resource sector to the non-resource sector can occur exclusively through market mechanisms, but in most countries of the world, this is hindered by insufficient savings and structural deformations, as well as an objective factor of higher profitability of the resource sector compared to non-resource industries.

The importance of increasing the overall level of investment as a factor in overcoming the raw material orientation in the economy and improving the qualitative structure of exports is duly confirmed. Empirical estimates for 16 low-income commodity exporters find that the share of high-tech goods in engineering exports depends on investment (2):

$$\underset{}{TECH_t} = \underset{(2,75^{***})}{0,334 I_t} + \underset{(2,45^{**})}{0,198 TIME_t} + \underset{(1,74^{*})}{3,45 CRISIS_t} \quad R^2 = 0,17 \qquad (2)$$

$TECH_t$ – the share of high-tech exports in total exports of industrial products (%), I_t – investments (% from GDP), $TIME_t$ – fictitious variable that takes into account the time trend, $CRISIS_t$ – fictitious variable that takes into account the crisis of an individual country.

An increase in investment by 1% of GDP leads to an increase in the share of high-tech goods in engineering exports by 0.33 percentage points. This is relatively little, but it should be taken into account that we are talking about total investments in both sectors - raw materials and non-commodity. The reorientation to high-tech goods occurs over time (replaceable $TIME_t$), that is, it can be argued that globalization has had a positive impact in recent years, and most importantly, that crisis phenomena contribute to this (replaceable $CRISIS_t$). Consequently, the improvement in the structure of exports occurs mainly under the pressure of unfavorable circumstances. This means that the favorable impact of crisis phenomena (2) serves as an approximate characteristic of changes in fiscal policy, which, when the economic situation worsens, become favorable for non-primary industries.

Favorable features of improving the qualitative structure of exports are Mexico and Thailand. It is not difficult to explain the specifics of both countries. The advantages of Thailand are determined by cheap labor and the intensive attraction of Chinese capital.

Other factors can be used to stimulate the investment process (3-5):

$$\underset{}{I_t} = \underset{(11,37^{***})}{0,369 S_t} + \underset{(2,90^{***})}{0,050 TIME_t} \underset{(-1,93^{*})}{-1,129 CRISIS_t} \quad R^2 = 0,55 \qquad (3)$$

$$\underset{}{I_t} = \underset{(-4,84^{***})}{-0,074 RREAL_t} \underset{(-2,94^{***})}{-0,021 TIME_t} \underset{(-1,42)}{-1,124 CRISIS_t} \quad R^2 = 0,50 \qquad (4)$$

$$\underset{}{I_t} = \underset{(-6,17^{***})}{-0,089 R_t} \underset{(-3,13^{***})}{-0,095 TIME_t} \underset{(-1,38)}{-1,037 CRISIS_t} \quad R^2 = 0,48 \qquad (5)$$

S_t – saving (% from GDP), R_t і $RREAL_t$ – nominal and real interest rates (%).

First of all, we are talking about increasing savings, which may not be directly related to fiscal policy. For example, an increase in savings is facilitated by a change in intertemporal priorities in private consumption in favor of future periods with a decrease in the number of so-called "impatient" consumers. The consequences of excessive optimism in the private sector are the opposite, as happened in Turkey in 2002-2007, when a decrease in private savings completely offset the consequences of an improvement in the budget balance. The reasons for the decline in private savings are usually the crisis background and excessive social protection of the population. If so, savings should grow as the quality of the stabilization policy improves (usually inflation is considered as its indicator) and the “dismantling” of the constructed system of social guarantees. Both remarks are relevant for modern Ukraine. Inflation is too high, and the level of social protection does not match the capabilities of the fiscal sector.

For the countries studied, an increase in total savings of 1% of GDP leads to an increase in investment by about 0.37% of GDP. This feature expresses the need to increase savings for many countries, but primarily for Ukraine. Although at the end of 2018 this indicator increased to almost 19% of GDP, the average value for 2009-2015 accounted for only 14% of GDP.

The inflationary "pass-through" from world commodity prices is significant primarily in industrialized countries, but the impact on investment is nonetheless seen in low-income countries as well (6):

$$\underset{}{I_t} = \underset{(-2,66^{***})}{-0,044 \Delta P_t} \underset{(2,78^{***})}{+0,061 TIME_t} \underset{(-2,42^{***})}{-1,683 CRISIS_t} \quad R^2 = 0,40 \qquad (6)$$

ΔP_t – inflation (%).

True, such a negative impact is not too powerful, because the acceleration of inflation by 10 percentage points leads to a decrease in investment by only 0.44% of GDP. Similar to specification with savings (3), when adjusted for inflation, time trend dependence becomes favorable. Then we can assume that the negative dependence on the time trend in the remaining specifications is actually due to the influence of savings or inflation.

The more important factors in the investment process should be considered the direct effect of improving the budget balance and two indirect effects - from an increase in savings and a decrease in the interest rate.

An improvement in the budget balance affects the reduction of government spending and an increase in budget revenues (to a lesser extent) (7):

$$\underset{}{I_t} = \underset{(-4,78^{***})}{-0,192 G_t} \underset{(6,30^{***})}{+0,124 TIME_t} \underset{(-2,53^{***})}{-1,701 CRISIS_t} \quad R^2 = 0,45 \qquad (7)$$

$$\underset{}{I_t} = \underset{(0,95)}{0,049 T_t} \underset{(4,61^{***})}{+0,192 TIME_t} \underset{(-2,49^{***})}{-1,647 CRISIS_t} \quad R^2 = 0,45$$

$$\underset{}{I_t} = \underset{(2,74^{***})}{0,136 T_t} \underset{(-2,95^{***})}{-1,979 CRISIS_t} \quad R^2 = 0,43$$

G_t – government spending (% from GDP), T_t – tax revenues (% from GDP).

If government spending is reduced by 1% of GDP, this will lead to an increase in investment by 0.19% of GDP. Tax revenues do not affect the amount of investment in specifications with a time trend, but a statistically significant effect appears if such a trend is not taken into account. An increase in budget revenues by 1% of GDP is reflected in an increase in investment by 0.14% of GDP. This means that the favorable growth in investment over time reflects the upward trend in government revenues. Like other specifications, the negative dependence of investments on crisis phenomena is visible.

The empirical estimates obtained show that commodity prices mostly do not affect investment (in 13 out of 20 countries), while independence from price volatility is much weaker (only 8 countries). In most countries, rising commodity prices limit investment, both in industrial countries (Canada, South Korea) and low-income countries (Mexico, Malaysia, South Africa). The stimulating effect of commodity prices is at a statistically significant level only in Brazil, although Kazakhstan is close to such a dependence. In most cases, negative dependence on the price index is combined with a similar reaction to its volatility (Canada, South Korea, Mexico, South Africa), but this is not the case in Malaysia, volatility becomes a factor in investment growth. This is only seen in Indonesia. There are only 10 cases of negative impact of commodity price volatility, including Ukraine.

For the three industrial countries and Turkey, the dependence of investment on commodity prices appears for individual sub-indices, but this is not the case in Belarus and Kazakhstan. In most countries, the dependence of investment on the volatility of the general price index reflects the impact of crude oil prices. In Thailand, dependence on the volatility of prices for agricultural raw materials is added, South Africa - on the prices of food products, and in Ukraine - on the prices of food products and metal products.

Except for South Korea and Portugal, investment in industrialized countries is declining due to declining RER, which is very clear in the general price index and sub-indices. Chile and Turkey are characterized by a similar inverse relationship. The inverse relationship between RER and investment can be most easily explained by the marked dominance of dependence on imports of technological goods.

The resulting dependencies can be used to substantiate the often repeated thesis that the favorable price environment in the world commodity markets is not used by exporting countries to increase investment, which worsens the dynamics of long-term economic growth and (possibly) hinders the diversification of the economy. This fully applies to Ukraine.

6. CONCLUSIONS

Insufficient diversification of the economy may partly be a consequence of the deterioration in the structure of government spending. In an economy with a high budget deficit and significant public debt, diversification is hampered, on the one hand, by growing social spending, and on the other, by growing costs of servicing internal and external public debt.

The novelty of the study lies in the empirical proof of the importance of increasing the overall level of investment as a factor in overcoming the raw material orientation of the economy and improving the qualitative structure of exports (i.e., increasing the share of goods with a high degree of added value).

A negative dependence of investments on world commodity prices against the background of a favorable dependence on an increase in the exchange rate (most industrial countries, Turkey and Chile) is revealed, which denies the widespread thesis about the determining influence of the exchange rate on the occurrence of the "Dutch disease". According to data from 16 commodity-exporting countries, an increase in investment by 1% of GDP leads to an increase in the share of high-tech goods in engineering exports by 0.33 percentage points. The reorientation to high-tech goods occurs over time, that is, it can be argued that globalization has had a positive impact in recent years, and most importantly, that crisis phenomena contribute to this.

It has been empirically found that an increase in total savings by 1% of GDP leads to an increase in investment by about 0.37% of GDP. This fact justifies the need to increase savings for many countries, but, above all, for Ukraine. Improvement in the budget balance stimulates the investment process by reducing government spending and increasing budget revenues (to a lesser extent). A decrease in government spending by 1% of GDP leads to an increase in investment by 0.19% of GDP, and an increase in budget revenues by 1% of GDP - by 0.14% of GDP.

An increase in the interest rate and an acceleration in inflation limits the growth of investment, but such an impact is not very important. Thus, an increase in the real interest rate from 0 to 10% leads to a decrease in investment by only 0.74% of GDP, and an acceleration of inflation by 10 percentage points - only by 0.44% of GDP.

It was revealed that for countries with an inflationary background and a propensity for currency crises, the following institutional guarantees of fiscal and monetary policy are primarily needed: guarantees of free competition and unhindered access to the market, deregulation, a liberal regime of foreign trade and capital movement, as well as the absence of political excesses ". The introduction of fiscal and monetary policy rules can become a significant factor not only to counteract the receipt of raw materials "rent", but also to create a healthier political climate, which is extremely important for improving the quality of the institutional environment.

To diversify exports to industrial raw material exporting countries, it is enough to reform the labor market and bring it to modern standards of industry 4.0, antitrust laws, and foreign trade liberalization (Portugal can be an example), while for low-income countries and “young democracy” it is necessary to create targeted incentives through government intervention. To date, the most effective way to stimulate modern technological production is to attract foreign direct investment, which makes it possible to do without traditional industrial policy instruments. However, it should be noted that investment inflows to economies with weak institutional frameworks may not have the expected stimulating effect. Turkey's experience confirms the danger of neglecting balance of payments restrictions when incoming foreign direct investment.

The free movement of resources from the primary to the non-primary sector requires the elasticity of the labor market and the absence of distorting price incentives. Labor market reforms, antitrust laws and foreign trade liberalization (Portugal can be an example) are enough to diversify exports in industrial countries exporting raw materials, while for countries with low incomes and “young democracies” (Ukraine in particular) it is necessary to create targeted

incentives through government intervention. One of them may be the strengthening of the monetary unit, and the other - the provision of preferences for activities in the non-primary (technological) sector. Since the direct financing of technology industries contains risks of abuse and economic inefficiency, it is more about developing infrastructure and stimulating the accumulation of human capital. To date, the most effective way to stimulate modern technological production is to attract foreign direct investment, which makes it possible to do without traditional industrial policy instruments. When attracting foreign direct investment, incentives for the internal redistribution of resources in favor of the commodity sector are leveled by the increased profitability of foreign investment in the commodity exporting country compared to the host country. However, it should be noted that investment inflows to economies with weak institutional frameworks may not have the expected stimulating effect. The expediency of the policy of administrative assistance to the transfer of production resources in the non-primary sector only increases in the event of structural shocks.

Ensuring a full-fledged industrial policy in most commodity-exporting countries prevents the inefficiency of public investment, which only worsens the distribution of resources in the economy, or problems with management. The experience of the countries of Southeast Asia shows that limited public investment in infrastructure, which creates the preconditions for attracting foreign direct investment in the manufacturing sector, will accelerate the development of the main aspects of industry 4.0. These recommendations are effective for countries with a resource-oriented economy and an existing technological (non-resource) sector.

REFERENCES

[1] Cavalcanti T.D.V., Mohaddes K., Raissi M. (2012). Commodity price volatility and the sources of growth. Journal of Applied Econometrics, 30(6): 857-873. https://doi.org/10.1002/jae.2407

[2] Hegerty, S. (2016). Commodity-price volatility and macroeconomic spillovers: Evidence from nine emerging markets. North American Journal of Economics and Finance, 35: 23-37. https://doi.org/10.1016/j.najef.2015.10.014

[3] Nikonenko, U., Medynska, T., Bilotskyi, O., Baran, M., Shevchuk, I. (2020). Analysis of institutional factors as part of the component of economic freedom as a background of improvement of structural proportions in the context of improving governance. Business, Management and Economics Engineering, 18(2): 206-225. https://doi.org/10.3846/bme.2020.12421

[4] Datsii, O., Datsii, N., Zborovska, O., Cherkashyna, M., Ingram, K. (2021). Financing of environmental programs for industrial waste management in times of crisis. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, (1): 130-136 https://doi.org/10.33271/nvngu/2021-1/130

[5] Czegledi, P. (2020). The consistency of market beliefs as a determinant of economic freedom. Constitutional Political Economy, 31: 227-258. https://doi.org/10.1007/s10602-020-09301-x

[6] Carrière-Swallow Y., Céspedes, L. (2013). The impact of uncertainty shocks in emerging economies. Journal of International Economics, 90(2): 316-325. https://doi.org/10.1016/j.jinteco.2013.03.003

[7] Sylkin, O., Kryshtanovych, M., Zachepa, A., Bilous, S., Krasko, A. (2019). Modeling the process of applying anti-crisis management in the system of ensuring financial security of the enterprise. Business: Theory and Practice, 20: 446-455. https://doi.org/10.3846/btp.2019.41

[8] Charnavoki, V., Dolado, J. (2014). The effects of global shocks on small commodity exporting economies: Lessons from Canada. American Economic Journal: Macroeconomics, 6(2): 207-237. https://doi.org/10.1257/mac.6.2.207

[9] Hausmann, R., Panizza, U., Rogobon, R. (2006). The long-run volatility puzzle of the real exchange rate. Journal of International Money and Finance, 25(1): 83-124. https://doi.org/10.1016/j.jimonfin.2005.10.006

[10] Bodart, V., Candelon, B., Carpantier, J.F. (2015). Real exchanges rates, commodity prices and structural factors in developing countries. Journal of International Money and Finance, 51: 264-284. https://doi.org/10.1016/j.jimonfin.2014.11.021

[11] Kryshtanovych, M., Akimova, L., Akimov, O., Kubiniy, N., Marhitich, V. (2021). Modeling the process of forming the safety potential of engineering enterprises. International Journal of Safety and Security Engineering, 11(3): 223-230. https://doi.org/10.18280/ijsse.110302

[12] Hama, H.H. (2017). State security, societal security and human security. Jadavpur Journal of International Relations, 21(1): 1-19. https://doi.org/10.1177/0973598417706591

[13] Reichenstein, W. (2019). Social security reforms. The Journal of Retirement, 6(4): 30-44. https://doi.org/10.3905/jor.2019.1.051

[14] Arezki, R., Gylfason, T. (2011). Commodity price volatility, democracy and economic growth. CESifo Working Paper Series, № 3619. 20 p.

[15] Schmitt-Grohe, S., Uribe, M. (2018). How important are terms of trade shocks? International Economic Review, 59(1): 85-111. https://doi.org/10.1111/iere.12263