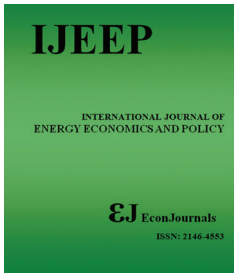

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Central Bank Independence and Oil Prices Impact on Macroeconomic Indicators

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ABSTRACT

The central bank's independence and oil prices can influence macroeconomic indicators. Many articles are devoted to studying their influence on individual macroeconomic indicators. As it turned out, the study's results depend on the sample of countries and the interval. They can lead to contradictory conclusions: From a negative or positive effect to its complete absence. However, these issues have not been sufficiently studied for post-Soviet countries with peculiarities in their past development. This study examines the impact of central bank independence (CBI) and oil prices on economic growth, inflation, and income inequality in post-Soviet and developed countries from 2001 to 2020. Based on the analysis of panel data, it was found that strengthening the independence of central banks does not significantly impact economic growth, inflation, and income inequality in developed countries but contributes to their reduction in post-Soviet countries. Higher oil prices reduce economic growth and increase income inequality in developed countries and reduce economic growth, but do not affect income inequality in post-Soviet countries. An increase in oil price increments increases inflation in both samples of countries. The results of this study may be useful for developing macroeconomic policies.

Keywords: Oil Price, Central Bank Independence, Growth, Inflation, Income Inequality, Gini Index
JEL Classifications: E31, E58, O47, Q43

1. INTRODUCTION

The influence of central bank independence and oil prices are two important factors in macroeconomic dynamics. The central bank's independence from political interference allows it to make decisions based on the economic situation and not subject to political or corrupt influences. This can lead to a more stable and predictable monetary policy promoting economic stability and growth. However, it is now believed that the concept of CBI may be outdated in today's low interest rates and inflation (Bernanke, 2017). However, Rogoff (2019) recalls that independent central banks were created to contain double-digit price increases. Believing that low inflation is inherent in the 21st-century economy is wrong. Refusal of the CBI will lead to the return of high inflation.

The price of oil also plays an important role in the behavior of macroeconomic indicators for both oil-exporting and importing countries. Oil price shocks trigger monetary policy responses from central banks, especially in oil-importing countries. In exporting countries, a high oil price can boost exports and national income, increase investment in the oil industry, and create new jobs. Therefore, it is important to study the joint impact of oil prices and CBI on the dynamics of macroeconomic indicators.

There is no single generally accepted criterion for the CBI. There are two most widely used indexes, named after the capital letters of the names of their authors. The GMT index of central bank independence contains two groups of sub-indices of political and economic independence (Grilli et al., 1991). The first reflects the

extent to which the central bank's management is appointed and performs its functions independently of the government. The second group shows the possibility of lending to the government by the central bank and the degree of its supervision over the actions of commercial banks. The GMT value for a central bank is determined by simply summing the values of all its sub-indices, which can take values 1 or 0.

The subsequently developed CWN index includes four sub-indices: personnel autonomy, monetary policy development, central bank priorities and objectives, and government budget financing constraints (Cukierman et al., 1992). Each subindex can take values from 0 to 1 depending on its contribution to the CBI. For a central bank, the CWN value is calculated as a certain weighted sum of all its subindices.

Both the GMT and CWN criteria provide a comprehensive assessment of CBI, in contrast to the proxy criteria used in some studies, such as the frequency of turnover of central bank governors, the degree of democratic representation in monetary authorities, or the internal indicators of central bank regulation. Traditionally, CBI is considered in the context of its impact on inflation, less often its impact on other macroeconomic indicators, while to the impact of oil prices, its impact on economic activity is most often studied.

This study aims to study the impact of CBI and world oil prices on macroeconomic indicators: Economic growth, inflation, and income inequality in post-Soviet and developed countries from 2001 to 2020. At the same time, we assess the impact of both the GMT and CWN indices and their sub-indices, which allows us to identify which have a significant impact for each of these indicators and each sample of countries.

The remaining part of this paper is organized as follows. Section 2 briefly describes the literature review. Section 3 presents the estimation methods and data sources. Empirical results and discussion are presented in Section 4. Section 5 is the conclusion.

2. LITERATURE REVIEW

A lot of research has been devoted to the problem of the influence of CBI and oil prices on the macroeconomic indicators of countries. The results depend on the group of countries being studied, developed or developing, exporters or importers of oil, and their other characteristics. There are conflicting opinions about the impact of CBI on economic growth. Haan and Kooi (2000), using a new indicator based on managerial turnover rates for 82 developing country central banks over 1980-1989, find no evidence that CBI is associated with economic growth.

However, the CBI can help countries mitigate the impact of political cycles on business cycles, strengthen financial system stability, and improve fiscal discipline without incurring any costs in terms of output volatility or reduced economic growth. Economic theory assumes that central bank independence from political power entails a split between political and monetary power. Such a split is inevitable because it allows price volatility to be controlled without harming other macroeconomic variables, such as economic growth or unemployment (Bogari, 2020). In addition, the actual independence of the central bank may deviate from its legal independence, which, according to (Jafari-Samimi et al., 2010; ElHodaiby and ElSamman, 2021), does not impact economic growth. Nagac and Rizvanoghlu (2018) examined the relationship between CBI and macroeconomic indicators, particularly GDP growth, a GDP deflator, based on data from the Caucasus and Central Asia. They note that the actual CBI may often differ quite significantly from the degree of legal independence. Such deviations are more noticeable in developing countries than in developed ones.

Consolidation of inflation is associated with CBI. Choi et al. (2022) ask whether it can contribute to economic growth. Using panel data on industry growth for 22 manufacturing industries from 39 advanced and emerging economies over 1990-2014, they find that industries with high external financial dependence and R&D intensity tend to grow faster in countries with well-entrenched inflation expectations.

Small oil importers take the price as given, and high oil prices in these countries are associated with low economic growth. When oil and gas prices rise, production costs increase, resulting in decreased economic growth (Wu et al., 2018; Luqman et al., 2019; Lawal et al., 2020; Deluna et al., 2023; Tala and Hlongwane, 2023). Large countries are less susceptible to oil price shocks affecting global oil markets. For them, the impact of such shocks is weaker compared to small oil-importing countries (Wu et al., 2018; Raggad, 2021).

However, oil exporting countries benefit from high oil prices (Tuzova and Qayum, 2016; Abdelsalam, 2023; Bagadeem, 2023; Neifar and Kammoun, 2022). For them, although oil shocks positively impact economic growth, the negative impact can be very large. Herrera et al. (2019) found that US oil price shocks are asymmetrically associated with industrial production. Moghaddam (2023) also points out the heterogeneous impact of oil price changes on Canadian provinces' economic growth. Studies by Deluna et al. (2023) show that oil price volatility affects economic growth in developing and oil-importing countries, with oil prices affecting output symmetrically or linearly.

There are also conflicting opinions about the impact of CBI on inflation (Bernanke, 2017; Rogoff, 2019). King and Ma, (2001) argued that CBI and inflation do not have a significant relationship. However, Brumm (2002) explained this finding using an imprecise proxy for CBI and presented their results, proving the existence of a strong negative relationship between CBI and inflation. The same conclusion was reached by Berger et al. (2001), who, based on a survey study, concluded that the negative relationship between CBI and inflation is strong. Meanwhile, Agoba et al.'s (2017) analysis concludes that countries with higher levels of respect for political rights and the rule of law tend to have lower inflation rates and argue that increased central bank independence reduces inflation only in developed countries.

It has been doubted that the CBI is keeping inflation low (Baumann et al., 2021). They argue that, if there is one, there is only a

weak causal relationship between independence and inflation. According to Bandaogo (2021), the benefits of central bank independence from political interference are undeniable. It has ensured low inflation in countries worldwide and contributed to debt sustainability.

Some studies of the relationship between CBI and inflation use criteria other than GMT and CWN and are based on the frequency of governor or law turnover and internal indicators of central bank regulation. Chiquiar and Ibarra (2020), based on an analysis of 182 countries, find that larger CBI correspond to lower inflation rates in both high-income and low- and middle-income countries. Lim (2021), based on the degree of democratic representation as an instrument of monetary authority independence, refutes the standard negative dependence of inflation on CBI.

Examining the impact of legal independence in developing countries, Garriga and Rodriguez (2020), for a sample of 118 countries between 1980 and 2013, found that higher central bank independence corresponds to lower inflation rates. The study by Kokoszczyński and Mackiewicz-Łyziak (2020) also shows that the CBI significantly negatively impacts inflation, mainly due to the results for undeveloped countries.

Changes in oil prices have always been significant and controversial factors for developing the economies of both oil-importing and oil-exporting countries. They influence, especially in importing countries, the cost of production and, therefore, the general price level. Noting that Pakistan's economy is highly sensitive to changes in oil prices, Triantoro et al. (2023) examined their impact on inflation and other macroeconomic variables. Ha et al. (2023) use data from 55 countries to find that in a typical economy, oil price shocks account for 4% of the variation in inflation, but recent global shocks have increased this to 9%. Oil price shocks were more likely to drive inflation fluctuations in advanced economies, commodity importers, and net energy importers. The extent to which European Central Bank interventions mitigate the impact of oil prices on inflation was examined in (Jawadi et al., 2023). They also estimated the threshold level at which the impact of changes in oil prices is significant.

Many studies pay attention to the asymmetric impact of oil prices on inflation. Goh et al. (2022) indicate that in Indonesia, in the long run, an increase in oil price tends to increase the inflation rate with a larger deviation, and a decrease in oil price tends to reduce the inflation rate with a smaller deviation. On this basis, they conclude that consumers do not benefit from lower oil prices. Cheikh et al. (2023), examining the impact of oil price shocks on inflation in the euro area, find that risks associated with adverse geopolitical events increase the inflationary impact of oil price shocks when they exceed a certain threshold. Moreover, inflation in the eurozone is more vulnerable to their impact than in the United States.

Fluctuations in oil prices can lead to significant spikes in inflation and cause corresponding responses from central banks. Jena and Kataruka (2022), in a study of five Asian countries, found the effectiveness of inflation targeting in mitigating oil shocks. The results of López-Villavicencio and Pourroy (2019) show that the pass-through effect of changes in oil prices is higher in countries with inflation targeting. In addition, they note that the introduction of inflation targeting reduces the asymmetry of the pass-through.

Aklin and Kern (2021) explain the existence of a link between CBI and inequality, firstly, by weakening the government's ability to engage in redistribution as CBI constrains fiscal policy. Secondly, due to the deregulation of financial markets, there is a boom in the value of assets, mainly owned by the wealthier segments of the population. Third, in the face of inflationary pressures, government policies weaken workers' bargaining power.

The impact of CBI on income inequality can be manifested through its effect on inflation. Although numerous studies confirm a positive correlation between inflation and income inequality, Binder (2019) states that this correlation has changed, especially in European economies. Whether it is positive or negative depends on the period and the sample of countries. Estimates based on panel regression revealed that in democratic countries, independent central banks, under political pressure, can limit inflation, helping reduce income inequality. A study of 44 African countries showed that CBI helps control inflation and, through it, also reduces poverty (Gyeke-Dako et al., 2022).

The weak rule of law in the absence of CBI contributes to the policy of easing monetary policy. Such policies will increase the exploitation of workers. At the same time, CBI, combined with the rule of law, can reduce economic inequality (Tomita, 2023).

Income inequality can be significantly affected by movements in the price of oil. Moreover, there may be differences in this influence for oil importing and oil exporting countries. Examining the interaction between oil price shocks and income inequality in the Association of Southeast Asian Nations countries, Tan and Uprasen (2023) find that higher oil prices increase income inequality in oil-importing countries but reduce it in oil-exporting countries. Overall, they find that oil price shocks tend to have a negative rather than a positive effect on income inequality in oil-importing and exporting countries.

Although the resource curse is usually associated with poor countries rich in natural resources, Berisha et al. (2021), based on an analysis of data from the United States, argue that the resource curse can also be observed in a rich country with large endowments of resources. They found that increasing oil production in states with low oil production would reduce income inequality. In contrast, income inequality would increase in states with high oil production due to a negative impact on the income distribution gap. Oil price changes are more likely to affect oil-dependent countries due to rising income inequality. O'Hara and Gentile (2009) conducted a large-scale geographic analysis of household incomes across Kazakhstan. The purpose of the study was to determine to what extent the increase in personal income of the population corresponded to the growth of Kazakhstan's GDP in the post-Soviet period. They concluded that oil and gas production benefits are unevenly distributed among the country's population. They identified beneficiary regions largely concentrated in the country's two main urban centers and resource-producing areas.

Thus, summarizing the considered research results from different countries, the following conclusions can be formulated:

1. CBI mainly contributes to economic growth. Higher oil prices can slow economic growth, although oil-exporting countries can benefit from higher oil prices for their economic growth.
2. There are conflicting statements about the influence of CBI on inflation: from complete denial of the influence of CBI on the inflation rate to the recognition of a negative relationship between them. Fluctuations in oil prices can cause unidirectional inflation responses in oil-importing and oil-exporting countries. The introduction of inflation targeting in the country may impact them.
3. The impact of CBI on income inequality can be either downward or upward since it also depends on the sample of countries, the level of democracy, and the rule of law. Evidence shows that rising oil prices reduce income inequality in oil-exporting countries and increase it in importing countries. However, even in oil-exporting countries, rising oil prices can increase income inequality if the country's oil revenue distribution is uneven.

3. RESEARCH DATA AND METHODS

3.1. Data

The study uses annual data from 2001 to 2020 for developed and post-Soviet countries. We obtained growth, inflation rate, income inequality, and oil prices data from the World Bank website (World Bank, 2023). Data on the GMT and CWN central bank independence indices and their sub-indices are collected from each country's central bank's laws and presented on the Internet. Based on the availability for the country of at least three editions of the Law on the Central Bank during the period under consideration, we included eighteen developed countries in the study: Canada, Australia, Belgium, Croatia, Cyprus, Estonia, Finland, Hungary, Latvia, Lithuania, the Netherlands, Portugal, Romania, Slovakia, Iceland, Norway, Switzerland, Great Britain, as well as nine post-Soviet countries: Azerbaijan, Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Ukraine.

The GMT-index of central bank independence *gmt* is equal to the sum of two sub-indices *gmt1* and *gmt2,* which in turn contain second-level sub-indices (Grilli et al., 1991), where

- *gmt1*-subindex of political independence, equal to the sum of its subindices:
- *gmt11*-the governor of the central bank is appointed without government intervention,
- *gmt12*-the governor of the central bank is appointed for a term of more than 5 years,
- *gmt13*-the board of the central bank is appointed without the participation of the government,
- *gmt14*-members of the board of the central bank are appointed for a term of more than 5 years,
- *gmt15*-no mandatory presence of government representatives on the board of the bank
- *gmt16*-no need to approve the main directions of monetary policy by the government,
- *gmt17*-fixing price stability in the legislation as the main goal of the central bank,
- *gmt18*-availability of legal support from the central bank in case of conflict with the government,
- *gmt2*-subindex of economic independence, equal to the sum of its subindices:
- *gmt21*-there is no automatic procedure for issuing loans to the government,
- *gmt22*-the central bank does not participate in the initial placement of government securities,
- *gmt23*-the central bank independently sets interest rates for its operations,
- *gmt24*-supervision of banks is not included in the functions of the central bank.

If the answer is yes, the second level subindex value is 1 and 0 otherwise.

And the CWN-index of central bank independence *cwn* is defined as the weighted sum of its four sub-indices: $cwn = 0.2cwn1+0.15cwn2+0.15cwn3 +0.5cwn4$ (Cukierman, et al., 1992), where

- *cwn1*-personnel autonomy subindex,
- *cwn11*-term of office of the central bank's management,
- *cwn12*-the institution that appoints the governor of the central bank,
- *cwn13*-early removal of the governor of the central bank from office,
- *cwn14*-the ability of the governor of the central bank to perform other functions in the government,
- *cwn2*-development of monetary policy,
- *cwn21*-the institution engaged in the development of monetary policy,
- *cwn22*-the institution that has the last word in conflict resolution,
- *cwn23*-Central Bank involvement in developing fiscal policy,
- *cwn3*-priorities and main objectives of monetary policy,
- *cwn4*-restrictions on financing the state budget deficit,
- *cwn41*-restrictions on the issue of direct loans to the government,
- *cwn42*-purchase of government securities,
- *cwn43*-credit terms,
- *cwn44*-potential borrowers from the bank,
- *cwn45*-limits on lending by the central bank,
- *cwn46*-maturity of loans,
- *cwn47*-interest rates on loans,
- *cwn48*-transactions with government securities in the primary market.

A peculiarity of data on indicators of central bank independence is their low variability over the years since countries rarely change the law on the central bank. Therefore, we used averaged data over four 5-year intervals: 2001-2005, 2006-2010, 2011-2015, and 2016-2020. Table 1 presents descriptive statistics for the main CBI indexes *gmt* and *cwn* and variables *Poil*-real price of oil, *dPoil*-real oil price increment, *Growth*-GDP growth rate, *Infl*-inflation rate, and *Gini*-Gini index. Please note that the average values for the rate of economic growth, the rate of inflation and the level of income inequality in post-Soviet countries are higher than in developed countries.

Table 1: Descriptive statistics

Variable	developed countries				PostSoviet countries			
	Mean	SD	Min	Max	Mean	SD	Min	Max
gmt	7.92	2.26	4	12	9	1.71	6	11
cwn	0.50	0.07	0.38	0.63	0.53	0.07	0.39	0.67
Poil	66.1	18.6	41.7	89.1	66.1	18.6	41.7	89.1
dPoil	15.6	35.3	−33.1	65.9	15.6	35.3	−33.1	65.9
Growth	2.18	1.86	−1.60	8.17	4.66	3.98	−2.84	16.9
Infl	2.95	3.01	−0.37	22.3	8.70	6.72	0.95	32.5
Gini	25.6	9.51	0	36.9	28.3	10.3	0	40.8

Since the number of periods is small, there was no need to check the data for stationarity.

3.2. Methods

The panel data model is most suitable for the available data structure. It relates both the spatial components of the data and their temporal changes. The panel data model controls individual heterogeneity of objects, which is not always available for cross-sectional and time series models. As is known, the presence of individual heterogeneity can lead to biased estimates of regression coefficients. For example, the properties of panel data models are presented in (Baltagi, 2013). We used averaged data over four 5-year intervals for calculations using a panel data model of the following form:

$$Depvar_{it} = \beta_0 + \beta_1 CBInd_{it} + \beta_2 Poil_t + u_i + \varepsilon_{it} \quad (1)$$

Here:

$Depvar_{it}$ is the dependent variable, $Growth_{it}$ is economic growth rate, or $Infl_{it}$ is inflation rate, or $Gini_{it}$ is decile Gini index of income inequality;

$CBInd_{it}$ is an index or sub-index of central bank independence;

$Poil_t$ is the world price of oil;

$\beta_0, \beta_1, \beta_2$ are coefficients, u_i is an unobservable individual-specific effect, ε_{it} is a remainder disturbance, i is an index of country, and the index of interval t takes values from 1 to 4.

Each equation of type (1) includes only one index or sub-index of central bank independence, since, firstly, mixing the index of its sub-indices as independent variables does not make sense, and secondly, many sub-indices are correlated with each other. Also, time effects are not included in equation (1) due to the small number of periods.

4. RESULTS AND DISCUSSION

For the dependent variables *Growth, Infl*, and *Gini*, equation (1) was estimated with the independent variable *cwn* or *gmt*, or each of their subindexes, and the oil price variable *Poil* or its first difference *dPoil*. The corresponding estimation results of the fixed-effects panel data model are shown in Tables 2-4. Robust estimates were obtained to assess the estimated coefficients' significance to eliminate the consequences of possible heteroskedasticity. The Hausman test confirmed the preference for using a fixed effects model over a random effects model. Moreover, the tables show the results only for those equations where the estimated coefficients were significant, at least at the 5% level.

4.1. Growth

Table 2 presents the results of estimating equation (1) with the dependent variable *Growth*. First, we note that the influence of the GMT and CWN indices on the economic growth variable was insignificant for developed countries but was significant for post-Soviet countries, and the coefficients for them are negative. This means that the independence of the central banks of developed countries did not significantly impact their economic growth rates, which is consistent with (Haan and Kooi, 2000; Bogari 2020, Jafari-Samimi et al., 2010). But for post-Soviet countries, it reduced their rates of economic growth. This can be explained by the fact that the lower degree of independence of the central bank allows the government to intervene in its activities to promote economic growth and that there may be deviations between the actual independence and the legal independence of central banks in these countries (Nagac and Rizvanoghlu, 2018). Higher oil prices, while increasing production costs, also generally reduced economic growth rates in developed and post-Soviet countries in all combinations with the GMT and CWN indices and their subindices in equation (1). These results are consistent with findings, for example, in (Wu et al., 2018; Luqman et al., 2019; Lawal et al., 2020; Raggad, 2021; Deluna et al., 2023).

The influence of *gmt1* "GMT sub-index of political independence" on the Growth indicator was insignificant for developed countries. At the same time, its two subindexes, *gmt11*, "Central bank governor appointed without the participation of the government," and *gmt16*, "There is no need to approve the main directions of monetary policy by the government," were significant but influenced Growth in opposite directions. The first means weakening the government's ability to intervene in the central bank's activities and encourage it to support economic growth. The second shows the central bank's independence in choosing monetary policy, which is usually aimed at maintaining price stability that promotes business activity in the country's economy.

For post-Soviet countries, the influence of *gmt1* "GMT sub-index of political independence" on economic growth was significant and negative, as well as its one sub-index *gmt17* "Fixing price stability in the legislation as the main goal of the central bank." Fixing price stability in the law on the central bank as its main goal weakens the ability of the Central Bank to pursue other goals, including supporting economic growth.

The impact of *gmt2* "GMT sub-index of economic independence" on economic growth was positive in developed countries and

Table 2: Panel regression with fixed effects, the dependent variable is *Growth*, four 5-year intervals for 2001-2020

Equation with CBI indicator	Developed countries			Post-Soviet countries		
	CBI indicator	*Poil*	Constant	CBI indicator	*Poil*	Constant
gmt-GMT index				−1.08***	−0.065**	18.67***
				(0.24)	(0.022)	(2.59)
gmt1-GMT sub-index of political independence				−2.17**	−0.065**	22.53***
				(0.49)	(0.022)	(3.35)
gmt11-Central bank governor appointed without the participation of the government	−0.65***	−0.041***	5.32***			
	(0.20)	(0.010)	(0.76)			
gmt16-There is no need to approve the main directions of monetary policy by the government	4.13***	−0.042***	7.51***			
	(1.25)	(0.010)	(1.10)			
gmt17-Fixing price stability in the legislation as the main goal of the central bank				−4.57***	−0.063**	12.47***
				(1.23)	(0.022)	(1.56)
gmt2-GMT sub-index of economic independence	0.30**	−0.041***	3.94***	−2.16**	−0.065**	14.82***
	(0.14)	(0.010)	(0.47)	(0.49)	(0.022)	(1.93)
cwn-CWN index				−23.14***	−0.063**	21.09***
				(5.39)	(0.022)	(3.28)
cwn12-Institution that appoints the central bank governor	−2.58***	−0.041***	5.56***			
	(0.81)	(0.010)	(0.82)			
cwn3-Priorities and main goals of monetary policy				−7.63***	−0.063**	12.80***
				(2.05)	(0.022)	(1.60)
cwn43-Lending terms	2.65***	−0.039***	4.46***			
	(1.14)	(0.010)	(0.75)			
cwn44-Potential borrowers from the bank	2.53***	−0.039***	4.38***			
	(0.62)	(0.010)	(0.72)			
cwn48-Transactions with government securities in the primary market	−7.79***	−0.042***	10.61***			
	(1.19)	(0.0094)	(1.31)			
Poil-Price of oil		−0.040***	4.85***		−0.064**	8.91***
		(0.010)	(0.63)		(0.021)	(1.42)

In parentheses, there are robust standard regression coefficient errors; **, *** – the significance of coefficients at 5%, and 1% levels, respectively. Each row shows the estimated coefficients of equation (1) for the corresponding CBI index or subindex and Poil. Rows containing insignificant coefficients for developed and post-Soviet countries are omitted

Table 3: Panel regression with fixed effects, the dependent variable is *Infl*, four 5-year intervals for 2001–2020

Variables	Developed countries			Post-Soviet countries		
	CBI indicator	*dPoil*	Constant	CBI indicator	*dPoil*	Constant
gmt-GMT index				−0.99***		17.57***
				(0.16)		(1.48)
gmt1-GMT sub-index of political independence				−1.97***		21.08***
				(0.33)		(2.07)
gmt12-Central bank governor is appointed for a term of more than 5 years	1.72**	0.027***	1.50***			
	(0.66)	(0.007)	(0.35)			
gmt13-The board of the central bank is appointed without the participation of the government	−0.55***		3.24***			
	(0.08)		(0.042)			
gmt14-Members of the board of the central bank are appointed for a term of more than 5 years	2.34**	0.025***	1.53***			
	(0.61)	(0.007)	(0.24)			
gmt16-There is no need to approve the main directions of monetary policy by the government	−4.59***	0.020***	5.27***			
	(1.66)	(0.006)	(1.06)			
gmt2 – GMT sub-index of economic independence	0.21***		2.30***	−1.97***		14.07***
	(0.05)		(0.15)	(0.33)		(0.90)
cwn – CWN index				−23.21***		20.98***
				(4.09)		(2.16)
cwn1 – Personnel autonomy				−37.34**	0.063***	28.01***
				(12.77)	(0.011)	(6.89)
cwn43 – Lending terms	38.45***		−1.60***			
	(2.85)		(0.34)			
dPoil – First difference of oil price		0.020***	2.64***		0.069***	7.96***
		(0.0052)	(0.081)		(0.011)	(0.055)

In parentheses, there are robust standard regression coefficient errors; **, ***-the significance of coefficients at 5%, and 1% levels, respectively. Each row shows the estimated coefficients of equation (1) for the corresponding CBI index or subindex and dPoil. Rows containing insignificant coefficients for developed and post-Soviet countries are omitted

negative in post-Soviet countries. The fact is that during the study period in developed countries, inflation was at a low level, and their central banks were little concerned about lowering prices and could direct their monetary policy to support economic growth. And in post-Soviet countries, inflation was relatively high, and their central banks focused their main efforts on reducing it without paying much attention to supporting economic growth.

Table 4: Panel regression with fixed effects, the dependent variable is *Gini*, four 5-year intervals for 2001–2020

Variables	Developed countries			Post-Soviet countries		
	CBI indicator	*Poil*	Constant	CBI indicator	*Poil*	Constant
gmt-GMT index				−3.84***		62.85***
				(0.63)		(5.67)
gmt1-GMT sub-index of political independence				−7.68***		76.50***
				(1.26)		(7.91)
gmt11-Central bank governor appointed without the participation of the government	4.94**		22.25***			
	(2.12)		(1.45)			
gmt17-Fixing price stability in the legislation as the main goal of the central bank				−15.68***		40.83***
				(2.65)		(2.12)
gmt2-GMT sub-index of economic independence	−9.28***	0.28***	35.80***	−7.68***		49.20***
	(1.50)	(0.05)	(4.56)	(1.26)		(3.43)
gmt24-Supervision of banks is not included in the functions of the central bank	−8.39***	0.28***	11.18***			
	(0.62))	(0.05)	(2.95)			
cwn-CWN index				−84.45***		72.99***
				(14.16)		(7.49)
cwn1-Personnel autonomy				−27.02***		42.67***
				(3.40)		(1.81)
cwn12-Institution that appoints the central bank governor	19.76**		20.33***			
	(8.49)		(2.28)			
cwn13-Early removal of central bank governor from office	17.31***		20.10***			
	(4.07)		(1.30)			
cwn2-Development of monetary policy	−71.07**	0.29***	58.32***			
	(27.28)	(0.051)	(18.68)			
cwn22-An institution that has the last word in conflict resolution	−35.52**	0.29***	32.96***			
	(13.65)	(0.024)	(9.31)			
cwn3-Priorities and main goals of monetary policy				−26.13***		42.00***
				(4.42)		(2.32)
cwn4-Restrictions on financing the state budget deficit	−264.9**	0.25***	71.2***			
	(101.5)	(0.044)	(24.6)			
cwn43-Lending terms	−67.27***	0.25***	17.32***			
	(5.29)	(0.04)	(3.41)			
cwn44-Potential borrowers from the bank	−43.70***	0.25***	15.56***			
	(3.82)	(0.04)	(3.17)			
Poil-Price of oil		0.27***	7.46**		−0.068	32.79***
		(0.05)	(3.17)		(0.058)	(3.82))

In parentheses, there are robust standard regression coefficient errors; **, *** – the significance of coefficients at 5%, and 1% levels, respectively Two subindices of the CWN index, *cwn1*, "Personnel autonomy" and *cwn3*, "Priorities and main goals of monetary policy," did not affect inequality, and an increase in subindices *cwn2*, "Development of monetary policy" and cwn4, "Restrictions on financing the state budget deficit" contributed to a decrease in inequality. The coefficients for some of their subindices are positive or negative, but the effect for the CWN and the GMT index was generally insignificant

Of the four subindices of the CWN index, the influence of only one of its subindexes, *cwn3* "Priorities and main goals of monetary policy," on the Growth indicator is significant and negative for post-Soviet countries. For developed countries, it is insignificant. In post-Soviet countries, the ability to independently determine the priorities and goals of their monetary policy puts the support of price stability in the first place, reducing central banks' interest in accelerating economic growth.

Table 2 shows several sub-indices of the second-level CWN index that significantly impacted the economic growth rate in developed countries. Among them, *cwn12* "Institution that appoints the central bank governor" and *cwn48* "Transactions with government securities in the primary market," the increase harmed Growth, and *cwn43* "Lending terms" and *cwn44* "Potential borrowers from the bank," the increase, on the contrary, contributed to decrease in Growth. At the same time, none of the second-level CWN index sub-indices significantly impacted economic growth in post-Soviet countries.

4.2. Inflation

The results in Table 3 show that the impact of the main independence indices GMT and CWN on the inflation rate inflation and economic growth in the previous table was insignificant for developed countries but significant and negative for post-Soviet countries. In developed countries, inflation is low, and in such a situation, CBI has no significant influence on it (Bernanke, 2017; Rogoff 2019; Chiquiar Ibarra, 2020; Garriga and Rodriguez, 2020). The CBI has a significant downward effect in post-Soviet countries, where inflation is much higher. The estimated coefficients for the variables *gmt* and *cwn* are significant and negative. As it turned out, it is not the price of oil but its change that significantly affects inflation. The results show that an increase in oil price increment increased the inflation rate in developed and post-Soviet countries. It is oil price shocks that Ha et al. (2023), Cheikh et al. (2023), and others pay attention to when studying their impact on inflation.

The *gmt1* indicator "GMT sub-index of political independence" did not significantly impact the inflation rate in developed countries. However, its second-level sub-indices, *gmt13*, "The board of the central bank is appointed without the participation of the government," and *gmt16*, "There is no need to approve the main directions of monetary policy by the government," had a downward impact on inflation. Increase in sub-indexes *gmt12* "Central bank governor is appointed for a term of more

than 5 years", *gmt14* "Members of the board of the central bank are appointed for a term of more than 5 years", as well as sub-index *gmt2* "GMT sub-index of economic independence" acted in the direction of increasing inflation. Among the subindices of the CWN index, the impact on inflation of only one subindex, *cwn43* "Lending terms," was significant, and its increase, on the contrary, increased inflation. In general, the resulting impact on inflation of the GMT and CWN indices in developed countries was insignificant.

For post-Soviet countries, the coefficients for the subindices *gmt1* "GMT sub-index of political independence" and *gmt2* "GMT sub-index of economic independence" are negative, which corresponds to the downward impact of central bank independence on inflation, measured by the GMT index. The negative coefficient for the subindex cwn1 "Personnel autonomy" indicates that its increase, corresponding to strengthening the central bank's independence, also helps reduce inflation.

4.3. Income Inequality

Table 4 shows estimates of the impact of the GMT and CWN indices and their subindices on income inequality, as measured by the Gini index, by decile group of the population. GMT and CWN indices did not significantly impact income inequality in developed countries, but their increase reduced inequality in post-Soviet countries. There are mixed opinions about the impact of CBI on income inequality, for example (Binder, 2019; Aklin and Kern, 2021; Tomita, 2023). The calculation results in Table 4 show that rising oil prices increased in developed countries, but in post-Soviet countries did not significantly impact the inequality level. Researchers Tan and Uprasen (2023), Berisha et al. (2021), and O'Hara and Gentile (2009) showed that an increase in the price of oil can increase or decrease income inequality depending on whether a country is an oil exporter or importer, and whether it is a small or large resource-rich country whether the benefits from oil or gas production are distributed evenly among the population across regions of the country.

For developed countries, the indicator *gmt1*, "GMT sub-index of political independence," did not affect inequality, and an increase in its sub-index *gmt11*, "Central bank governor appointed without the participation of the government," increased inequality. But the increase in *gmt2*, "GMT sub-index of economic independence," and its sub-index *gmt24*, "Supervision of banks is not included in the central bank functions," reduced inequality.

In post-Soviet countries, both sub-indexes *gmt1*, "GMT sub-index of political independence," and *gmt2*, "GMT sub-index of economic independence," as well as the second level sub-index *gmt17*, "Fixing price stability in the legislation as the main goal of the central bank" with their increase influenced the decrease in the Gini index. The growth of two of the four subindices of the CWN index, *cwn1*, "Personnel autonomy," and *cwn3*, "Priorities and main goals of monetary policy," reduced inequality. All coefficients for the GMT and CWN indices and their subindices are negative.

5. CONCLUSION

The purpose of this study was to empirically investigate the impact of central bank independence and oil prices on macroeconomic indicators, namely growth, inflation, and income inequality, using panel data of post-Soviet and developed countries from 2001 to 2020. The study also identified which sub-indices of the GMT and CWN indices and how they affect these macroeconomic indicators. Other previous studies for groups of countries and periods have shown mixed effects of CBI on these macroeconomic indicators, ranging from positive or negative effects to no significant impact. This study revealed significant differences in the impact of CBI for post-Soviet and developed countries.

Higher CBI values in developed countries did not significantly impact economic growth, inflation, and income inequality. But in post-Soviet countries, they contributed to slower economic growth, lower inflation, and lower income inequality. This can be explained by the fact that in developed countries, macroeconomic indicators have been reached, at which further increases in the independence of central banks no longer significantly impact these indicators. But in post-Soviet countries the situation is different; the average inflation and economic growth levels in them are much higher. In these countries, increasing the CBI reduces the government's ability to support economic growth and, at the same time, increases the central bank's ability to contain price increases. The CBI does not directly affect inequality but can influence it indirectly through economic growth and inflation changes.

Rising oil prices slowed economic growth in both developed and post-Soviet countries. It also reduced income inequality in developed countries but did not significantly impact post-Soviet countries. Oil prices do not affect inequality in post-Soviet countries can be explained by the weak redistribution of income from oil production or its use between different population groups. As it turned out, inflation was affected not by an increase in the price of oil but by an increase in its increment. It increased inflation both in developed countries and in post-Soviet countries. The results of this study shed light on the role of CBI and the impact of oil prices on the dynamics of macroeconomic indicators. They can be useful for developing macroeconomic policies.

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