THE WORLD INDUSTRIAL PRODUCTION – STRUCTURAL DETERMINANTS

ANDREI RĂDULESCU, Ph.D.
Department of International Economic Analysis
Institute for World Economy
13, 13 September Avenue, Bucharest
ROMANIA
iemradulescu@gmail.com

Abstract: The annual pace of industrial production has shown a downward trend in the recent quarters, in the context of the fragmentation caused by the intensification of the geopolitical tensions following the outbreak of the crisis in Ukraine. Furthermore, the potential growth pace of this important coincident indicator for world economic activity is at very low level at present, at least compared to the developments in the cycle prior to the outbreak of the Great Financial Crisis (GFC). In this paper we apply standard econometric tools and use the databases of the Netherlands Bureau for Economic Policy Analysis (CPB), Federal Reserve (FED), and Bloomberg in order to assess the relation between the evolution of the world industrial production and several fundamental indicators, including the volume of world trade, the long-term real interest rate, and the volatility in the financial markets during the period January 2001 – January 2025. The econometric estimates confirm the direct relation between the evolution of industrial production and the dynamics of world trade. On the other hand, an inverse relationship is observed between the evolution of the industrial production and the dynamics of the long-term real interest rate and the volatility in the financial markets.

Keywords: world industry, world trade, real interest rates, volatility

JEL Classification : E44, F00, F13, F14

1 Introduction

From the historical perspective the industry has been the engine of the economy, either in advanced economies or in the emerging and developing countries.

Over the past years world industrial production has been confronted with the consequences of the coronavirus pandemic and the outbreak of the geopolitical crisis in Ukraine, including the fragmentation of international trade, and the increase of the real financing costs.

In this paper, we analyse the evolution of the volume of world industrial production and its dependence on several structural indicators, such as the volume of the international trade in goods, the long-term real interest rates, and the volatility in the financial markets.

In this respect, standard econometric tools are applied (Hodrick-Prescott filter, and the OLS regression) while using the databases of the Netherlands Bureau for Economic Policy Analysis, Federal Reserve and Bloomberg, monthly observations for the period January 2002 – January 2025.

According to the econometric estimates, the annual potential growth pace of the volume of the industrial production severely deteriorated after the outbreak of the crisis in Ukraine, given the geo-economic fragmentation, the upward trend of the real financing costs, and the high level of uncertainty.

The rest of the paper has the following structure: the literature review is briefly described in the next chapter; the methodology is presented in the third chapter; the fourth chapter is focused on the analysis of the recent developments of the volume of world industrial production; the analysis of the results of the econometric estimates follows in the fifth chapter; the conclusions are drawn in the last chapter.

2 Literature Review

The industrial production has always been an important component of economic activity, playing the role of an engine in the past centuries. Many experts analyzed the developments of industrial production and its

contributions to the growth and development of countries in the past decades. For instance, Szirmai (2012) emphasizes the contribution of industrialization to economic development across developing countries since 1950. The role of industry as the backbone of the economy was also underlined by Lichtblau et al. (2013), as the dynamics of the activity in this area have spillover impact for other sectors in the economy, given the strong interconnectedness. According to this paper, industry has a multiplier effect of 1.68 in EU economic activity. As regards macroeconomic analysis and forecasting, world industrial production represents a coincident indicator, as it is also considered a proxy for the dynamics of fixed investments in the real economy. Analysing the structural developments of world industrial production is very important nowadays, in the context of the implementation of technological progress and the persistence of unprecedented risks and challenges at a high level (including the trade war and geopolitical tensions).

On the one hand, the Digital Revolution and the Artificial Intelligence Revolution are transforming the real and financial sides of the economy with unprecedented speed. In fact, the current 4.0 Industrial Revolution is contributing to improving the performance of the economy through the optimization of the allocation of resources and the mitigation of risks, as emphasized by Malik et al. (2024). However, the recent exogenous shocks (coronavirus pandemic, the intensification of geopolitical tensions) and their consequences have had an important impact on the dynamics of industrial production.

Therefore, countries across the world have recently launched new industrial policies (NIP). In this respect, the study of Evenett et al. (2024) pointed out that industrial policy nowadays is also correlated with several factors, such as the electoral context, structural factors, and the current macroeconomic climate.

3 Methodology

In this paper standard econometric tools are applied in order to assess the structural developments of the volume of world industrial production, and its relation with fundamental indicators, such as the volume of the international trade in goods, the long-term real interest rate, and the volatility on the financial markets.

On the one hand, the Hodrick-Prescott filter is applied to distinguish between the structural and cyclical components of the macroeconomic indicators – the volume of the world industrial production, the volume of the international trade in goods, the long-term real interest rate, and the volatility on the financial markets.

This econometric filter is a well-known method implemented in the macroeconomic analysis, being based on the following relation:

$$\textbf{Min} \sum_{t=1}^{T} (\ln Y_t - \ln Y_t^*)^2 + \lambda \sum_{t=2}^{T-1} ((\ln Y_{t+1}^* - \ln Y_t^*) - (\ln Y_t^* - \ln Y_{t-1}^*))^2 \quad (1),$$

in which Y_t, Y_t^* and λ are the macroeconomic indicator, its trend (or the structural component), and the smoothness parameter. We used a level of 14400 for this parameter, the same as used by Hodrick-Prescott while working with monthly observations.

Afterwards, we estimated a standard OLS regression, with the trend component of the annual volume of the world industrial production being the dependent variable, while the trend component of the annual volume of the international trade, the trend component of the long-term real interest rate and the trend component of the volatility indicator as independent variables. This regression is expressed in the following line:

$$\text{Worldindtr} = c(1)+c(2)*\text{Inttradetr}+c(3)*\text{Longrealratetr}+c(4)*\text{Vixtr} \quad (2),$$

where Worldindtr is the trend component of the annual volume of the world industry, Inttradetr represents the trend component for the annual pace of the international trade in goods, Longrealratetr is the trend component of the long-term real interest rate, while Vixtr represents the trend component for the volatility index on the financial markets.

In this paper we used the 10YR real interest rate in the US as the proxy for the long-term real interest rate, and the VIX Index (which measures the volatility on the S&P 500 Index) as a proxy for the volatility on the financial markets.

We worked with monthly observations from January 2001 to January 2025, the data were collected from the Netherlands Bureau for Economic Policy Analysis (for international trade in goods, and world industrial

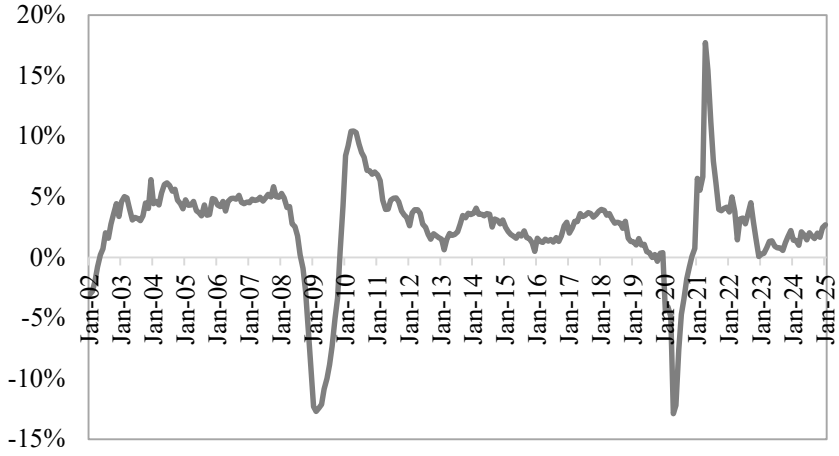
production), Federal Reserve (for the 10YR real interest rate in the US), and Bloomberg (for VIX indicator).

In this paper the econometric software E-Views was used.

4 The world industrial production – recent developments

The volume of the world industrial production has improved at the turn of the year 2025, before the implementation of the new trade tariffs by the largest economy in the world. According to the data released by the Netherlands Bureau for Economic Policy Analysis (CPB), the annual pace of the volume of world industrial production accelerated from 2.5% in December 2024 to 2.7% in January 2025. It is the best growth rate since October 2022, as can be noticed in the following chart. Overall, the volume of world industrial production climbed for the fourth year in a row in 2024, while the annual pace accelerated to 1.7%.

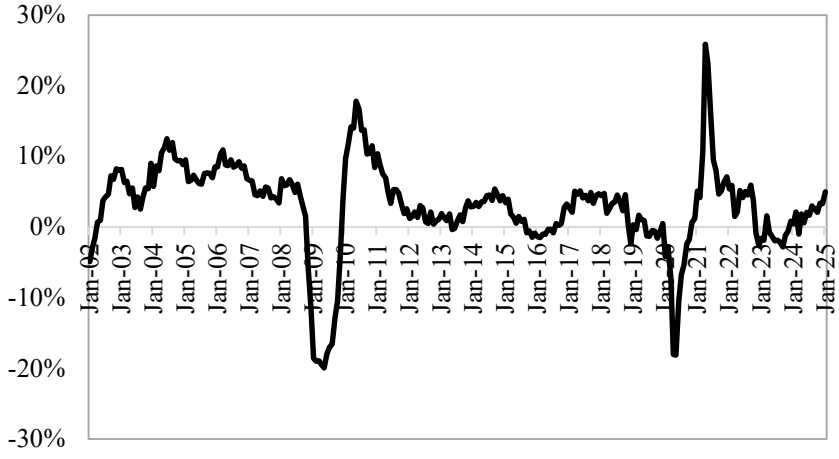
Figure 1. The annual pace of the volume of the world industrial production



Source: representation of the author based on the data of the Netherlands Bureau for Economic Policy Analysis (CPB), 2025

This evolution was mainly determined by the improvement in the volume of the world trade in goods. This indicator grew for the 10th month in a row in January 2025, while the annual pace accelerated to 5.0%, the highest level since September 2022, as reflected in the following chart. In 2024 the volume of the international trade in goods rebounded, climbing by an annual pace of 1.8%, following the contraction by an annual pace of 1.2% in 2023.

Figure 2. The annual pace of the volume of the world trade with goods



Source: representation of the author based on the data of the Netherlands Bureau for Economic Policy Analysis (CPB), 2025

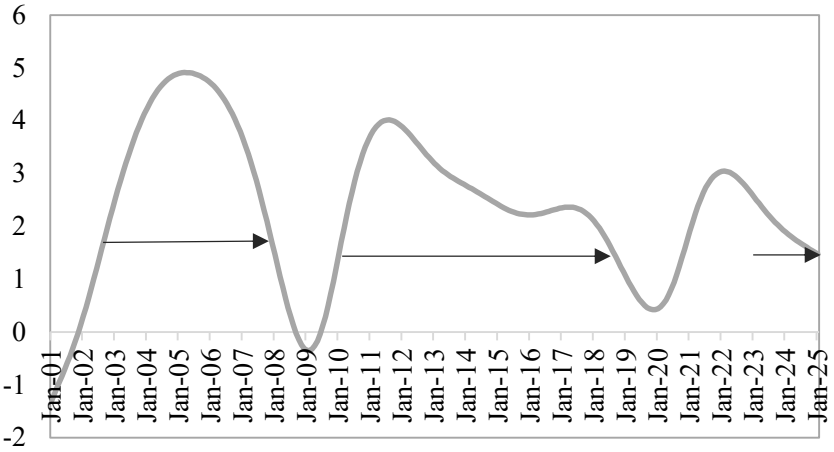
This, in turn, was determined by the measures implemented by the companies in anticipation of the increasing trade tariffs, one of the main topics on the Agenda of the New Administration in the USA, the largest economy in the world, with a nominal GDP of USD 29.2tn in 2024, according to the estimates of the Bureau for Economic Policy Analysis.

However, there can be noticed the divergence among the largest economies in the world in terms of the evolution of industrial production in January 2025. The US industrial production rose for the second month in a row in January, with the annual pace accelerating to 1.9%, the highest since October 2022. On the other hand, the annual pace of the volume of the industrial production in China (the second largest economy in the world, with a nominal GDP of over USD 18tn in 2024, according to the National Bureau of Statistics of China) decelerated to 5.7% in January 2025, the weakest since November 2024. Last, but not least, the volume of the industrial production in the Euroland (the main component of the European Union, with a nominal GDP of over EUR 15tn in 2024, according to Eurostat) continued to contract in January, but at a slower pace of 0.2%.

5 Interpretation of the results

According to the results of the econometric analysis, the annual potential pace of the volume of the world industrial production decelerated from around 3.0% in February 2022 (the month of the outbreak of the crisis in Ukraine) to 1.5% in January 2025. It is the lowest level since the month of October of the pandemic year 2020, as can be noticed in the following chart.

Figure 3. The annual potential pace of the volume of the world industrial production (%)



Source: representation of the author based on the results of the analysis using data of the Netherlands Bureau for Economic Policy Analysis (CPB)

Furthermore, the above chart allows us to notice the downward trend for the average annual potential pace of world industrial production over the past economic cycles.

According to the results of our econometric estimates, the annual potential growth pace for the volume of the world industrial production presented average levels of 3.5% during the pre-crisis economic cycle (2002-2007), 2.5% during the post-crisis cycle (2010-2019), and 2.2% after the outbreak of the crisis in Ukraine (period March 2022 – January 2025).

In other words, the potential growth pace of the volume of the world industrial production deteriorated significantly after the outbreak of the Great Financial Crisis, the worst financial crisis in the world since the Great Depression, as also underlined by the Kose et al. (2020). This evolution was determined by the negative impact of this crisis on the investment climate.

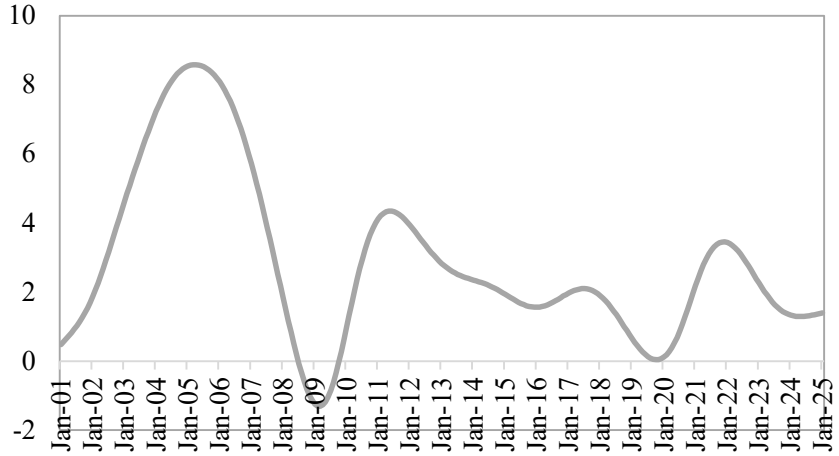
This downward trend of the annual potential growth pace of the world industrial production was mainly determined by the deterioration of the annual potential dynamic of the international trade in goods.

The results of the econometric estimates show that the annual potential pace of the volume of the international trade in goods registered an average of 6.1% during the pre-financial crisis economic cycle, the period 2002-2007.

During the post-crisis cycle the average level of the annual potential pace of the volume of the international trade in goods stood at only 2.2%, significantly lower compared to the previous cycle.

Furthermore, during the period March 2022 (the month after the outbreak of the crisis in Ukraine) – January 2025 the annual potential growth pace of the volume of international trade in goods presented an average of only 1.9%, as reflected in the following chart.

Figure 4. The annual potential pace of the volume of the international trade in goods (%)



Source: representation of the author based on the results of the analysis using data of the Netherlands Bureau for Economic Policy Analysis (CPB)

In fact, the econometric estimates confirm the direct relation between the evolution of the world industrial production and the dynamics of the international trade in goods, as can be noticed in the following table. According to our econometric analysis, the increase of the international trade in goods by 1% determined an advance of the world industrial production by 0.55% during January 2001 – January 2025, as can be noticed in the Table 1.

On the other hand, there can be noticed the negative relation between the evolution of the world industrial production and the dynamics of the long-term real interest rate in the US (a benchmark for the long-term interest rate in the world economy) and the volatility on the financial market in the US.

During January 2001 – January 2025 the increase in the long-term real interest rate in the US (the largest economy in the world) by 1% determined the contraction of the world industrial production by 0.69%. In fact, the increase of the real financing costs has a negative impact for the investments of the companies, with consequences for the production, as emphasized by Keynes (1978).

Last, but not least, the increase of the volatility on the US financial market by 1% had a negative impact of 0.05% for the evolution of the world industrial production in the interval January 2001 – January 2025, according to the results of our econometric analysis.

We point out that the level of the R-squared is above 91%, expressing that the dynamic of the world industrial production is explained to a large extent by the international trade in goods, long-term real interest rate in US, and the volatility of the S&P 500 index during the period January 2001 – January 2025.

Table 1. Results of the regression (2)

Dependent Variable: WORLDINDTR
Method: Least Squares
Date: 04/02/25 Time: 13:09
Sample(adjusted): 2001:01 2025:01
Included observations: 289 after adjusting endpoints
*WORLDINDTR = C(1)+C(2)*INTTRADETR+C(3)*LONGREALRATETR*
*+C(4)*VIXTR*

	Coefficient	*Std. Error*	*t-Statistic*	*Prob.*
C(1)	*2.447280*	*0.131535*	*18.60558*	*0.0000*
C(2)	*0.554869*	*0.012453*	*44.55825*	*0.0000*
C(3)	*-0.691761*	*0.040915*	*-16.90725*	*0.0000*
C(4)	*-0.047391*	*0.005965*	*-7.944193*	*0.0000*

R-squared	*0.912973*	*Mean dependent var*	*2.352093*
Adjusted R-squared	*0.912056*	*S.D. dependent var*	*1.423959*
S.E. of regression	*0.422279*	*Akaike info criterion*	*1.127443*
Sum squared resid	*50.82106*	*Schwarz criterion*	*1.178189*

Log likelihood	*-158.9155*	*Durbin-Watson stat*	*0.003668*

Source: representation of the author based on the results of the econometric analysis using data of the Netherlands Bureau for Economic Policy Analysis (CPB), Federal Reserve (FED), and Bloomberg

6 Conclusions

This article focused on the structural developments and determinants of world industrial production over the past decades.

The results of our econometric analysis emphasized the strong dependence of the world industrial production on the evolution of the international trade in goods. This result is very important, especially taking into account the present context, dominated by the change of the trade policy in the USA, as at the beginning of April the largest economy in the world decided to significantly increase trade tariffs with the rest of the world (by at least 10%).

These recent measures would have a negative impact on the international trade in goods in the short and mid-run.

Therefore, according to the results of our econometric estimates, the outlook for the world industrial production in the coming quarters is negative, with consequences for the evolution of the overall economic activity in the world. In fact, the probability of a global economic recession by the end of 2025 has significantly increased.

Another recession in the world economy following the multiple shocks in recent years (pandemic, geopolitical tensions, cost of living crisis) would have tremendous consequences for the development process and the transition to green economy, especially taking into account the very low manoeuvre room of the economic policy.

Against this background, we emphasize the importance of negotiations among the most important blocs in the world economy in order to avoid an escalation of the trade war and to adhere the WTO rules.

References:

[1] Bloomberg (2025). Bloomberg Professional Services. Available at www.bloomberg.com/professional/products/data

[2] Bureau of Economic Analysis (2025). Gross Domestic Product, 4th Quarter and Year 2024 (Third Estimate), GDP by Industry, and Corporate Profits. Available at www.bea.gov

[3] Evenett, S., Jakubik, A., Martin, F., Ruta, M. (2024). The Return of Industrial Policy in Data, International Monetary Fund, Vol.2024, No.1, pp. 1-31. Available at https://www.elibrary.imf.org/view/journals/001/2024/001/article-A001-en.xml

[4] Federal Reserve Saint Louis (2025). FRED Economic Data. Available at www.fred.stlouisfed.org

[5] Hodrick, R., Prescott, E. (1997). Postwar U.S. Business Cycles: An Empirical Investigation, Journal of Money, Credit and Banking, Vol.29, No.1, pp. 1-16. Available at www.jstor.org/stable/2953682

[6] Keynes, J. M. (1978). The Collected Writings of John Maynard Keynes, Volume 14: The General Theory and After: Part II, Defence and Development. Royal Economic Society, London

[7] Kose, A., Sugawara, N., Terrones, M. (2020). Global Recessions, World Bank Policy Research Working Paper 9172. Available at https://documents1.worldbank.org/curated/en/185391583249079464/pdf/Global-Recessions.pdf

[8] Lichtblau, K, Matthes, J., Fritsch, M., Bertenrath, R., Gromling, M., Busch, B. (2013). Industry as a growth engine in the world economy, Institut der Deutschen Wirtschaft. Available at https://www.iwkoeln.de/fileadmin/publikationen/2014/142508/Industry_as_a_growth_engine_in_the_global_economy.pdf

[9] Malik, S., Muhammad, K., Waheed, Y. (2024). Artificial intelligence and industrial applications-A revolution in modern industries, Ain Shams Engineering Journal, Vol.15, No.9. pp. 1-11. Available at https://www.sciencedirect.com/science/article/pii/S2090447924002612#:~:text=Industrial%20Revolution%204.0%20involves%20the,machines%2C%20and%20functions%20like%20humans

[10] Netherlands Bureau for Economic Policy Analysis (2025). World Trade Monitor January 2025. Available at https://www.cpb.nl/en/cpb-world-trade-monitor-january-2025

[11] Postwar U.S. Business Cycles: An Empirical Investigation (1997), Journal of Money, Credit and Banking, Vol.29, No.1, pp. 1-16. Available at www.jstor.org/stable/2953682

[12] Szirmai, A. (2012). Industrialisation as an engine of growth in developing countries, 1950 – 2005, Structural Change and Economic Dynamics, Vol.23, No.4, pp. 406-420. Available at https://www.sciencedirect.com/science/article/pii/S0954349X1100018X?via%3Dihub