Krakow University of Economics

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Dear Readers,

This latest issue of *Argumenta Oeconomica Cracoviensia*, which publishes original works in the field of economics and finance, outlines some very important key themes and makes invaluable scholarly contributions, paying detailed attention to the issue of inflation, an economic and financial phenomenon, which has multidimensional impacts on an economy. The problems with inflation, both theoretically and practically, that intensified during the COVID-19 pandemic, again demonstrated not only the complexities of the drivers but also the unusual efforts demanded by central banks to tackle this phenomenon. A lot of economies and countries recorded high inflationary pressures, among these countries was Poland, where inflation rates were among the highest of all European Union member states. In 2023, the inflation rate exceeded 18%, while the established operational target was –2.5%.

It is a well-established fact in the literature that shaping (controlling) inflation by monetary authorities is a difficult task due to the multiplicity of factors that influence it to a great extent. Several objectives, subjective, internal, external, monetary, fiscal, and others, all come into play when trying to target, measure, and control inflation. An additional difficulty in controlling inflation results from the fact that, based on observations of the monetary policy pursued by various central banks of many countries, there are the effects of policy delays (time lags), i.e. which comprise the time taken for the identification stage of an issue, introduced decisions (tools) and the expected outcome. This means that the decisions of the monetary authorities should be made well in advance. Hence, it is worth recommending the article by Jan Czekaj, Paweł Oleksy and Maciej Bolisęga titled "Inflation Targeting and Inflation Forecasts under Conditions of Increased Uncertainty: Evidence from Poland".

This issue of the journal also delves into the model solution for the financial (economic) system, which favours price controls, providing the monetary authorities (central banks) with institutional and political independence.

This model is tried and tested as we witnessed in the early stages of the eurozone where inflation was low, and most economies experienced steady and sustained growth with low rates of unemployment. Moreover, both collegiality in decision-making and the term of office of the central bank bodies (authorities) also buttress the model adopted. The preference for such a model was, and still is, visible with the creation of the eurozone within the European Union. The Maastricht Treaty specified the above--mentioned institutional principles of monetary policy of member states and clearly states the position of central banks in the economic system. Problems and challenges that appeared with the 2007 financial crisis, forced the European Central Bank (ECB) to temporarily relax the ban on supporting governments of eurozone countries with loans but not in the case of Poland, where the National Bank of Poland (NBP), is prohibited by constitutional provisions and other financial legal acts. But by virtue of membership of the ECB, Poland, among other countries, was obliged to comply with the granting of loans to the government (state budget) during the COVID-19 pandemic period as this was an abnormal time. It was during this period that the NBP supported the government by purchasing treasury bonds, an action which was often the subject of extreme criticism. After the change of the government in 2023, attempts were made to bring the Governor of the Central Bank (NBP) before the State Tribunal to account for certain actions taken. This would have constituted an unprecedented case and is currently the subject of dispute and controversy. The above situation is further analysed in an article by Stanisław Owsiak on the theme, "Monetary and Fiscal Policy Controversies: A Polish Perspective", which expands and explores arguments for and against this contentious relationship between Poland's monetary and fiscal policies and its institutional and legal frameworks.

The economic journal broadens its scope with a contribution by two authors Bartolomeus Azel Winpor and Ariodillah Hidayat titled "The Effect of Interest Rates, Exchange Rates, and Foreign Direct Investment on Financial Stability in Indonesia". The paper presents an interesting view in which the authors shed light on the experience of the Indonesian economy and the effect of the 2007 financial crisis on financial stability and the various aspects of the crisis. Therefore, it is worth reading due to the international perspective it provides on the similar themes mentioned in this issue, such as inflation and interest rates that are among many other factors that shape financial stability in some emerging markets.

Additionally, this issue includes works from the field of economic theory focusing on methodological issues in the study of economic and financial phenomena. The journal features an article by Klaudia Lenart titled "Anomaly Detection Based on Measures of Influence for Modelling Economic Phenomena".

Corruption is a phenomenon that significantly disrupts the harmonious economic and social development of many countries. It also makes it difficult to control inflation, let alone maintain financial stability, increase income and close inequality gaps. The negative effects of corruption and its ubiquity are undoubtedly influenced by institutional underdevelopment and weak democratic mechanisms. Corruption is a huge problem in developing countries because financial and economic aid that reaches these economies in various forms is wasted, thereby weakening economic growth. Many studies show that corruption is particularly severe in almost all African countries. I am certain, therefore, that the article by Ergin Akalpler and Oluwatoyin Abidemi Somoye titled "Impact of Government Corruption and Economic Growth in Sub-Saharan Countries" will give readers insights into the above-mentioned menace.

The periodical *Argumenta Oeconomica Cracoviensia* should have been published, according to plan, twice a year. Due to the COVID-19 pandemic, there were some difficulties related to the inflow of articles, as well as concerns about how to proceed. For these reasons, the journal was not published in the years 2022–2023. When publishing this issue 1–2(26–27)/2024, the numbering sequence was followed in order to emphasise the continuation of publication of the journal.

I wish our esteemed readers an inspirational reading experience and invite you to explore these original texts which report and reflect on important scientific issues, and the reviews of outstanding articles in scientific journals. The Editors promise a broad and insightful exploration of contemporary economic and financial challenges in this issue and in those to follow.

Prof. Stanisław Owsiak
Editor-in-chief

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Jan Czekaj
Paweł Oleksy
Maciej Bolisęga

INFLATION TARGETING AND INFLATION FORECASTS UNDER CONDITIONS OF INCREASED UNCERTAINTY: EVIDENCE FROM POLAND

Abstract

Objective: This paper aims to assess the National Bank of Poland's efficacy in implementing inflation-targeting monetary policy amidst heightened uncertainty and inflationary pressures during the 2020–2022 period.
Research Design & Methods: Standard forecast error metrics (MAE, MAPE, RMSE) are employed to evaluate the accuracy of inflation forecasts by the National Bank of Poland (NBP). Additionally, qualitative analysis of NBP communication is conducted to discern signals or processes that indicate a departure from the pure inflation--targeting regime. Furthermore, outright buy operations of the NBP are scrutinised to ascertain the true purpose of quantitative easing undertaken during 2020–2021 and its alignment with inflation-targeting policy. Finally, both actual and projected inflation rates are examined for potential inconsistencies in the central bank's responses to ongoing inflationary trends.

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Findings: Analysis of forecast errors and accuracy metrics reveals a significant deterioration in the quality of inflation projections, rendering them ineffective in guiding monetary policy decisions in extreme times. Moreover, examination of selected actions by the NBP indicates deviations from the strict inflation targeting regime, resulting in inappropriate and untimely decisions to tighten monetary policy.
Implications/Recommendations: Discrepancies observed between formal and actual goals of domestic monetary policy, evident in central bank communication, the true purpose of quantitative easing (QE) operations, and the timing or direction of monetary decisions between 2020 and 2022, suggest the need for policymakers to recalibrate or reinforce the legal framework.
Contribution: This study extends the current understanding of the effectiveness of monetary policy under strict inflation targeting in a volatile economic environment. Analysing the approach of the National Bank of Poland in 2020–2022, it provides valuable insights into how discrepancies between the formal and actual goals of monetary policy may impact inflation rates.

Keywords: inflation targeting, inflation forecasts, forecast accuracy, monetary policy.
JEL Classification: E31, E52, E58.

1. Introduction

Inflation targeting has recently become a prevalent monetary policy regime worldwide (Mishkin & Schmidt-Hebbel, 2001; Zhang & Wang, 2022). Explicitly, this is a strategy in which the central bank sets an inflation target with a predefined tolerance range and aims to maintain the desired inflation rate consistent with this target over a specified time horizon (Bernanke & Mishkin, 1997). It assumes that maintaining price stability, i.e. a low and stable inflation rate, is the most substantial contribution of monetary policy to ensuring sustainable economic growth in the long term (Svensson, 1997). Previous monetary policy mechanisms were characterised by short-term manipulation of monetary instruments to achieve other goals, such as low unemployment or high GDP growth, which, in many situations, contradicts the goal of maintaining price stability.

Technically, inflation targeting may be referred to as forecast-based policy (Bernanke & Woodford, 1997; Svensson, 1997, 1999, 2009, 2020; Bernanke, 2004; Orphanides & Williams, 2005; Woodford, 2010). In general, it prompts the central banks to look ahead and to tighten monetary policy earlier, before inflation rates reach high levels. Central banks pursuing inflation targeting employ various types of forecasts to depict the future trajectory of inflation. Comparing these forecasts with the inflation target enables preemptive decision-making before inflation exceeds undesirable thresholds (Debelle *et al*., 1998). If the forecast-based policy is to be effective, some

conditions must be met. Among them two in particular stand out as crucial: firstly, inflation projections must demonstrate high accuracy, minimising disparities from actual inflation levels across the forecast horizon; secondly, the decisions of monetary authorities must rely heavily on these projections. If actual inflation deviates considerably from the projections or decisions are based on other premises, the inflation targeting framework cannot function properly.

Formally, central banks have been charged with either strict or flexible inflation-targeting monetary policy mandate (Svensson, 2009). While the former restricts them concentrating on stabilising inflation around the target only, the latter further extends their responsibilities to ensuring the stability of the real economy. Therefore, under a flexible regime, monetary authorities are continuously seeking a compromise between stabilising output and inflation and may temporarily prioritise one of the sub-targets. As suggested by Bernanke and Woodford (1997), although inflation forecasts may be useful for monetary authorities, when making monetary decisions they should rather rely on extensive structural models of the domestic economy.

In practice, forecasting inflation is always a difficult task, but it is especially challenging when general economic conditions are affected by serious shocks. Empirical evidence suggests that inflation projections were quite accurate until the Great Financial Crisis, during the period called Great Moderation (McNees, 1992; Debelle *et al*., 1998; Cristadoro, Saporito & Venditti, 2013; Gestsson, 2018; Bennett & Owyang, 2022; Chahad *et al*., 2022). The recent global surge in inflation in the aftermath of the COVID-19 pandemic crisis and instabilities caused by Russian aggression in Ukraine has exposed the vulnerabilities of inflation-targeting monetary policy that relies heavily on inflation forecasts. First, under increased uncertainty caused by the extraordinary events (pandemic, war) the quality of inflation projections has deteriorated significantly, which makes them inadequate for making monetary policy decisions in extreme times. Secondly, macroeconomic shocks have prompted an informal reordering of the priorities of monetary policy, shifting focus away from the primary objective of combating inflation towards a greater emphasis on addressing other economic goals important for crisis management (e.g. reducing unemployment, enhancing liquidity of government bond markets, supporting the state budget, stimulating the real economy). While formal monetary policy goals have remained unchanged, their dilution has diminished the efficacy of monetary policy in keeping inflation close to the target. In this

paper we examine the efficacy of the National Bank of Poland (NBP) in pursuing inflation-targeting monetary policy under conditions of increased uncertainty and inflationary pressure. Specifically, we assess the utility and accuracy of inflation forecasts prepared by the NBP and indicate possible deviations of formal monetary goals from the norms prescribed by a strict inflation-targeting regime. To achieve this, we conducted a comparative analysis of conventional forecast error metrics alongside the identification of inconsistencies between the pursued monetary policy and its formal objective. Our hypothesis posits that, since the onset of the pandemic, the inflation projections of NBP have deteriorated drastically, coupled with a diminished role for the inflation target in monetary policy decisions, which have collectively undermined the efficacy of monetary policy, culminating in significantly elevated levels of inflation. Poland, as an emerging economy neighbouring Ukraine and Russia, has been particularly exposed to shocks and high uncertainty effects that shape the local economic conditions. Nevertheless, the adopted inflation-targeting monetary policy framework leaves, at least formally, no room for deviations from its primary focus, which remains price stability irrespective of circumstances. By identifying discrepancies between formal and actual goals of domestic monetary policy, which are evident in both central bank communication, the real purpose of quantitative easing (QE) operations, and the timing or directions of monetary decisions, we uncover the true nature of inflation-targeting regime in Poland between 2020 and 2022, which may be an indication for policymakers to recalibrate and strengthen the legal framework.

The structure of the paper is as follows. Section 2 describes the monetary policy mandate of NBP and characteristics of inflation forecasts. Section 3 clarifies the nature and limitations of the data set and methodology. Section 4 discusses the results and their implications. Concluding remarks follow in section 5.

2. Inflation-targeting and Inflation Forecasts of the National Bank of Poland

As stipulated in the Constitution of the Republic of Poland and the Act on the National Bank of Poland, NBP's principal aim is to uphold price stability while supporting the economic policy of the Government, provided that this does not impede NBP's primary mandate. This general regulation serves as the foundation for the inflation-targeting framework developed by the Monetary Policy Council (MPC), which specifies NBP's primary

objective as achieving a stable inflation rate of 2.5% with a permissible tolerance band of +/– 1 percentage point over a medium-term horizon (NBP, 2003). Thus, monetary policy in Poland has taken the form of a strict inflation-targeting regime. While monetary policy has evolved over the years, the inflation target has remained unchanged since 2004 (Ciżkowicz-Pękała *et al*., 2019).

In order to pursue this strategy, NBP, following other central banks which have implemented an inflation targeting regime, prepares cyclical projections of inflation and GDP, which guide monetary policy decisions. In practice, inflation and GDP projections are developed using the NECMOD model, which after several revisions and improvements has become the primary forecasting tool of the NBP[1].

Model parameters are subject to adjustments by NBP experts, yet the extent to which these experts contribute to the final results of the model projections remains undisclosed. Initially, the projections included information about expert adjustments and their impact on the final results. However, since February 2010, the publication of this information has been discontinued. From February 2008 onward, the projections have included a statistical summary of the results, facilitating comparisons between previous and present inflation forecasts. It should be noted, however, that projections until November 2019 are based on annual periods, while those from March 2020 onward are based on quarterly periods. The frequency of inflation projections, whether annual or quarterly, is crucial for assessing their accuracy. Therefore, the analysis is divided into two periods: from 2009 to 2022 it will cover annual projections, and from 2020 to 2022 it will focus on quarterly projections. This approach is further justified by the relatively stable economic conditions, except for the crisis of 2008–2009, during the period from 2009 to 2019. However, its impact on inflation was not as great as the recent shocks, so the inflation rates remained relatively stable over and after the financial crisis. Therefore, the period covering 2020–2022 characterised by increased uncertainty and dramatic price dynamics is the primary focus in this study.

[1] According to Budnik *et al.* (2009, p. 6): "NECMOD is the structural macroeconomic model of the Polish economy, which was developed foremost to facilitate implementation of the monetary policy in Poland through a regular delivery of inflation and GDP projections. The model encompasses all major channels of the monetary policy transmission mechanism and is able to deliver a comprehensive account of factors underlying the main economic developments. With its complex labor market structure, explicit incorporation of inflation expectations, distortionary fiscal policy and heterogeneity of the capital stock, NECMOD is able to describe propagation of a range of macroeconomic shocks. As a forecasting tool, the model is specifically designed to reflect the dynamic nature of a converging economy".

An essential consideration for inflation-targeting monetary policy is the choice of an inflation indicator that accurately reflects price dynamics in the medium term. While the consumer price index (CPI) is the primary indicator used to express the inflation target, core inflation is often considered a superior measure of inflationary pressure in the economy (Cristadoro, Saporito & Venditti, 2013; Liu & Smith, 2014). In recent years the central bank has frequently attributed the underestimation of inflation to global factors beyond its control. In this context, it is worthwhile to examine inflation projections that exclude the impact of energy and food prices, referred to as core inflation. Monetary policy exerts greater influence on the course of processes related to core inflation, thus it should remain largely under the control of the central bank.

Nevertheless, in our analysis we include actual and forecasted values of both CPI and core inflation, as well as deviations between the indicators, in order to be consistent with NBP practice. Figure 1 illustrates the formation of actual inflation rates and the NBP reference rate. Furthermore, inflation projections for CPI and core inflation are presented on Figure 2 and Figure 3, respectively.

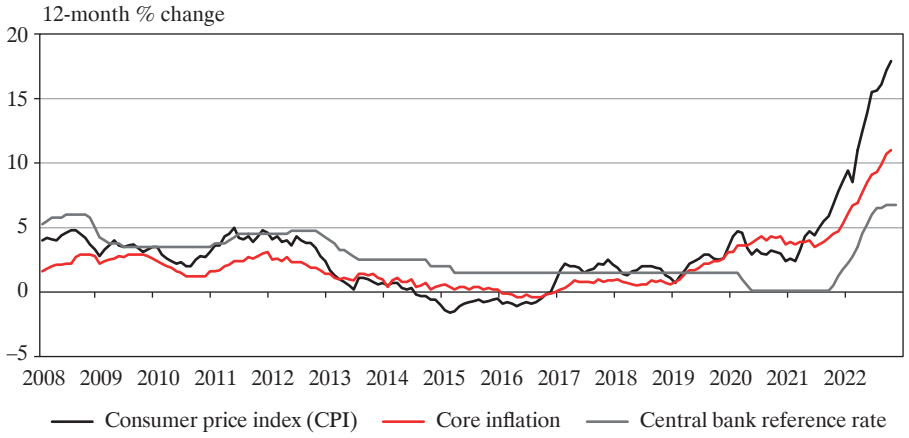

Fig. 1. Consumer Price Inflation (CPI), Core Inflation and the Central Bank Reference Rate in Poland, between 2008 and 2022 (October)

Source: National Bank of Poland, Statistics Poland.

From the beginning of 2018 to July 2021, inflation fluctuated between –1.6% and 5% year-on-year. Only in August 2021 did it exceed 5% (5.5%).

However, increased price change dynamics had already been observed from 2019, peaking in October 2022. Taking into account the rapid increase in inflation, compounded by unpredictable supply-side factors, accurate forecasting of inflation under such conditions is extremely difficult, if not impossible. However, core inflation, particularly in late 2019 and early 2020, seems not to be properly taken into account in the NBP projections and, consequently, not adequately addressed in monetary decisions. Notably, the official inflation forecasts of NBP showed a systematic underestimation of inflation dynamics in this period.

In the years 2020–2022, NBP inflation reports suggested that inflation would typically peak within 1–2 quarters following the publication of the report, and then fall towards the inflation target. However, inflation continued to rise throughout this period, undermining the accuracy of the forecasts. The most evident consequence of the systematic underestimation of inflation is the periodic elevation of the levels from which the medium--term projections anticipated inflation would begin to decline toward the target.

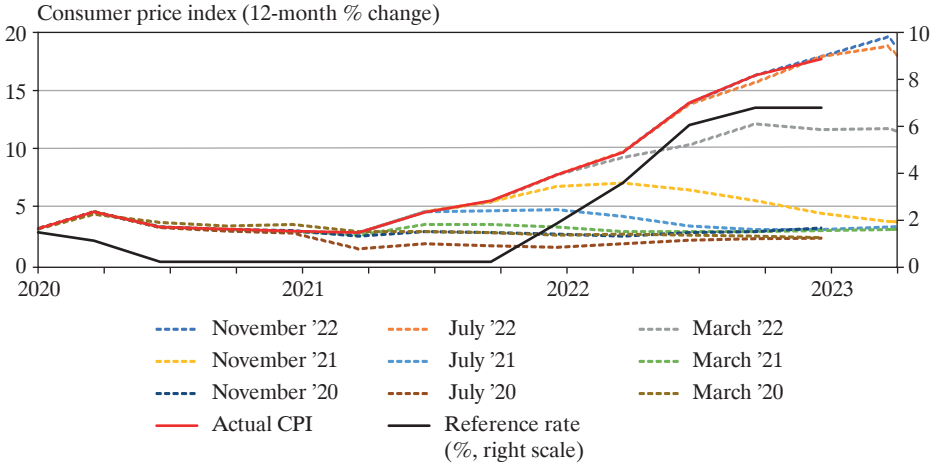

Fig. 2. CPI Inflation Projection According to NBP Inflation Reports Published between 2020 and 2022

Source: National Bank of Poland, Statistics Poland.

Figure 3 presents a series of NBP projections of core inflation, alongside its actual trajectory. Notably, as early as 2020, the actual level of inflation significantly exceeded the central bank's forecasts. Furthermore, despite

the majority of inflation reports between 2020 and 2022 indicating a decline in inflation, the actual reported core inflation remained consistently high, hovering around 4% throughout 2020 and 2021, before beginning to accelerate from the 4th quarter of 2021.

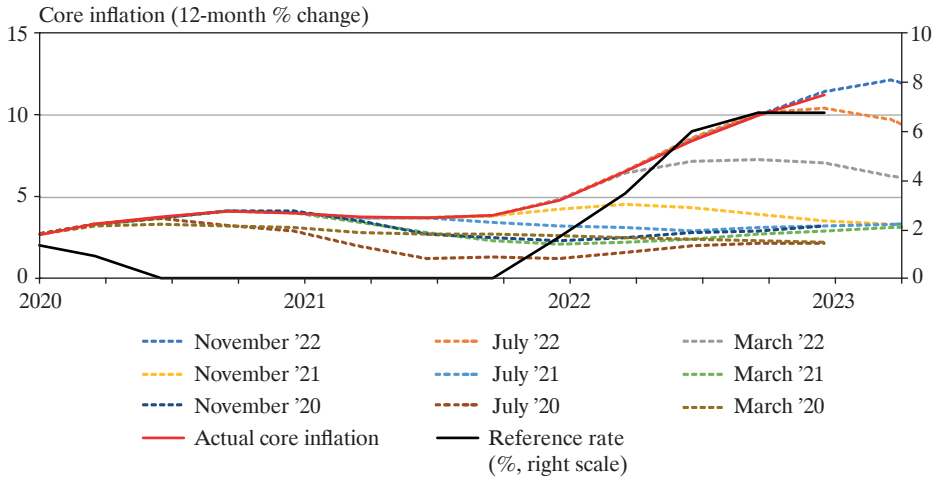

Fig. 3. Core Inflation Projection According to NBP Inflation Reports Published between 2020 and 2022

Source: National Bank of Poland.

3. Methodology and Data

3.1. Data

For the analysis of forecast accuracy we utilise data on the consumer price index (CPI) and core inflation (CPI net of food and energy prices), as well as the forecasts announced by the NBP. Inflation projections are released three times a year (in March, July and November) and cover price developments up to three years into the future from the publication date. The data frequency is annual for 2009–2019, and quarterly for 2020–2022. In both cases the respective inflation rates are computed on a year-to-year basis and are available in Excel format on the NBP website.

As our focus is primarily on recent developments in inflation trends, we divide the data set into two subsamples: subsample A covering projections for the period 2009–2019, and subsample B – with projections for the years 2020–2022. While subsample A includes inflation rates recorded in times of relatively stable price movements, ranging between –1.6% and 5% year-

-to-year (see Fig. 1), subsample B is characterised by highly dynamic price growth driven by increased political and economic uncertainty caused by the COVID-19 pandemic, the energy crisis, and Russia's aggression against Ukraine. Both subsamples can alternatively be considered as "normal" and "uncertain" conditions, respectively.

Importantly, since successive inflation projections are released every four months and incorporate updated information on the current macroeconomic conditions and prospects for the economy, we group them according to comparable time horizons (Table 1). While these horizons are not entirely equal in length, they are sufficiently close to be clustered together without significantly biasing the analysis. For instance, inflation projections for 2009–2010 announced in February, June and October have been grouped together with the respective projections from March, July and November in this subsample. Likewise, a comparable grouping procedure has been applied for projections of similar length (1q, 2q or 4q) classified as spring, summer and autumn in subsample B.

Table 1. NBP Inflation Forecasts for 2009–2019 and 2020–2022

Forecast Published in	Short Name	Forecast for (Annual Average as at the End of)	Approximate Length (in Quarters)
Subsample A: 2009–2019			
February/March in year t	Spring_long	year $t + 1$	$q + 7$
June/July in year t	Summer_long	year $t + 1$	$q + 6$
October/November in year t	Autumn_long	year $t + 1$	$q + 5$
Subsample B: 2020–2022			
March in year t	Spring_1q	2nd quarter of year t	$q + 1$
	Spring_2q	3rd quarter of year t	$q + 2$
	Spring_4q	1st quarter of year t + 1	$q + 4$
July in year t	Summer_1q	3rd quarter of year t	$q + 1$
	Summer_2q	4th quarter of year t	$q + 2$
	Summer_4q	2nd quarter of year $t + 1$	$q + 4$
November in year t	Autumn_1q	4th quarter of year t	$q + 1$
	Autum_2q	1st quarter of year $t + 1$	$q + 2$
	Autumn_4q	3rd quarter of year $t + 1$	$q +4$

Source: own elaboration.

As a result, the total number of available observations varies between 6 and 11 data points depending on forecast length (Table 2).

Table 2. Summary Statistics for Forecast Errors

Specification	CPI		Core Inflation		Number of Observations
	Average (%)	Standard Deviation (%)	Average (%)	Standard Deviation (%)	
Subsample A: 2009–2019					
Spring_long	–0.43	1.41	–0.75	0.42	11
Summer_long	–0.47	1.32	–0.63	0.61	11
Autumn_long	–0.56	1.24	–0.62	0.57	11
Subsample B: 2020–2022					
1q	0.85	1.23	0.53	0.49	8
2q	1.72	1.71	1.24	1.06	7
4q	5.61	4.53	3.41	2.17	6

Source: own elaboration.

Furthermore, the qualitative analyses of deviations from the inflation-targeting regime is based on various sorts of data. The statements of the NBP president or the minutes of the Monetary Policy Council are used to identify non-inflationary targets of the monetary authorities. Additionally, the information on outright buy operations of the NBP and the characteristics of bond emissions subject to QE operations serve to identify the primary focus of the NBP in supporting the government's crisis management.

3.2. Methodology

In the first step, consistent with prior research (Bryan, Cecchetti & Wiggins, 1997; Öller & Barot, 2000; Nguyen & Tran, 2015; Sari, Mahmudy & Wibawa, 2016; Grechuta, 2018), we employ standard forecast error metrics to examine the accuracy of inflation forecasts made by the NBP. These typically include mean absolute forecast error (MAE), root mean squared forecast errors (RMSE), or mean absolute percentage error (MAPE).

In general, inflation forecast error ($E_{t+q,t}$) for a forecast q periods ahead made in period t can be expressed as follows:

$$E_{t+q,t} = \pi_{t+q} - \pi_{t+q,t},$$

where: π_{t+q} is the actual inflation rate in period $t + q$, $\pi_{t+q,t}$ – the inflation forecast q periods ahead prepared in period t, $q > 0$. Positive values of errors indicate an underestimation, while negative values indicate an

overestimation of the forecasted inflation rates. Smaller forecast errors imply greater forecast accuracy.

In order to compute the average error size and simultaneously avoid the mutual cancellation of negative and positive forecast errors, the mean absolute forecast errors (MAE_q) are calculated based on the following formula:

$$MAE_q = \frac{1}{n} \cdot \sum \left| \pi_{t+q} - \pi_{t+q,t} \right|,$$

where: n is the number of observations. Hence, MAE_q measures the average deviation of forecasts q periods ahead from actual inflation by assuming all forecast errors to be positive values. The larger the MAE_q, the less accurate the inflation forecast is. Relatedly, the mean absolute percentage error ($MAPE_q$), which measures the average of absolute forecast errors q periods ahead divided by the actual inflation rates from the corresponding period, is calculated according to the formula:

$$MAPE_q = \frac{100}{n} \cdot \sum \left| \frac{\pi_{t+q} - \pi_{t+q,t}}{\pi_{t+q}} \right|.$$

While MAE_q measures the absolute difference between the actual and the predicted inflation rates, $MAPE_q$ expresses these differences as a relative percentage by dividing them by the actual inflation from the specific period.

Additionally, the root mean squared forecast errors ($RMSE_q$), which represent the standard deviation of the prediction errors, are calculated according to the formula:

$$RMSE_q = \sqrt{\frac{1}{n} \cdot \sum \left(\pi_{t+q} - \pi_{t+q,t} \right)^2}.$$

All metrics have their advantages and disadvantages and can provide varying degrees of accuracy. For instance, when the actual inflation rates are close to or equal to zero, calculating $MAPE_q$ becomes problematic due to the denominator, which can lead to undefined values. Therefore the analysis will be complemented by a graphical presentation of forecast projections and errors to avoid possible misinterpretation.

Furthermore, we aimed to identify monetary policy-related signals or processes that indicate a departure of the NBP from the pure inflation--targeting regime during the period of increased uncertainty. To achieve this, we first conducted a qualitative analysis of both the minutes of the Monetary

Policy Council, chaired by the NBP president, and the subsequent statements made by the president following these meetings. In this respect we build upon empirical evidence suggesting that the NBP exhibits lower consistency in following its forecasts compared to some other inflation targeting central banks (Szyszko & Rutkowska, 2019), and the official or unofficial communications from bank officials pertaining to the NBP's primary mandate which exhibit internal consistency in the short term (Rybinski, 2019). Complementarily, we investigate outright buy operations of the NBP to verify the real purpose of quantitative easing carried out in 2020–2021 and its links to inflation-targeting policy. Finally, we examine both the actual and projected inflation rates in terms of possible inconsistencies in the central bank's reactions to the ongoing inflationary processes.

4. Results and Discussion

4.1. Accuracy of Inflation Forecasts

For the specified inflation projections (Table 1), we present graphical representations of the forecast errors and provide selected accuracy measures. These are reported in Figure 4 and Table 3 for subsample A and in Figure 5 and Table 4 for subsample B. While the metrics for subsample A have been computed by taking into account three periods indicating the subsequent projection announcements (spring, summer, autumn), those for subsample B, due to the limited data set, have been classified based on the length of the forecast horizon (1q, 2q, 4q), irrespective of the announcement time.

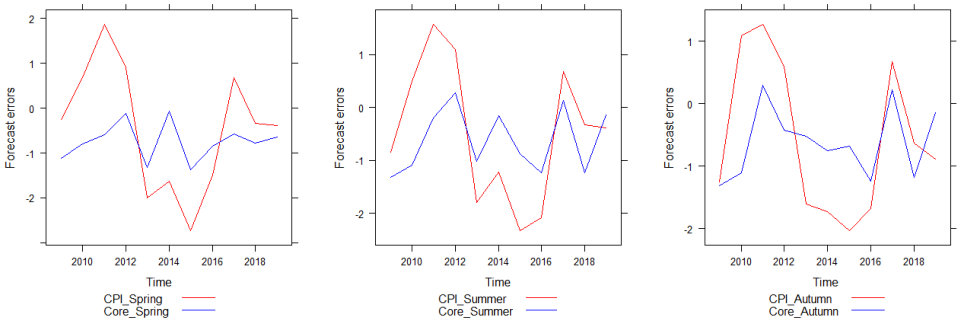

Fig. 4. Forecast Errors for CPI and Core Inflation in 2009–2019 (Subsample A) for Spring, Summer and Autumn Projections

Source: own elaboration.

Table 3. Forecast Accuracy Measures for Subsample A (2009–2019)

Measure	CPI			Core Inflation		
	Spring_ long	Summer_ long	Autumn_ long	Spring_ long	Summer_ long	Autumn_ long
MAE	1.18	1.17	1.22	0.75	0.70	0.72
RMSE	1.41	1.34	1.31	0.85	0.85	0.83
MAPE	676.57	535.28	710.83	112.28	111.76	112.27

Source: own elaboration.

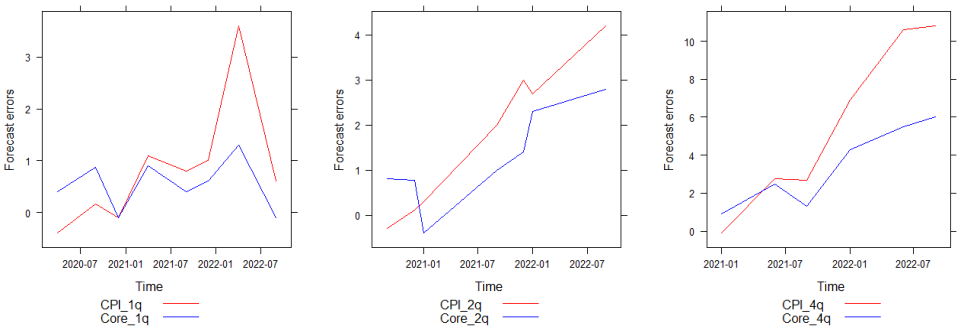

Fig. 5. Forecast Errors for CPI and Core Inflation in 2020–2022 (Subsample B) for Projections of Length 1q, 2q, 4q

Source: own elaboration.

Table 4. Forecast Accuracy Measures for 2020–2022 (Subsample B)

Measure	CPI			Core Inflation		
	4q	2q	1q	4q	2q	1q
MAE	5.64	1.80	0.97	3.41	1.35	0.58
RMSE	6.97	2.33	1.43	3.94	1.58	1.43
MAPE	54.74	22.08	12.01	51.99	23.62	12.01

Source: own elaboration.

The results reveal relatively small errors for core inflation compared to CPI forecasts. This is not surprising, as core inflation excludes changes in food and energy prices that are prone to temporal fluctuations or supply shocks. The high values of MAPE are mostly influenced by the close-to--zero actual deflation rate in 2014, which also reveals the weakness of this measure.

For the period 2020–2022 we present the same accuracy measures for the forecast horizons of one quarter (1q), two quarters (2q) and four quarters (4q) ahead (Table 4, Fig. 5). The relatively high errors across all horizons confirm the strong deterioration of NBP inflation projections since 2021. Interestingly, the short-term forecast errors under increased uncertainty significantly exceed the errors of forecasts extending more than one year in "normal" times. Forecasts with errors several times higher than the inflation target essentially disqualify them as a suitable tool for guiding monetary decisions under an inflation-targeting regime. The accuracy metrics provide supplementary confirmation of discrepancies between actual and projected inflation rates in the period of increased macroeconomic pressure.

4.2. Departures from the Inflation-targeting Regime

4.2.1. General Remarks

In times of increased uncertainty and in crisis situations, monetary authorities take active countermeasures to stabilise the domestic economy and the financial system. The type and scope of actions taken should comply with the legal regulations and be consistent with the monetary policy strategy adopted. Nevertheless, in practice, special circumstances often lead monetary authorities to deviate from inflation-targeting policy and unofficially prioritise other economic objectives. While providing financial support to mitigate macroeconomic shocks is highly desirable, it also raises concerns due to the economically disruptive effects of deviations from official goals. In this subsection we concisely analyse three cases of periodic departures by the Polish central bank from its inflation-targeting regime at the expense of maintaining price stability.

4.2.2. Central Bank Communication

Central bank communication is widely recognised as a pivotal conduit through which monetary policy actions exert influence on the economy (Blinder *et al*., 2008; Baranowski *et al*., 2021). Leveraging this insight, upon scrutinising the announcements by the Polish monetary authorities, there is no doubt that during the analysed period, the NBP has moved away from its strict inflation targeting strategy. This is evident in both the documents of the Monetary Policy Council from decision-making meetings and in the speeches of the NBP governor at monthly press conferences following MPC meetings, where the

motives behind the decisions made were explained in the context of the specific economic situation.

In a situation where, in September 2021, CPI inflation was approaching 6% and core inflation exceeded 4%, and had remained at elevated levels for nearly two years, the central bank, as stated by the governor, deemed these factors insufficient to justify a reduction in overly accommodative monetary policy, thus maintaining the central bank's reference rate at 0.1% (NBP, 2021): "Central banks should not respond to negative supply shocks by raising interest rates. That would be a schoolboy error, leading only to lowering the pace of economic growth, or directly to stifling economic growth. Those who advocate for such a significant, abrupt reaction, raising interest rates in the face of negative supply shocks, actually encourage us to have stagnation or even stagflation. (…) If there is a risk of persistently exceeding the inflation target due to sustained demand pressure, under a strong labour market – meaning low unemployment, and amidst favourable economic conditions, we will promptly tighten monetary policy (…)."

On the other hand, as the cycle of interest rate hikes came to a halt in October 2022, with CPI inflation approaching 18% and core inflation exceeding 10%, the NBP governor articulated that further rate hikes would pose a threat to the economy, hampering economic processes in some way (NBP, 2022b). The MPC's decision to adopt a wait-and-see stance occurred despite the central bank's forecasts not indicating that CPI inflation would return to near the inflation target within the next two years.

It is worth adding that documents published by the MPC confirm the position of the NBP governor, indicating that the general economic situation is treated by the monetary authorities as more important than the inflationary processes that were taking place at the same time. The minutes of the Monetary Policy Council decision-making meeting held on October 5, 2022 (NBP, 2022a), explicitly state: "The majority of the Council members pointed out that, given strength and persistence of the current shocks that remained beyond the impact of domestic monetary policy, a return of inflation towards the NBP inflation target would be gradual. Alongside that, it was underlined that, in accordance with the Monetary Policy Guidelines for 2022, the Council flexibly determined the desirable time necessary to bring inflation back to the target, as bringing inflation rapidly back to the target might entail significant costs to macroeconomic stability".

Since the beginning of 2020, the responses of the monetary authorities in Poland have closely resembled a flexible inflation-targeting strategy similar to that of the Federal Reserve System. The mandate of the US monetary authority is

known as a dual mandate, focusing on price stability and maximum sustainable employment, with both objectives of monetary policy being treated equally. However, while this approach is regulated by law through the Federal Reserve Act in the United States, the implementation of such a strategy in Poland is an independent decision of the monetary authorities.

4.2.3. The Real Purpose of QE Operations

The announcement of large-scale asset purchase operations by the NBP was made in a statement by the NBP Board of Directors on March 16, 2020 and reiterated in a statement following the Monetary Policy Council meeting on March 17, 2020. Initially, the aim of these operations was to purchase government bonds in the secondary market. Their purpose was to alter the long-term structure of liquidity in the banking sector and to ensure liquidity maintenance in the secondary market for government bonds. As of April 8, 2020, the range of instruments purchased was expanded to include debt securities guaranteed by the Treasury, and the purpose of the operations was augmented to enhance the impact of lowering interest rates on the economy, i.e. strengthening the monetary transmission mechanism. In practice, the group of debt securities guaranteed by the Treasury encompassed bonds issued by the Polish Development Fund (PFR) for financing the financial shield and those issued by Bank Gospodarstwa Krajowego (BGK) for the COVID-19 Counteracting Fund (FPC).

Notably, the schedule of tenders for NBP structural operations coincided significantly with the timing of PFR and BGK bond issues. For example, BGK bonds marked FPC0427, with an issue volume of up to PLN 33.585 billion, were issued on April 23, 2020 and then largely purchased by the central bank at subsequent tenders on April 29 (PLN 8.763 billion), May 13 (PLN 4.074 billion), May 27 (PLN 7.999 billion) and June 10 (PLN 1.861 billion). Similarly, PFR bonds marked PFR0324, with an issue size of up to PLN 16.325 billion, were issued on April 27, 2020 and then purchased by the NBP after just 2 days, i.e. at a tender on April 29 (PLN 3.69 billion), and again at a tender on May 13 (PLN 0.76 billion). Table 5 presents the first structural outright buy operations carried out by NBP since the outbreak of the pandemic (March–June 2020). Securities marked with an abbreviation starting with "PFR" or "FPC" indicate bonds issued by off-budget entities, i.e. PFR and BGK, respectively.

Table 5. Structural Open Market Operations of NBP in March–June 2020

No.	Date of Tender	Name of Paper	Maturity Date	Nominal Value of Accepted Offers (mln PLN)	Average Profitability (%)
1	2020-03-19	PS0422	2022-04-25	1,472.04	1.05
	2020-03-19	DS0725	2025-07-25	343.98	1.73
	2020-03-19	DS1029	2029-10-25	680.03	1.97
2	2020-03-23	PS0422	2022-04-25	5,538.69	1.00
	2020-03-23	PS0424	2024-04-25	60.00	1.21
	2020-03-23	DS0727	2027-07-25	20.00	1.81
3	2020-03-26	PS0422	2022-04-25	248.34	0.82
	2020-03-26	DS0725	2025-07-25	37.50	1.23
	2020-03-26	DS0726	2026-07-25	5,032.64	1.44
	2020-03-26	DS0727	2027-07-25	165.45	1.65
	2020-03-26	WS0428	2028-04-25	200.00	1.77
	2020-03-26	DS1029	2029-10-25	5,000.00	1.77
4	2020-04-16	OK0521	2021-05-25	50.00	0.50
	2020-04-16	PS0422	2022-04-25	25.00	0.63
	2020-04-16	OK0722	2022-07-25	500.00	0.65
	2020-04-16	DS0725	2025-07-25	10,037.40	1.04
	2020-04-16	WS0428	2028-04-25	5,042.00	1.38
	2020-04-16	DS1029	2029-10-25	15,000.00	1.38
5	2020-04-29	PS0123	2023-01-25	200.00	0.59
	2020-04-29	PFR0324	2024-03-29	3,690.00	1.40
	2020-04-29	DS0726	2026-07-25	334.50	1.18
	2020-04-29	FPC0427	2027-04-27	8,763.28	1.90
	2020-04-29	WS0428	2028-04-25	194.95	1.42
6	2020-05-13	DS1023	2023-10-25	100.00	0.64
	2020-05-13	PFR0324	2024-03-29	760.00	1.40
	2020-05-13	PFR0325	2025-03-31	3,495.00	1.71
	2020-05-13	FPC0427	2027-04-27	4,074.60	2.09
7	2020-05-27	PS0123	2023-01-25	50.00	0.58
	2020-05-27	PFR0325	2025-03-31	1,011.00	1.71
	2020-05-27	PFR0925	2025-09-22	5,278.00	1.68
	2020-05-27	FPC0427	2027-04-27	7,999.20	1.92

Table 5 cnt'd

No.	Date of Tender	Name of Paper	Maturity Date	Nominal Value of Accepted Offers (mln PLN)	Average Profitability (%)
8	2020-06-10	FPC0427	2027-04-27	1,861.34	1.82
	2020-06-10	PFR0627	2027-06-07	4,490.00	1.87
	2020-06-10	WS0428	2028-04-25	83.00	1.29
	2020-06-10	FPC0630	2030-06-05	1,964.50	2.14
9	2020-06-24	DS0727	2027-07-25	15.00	1.13
	2020-06-24	WS0428	2028-04-25	190.00	1.26
	2020-06-24	DS1029	2029-10-25	180.00	1.31
	2020-06-24	FPC0630	2030-06-05	1,990.40	2.18

Source: National Bank of Poland.

In this manner, the NBP *de facto* financed the government's anti-crisis programme. Along with the government and its affiliated institutions, it established a closed circuit to set these measures in motion. Consequently, the central bank in Poland appeared to extend its mandate informally from primarily ensuring price stability to assuming responsibility for the stability of the entire economy.

4.2.4. Timing and Directions of Monetary Decisions

Another question regarding the efficacy of monetary policy pertains to the timing and direction of monetary decisions. In this regard, several instances emerge where monetary policy decisions were inadequate or delayed. The first occurred at the onset of the first and second quarter of 2020. The actual inflation rate continued to rise from the beginning of the year and March's inflation projection indicated that inflation would remain at elevated levels in the coming months. This was particularly evident in core inflation which exhibited an upward trend, surpassing 4.2% in September, well above the inflation target, and persisting at this level until September 2021 before rising again. Despite increasing inflation pressure, the Monetary Policy Council reduced the basic interest rate to virtually zero, whereas, according to the inflation targeting regime, they should have done the opposite. In our view, this marks the true onset of inflation increases in Poland, primarily driven by demand factors.

Another episode of such underreaction is the behaviour of the MPC in 2021. CPI began to rise at the beginning of the second quarter of that year from the

level of 2.4% in February, and core inflation had remained elevated since the beginning of 2020. Despite obvious arguments, the MPC began to increase the basic interest rate in October, at least 7 months too late, when the real CPI reached 6.8%. We may also argue that the increases were not sufficient because CPI continued its upward trend unabated until November 2022, marking 20 consecutive months of increase.

5. Conclusion

In 1998 the NBP adopted an inflation targeting regime in monetary policy. This strategy proved to be effective in reducing high inflation rates and ensured low inflation over the following 20 years. This changed dramatically in 2021 and 2022 when inflation soared to levels not seen for over two decades.

Basically, there are two sets of reasons that have recently contributed to such a sharp rise in inflation. The first set relates to external shocks caused by the COVID-19 pandemic and the war in Ukraine, which generally increased inflation volatility. The second set results from errors in monetary policy. As our research shows, there are two primary sources of these errors. First of all, the quality of inflation projections has drastically deteriorated, rendering them *de facto* useless in guiding monetary policy decisions. In general, forecasts grossly underestimated the actual inflation rate, so monetary policy decisions lost their fundamental rationale. Second, monetary policy deviated from the strict inflation targeting. In minutes of the Monetary Policy Council decision-making meetings as well as in the statements of the NBP president, unemployment and GDP growth were at least as important as inflation. This led to inappropriate and delayed decisions to tighten monetary policy. Thus, actual inflation in Poland has become too high and persistent. This conclusion may be indicative for policy makers to rethink the monetary policy framework to better align monetary actions with an inflation-targeting strategy under increased uncertainty.

Our study suffers from several limitations. First, the data encompassing internal inflation forecasts of NBP is extremely limited, which restricts our empirical analysis to basic forecast accuracy metrics and graphical presentations of inflation forecasts and their errors. Second, the varying lengths of forecast time horizons make it challenging to compare forecast errors and accuracy measures. Third, our qualitative analysis of recent shifts in monetary policy strategy relies on selected actions or statements of the monetary authorities. Employing more formalised empirical methods would

enable a more comprehensive analysis of potential deviations from the primary goal of monetary strategy pursued by the NBP. Fourth, our research is confined to the inflationary processes observed in Poland. Including other countries with inflation-targeting regimes in the analysis would provide additional insights into differences in inflationary patterns and central bank actions in extreme times. We will address these shortcomings in our next study of the efficiency of the inflation-targeting regime in Poland.

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Stanisław Owsiak

MONETARY AND FISCAL POLICY CONTROVERSIES: A POLISH PERSPECTIVE

Abstract

Objective: The objective of the article is to determine whether the policy of the National Bank of Poland (NBP) as conducted in recent years may be the basis for bringing the president of the NBP before the State Tribunal for violating the Constitution of the Republic of Poland.
Research Design & Methods: The independence of the central bank is of undoubted value in terms of controlling the price level (inflation), but the ban on supporting the government during periods of financial crisis, for example the COVID-19 pandemic crisis, cannot be inviolable. In the detailed analysis of the subject literature, the significance of the activities of other central banks, primarily the European Central Bank, in 2007, is included. An analysis of the NBP's activities during the COVID-19 pandemic was carried out, with particular emphasis on inflation, independence from the government, communication with the public, and financing the government's borrowing needs.
Findings: Analysis of allegations regarding the NBP policy, including the validity of criticism (inflation). However, there are a number of counter-arguments against taking such drastic steps against the president of the National Bank of Poland, whose actions resulted in government support (redemption launched on the secondary market) during the COVID-19 pandemic period, for violating the Constitution.
Implications/Recommendations: It is necessary to introduce a provision into the Constitution allowing the NBP to purchase treasury bonds on the secondary market during periods of extraordinary difficulties on financial markets. Consideration should be given to changing the method of appointing members of the Monetary Policy Council (MPC) in order to prevent a single political grouping exercising political power for more than one term.

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Contribution: The policies of many central banks in the world, including the ECB, the Fed, the Bank of England, and others, confirm the hypothesis that central banks cannot be (and are not) inactive during periods of crisis, in which the fiscal policy resources available to the government are insufficient. The paper draws particular attention to the need for a pragmatic approach in Poland in extreme/crisis conditions. It also points out the need for institutional coordination of fiscal and monetary policy at the Financial Stability Committee.

Keywords: monetary policy, fiscal policy, central bank, inflation, budget deficit, public debt.
JEL Classification: E02, E12, E58, H6.

1. Introduction

Issues related to the theory and implementation of monetary policy are presented in this journal (see for example: Shevchuk, 2020), including an article devoted to the problem of inflation (Czekaj, Oleksy & Bolisęga, 2024). In the process of political and economic transformation in most post-communist countries, reference was made to the achievements of economic theories and practical solutions in the field of the institutional models that constitute the basis of monetary and fiscal policy, and the possibilities for combining them. After the change of political power in Poland, i.e., parliamentary elections in 2023, criticism of the monetary policy pursued by the National Bank of Poland (NBP), its independence, relations with the government, and information (communication) policy have intensified. Furthermore, desires and plans to hold the Governor of the NBP constitutionally accountable (Constitution of the Republic of Poland of 2nd April, 1997, as published in Dziennik Ustaw No. 78, item 483, article 198), would constitute an unprecedented event in the history of the central bank, not only for Poland but also for the European Banking Authority, which is responsible for stability and effectiveness of the European financial system. Due to the broader context of this issue, i.e. the fact that Poland is a member of the European Union, as well the National Bank of Poland being a member of the European System of Central Banks, it is worth referring to and discussing these issues and addressing the allegations directed at the Governor of NBP. The intention to bring punitive actions against the Governor of the Central Bank (NBP), which might cause systemic consequences for the European Banking Authority cannot be underestimated.

2. The European Union Is a Model of Institutional Solutions for Countries Undergoing Systemic Transformation

Historically, two models of relations can be distinguished between the central bank as an entity conducting monetary policy on one hand, and the government conducting fiscal policy on the other. As part of the traditional state financial policy, decisions made by these two entities were coordinated, facilitated by the state control of money, based on legal coercion and economic security (goods and services). Coordination of monetary and financial policies, depending on the status of the monetary and fiscal authorities in each country in a given period, does not exclude the dominance of monetary goals over fiscal goals (see for example, Moreira, Mendonça & Sachsida, 2021). The problem is that these goals may be difficult to achieve at a level that satisfies both policy actors. The point here is to maintain effective control over prices (inflation) using the basic tool at the central bank's disposal, especially interest rates. However, the interest rate policy is not indifferent to entities in the real economy, i.e. production, employment, investment, etc., a typical measure of which are changes in GDP. In simplified terms: the domination of financial policy by the government (fiscal dominance), which involves the forcing of "printing money" to finance expenses that are not covered by income (taxes), resulted in an increase in inflation with many negative effects on society and the economy (Mishkin, 2011, p. 4). In recent years, attention has been drawn to the risk of this phenomenon also occurring in developed economies (Calomiris, 2023). In turn, the situation referred to in the literature as monetary dominance means that monetary policy is active, while fiscal policy is the passive side of financial policy. Thus, the price level in the economy remains under the control of the monetary authority (ECB, 2021), but in crisis situations, the fiscal authorities may, due to the collapse of public finances, lose the ability to act effectively without support from the monetary authorities.

The formation of the European Union by 12 member states based on the pillars of the Maastricht Treaty in 1992–1993 marked a watershed moment that shaped the socio-economic and political transformations within Europe, including Poland. The Treaty established the bedrock and foundational mechanism that would influence and shape a resilient political and economic cohesion through the adoption of similar policies and solutions among member states. The consequence of this event was the gradual expansion of this economic, social and political grouping.

An important step was the admission of 10 new members, including Poland, in 2004. In the Polish context, what is striking was the determination of the political elites to quickly introduce the country to the European Union, at an early stage of economic transformation. This whole process occurred in the turbulent periods of the 1990s with a spontaneous, painful political and economic transformation taking place. The architects of the political and economic changes showed great imagination and determination in this respect.

This was expressed by the adoption of fundamental solutions bringing Polish tax system closer to the EU norms (1992/1993), especially when it came to the future harmonisation of indirect taxes (VAT, excise duty). A manifestation of Poland's determination to join the European Union were the institutional solutions in the adopted Constitution of the Republic of Poland (1997), which introduced the institutions of an independent central bank, collegiality in making monetary decisions, setting the term of office of monetary authorities, and in fiscal policy – a ban on financing government programmes through borrowing (budget expenditures) by the National Bank of Poland. Additionally, setting a limit on the state's debt, similar to the EU (60% of GDP), which also meant indirectly enforcing discipline on the government in terms of the scale of budget deficits, as these values are related. Further fiscal restrictions for the government appeared after joining the EU (2004), when Poland was subjected to the excessive deficit procedure (EDP) three times, in 2004, 2009, 2024, and then to the EU stabilising expenditure rule. Thus, over time, there was gradual institutional integration in the field of fiscal policy.

3. Verification of Model Institutional Arrangements

The model solutions adopted in the Maastricht Treaty were fundamental to the formation of the European Union, as well as to the creation of the eurozone and the European Central Bank (1999). For any further consideration and evaluation of the current situation in Poland, it is important to try to answer the question of whether, and to what extent the institutional solutions adopted with regard to monetary policy and fiscal policy and the relationship occurring between these two areas of state activity were implemented in practice. The analysis of empirical data leads to the conclusion that after the adoption of the Maastricht Treaty, which established formal (nominal) convergence criteria, a gradual disciplining of public finances of member states intending to join the euro area could be

observed. This was reflected in the gradual improvement of the relationship between public debt and gross domestic product. When analysing the qualifying criteria or status of countries for the eurozone, a pragmatic approach was visible in that the debt criterion was not treated as absolute. The level of the ratio (debt/GDP) was not categorically adopted as the basis for fiscal adjustment, but a downward trend in this ratio could be observed in many countries. Otherwise, countries such as Italy, Belgium, and even Germany could not meet this requirement in such a short time. Therefore, the determination of governments to improve the fiscal situation and consolidate public finances, contributed towards pushing EU member states into achieving a common budgetary balance, as one of the pivotal conditions of ascension or entry for member states. An expression of pragmatism was the qualification of 11 out of 12 countries to the eurozone in 1997. Greece was not among these countries, as it joined the eurozone only in 2001, with various, most often negative, consequences.

4. The Independence of the ECB during the Period of Prosperity and during the Financial Crisis

It is interesting to observe the first years of the eurozone, in which the right to issue money was transferred from member countries to the ECB. The existing independence of the central bank and the ban on lending to governments for budget purposes worked almost perfectly. The inflation target set for the ECB at a continuous target of 2% was successfully implemented (ECB, 2003, p. 79) and there was no apparent pressure from the eurozone's constituent countries for the ECB to cover their governments' borrowing needs. This was fostered by a relatively strong economy affecting public finances favourably, and the potential borrowing needs of some member countries were met on the financial markets. Therefore, it can be concluded that the adopted model of independent monetary policy was validated, from the point of view of economic growth, low unemployment rate, fiscal discipline, and, more importantly, lower inflation.

The first major revision of the EU's institutional model in the sphere of monetary and fiscal policy occurred during the 2007/2008 financial crisis. The crisis affected almost all countries to a greater or lesser extent. However, its effects were felt most acutely in the countries of the eurozone, where national central banks had transferred the right of issue to the ECB (De Grauwe, 2011). The crisis caused a decline in the rate of economic growth, and in many member states the value of GDP fell in absolute terms in

2009 (the deepest crisis in the real sphere). In all the EU countries (with the exception of Poland) there was a decline in economic growth compared to previous years. Unsurprisingly, this phenomenon was accompanied by other negative phenomena such as an increase in unemployment and a decline in public revenues, with simultaneous pressure on public spending. The latter phenomenon was triggered by state spending needs of a social nature, bailouts of financial institutions (banks), and the implementation of fiscal stimulus packages (Staehr, 2010). As a result, the state of public finances in the eurozone countries, as well as in the European Union as a whole, collapsed, as evidenced by the fact that in 2009–2011 the excessive deficit procedure (EDP) was imposed on all member countries (except Estonia). This raised the urgent question of how to finance these additional spending needs of governments. The situation was so serious that some economists called for the disintegration of the eurozone (The Economist, 2011). The situation of governments in terms of their ability to borrow from banks and in the financial markets in general was also affected by the fact that many financial institutions had lost some of their assets, thereby creating a lack of stability and eroding investor confidence in the lending market. Issued securities (bonds) were not in high demand, despite the relatively high lending rates offered by some member states. A classic example was the Greek government bond issues, whose interest rates were many times higher than in countries such as Germany or France, and yet they did not attract sufficient buyers (Jenkins, Dobson & Meakin, 2011).

5. From Dogmatism to Pragmatism

In this situation, the behaviour of the authorities of the European Central Bank attracted a lot of attention, especially during the initial period of the crisis (GFC 2007/2008). Acting ECB President Jean-Claude Trichet (2003–2011) was a strong advocate of respecting the independence of the ECB and not lending to the governments of the eurozone countries[1]. There were sharp tensions between the governments of the eurozone countries, for example France (President N. Sarkozy) (Buiter, 2007) and the ECB authorities. This applied not only to the countries of Southern Europe and Ireland, but also, for example, France. Faced with the impossibility of borrowing on the financial markets and the ECB's refusal to finance

[1] It should be noted that during the presidency of J. C. Triche, the ECB decided to intervene in the debt market of euro area member states only as part of two rounds of the Securities Market Programme. As part of it, the ECB purchased bonds from countries such as: Greece, Italy, Portugal, Spain, and Ireland (Eser & Schwaab, 2013).

them, most countries decided to pursue a policy of tight and restrictive fiscal policy (austerity), with severe social and economic consequences. For incomprehensible reasons, the UK led the way in austerity policies, which can only partly be justified by the need to bail out banks and financial institutions (Hoddinott, Fright & Pope, 2022). With Britain not being a member of the eurozone, but as a member of the European Union at the time, it was obliged to comply with the treaty obligations, but the tradition of monetary policy in the country was so strong that the objectives of monetary policy were set by the government, and the task of the Bank of England authorities was to select the tools to achieve these goals. This fact enabled the British government under the G. Brown's administration to pursue austerity policies while actively bailing out financial sector institutions. The situation was different in the United States, where the crisis began and was the deepest, but in this country the independence of the central bank (Fed) was not limited by treaty arrangements. This allowed the Fed to be involved in the bailout and stimulus activities of the federal government, while the consequence of this was an increase in public debt to levels comparable to the World War II period. A change in the European Central Bank's approach to the financial crisis became apparent with the change in the position of ECB President Mario Draghi (2011–2019). The appointment of M. Draghi as president of ECB coincided with increasing turbulence within the financial markets, a liquidity crisis, which negatively affected the position of governments in raising loan funds. The years 2011–2012 posed the greatest threat to the existence of the eurozone. This threat was primarily of a fiscal nature due to governments' lack of access to loans, especially in countries such as Portugal, Ireland, Italy, Greece, and Spain (PIIGS). The ECB's monetary policy decisions are made, as stipulated by the Maastricht Treaty and the Statute of the ECB – collegially. However, the position of the president, his scientific status, and his professionalism were undoubtedly of great importance in these decisions. M. Draghi persuaded the ECB authorities to make the central bank of the eurozone more involved in its rescue. The phrase used by M. Draghi in July 2012, when he stated that the ECB would take any action to save the eurozone, "the ECB is ready to do whatever it takes to preserve the euro" (ECB, 2012), is very telling. The result of such a declaration was the announcement by the ECB's Governing Council in September 2012 of an instrument called outright monetary transactions (OMT). Under it, the eurozone central bank was to buy government bonds of eurozone member states on the secondary market – under certain conditions. It should be clearly emphasised that any

indirect support for governments provided by the ECB under the OMT was to be conditional on specific (jointly with the European Commission) recovery programmes disciplining the public finances of these countries. In the end, the ECB only decided on this kind of action in the early months of 2015. At that time the repurchase of government bonds took place within the framework of the public sector purchase programme[2], but unlike the OMT programme, the central bank's intervention in the debt market was not conditional on the implementation of public finance reform programmes by the member country in question. It is also worth noting that in view of the lack of liquidity in the financial markets, the ECB in March 2016 decided to buy corporate (company) bonds[3]. Such actions of the central bank are referred to as credit policy by Borio and Disyatat (2009). As studies by De Santis *et al*. (2008) show, the corporate sector purchase programme has contributed significantly to reducing the problems of eurozone companies in accessing financing. At the same time, it should be noted that there is a great deal of controversy associated with this type of central bank action.

The ECB's activities in directly related to the eurozone and indirectly to the European Union should be evaluated positively, as a manifestation of pragmatism rather than any legislative doctrine. There are several arguments in favour of such an assessment. Thanks to such policies, almost all member countries have managed to return to the path of economic growth, rebuilding production, employment, investment, etc., compared to the period before the financial crisis. The recovery processes in the real sphere have been accompanied by inflation kept under control. Another argument in favour of a positive assessment of such an attitude and the actions of the ECB to manage the crisis is the fact that assistance to governments was made conditional on, and in cooperation with the authorities of the European Union (Commission) and the instruments it used. This is especially true of the excessive deficit procedure. This instrument proved so effective that after 4–5 years, its application resulted in the removal of EDP from almost all countries. The lessons learned from the 2007/2008 financial crisis and beyond provided a valuable lesson for the COVID-19 pandemic, which challenged both public finances and monetary policy authorities.

[2] This programme was part of the asset purchase programme.

[3] ECB adds corporate sector purchase programme (CSPP) to the asset purchase programme (APP) and announces changes to APP (ECB Press Release, 10 March 2016).

6. Independence of the National Bank of Poland during the Financial Crisis

The case of Poland is interesting in that the country is the only one in the European Union that did not record a negative economic growth rate in 2009. It is noted that less developed countries have benefitted from the deferred annuity created by the underdevelopment of the financial sector and the relevant toxic financial instruments (derivatives) on a wider scale. Nevertheless, the Polish economy also felt the effects of the crisis, symptomatic of which was a decline in economic growth (from 5.1% in 2008 to 1.6% in 2009) (Statistics Poland, 2012, p. 684). Consequently, there was an increase in the deficit and in public debt. An EDP (2009) was imposed on Poland (Council Decision of 7 July 2009 on the existence of an excessive deficit in Poland, Official Journal of the European Union, 2009/589/EC). Toward the end of that year, difficulties in financing state budget expenditures (budget liquidity) appeared on the horizon. Possible assistance from the NBP was under consideration, although it was not specified what it would consist of (the form of assistance was in question). In any case, such a solution would violate the constitutional prohibition on lending to the government. In September 2009, the Government of Poland negotiated with the European Commission for the EU to transfer funds due to Poland for ongoing projects in advance. In this way the liquidity of the state budget was maintained. In any case, unlike in the case of eurozone countries, where indirect or direct intervention (bailout activity) for governments by the ECB was necessary, in the case of Poland the prohibition on the financing of borrowing needs by the NBP has not been violated since the Constitution of 1997. It should be noted, however, that during the period of the global financial crisis, the structural open market operations that the NBP decided to use took the form of early redemption of NBP bonds (National Bank of Poland, 2010, p. 40).

7. Do Tenure and Collegiality of Decision-making Monetary Authorities Always Work?

One of the assumptions of the independent monetary policy model is the collegiality of the decision-making authorities that carry out this policy. The essence of this assumption is that different views, assessments, different interpretations of analyses, research results, etc. clash during the decision--making process. It is no secret that among the economists who sit on the

collegiate bodies of the central bank are adherents of different economic schools and different streams of economic thought, especially monetary economics and Keynesian economics. This should be conducive to optimising decision-making. However, an important issue is to answer the question of who nominates members to collegiate bodies. While, at the ECB level the formation of decision--making bodies is, as far as possible, distanced from politics, the case is different for the central banks of EU countries that are not part of the eurozone. An attempt to neutralise (limit) the influence of state authorities on monetary policy was made by varying the term of office of state authorities and the term of appointment of members of decision-making bodies in the central bank. In the case of Poland, according to the Constitution, the term of office of members of collegiate bodies is 6 years, while the term of office of the Sejm and Senate is 4 years, and that of the president is 5 years. All these bodies have the right and obligation to designate 3 members each to the Monetary Policy Council. These solutions are intended to guarantee the independence of the central bank, and thus, as Rogoff (1985) noted, reduce the problems that can arise from dynamic inconsistencies in monetary policy implementation. The mode of appointment of board members, including the president, is different, but undoubtedly influenced by political authorities, meaning that the body (council) on monetary policy matters is dominated by the ruling party, which may make decisions that are more favourable to the government and less in line with the central bank's mission of maintaining price controls and fighting inflation. Such a situation can be dangerous if the council includes members designated by the grouping in power for two terms of parliament. Such a situation has occurred in the last 8 years in Poland. Among central bank authorities, the role of the president of NBP, who chairs the Monetary Policy Council, is special. A confluence of political circumstances (the political cycle) in Poland resulted in the fact that, due to the calendar, the president of the NBP for the next term was designated by a political faction, which, although lost power on October 15, 2023, managed, with the help of the president of Poland, to appoint the current president for a second 6-year term.

The non-overlapping periods of the political cycle and the monetary authority election cycle is desirable, but, in the real-world, various situations arise that can have a significant impact on the degree of independence of the central bank from the government. If, for example, a party (political grouping) is in power for two consecutive 4-year terms, this means that the composition of the board of directors and the decision-making body (council) on monetary policy matters is dominated by the ruling party, which can lead to decisions more favourable to the government. Despite the harsh criticism of the NBP for its actions in the

previous term, this new situation poses a challenge after the opposition's election victory[4]. However, regardless of the outcome of the current ruling coalition's attempt to bring the NBP president before the Tribunal of State, which would prevent him from performing his current functions, let's try to consider the arguments raised, and which of them can be considered valid. A key issue is the question of fighting inflation, which in Poland, after slight deflation in 2015–2016, has increased by leaps and bounds in 2022–2023, when the average annual rate reached 14.4% and 11.4% respectively (Statistics Poland, 2022), with a set current inflation target of 2.5% (+/– 1%). This resulted not only in a loss of the real value of the current income (wages, pensions, benefits), but also in a dramatic decline in the real value of household cash savings. This was caused, on the one hand, by high inflation, and on the other by almost zero interest for savings deposits in banks. Such a situation seriously damaged the reputation of the NBP, which is responsible for anti-inflationary policy, and maintaining confidence in the state. Thus, these are serious charges, since, according to many economists, including the author of this text, the NBP's decisions on the issue of countering price growth were too late and too weak. It cannot be ruled out that these decisions were influenced by the government, for which high inflation meant the realisation of an inflationary bonus (higher revenues for the public finance sector) and greater opportunities to "buy" voters with various social programmes before the upcoming parliamentary elections. Chaos and inconsistencies have been noticeable in the NBP's activities in recent years. A surprise, for example, was the radical reduction of interest rates in September 2023 from 6.75% to 6.0%, just before the parliamentary elections in October 2023. Although the CPI Index was on a downward trend from its record high of 18.4% in February 2022, inflation was still high relative to the target in September 2023, as the CPI was at 8.2% (National Bank of Poland, 2023, p. 17). This step was described as incomprehensible and motivated by political considerations (winning the votes of voters repaying loans) (Gera, 2023). Despite the undoubtedly controversial behaviour and decisions of the NBP on inflation issues, proving the president's guilt will be difficult for several reasons. First and foremost, because decisions were made collegially, and the fact that the decision-making body (with a majority) and with the special role of the president in the voting system ("golden share"), is formally beyond question. The collegial system of voting on monetary decisions blunts the cutting edge of criticism and dilutes accountability.

[4] Even before the elections, the opposition announced that it would bring charges against the president of the NBP (Hancock, 2023).

Another accusation relates to information activities (communication, justification of decisions) to stakeholders. In this area, much can be blamed on the NBP, including the president, especially the form and nature of this communication. However, it cannot be overlooked that the NBP's projections are only forecasts, as there is a lag effect in the conduct of monetary policy, which makes it difficult to make decisions on interest rates. Unfortunately, monetary policy itself is, on the whole, conducted by trial and error, and not only in Poland.

The next allegation against the NBP relates to the manipulation of profit, the amount of which (less 5% allocated to the reserve fund of the NBP) paid to the state budget in accordance with the Law on the National Bank of Poland[5]. It should be noted that in the relationship between the NBP and the government (the state budget) in the context under consideration, there is a temporal discrepancy in that the payment to the state budget is made after the approval of the financial statements, which means that the payment made this year is based on NBP's profits of the previous year. Hence, the president of the NBP is obliged to inform the government of the expected payments. This issue requires more elaboration, which is beyond the scope of this paper. In any case, in addition to the issue of the timing and the anticipated payment to the government, there is the question of the factors shaping this result. Without elaborating on this topic, it is worth noting that the year 2023, in which a negative result (loss) occurred, was by no means the first such case. Losses, and consequently a lack of payments to the state budget, occurred in 2007 and 2008. Among the many factors affecting the NBP's profit, a special role is played by foreign exchange reserves, which the NBP is obliged to accumulate. There are differences in the valuation of foreign currency reserves according to the rate of acquisition of PLN at the rates adopted for the balance sheet at the end of the year. The appreciation of currencies causes – in accounting terms – a loss, while the depreciation of the zloty to foreign currencies causes the opposite (profit). According to the NBP's announcement, the main reason for the loss in 2023 was the appreciation of the zloty (National Bank of Poland, 2024). From a formal point of view, it should be noted that the NBP's financial statements are audited by a reputable auditing firm. This, of course, does not exclude irregularities in the financial management of the NBP, such as with regard to income and expenses, affecting the financial result, in addition to the appreciation (depreciation) of the currency. The NBP's official reports and statements are subject to examination by the Supreme Audit Office (NIK). For those less familiar with the topic (e.g., politicians), the central bank's loss may appear to be a paradox (curiosity), especially when previous years have

[5] The Act on Narodowy Bank Polski of 29 August 1997 (Journal of Laws of 2022, item 2025).

seen profits and significant payments to the state budget (e.g., 2022). The fact that there is no payment to the state budget in 2024, when a different party is in power, may also be perceived in this way. In any case, the supposedly intentional behaviour of the NBP in this matter provides a weak basis for charges, unless the NIK were to demonstrate, beyond any reasonable doubt, significant irregularities in this regard.

While the issues discussed above seem dubious (fraudulent and criminal conduct) reasons to summon the central bank (NBP) governor by bringing him before the Tribunal of State due to the politicisation of his activities, which would imply violations of the independence of the central bank, there is a problem with the last argument that is not only formal. It is about the relationship between the government and the central bank in terms of loans to the government for the government's financial needs. The fact is that, during the COVID-19 pandemic and after the outbreak of war in Ukraine, there were difficulties in financing budget expenditures. These were due, in part, to the decline in the rate of economic growth (in 2020, the value of GDP fell by –2.5% in real terms compared to the previous year) (Statistics Poland, 2021, p. 693), which negatively affected the size of government revenues, the need for the government to subtract bailout activities for businesses and shielding activities for households. In view of the financial difficulties, not only of the government (state budget), during the COVID-19 pandemic period the National Bank of Poland undertook actions to buy government bonds guaranteed by the Treasury. It was this activity of the NBP during the COVID-19 pandemic and the outbreak of war in Ukraine that were most controversial. They are related to the asset purchase programme which, in the terminology of the NBP, was referred to as Structural Open Market Operations[6]. Ultimately, in 2020–2021, it purchased State Treasury bonds, as well as bonds of the COVID-19 Countermeasure Fund (Fundusz Przeciwdziałania COVID-19) guaranteed by the State Treasury and issued by Bank Gospodarstwa Krajowego and also bonds of the Polish Development Fund[7]. The total nominal value of bonds purchased by the NBP amounted to more than PLN 140 billion (National Bank of Poland, 2022, p. 14).

[6] In this context, it is worth recalling that the NBP decided to conduct a structural operation in response to the global financial crisis, but at that time the subject of the central bank's unconditional transactions were its own bonds.

[7] Not regardless of the type of bank balance sheet policy, which was used by Borio and Disyatat (2009, p. 7) with the term quasi-management of public enterprises

It should be noted that, in the face of the COVID-19 pandemic, a number of central banks decided to do the same. Research by Fratto *et al*. (2011) showed that such a situation affected nearly thirty developing economies (including some for the first time in their history). At the same time, in the context of the actions of the NBP, important questions arise about the purpose that the above actions were intended to serve. To what extent was it consistent with the central bank's mandate as described in the Polish Constitution and the National Bank Act. The problem of the division of powers between the constitutional bodies of the NBP regarding the conduct of structural open market operations and the nature of the market in which the outright operations were carried out are also key issues. This is largely a dispute of a legal nature. However, one must ask what other option – besides purchasing Treasury bonds in the secondary market – the central bank had when faced with the challenges caused by the COVID-19 pandemic. The Chilean central bank's experience is some answer to this question. As economists at the Committee on the Global Financial System note, this bank was not allowed (due to existing constitutional legal arrangements) to purchase government bonds under any circumstances, including in the secondary market, during the initial phase of the pandemic (BIS, 2023, pp. 29–30). In the end, the bank's policy was limited only to the early purchase of its own bonds and bonds issued by commercial banks[8].

The fact is that the government's activities in the sphere of public finances during the COVID-19 pandemic and the war in Ukraine were not very transparent. In addition, much of the public finances were out of parliamentary control and oversight. This is evidenced by the differences between the Polish government's approach to the General Government (GG) balance sheet and Eurostat's (EU) approach. These differences include the Bank Gospodarstwa Krajowego, where the COVID-19 Prevention Fund was held. There are many justifiable reservations with regard to the transparency of public finances during the period of the previous government's rule. The annual reports on the implementation of the state budget for annual periods, an important document for assessing the state of public finances, the balance sheet of the public finance sector, was discontinued from 2021. One is free to believe that this was not an intentional act. However, in support of transparency in the relationship between the government and the National Bank of Poland, is the fact that in the official documents of the Council of Ministers, i.e. in the annual reports on the implementation

[8] It should be emphasised here, however, that such a possibility has been very severely limited in terms of the required circumstances and the duration of such interference (BIS, 2023, p. 30).

of the state budget, the amount of obligations (debts) of the budget to the NBP was given, starting from 2021 (for the year 2020). In other words, the possibility of the NBP violating the Constitution was known as early as 2021, but the political set-up at the time precluded the possibility of bringing the NBP president before the Tribunal of State.

8. Conclusions

Referring to the activities of the NBP in assisting the government during the period of the pandemic crisis and the war in Ukraine, it should be noted that these activities were broadly similar to those of other central banks such as the ECB, Fed, Bank of England, and the Bank of Chile. Thus, without denying the necessity for full political independence of the central bank from government, which is imposed by treaty (legal) obligations and the Constitution of the Republic of Poland, one cannot help but ask a question like this: in conditions of economic and financial crisis, social crises, pandemics, natural disasters, etc., should central banks remain passive, since the fiscal tools available to governments are insufficient. Life has refuted this approach, as evidenced by the actions of central banks. Failure to recognise this fact would be an example of hypocrisy and could be dangerous for society and the economy. What is overlooked in the criticism of central banks, is the fact that central banks have generally cooperated with governments in the bailouts they have undertaken, which has manifested itself in, among other things, setting robust conditions on which aid can be provided. A classic example is the case of Greece.

As for Polish solutions, the relationship of the NBP with the government in the Constitution of the Republic of Poland is too loosely defined, hence it would be necessary to clarify, for example, whether it concerns loans on the primary market or on the secondary market. As a proponent of the classical model of financial policy, I would rule out a complete ban on assisting the government in emergency, crisis situations. It would be worth considering solutions that minimise the possibility of such a balance of power in the Monetary Policy Council, which should not be dominated by a single political party, further strengthened by the special position of the NBP president in the monetary decision-making process. This could probably be made possible by changing the mode of appointment of MPC members (e.g., rotating a proportion of the members every two years). Since possible changes will not be possible in the foreseeable future (amendment of the Constitution), at least a partial return to classical coordinated monetary

and financial policy is necessary. The forum for such coordination can, and should, be the Financial Stability Committee, established in November 2008 in response to the 2007/2008 financial crisis (Act of November 7, 2008 on the Financial Stability Committee, Journal of Laws of 2008, No. 209, item 1317), in which responsibility for inflation targets would also be shared by the government, whose decisions are, without doubt, influential. Similarly, monetary policy cannot ignore the government's priorities, namely economic growth, employment (unemployment), investment, balance of trade, sources of financing of budget deficits, and maintaining control over the level of public debt. There are fundamental issues for society and the economy that should be analysed by both monetary and fiscal authorities.

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THE EFFECT OF INTEREST RATES, EXCHANGE RATES, AND FOREIGN DIRECT INVESTMENT ON FINANCIAL STABILITY IN INDONESIA

Abstract

Objective: The purpose of this study is to analyse the effect of interest rates, exchange rates, and foreign direct investment on the financial stability of banks in Indonesia.
Research Design & Methods: This study uses secondary data in the form of time series data from 2007 to 2021. Data sources come from publications and dynamic statistics of the World Bank and International Monetary Fund (IMF). The analysis technique used is multiple linear regression analysis with the Ordinary Least Squares (OLS) method.
Findings: The findings show that interest rates have a significant negative correlation with banking stability, while exchange rates and foreign direct investment have a significant positive correlation. Rising interest rates can reduce demand for credit and economic activity, while exchange rate depreciation can help improve financial stability by improving competitiveness of exports. Foreign direct investment also plays an important role in providing banks with stable long-term capital flows, helping to overcome liquidity challenges, and increasing the diversity of bank income. Policy responses to foreign direct investment during the global crisis and the COVID-19 pandemic showed significant differences, with an emphasis on incentives and stimuli to support post-pandemic economic recovery.

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Implications/Recommendations: Monetary and banking authorities need to work together to closely monitor and manage interest rate policy, thus maintaining a balance between supporting economic growth and the stability of the banking. Indonesian banks need to improve their foreign exchange risk management. Policies should support sound foreign investment while addressing potential risks.
Contribution: This study makes an important contribution to understanding the complexity of the interaction between interest rates, exchange rates, and foreign direct investment, and their effects on the financial stability of banks in Indonesia. The findings of this study provide valuable insights for policymakers, monetary authorities, and banking industry players in designing effective economic policies and maintaining the stability of the financial sector. In addition, this research can also provide a foundation for further research in this field, which can further contribute to the development of theory and practice related to financial stability in developing countries.

Keywords: interest rate, exchange rate, foreign direct investment, financial stability.
JEL Classification: E42, E43, G21.

1. Introduction

Globalisation and technological advances have had a significant impact on the financial industry, leading to a more integrated financial system as well as diversification of financial products with higher stability (Jaumotte, Lall & Papageorgiou, 2013). However, these changes can also lead to instability in the financial system (Laeven, Levine & Michalopoulos, 2015). Analysis of the causes of financial system instability is essential to predict potential hazards and anticipate their impact on the economy. Instability in the financial system can hinder the process of effective allocation of funds, affect monetary policy, disrupt the intermediation function, and cause public distrust (Pistor, 2013). Therefore, efforts to avoid or reduce the risk of financial system instability are essential to maintaining economic growth.

In the financial world, maintaining the stability of the financial system is a top priority for all countries (Platonova *et al*., 2018). Financial stability has recently become a concern for central banks and governments in an effort to prevent a crisis in the financial sector. In general, the financial system can be said to be stable if it can maintain real sector and financial system activities through allocation of sources of funds and good absorption of economic shocks, and can support economic growth and economic mechanisms in pricing (Beck, Degryse & Kneer, 2014). Past financial crises, such as the global financial crisis of 2008, have revealed how important it is to pay

attention to the stability of the financial system as a precaution against widespread and prolonged economic decline (Bordo & Meissner, 2016).

The global financial crisis led to a worldwide reduction in confidence in the market. The global crisis of 2008 was felt not only in the United States but also in all countries in the global market. They were forced to sell their assets on financial markets due to the withdrawal of foreign investors' funds and declining confidence. These shocks in financial markets can disrupt financial stability (Creel, Hubert & Labondance, 2015). Therefore, the management and maintenance of stability in the financial system has become a major focus of economic policy and financial regulation. Babar *et al*. (2019) support the idea that financial stability can be achieved through operational efficiency of the financial system, control of financial risks, and efforts to minimise the impact of systemic crises.

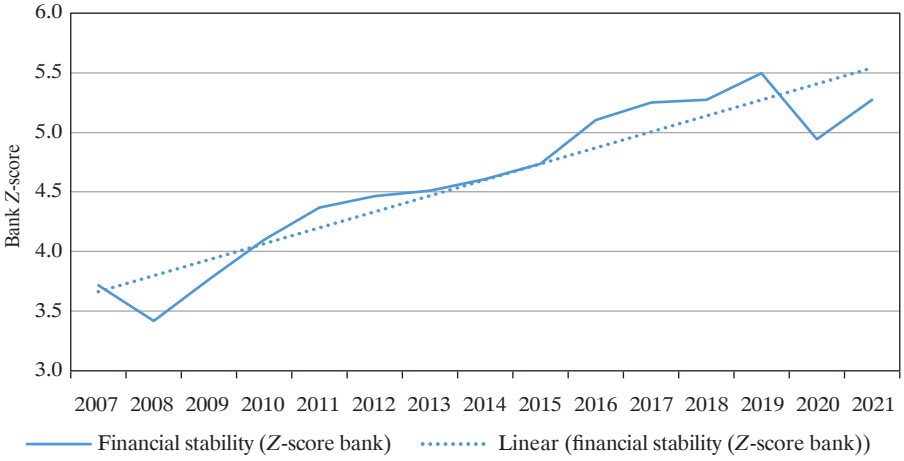

Fig. 1. Movements in Financial Stability in Indonesia

Source: World Bank (2007–2021).

In addition to the global financial crisis of 2008, the most recent global crises namely the COVID-19 pandemic and the war in Ukraine demand serious attention from countries around the world to prevent a continuing crisis (Allam, Bibri & Sharpe, 2022). Financial institutions, including banking institutions, must have strong resilience to shocks caused by the COVID-19 pandemic, and must also be prepared for upcoming challenges (Ghosh & Saima, 2021). Previous crises have significantly affected financial

mobility in many countries, with depositors more likely to be anticipatory and withdraw funds, and financial intermediary partners reducing the amount of funds disbursed (Elnahass, Trinh & Li, 2021).

Indonesia is one of the countries that is highly dependent on commodity exports, such as crude oil, natural gas, and coal. This dependence on commodity exports makes the Indonesian economy vulnerable to fluctuations in world commodity prices that can affect the stability of the financial market (Hidayat *et al*., 2023). Financial stability in Indonesian banks experienced an upward trend during the 2007–2021 period, as shown in Figure 1. This indicates an improvement in financial stability, despite the impact of the global financial crisis of 2008 and the COVID-19 pandemic in 2020. The COVID-19 pandemic has affected the economy as a whole, including declining business performance, declining revenues, and increased credit risk and economic uncertainty (Flögel & Gärtner, 2020). The decline in bank *Z*-scores reflects significant pressure on the banking sector and indicates potential systemic risks that could disrupt financial stability (Klomp, 2014). However, towards 2021, there were signs of recovery and improvements in banking stability over time. This can be explained by the policies taken by financial and monetary institutions to overcome the negative impact of the pandemic (Elnahass, Trinh & Li, 2021). Despite signs of recovery, it points to a more significant improvement in banking stability, Thus, careful monitoring of banking stability and an in-depth assessment of the vulnerability of the banking sector in the midst of the COVID-19 pandemic remain important priorities (Siregar, Gunawan & Saputro, 2021).

By investigating the complex interactions between interest rates, exchange rates, and foreign direct investment, and their effect on Indonesia's financial stability, this study is expected to contribute significantly to the economic literature. This research allows decision-makers to better understand how fluctuations in interest rates and exchange rates, as well as the magnitude of foreign direct investment, can shape the framework that affects a country's financial stability. In contributing to economic literature in Indonesia, this research fills knowledge gaps that have not been previously explored by in-depth analysis by looking at the movement of variables. In addition, the study has the potential to provide a more holistic view of ways of managing and maintaining financial stability in complex situations, and the interdependence between those variables.

2. Literature Review

Monetary policy is expected to play a more active role in maintaining Indonesia's financial stability. Stabilisation can be achieved by controlling the money supply, interest rates, and exchange rates. Explanation of financial stability issues is only undertaken by monetary authorities when they affect the outlook for price stability and economic activity (Vredin, 2015). According to Fahr *et al*. (2013), both standard and non-standard monetary policies initially maintain stability in the financial system, overcoming dysfunctional financial markets, as well as opening up blocked monetary transmission processes.

Financial stability is important because instability brings various adverse impacts such as inefficient allocation of funds, which occurs as a result of ineffective intermediation, and which can disrupt economic growth (Phelan, 2016). A low level of public confidence in the financial system can make investors withdraw their funds, thereby increasing liquidity risks (Abdel Megeid, 2017). The cost of economic recovery due to a crisis is higher if it is a crisis that has a systemic impact and the recovery is prolonged.

After the financial crisis financial stability became one of the important issues for economists and policymakers because of its far-reaching socioeconomic impact (Saha & Dutta, 2021). Although financial stability is very important, there is no unanimously agreed definition of the term. However, Phan *et al*. (2021) citing financial stability as an attribute of the financial system that addresses financial imbalances resulting from the system or from adverse and unanticipated external events. A stable financial system is able to absorb internal and external shocks (economic and non-economic) through built-in automatic stabilisers, thus protecting the economy and other financial systems from disruption.

When measuring financial stability, this study uses bank *Z*-scores as a proxy for these variables. This is because the data is complete, available, and easily obtained (Ahamed & Mallick, 2019). The bank *Z*-score is also widely used as a measure of financial stability (Vo, Nguyen & Van, 2021). According to Mare, Moreira and Rossi (2017), bank *Z*-score is a comprehensive measure based on accounting information that combines indicators of solvency, profitability, and variability of revenue. This combination of information aims to provide a fairer estimate of vulnerabilities in the banking sector. A high bank *Z*-score indicates a lower risk of bankruptcy and higher financial stability. Anarfo, Abor and Osei (2020) state

that the bank *Z*-score is able to illustrate the profitability of the default banking system in a country.

As yet, there is no accurate and definitive definition of financial stability. First, where the causes are interconnected, the bankruptcy of an institution can lead to the failure of the banking system in general (systemic crisis) (Battiston *et al*., 2016). Secondly, it occurs when shocks affect many actors and cause simultaneous failures that destabilise the entire economy (Oatley *et al*., 2013). According to the Financial Services Authority (Otoritas Jasa Keuangan, 2023), financial system stability refers to conditions in which the financial system is stable, is able to allocate funds effectively, and can absorb and handle shocks to keep the real sector and the financial system running well.

According to Morozova and Sahabutdinova (2013), stability in the financial system refers to the ability of the financial system to withstand shocks and reduce barriers in the financial intermediation process. Whereas, according to Warjiyo and Juhro (2020), financial system stability can affect or be affected by monetary policy through several factors, such as interest rates, exchange rates, liquidity, bank credit, and corporate decisions. According to Fink *et al*. (2016), bank *Z*-scores calculate the probability of default for a bank or banking system, and are used by certain authors to describe financial stability in the banking industry.

3. Research Methods

The data used in this study is quantitative data in the form of a time series collected by taking secondary data, namely data in the form of publications from one institution relevant to this study. The source of data in this study comes from publications and dynamic statistics of the World Bank and the International Monetary Fund (IMF) (see Table 1). The data period used annual data from 2007 to 2021.

This study used quantitative analysis techniques using calculation methods with multiple linear regression estimation techniques Ordinary Least Squares (OLS). Monetary variables are used as independent variables, and financial stability as a dependent variable, so the functions of this study are formed as follows:

$$BZS = f(SB, NT, FDI). \tag{1}$$

From the above function, a regression equation can be formed for this research model, which is as follows:

$$BZS = \alpha + \beta_1 SB_t + \beta_2 NT_t + \beta_3 FDI_t + \varepsilon. \quad (2)$$

BZS is financial stability, β_1, β_2, β_3 are the coefficients of the independent variable, *SB* as the interest rate variable, *NT* as the exchange rate variable, and *FDI* as the foreign direct investment variable, α as the constant, and ε is the standard error.

Table 1. Variable and Data Source Description

Variable	Notation	Measurement Variable	Formula	Data Sources
Bank *Z*-score	*BZS*	*Z*-score bank data	$Z = \frac{ROA + \left(\frac{Equity}{Total\ assets}\right)}{ROA}$	World Bank
Interest	*SB*	annual interest rate	$EAR = \left(1 + \left(\frac{Interest\ rate}{n}\right)\right)^n - 1$	IMF
Exchange rate	*NT*	nominal exchange rate	$\frac{LCU}{US\$}$	World Bank
Foreign direct investment	*FDI*	net FDI	*FDI Capital inflow – FDI Capital outflow*	World Bank

Source: World Bank and IMF (2023).

4. Results and Discussion

4.1. Interest Rate Movements in Indonesia

Interest rate movements in Indonesia experienced a downward trend, however, on the other hand, the variable of bank stability showed an upward trend. This indicates that there is a negative correlation between the two variables (Fig. 2). A very significant reduction in interest rates occurred in 2009, the global financial crisis that occurred in 2008 was caused by the subprime mortgage crisis in the United States (Simorangkir & Adamanti, 2010). This crisis then spread throughout the world and affected many countries, including Indonesia. As a result, interest rates fell and Indonesia's economic growth, which in 2008 was 6.01%, fell to 4.63% in 2009 with downside risks especially if the global economic downturn was greater than expected. During the global crisis, Indonesia's benchmark interest rate was lowered significantly in response to deteriorating economic conditions (Taylor, 2011). Measures were taken to stimulate economic activity, minimise the risk of investment decline, and facilitate access to credit (Di Maggio *et al*., 2017).

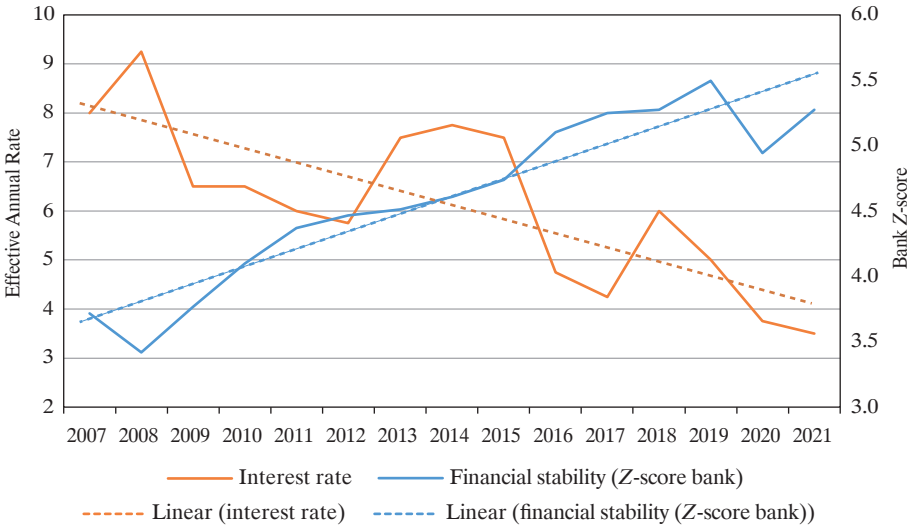

Fig. 2. Interest Rate Movements in Indonesia

Source: World Bank and IMF (2007–2021).

In 2018, Bank Indonesia raised its benchmark interest rate six times from 4.50% to 6.00%. This was done to maintain rupiah stability against higher American interest rates. The weakening rupiah exchange rate against the dollar to reach Rp 14,000 in 2018 was one of the reasons for Bank Indonesia to raise interest rates. Since 2018, the benchmark interest rate in Indonesia has always shown a decline. Inflation that remains under control and within the target range set by Bank Indonesia provides room for the central bank to adjust interest rates (Juhro, 2022). The interest rate cut after the COVID-19 pandemic was also an effort to ameliorate financial risks arising from global uncertainty (Song & Zhou, 2020). Low interest rates can reduce potential interest expenses for companies and households, thereby minimising the risk of default or bad loans that can disrupt the stability of the financial system.

4.2. Exchange Rate Movements in Indonesia

Indonesia currently uses a free-floating system. This means that the position of the exchange rate against foreign currencies (in particular the USD) is determined by market mechanisms and forces. In a free-floating system, the laws of supply and demand will apply (Liu, 1990). Exchange rate fluctuations will depend on the conditions of demand and supply of the national currency in the foreign exchange market. When inflation occurs,

the local currency has low purchasing power against foreign currencies, so imported goods will be more expensive.

Figure 3 shows fluctuations in the exchange rate with an upward trend, with the highest increase in 2020. The main causes of depreciating exchange rates were, disruptions to the global economy caused by the COVID-19 pandemic which caused foreign capital withdrawals from emerging markets including Indonesia, falling world oil prices that harmed the Indonesian economy as an oil producer, and trade balance deficits and government policy responses that affected investor perceptions (Aloui, 2021). When compared to the variable movement of banking stability, there is a trend in line with the exchange rate, which shows a positive trend.

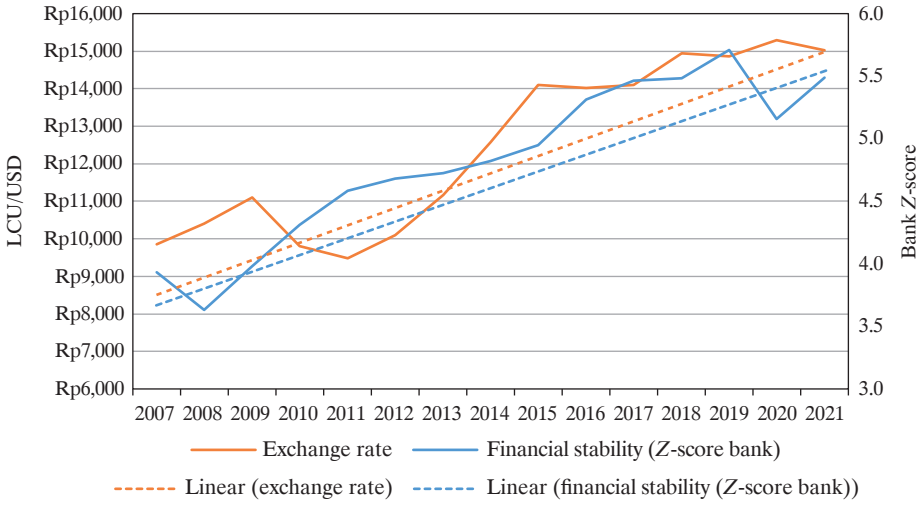

Fig. 3. Exchange Rate Movements in Indonesia

Source: World Bank (2007–2021).

The rupiah depreciated significantly in 2015 due to the decline in world oil prices (Husaini & Lean, 2021). The decline in world oil prices caused Indonesia's trade balance deficit to decrease and tight monetary policy from Bank Indonesia made investors more interested in investing in Indonesia (Purba, 2020). In 2020, the rupiah also depreciated, as a result of COVID-19 (Pontoh, Zahroh & Sunengsih, 2021). The spread of COVID-19 caused great volatility in global financial markets (Li, 2021). Investors tend to look for assets that are considered safer, such as the USD, causing pressure on emerging market currencies including the rupiah (Hasan *et al*., 2021).

The decline in economic activity as well as uncertainty about the economic recovery resulted in capital outflows from Indonesia's financial markets.

4.3. Movement of Foreign Direct Investment in Indonesia

Foreign direct investment in Indonesia shows a positive upward trend, in line with the trend of banking stability. As shown in Figure 4, the decline in foreign direct investment occurred in 2016. Indonesia is a country that depends on commodity exports such as oil, gas, coal, and palm oil (Chandrarin *et al*., 2022). In 2016, there was a significant decline in global commodity prices, reducing Indonesia's export earnings and making investment in the sector less attractive to foreign investors (Christensen, 2016). However, FDI in Indonesia in 2017 reached USD 32.24 billion, up 13.2% compared to the previous year. FDI in Indonesia is concentrated in three main sectors, namely the processing, mining and quarrying industries as well as electricity, gas and clean water (Gopalan, Hattari & Rajan, 2016). In the manufacturing industry sector, the largest FDI comes from Singapore and Japan. While in the mining and quarrying sector, the largest FDI comes from Australia and the UK.

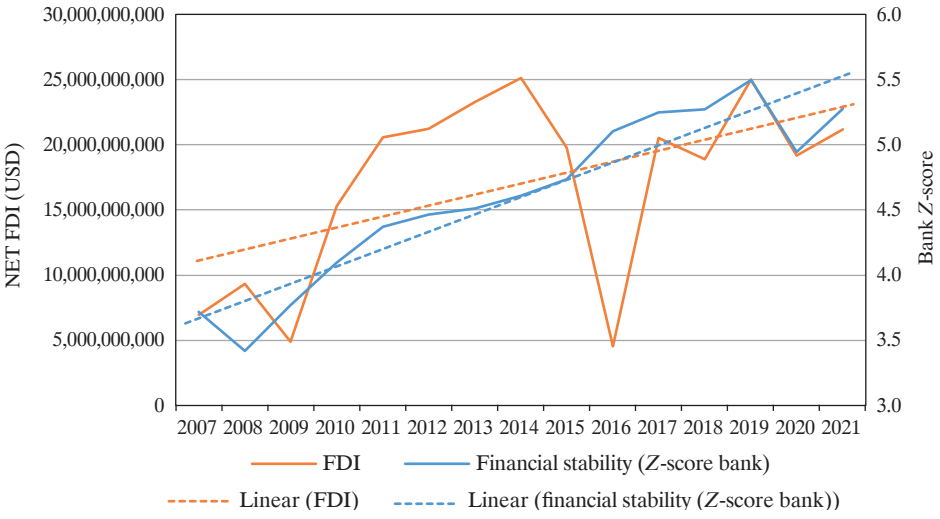

Fig. 4. Foreign Direct Investment Movements in Indonesia

Source: World Bank (2007–2021).

The COVID-19 pandemic has also had an impact on FDI in Indonesia. The long-term and uncertain impact of the COVID-19 pandemic on economic growth and investment prospects creates higher risks for investors. Uncertainty about when and how economic recovery will occur may hinder long-term investment decisions. The decline in global demand due to the impact of the pandemic on consumption and investment has had a negative impact on sectors that previously attracted foreign investment (Castañeda--Navarrete, Hauge & López-Gómez, 2021). In addition, disruptions in global supply chains due to factory closures, restrictions on the movement of goods, and logistical difficulties can affect foreign investment decisions (Liu, Lee & Lee, 2020).

4.4. Descriptive Statistics

Statistical descriptions for each variable used in this study are displayed in Table 2. The variables studied include bank *Z*-scores influenced by interest rates, exchange rates and foreign direct investment for 15 years from 2007 to 2021. The table shows the mean, median, maximum and minimum values, standard deviation, skewness, and kurtosis. The total number of observations is 15.

Table 2. Descriptive Statistics

Specification	*SB*	*NT*	*FDI*	*BZS*
Mean	1.776460	9.353589	23.43072	4.602078
Median	1.791759	9.381366	23.70789	4.607392
Maximum	2.224624	9.587557	23.94696	5.495973
Minimum	1.252763	9.079141	22.23657	3.418616
Standard deviation	0.288405	0.194892	0.589140	0.639159
Skewness	–0.375645	–0.131627	–1.133701	–0.373201
Kurtosis	2.141767	1.325869	2.710422	2.028808
Jarque-Bera	0.813124	1.795011	3.265604	0.937707
Probability	0.665936	0.407585	0.195381	0.625719
Sum	26.64691	140.3038	351.4608	69.03117
Sum Sq. Dev.	1.164487	0.531761	4.859197	5.719335
Observations	15	15	15	15

Source: Output EViews 9 (2007–2021).

Financial stability in the banking sector can be reflected by the bank *Z*-score variable, which shows the level of bank solvency in the face of crisis. The average bank *Z*-score for 15 years in Indonesia was 4.60% and the highest bank *Z*-score occurred in 2019 at 5.49%. However, the lowest bank *Z*-score occurred in 2008 with a value of 3.41%. From Table 2, it can be seen that the variable interest rate has a mean value of 1.77% with a highest value of 2.22%, and a lowest value of 1.25%. Next is the exchange rate variable which has an average value of 9.35% with a highest value of 9.58% and a minimum value of 9.07%. Then there is foreign direct investment which has an average value of 23.43% with a maximum value of 23.94%, and a minimum of 22.23%. Data variations in the variables in this study are quite diverse, as shown by different standard deviations. This indicates significant departures from the average value. Data distribution on interest rates, exchange rates, and banking financial stability has a negative tail, while FDI variables have a longer negative tail. These results indicate that there is a potential for low values or outliers on the negative side of these variables. In terms of distribution form, FDI stands out with the highest kurtosis. This reflects that the distribution of foreign direct investment data tends to be blunter than normal distribution and has a long tail.

4.5. Model Estimation Results

The results of the estimated model test using Ordinary Least Squares (OLS) are as follows:

$$\widehat{BZS} = -18.79606 - 0.715081(SB) + 1.845650(NT) + 0.316038(FDI). \quad (3)$$

Based on Table 3, it is known that the variables in the study have satisfied the classical assumptions. In addition, it is known, with a probability of less than $\alpha = 5\%$, that the variable interest rate has a negative direction, meaning that it has a negative and significant effect on banking stability, the exchange rate variable has a negative and significant effect on $\alpha = 1\%$, the variable of positive and significant foreign direct investment at $\alpha = 5\%$. From the probability *F*-statistic below $\alpha = 1\%$ shows that the three independent variables together affect financial stability.

Table 3. Regression Estimation

Variable	Coefficient	*t*-statistic	Probability
C	–18.79606	–3.395796	0.0060
BZS	–0.715081	–2.144548	0.0552*
NT	1.845650	3.699020	0.0035***
FDI	0.316038	2.400123	0.0352**
R-squared	0.848016		
Prob. (*F*-statistic)	0.000083		
Normality	Histogram-Normality Test		
Jarque-Fallow	0.319257		
Probability	0.852460		
Autocorrelation	Breusch-Godfrey		
F-statistic	0.303166		
Obs**R*-squared	0.946768		
Prob. *F*(2,9)	0.7457		
Prob. Chi-Square(2)	0.6229		
Heteroskedasticity	Breusch-Pagan-Godfrey		
F-statistic	2.125452		
Obs**R*-squared	5.504339		
Scaled explained SS	2.568008		
Prob. *F*(3,11)	0.1550		
Prob. Chi-Square(3)	0.1384		
Prob. Chi-Square(3)	0.4631		
Multicollinearity	Variance Inflation Factors		
Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	30.63730	5,815.549	–
SB	0.111183	68.24095	1.638412
NT	0.248958	4,136.168	1.675292
FDI	0.017339	1,807.920	1.066167
F table	2.769		
t-table	2.003241		

Notes: *, **, and *** indicate significance levels at levels of 10%, 5% and 1%.

Source: Output EViews 9 (2007–2021).

4.6. The Relationship between Interest Rates and Banking Financial Stability

Interest rates have a significant influence on banking stability, these two variables are negatively correlated. Interest rates are a major factor influencing performance and risk in the banking sector (Baselga-Pascual, Trujillo-Ponce & Cardone-Riportella, 2015). Rising interest rates can increase borrowing costs for consumers and companies, further reducing demand for loans and economic activity (Peltoniemi & Vieru, 2013). A decline in demand for credit has the effect of reducing the income from interest received by banks, disrupting their profit potential (Were & Wambua, 2014). At the same time, higher interest rates lead to increased credit risk for banks (Chaibi & Ftiti, 2015). Rising interest rates also cause interest payments on consumer and corporate debt to increase, making it difficult for them to meet financial obligations. This has the potential to lead to an increase in default risk and poorer asset quality in the bank's loan portfolio (Campbell & Cocco, 2015). In this situation, banks need to allocate more resources to allay higher credit risk. In addition, the negative correlation between interest rates and banking stability also has an impact on asset values. Rising interest rates tend to cause a decrease in the market value of fixed-interest assets such as bonds (Domanski, Shin & Sushko, 2017). If banks have significant bond portfolios, a drop in the value of these assets can reduce the total value of their assets as well as affect the health of capital. These results are in line with research by Köhler (2015), Fu, Lin and Molyneux (2014), and Smets (2014).

The BI7DRR (7-day reverse repo rate reference interest) policy implemented in Indonesia has had a significant impact on bank stability. The benchmark interest rate set by Bank Indonesia affects various operational and financial aspects of banks in Indonesia (Raharjo *et al*., 2014). The BI7DRR policy may also affect liquidity conditions in financial markets (Tanjung *et al*., 2022). Higher interest rates tend to attract funds from the real sector to the financial sector, thus affecting liquidity in the money market and capital market (Roberts, 2013). Banks need to monitor their liquidity carefully as well as taking appropriate measures to maintain their stability. Interest rate movements at home and abroad can affect BI7DRR policy. If other countries raise interest rates, or global conditions are unstable, Bank Indonesia needs to adjust interest rates to maintain domestic economic stability. During the COVID-19 pandemic, Bank Indonesia took a series of monetary policy measures to respond to significant economic impacts. One of the steps taken was the adjustment

of the benchmark interest rate, namely BI7DRR (Murdiana, Adrianto & Alfarisi, 2022). Bank Indonesia continued to monitor banking stability during the pandemic. The lower interest rate needs to be balanced with close monitoring of credit risk, liquidity, and the overall financial condition of the banking industry.

4.7. Exchange Rate Relationship to Banking Financial Stability

Based on the regression results, the exchange rate is positively correlated and significant in affecting banking stability in Indonesia. This result is in line with the rise in exchange rates shown in Figure 3, meaning that the Indonesian rupiah continued to depreciate against the US dollar. The depreciation or devaluation has had a positive effect on financial stability (Chuliá, Fernández & Uribe, 2018). In some cases, exchange rate depreciation can increase a country's export competitiveness, which can benefit the economy as a whole, including the banking sector (Zia & Mahmood, 2013). In addition, in some situations, controlled exchange rate depreciation can help improve overall economic stability by boosting export growth and reducing trade deficits (Sarno, Taylor & Frankel, 2003). However, on the other hand, exchange rate depreciation can be a problem if it is not well balanced with various other factors. Too large a depreciation can pose a risk to banks that have liabilities denominated in foreign currencies, as the value of their assets denominated in domestic currency may undergo a relative decline. This could affect the liquidity and solvency of banks (Bitar, 2021).

In a controlled floating exchange rate regime, monetary authorities attempt to keep the rupiah exchange rate within a certain range by targeted intervention in the foreign exchange market. Banks can manage their risks and business activities more effectively with a stable rupiah exchange rate (Warjiyo, 2013). In a controlled floating exchange rate regime, exchange rate stability maintained by the monetary authority is able to provide certainty to banks when planning operational policies and risk management (Bordo & Levin, 2017). Controlled exchange rate fluctuations can help banks anticipate the risk of exposure to foreign currency volatility and reduce uncertainty in international transactions. This has a positive impact on the stability of banking assets and liabilities related to foreign exchange transactions. In addition, exchange rate stability can also affect bank liquidity stability. In a controlled exchange rate regime, sudden changes in exchange rates can be better managed, and banks have a greater ability to anticipate liquidity needs (Diamond, Hu & Rajan, 2020). This helps reduce the risk of banks defaulting on their financial obligations. Banking

supervisory authorities have a clearer view of the risks associated with exchange rate fluctuations in a controlled regime. These results are in line with research by Ghosh (2015), Beck, Jakubik and Piloiu (2013), and Makri, Tsagkanos and Bellas (2014).

Based on movements in the Indonesian rupiah exchange rate during the 2008 global crisis and the COVID-19 pandemic, there were significant differences in policy decisions and responses. During the 2008 global crisis, the policy response focused on adjusting the benchmark interest rate as a means of controlling exchange rate movements. Such efforts are intended to maintain rupiah exchange rate stability against foreign currencies, especially the US dollar (Warjiyo, 2013). The main objective of the policy response during the global crisis period of 2008 was to prevent excessive depreciation of the rupiah exchange rate. Depreciation that is too rapid and sharp can encourage foreign capital outflows, which can, in turn, undermine economic and financial stability (Jongwanich & Kohpaiboon, 2013). In addition to adjusting the benchmark interest rate, the government and Bank Indonesia also took measures to control foreign capital outflows (Lindblad, 2015). This step was carried out as an effort to prevent further pressure on the rupiah exchange rate. On the other hand, during the COVID-19 pandemic, the policy response was more comprehensive and involved more policy instruments, not only the benchmark interest rate. The response included fiscal stimuli, liquidity policy, and real sector support. Bank Indonesia increased liquidity in financial markets through various mechanisms, such as adjusting liquidity regulations in the banking industry, purchasing government bonds and the like (Guofeng, 2021). This step helped to maintain liquidity and smooth transactions in financial markets. Despite the broader response, maintaining exchange rate stability remained one of the main objectives. Bank Indonesia took measures to maintain rupiah exchange rate movements in line with economic and foreign exchange market conditions.

4.8. The Relationship of Foreign Direct Investment to Banking Financial Stability

Foreign direct investment has a significant positive influence on the financial stability of banks. FDI is able to provide stable and sustainable long--term capital flows into the country, thus contributing to the strengthening of the economic and financial sectors (Bonatti & Fracasso, 2013). Foreign direct investment in Indonesia covers sectors such as manufacturing, energy, mining, technology, and infrastructure. FDI helps increase the country's foreign exchange reserves, which is one of the important indicators in

maintaining currency stability and international payments (Aizenman, Cheung & Ito, 2015). Foreign direct investment has played a crucial role in maintaining financial stability. FDI flows not only help increase investment in key sectors of the economy but also help reduce macroeconomic risks and financial instability (Mijiyawa, 2015). FDI brings in foreign capital that can be used by both companies and local financial institutions, including banks. With additional capital available, banks can overcome liquidity challenges and strengthen their capital positions. This helps banks deal with possible liquidity crises or capital shortages that could threaten financial stability. FDI is able to create relationships with foreign companies and institutional investors. Thus, allowing banks to diversify their sources of income. When banks have diverse incomes from different sectors and countries, the risk of dependence on one particular sector or market can be reduced, which ultimately increases their stability. Multinational companies are able to encourage more sophisticated risk management strategies and practices. It certainly affects risk management practices in local financial institutions, including banks. These results are in line with research by Fu, Lin and Molyneux (2014), Ozili (2018), and Dafermos, Nikolaidi and Galanis (2018).

Policy responses to foreign direct investment during the 2008 global crisis and the COVID-19 pandemic showed significant differences. In the 2008 global crisis, many countries focused on monitoring and incentives to attract FDI, especially in maintaining economic stability amid uncertain conditions. Measures such as more investor-friendly regulation and protection of intellectual property rights are used to strengthen the investment climate (Fernandez, Almaazmi & Joseph, 2020). However, the policy response during the COVID-19 pandemic has become more comprehensive and diverse. Deeper economic uncertainty can influence investment decisions, especially in affected sectors such as tourism and retail. Countries responded by providing support and flexibility to investors, by providing specific stimulus and incentives given to key sectors in need of economic recovery (Stern & Zenghelis, 2021; Rudenko *et al*., 2022). The focus on digital technology, health, and infrastructure has become more important, as efforts to revive post-pandemic economic growth.

5. Conclusions and Recommendations

Based on the results of the study, it was found that interest rates, exchange rates, and foreign direct investment (FDI) have a very strong influence on financial stability in Indonesia. An increase in interest rates could destabilise

the banking industry and overall economic activity. A stable exchange rate plays an important role in maintaining asset stability, liquidity, and risk management in banking. With the adoption of a controlled floating exchange rate regime, the Indonesian monetary authorities seek to keep the rupiah exchange rate within a controlled range and minimise adverse fluctuations. On the other hand, FDI flows can strengthen economic stability through contributions to foreign exchange reserves, additional capital, and help mitigate macroeconomic risks, with cooperation in the investment sector encouraging more sophisticated risk management strategies and practices. In addition, there are differences in terms of monetary policy responses taken by the monetary authorities and the Indonesian government between the financial crisis of 2008 and the COVID-19 crisis of 2020.

Uncontrolled interest rate policy as well as significant fluctuations in interest rates can create major challenges to banking stability. Monetary and banking authorities need to work together to closely monitor and manage interest rate policy in order to maintain a balance between supporting economic growth and the stability of the banking sector. Indonesian banks need to encourage improved management of their foreign exchange risks. If the exchange rate has a significant influence on a bank *Z*-scores, fluctuations in the exchange rate can have an impact on the bank's financial stability and health. More effective foreign exchange risk management can help banks reduce their exposure to exchange rate risk. Sudden fluctuations in foreign capital flows are capable of causing turmoil in financial markets and exchange rates, which negatively affect macroeconomic stability. Therefore, it is necessary to maintain a balance between supporting sound foreign investment and maintaining the availability of policy instruments needed to overcome any potential risks that may arise.

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Klaudia Lenart

ANOMALY DETECTION BASED ON MEASURES OF INFLUENCE FOR MODELLING ECONOMIC PHENOMENA

Abstract

Objective: Anomalies are data points (or sequences of points) for which relationships between variables are significantly different to those that can be observed under normal circumstances. Their presence in data used for estimating an econometric model may significantly influence the values of the parameter estimates. The result is a skewed projection of the real world and less accurate forecasts. The purpose of this study is to propose a method of identifying anomalies in data based on their influence on the regression function parameter estimates.
Research Design & Methods: This paper proposes a method of detecting anomalies by identifying data points with the most significant influence on the estimates of the model parameters using permutations of the dataset. The method was applied to data generated using copula functions, and anomalies were generated by changing the marginal distribution of the dependent variable. A fixed percentage of data points was identified as anomalies and removed. This method was compared with one based on distance to *k*-nearest neighbours.
Findings: The exclusion of the anomalies identified by the proposed method resulted in models with a significantly lower prediction error. Additionally the method based on influence of the observations was more accurate in identifying anomalies.
*Implications/Recommendation*s: Excluding anomalies can be an important stage in data preparation for estimating an econometric model, particularly when one aims to predict. Nevertheless, it is important to keep in mind the risk of deleting valid observations from the dataset.
Contribution: In the conducted simulation study removing the observations identified as anomalies resulted in models with a significantly lower prediction error, even when

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some typical observations were incorrectly classified as anomalies. The method based on influence on the model parameter estimates allowed for accurate identification of anomalies although it was dependent on correct prediction of the percentage of anomalous observations that would appear in the data.

Keywords: anomaly detection, influential observations, econometric model, outliers.
JEL Classification: C15, C18, C51.

1. Introduction

Econometric models should reflect the relationships between variables that can be observed in the real world. For this to be possible, data quality needs to be ensured, and, in particular, any data that was corrupted or observed under unusual circumstances needs to be excluded from the dataset. A good example of this is a model predicting crop yield based on the soil quality and fertiliser used. If data from regions affected by a flood is included in the analysis, the effect of the independent variables on the crop yield will become much less clear. Moreover, it is likely that the observations from those regions will be influential and, as such, will have a significant impact on the values of the model parameter estimates. This amplifies the issue of the estimated model providing a skewed projection of the real world but can also allow identification of the anomalous data.

In this paper a simulation study was used to test how accurately anomalies in data can be identified based on the influence on the model parameter estimates. This method was compared with a method based on the measurement of distance.

2. Anomalies and Influential Observations

The range of applications of anomaly detection means it is impossible to formulate a universal and unambiguous definition of an anomaly. The general definition of an anomaly is an observation (or in certain cases a group of observations) that is unusual for a given dataset (Chandola, Banerjee & Kumar, 2009), but what constitutes an unusual observation will be heavily dependent on the goal of the analysis. Additionally, the cost of making an error by classifying an observation as a false positive or false negative will differ depending on the anomaly detection application.

Hawkins (1980, p. 1) defines an outlier as “an observation which deviates so much from other observations as to arouse suspicions that it was generated by a different mechanism”. This definition is especially important for the subject of this paper as it points to the reason why anomaly

detection is important as a stage in data preparation during econometric model estimation. The foundation of multivariate statistical methods is the assumption that the observations all come from the same multivariate distribution. This is not true if the dataset contains anomalous observations that are an effect of unusual circumstances or have been corrupted (Trzęsiok, 2014). It should be emphasised that, as noted by Hawkins (1980), an unusual observation may either be generated from a different distribution or just be an unlikely realisation of a variable. Excluding the latter from the dataset may lead to incorrect analysis. Most researchers treat the terms "outlier" and "anomaly" as synonyms (Chandola, Banerjee & Kumar, 2009; Aggarwal, 2017; Mehrotra, Mohan & Huang, 2017). For the sake of clarity in this paper the term "anomaly" will be used when referring to observations generated from a different multivariate distribution while the word "outlier" will refer to all untypical observations. This distinction is especially important because, during the simulation study the desired result is detection observations generated from a different distribution and classifying them as anomalies.

This paper focuses on anomaly detection as a stage of data preparation during estimation of an econometric model. This is done to exclude from the model observations that misrepresent the relationships between variables which can be observed under normal circumstances, usually due to some factor that is not included in the available set of variables. To simulate this during the data generation the multivariate distribution of the dependent and independent variables will be changed.

Influential observation is defined by Belsley, Kuh and Welsch (1980) as an observation that either individually or together with several other observations has a demonstrably larger impact on the calculated values of various estimates than most other observations. An outlier will not necessarily be an influential observation. An observation may have an unusually high or low value of all variables but without significant differences in the proportions between variables, thus not impacting the estimates of model parameters (Draper & John, 1981). Similarly there may be influential observations for which all values of all variables considered separately are typical for the dataset – it is only the skewed relationships between the variables that impact the parameters' estimates. The fact that disrupted relationships between the variables are often the cause of an observation having an unusual level of influence on model parameter estimates should allow the identification of anomalies by identifying the influential observations.

There are several statistics proposed for measuring the influence observations have on the estimated model. Cook (1977) proposes statistics based on differences in the *y* estimates made by the models. A different approach is shown in the DFBETAS measure (Belsley, Kuh & Welsch, 1980) that is based on the differences in model parameter estimates. A variation of this approach was used during this study.

An important thing to note about the measurements mentioned above is that they are not statistical tests allowing verification of a hypothesis. Several methods for identifying the cut-off points for these measures have been proposed, but there is no unambiguous way of pinpointing the level of influence an observation must have on the model estimation to be classified as influential.

The terms "influential observation" and "outlier" are often connected. It is a typical approach to identify outliers based on the distance between observations (Mehrotra, Mohan & Huang, 2017). To compare a distance and influence based approach distance to *k*-nearest neighbours method will be used.

3. Generating Multidimensional Data Using Copulas

In order to carry out a simulation study a method for generating a multidimensional dataset with fixed relationships between variables is needed. Copula functions can be used for this purpose (Heilpern, 2007).

An m-dimensional copula is a function C with domain $[0, 1]^m$ when the following conditions are met (Nelsen, 1998):

– $C(1, \ldots, 1, a_n, 1, \ldots, 1) = a_n$,
– $C(a_1, \ldots, a_m) = 0$ if $a_i = 0$ for every $i \leq m$,
– C is m-increasing.

The foundation of the theory of copulas as well as its applications in statistics can be found in Sklar's theorem which was first published in (Sklar, 1959).

Let H be a joint distribution function with margins F and G. Then there exists a copula C such that for all x, y in $\overline{R}$,

$$H(x, y) = C(F(x), G(y)). \tag{1}$$

If F and G are continuous, then C is unique; otherwise, C is uniquely determined on $RanF \times RanG$. Conversely, if C is a copula and F and G are distribution functions, then the function H is a joint distribution function with margins F and G.

Over the years many copulas have been proposed differing in dependence structure and having unique properties. The normal copula, also known as the Gaussian copula was first described in (Lee, 1983). An important characteristic of this copula is the fact that the values of the correlation parameter θ, can be positive or negative, as long as it meets the condition $-1 < \theta < 1$. The normal copula can be written as:

$$C(u_1, u_2, \theta) = \Phi_G\left(\Phi^{-1}(u_1), \Phi^{-1}(u_2), \theta\right), \tag{2}$$

where Φ is the cumulative distribution function of the standard normal distribution (Trivedi & Zimmer, 2007).

4. The Proposed Method

The proposed method allows identification of the observations which have the biggest influence on the values of the estimated parameters, so that they can be classified as anomalies.

The use of the method requires that for a *k*-dimensional dataset consisting of *n* observations a linear regression function form is known as:

$$y_i = \alpha_0 + \alpha_1 x_{1i} + \alpha_1 x_{1i} + \ldots + \alpha_k x_{ki} + \xi_i. \tag{3}$$

The method relies on determining by how much removing each observation from the dataset influences the values of the estimated parameters of the linear regression function. This influence is quantified using the proposed *T* statistic, the calculation of which is described below.

The procedure of calculation of the *T* statistic consists of the following steps:

1. Estimation of the parameters of the linear regression function based on the entire dataset. The estimates are denoted as $a_{00}, \ldots, a_{0k}$.
2. For each $i \in [1, 2, \ldots, n]$ a subset of the data is created by excluding the *i*th observation.
3. Estimation of the parameters of the linear regression function based on the created subsets of data. The estimates are denoted as $a_{i0}, \ldots, a_{ik}$.
4. Calculation of the differences between the values of the parameters estimated based on the entire dataset and the *i*th subset:

$$R_{ij} = a_{ij} - a_{0j}. \tag{4}$$

5. Standardising the differences for each $j \in [0, 1, \ldots, k]$:

$$RS_{ij} = \frac{R_{ij} - \overline{R_i}}{S_{R_j}}, \tag{5}$$

where S_{R_j} is a standard deviation of the jth parameter estimates calculated on the subsets of data.

6. Calculation of the T statistic values for each $i \in [1, 2, \ldots, n]$ using the formula:

$$T_i = \sum_{j=0}^{k} \left| RS_{ij} \right|. \tag{6}$$

After the values of the T statistic are calculated the T_p can be determined by finding the quantile of the T statistic's vector corresponding to the percentage of the observations that will be identified as anomalies, which equals p. In this paper the value of p will always be equal to 5% although the question of determining p based on the values of the calculated T statistic is worth further research.

The ith observation is classified as an anomaly if the following condition is met:

$$T_i \geq T_p. \tag{7}$$

5. The Simulation Study

To test if the proposed method allows for accurate classification of the anomalies in the dataset a simulation study was conducted. The data was generated using copulas, implemented in the R programme (Hofert *et al.*, 2018), and the anomalies were added by changing the marginal distribution of the dependent variable. Two variants were considered, as shown in Table 1. In variant A beta distribution B(s_1, s_2) was used as the marginal distribution of the variables. In variant B the marginal distribution of the variables was a normal distribution N(μ, σ^2), where the mean of the variable was equal to μ and the variance was equal to σ^2. For the anomalous observations in variant B the distribution of y was changed to an exponential distribution with the λ parameter equal to 0.5.

Table 1. Marginal Distributions of the Generated Data

Variable	Variant A		Variant B	
	Typical Observations	Anomalies	Typical Observations	Anomalies
y	B(2, 6)	B(6, 2)	N(2, 2)	Exp(0.5)
x_1	B(2, 6)	B(2, 6)	N(4, 4)	N(4, 4)
x_2	B(2, 6)	B(2, 6)	N(10, 4)	N(10, 4)
x_3	B(2, 6)	B(2, 6)	N(10, 7)	N(10, 7)
x_4	B(2, 6)	B(2, 6)	N(3, 1.2)	N(3, 1.2)

Source: author's own work.

For each variant a total of 1,000 observations was generated three times. Each time the percentage of the anomalous observations was different (consecutively 2%, 5% and 10%) so that the consequences of the assumed percentage of the anomalies being over or underestimated could be tested. This data was then classified using the proposed method and the method using distance to *k*-nearest neighbours. The method described by Mehrotra, Mohan and Huang (2017) requires that for each *i*th datapoint the *k*-nearest neighbours are identified. We define *Near*(*i*, *j*) as the *j*th nearest neighbour of the *i*th observation and *d*(*a*, *b*) as a function of distance between two datapoints, *a* and *b*. The statistic used in this method is calculated as:

$$\alpha(p) = \sum_{j=1}^{k} d(p, Near(p, j)). \tag{8}$$

Similarly to the proposed method, a quantile of the $\alpha(p)$ vector can be used as a cut-off point. Then all observations for which the sum of distance to *k*-nearest neighbours is greater or equal to that quantile is identified as an anomaly.

As shown in Figure 1, the proposed method consistently achieved higher accuracy, the only exception being variant A with 2% of the anomalies, where both methods detected all anomalies correctly (note that, as the assumed percentage of the anomalous observations was different from the actual proportions, the maximal accuracy that could be achieved in this case was 97%). It is worth noting that when the assumed and real percentage of anomalies was equal for both variants, the proposed method correctly classified all observations.

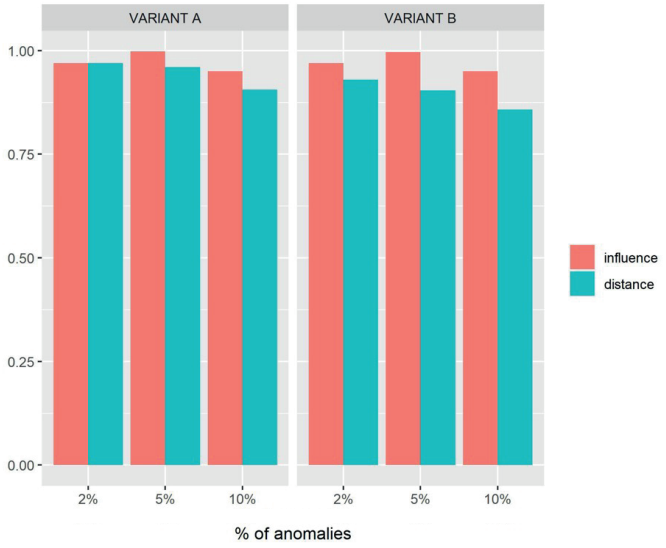

Fig. 1. Accuracy of the Proposed Method and the Method Using Distance to 20 Nearest Neighbours

Source: author's own work in the R programme.

The generated datasets were unbalanced, as the anomalies constituted only between 2–10% of the data instead of the observations being evenly spread between both classes. For this reason it is important to analyse not only accuracy but also recall. As shown in Figure 2, in most cases the proposed method correctly classified more than 90% of the anomalous observations, with the exception of datasets with 10% of the anomalies, where the maximal recall that could be achieved was 50%.

For each dataset, observations identified as anomalies were excluded. So prepared data was used to estimate parameters of the linear regression function. 500 new typical observations were generated for each dataset, so that performance of the models can be compared. The results are shown in Table 2.

As shown in Figure 2, excluding anomalies from the dataset had a positive impact on the precision of the prediction. Additionally, better accuracy of the proposed permutation method allowed for a bigger reduction in value of RMSE (root mean square error).

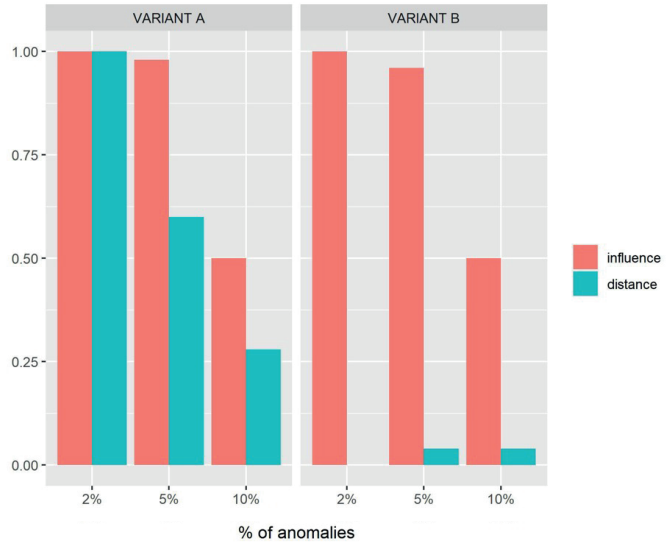

Fig. 2. Recall of the Proposed Method and the Method Using Distance to 20 Nearest Neighbours

Source: author's own work in the R programme.

Table 2. RMSE Values for Models with Anomalies Identified Using Different Methods Excluded from the Training Dataset

Data	Percent of Anomalies	Method		
		None	Distance	Influence
Variant A	2	0.0303	0.02846	0.02968
	5	0.03765	0.0313	0.0297
	10	0.0580	0.0493	0.0297
Variant B	2	0.0063	0.0070	0.0000
	5	0.0079	0.0105	0.0000
	10	0.0247	0.0287	0.0000

Source: author's own work.

6. Conclusion

The simulation study showed that removal of the anomalies based on the influence the observations had on the model parameter estimates allowed a significant reduction in the value of RMSE. Additionally, the proposed method was identifying observations for which the multivariate

distribution of the dependent and independent variables was changed more accurately than the method based on distance. It is worth noting that even the anomalies not identified by the proposed method would not have a large impact on the model parameter estimates.

There is no definitive method of identifying the cut-off point of the level of influence on the model parameter estimates an observation has to have to be considered influential. Because of this, cases where the assumed percentage of anomalies is larger and smaller than the real percentage were considered. In both cases, no significant increase of RMSE occurred when compared to the model estimated using the entire dataset. When more observations than necessary were deleted, there was no significant loss in precision of prediction information. However, it is important to note that, as this study is using generated data, the homogeneity of the data (excluding added anomalies) as well as the large number of observations could help reduce the consequences of deleting additional observations.

This paper shows that identifying anomalies based on the influence the observations had on the model parameter estimates may be an important step in model estimation, especially if the researcher expects that the data may contain anomalous observations. Additionally, it is often more important for the precision of the prediction than the more widely known issue of identifying outliers based on measurements of distance between observations. Nevertheless, it is necessary to keep in mind that outliers can occur naturally, particularly in the case of fat-tailed distributions. Because of this, the observations identified as anomalies should be carefully examined before their removal from the dataset.

The simulation study examined the accuracy of the proposed method when applied to a simple linear regression model. Further research could investigate applying this method to more complex models. In addition, more research to examine the sensitivity of the proposed method's accuracy to changes in the homogeneity of the generated data is needed.

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IMPACT OF GOVERNMENT CORRUPTION AND ECONOMIC GROWTH IN SUB-SAHARAN COUNTRIES

Abstract

Objective: This research aims to investigate the effectiveness of government in sustainable economic growth and its impact on the control of corruption in selected sub-Saharan African (SSA) countries between 2002 and 2017.
Research Design & Methods: In this study, the independent variables included in the model, Control of Corruption (CONC), Government Effectiveness (GEFF) and Rule of Law (RLAW), were investigated using panel data analysis to investigate their possible effects on the Annual GDP Growth Rate as the dependent variable. Data obtained from selected SSA countries were used in the model to analyse possible relationships between these variables in the specified period.
Findings: The findings show that controlling corruption is not statistically significant but negatively affects economic growth in SSA countries. Conversely, the rule of law is statistically significant and negatively impacts these countries.
Implications/Recommendations: The results highlighted the necessity of strengthening the institutional structures and controls to increase the positive effects of government effectiveness and corruption control on economic growth in SSA countries. Similarly, in line with the results obtained from this study, governments in the region are recommended to prioritise strengthening their institutional structures to promote economic development.

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Contribution: This study draws attention to the critical role of a properly functioning legal system and the rule of law in SSA countries, as well as to economic growth, and contributes to the existing literature in this context. In addition, the detrimental effects of weak institutional structures on the relationship between the control of corruption and economic performance in the region are also highlighted. Ultimately, the research highlights the need for joint initiatives and efforts to address governance challenges and promote sustainable economic development in SSA countries.

Keywords: sub-Saharan African countries, panel data, corruption, government effectiveness.
JEL Classification: G3, N17, C33.

1. Introduction

Some of the key factors responsible for differences in economic growth between countries are population, geography, trade, culture, and governance and institutions (United Nations, 2015). Based on new growth theories, for sustained economic growth to occur, good public governance is essential (Bayar, 2016). Although we do not have a precise meaning of what governance is, Kaufmann, Kraay and Mastruzzi (2010) view governance as the means whereby authority in a country is exercised through traditions and institutions. Therefore, governance is seen as 1) the process of selecting, monitoring and replacing governments; 2) the effective establishment and implementation of sound policies by the government; and 3) the respect of citizens and the state for the institutions that govern economic and social interactions. Corruption, however, can be defined as when entrusted power is abused and used for personal gain. It can be categorised as petty, grand, and political which depends on the total sum of funds lost and the sector in which the corruption takes place (Transparency International, 2018). This takes us to what is called government effectiveness.

Government Effectiveness is one of the World Governance Indicators (WGI) that measures the quality of the perception of public service, the quality of the civil service and how free they are from political pressure; the quality of policy formulation and implementation, and government's capability to implement policies. Other indicators of governance are political stability/absence of violence, voice and accountability, quality of regulation, rule of law, and control of corruption, all of which measure other functions of government. This research will therefore focus on how government effectiveness and corruption affect economic growth in sub-Saharan African (SSA) countries. In the literature we find that a high level of corruption is expected to lead to government ineffectiveness in any country which will, in turn, affect their economic growth. This was confirmed by Omoteso

and Ishola Mobolaji (2014) when they carried out a study on governance, corruption, and economic growth in SSA countries. They observed in their study that, on aggregate, sub-Saharan countries have not been performing well economically when compared to other developing countries. The reasons they gave for this underperformance were classified into two categories. One was external factors, and the other was internal factors. External factors included, among other factors, the global financial crisis and unfavourable terms of trade. The internal factors included corruption, ethnic conflicts, instability of the political environment, unstable and unbalanced policy regimes, civil unrest, security issues, weak institutions, and complex administrative and institutional frameworks.

Haydaroğlu (2016) further explained that one of the outcomes of institutional weakness is corruption, which leads to potential negative effects on the economic performance of a country. As a result of this effect, the reasons for and outcomes of corruption have been studied in detail over the last two decades. In this context, the problem of corruption has been a long-standing epidemic in Nigeria which is why a deliberate effort needs to be made to tackle the problem. Nigeria is one of the most richly endowed nations on Earth, blessed with a wide range of human and natural resources. If these resources were effectively utilised, Nigeria would have been one of the leading nations of the world in terms of growth, revenue and productivity (Ovat & Bassey, 2014).

Together with some other sub-Saharan countries like Guinea and Comoros, Nigeria ranks 148th out of 180 countries with a score of 27 out of 100 (CPI, 2017). The closer the mark is to 0, the more corrupt the nation is. In government effectiveness, Nigeria's percentile rank is 16.35 out of 100 countries in 2017. On the other hand, Botswana's economy tends to be doing well in terms of corruption and government effectiveness. Botswana is the leading African country in terms of low level of corruption, coming 34th with a score of 61 out of 100. Botswana was also ahead of Nigeria in terms of government effectiveness with a 68.75 percentile ranking. Rwanda is second to Botswana when it comes to the Corruption Perceptions Index. Rwanda ranks 48 out of 180 countries in the Corruption Perceptions Index and scores 63.46 in Government Effectiveness. Ghana, a West African country, ranks 81 out of 180 countries in the Corruption Perceptions Index and scores 49.04 in Government Effectiveness.

This research was therefore conducted to determine the impact of government efficiency and corruption on economic growth in the selected sub-Saharan African countries between 2002 and 2017. The period of

research is limited because of the data available. It is good to examine countries within the same region so as to know how well they are doing. The results of the examination will enable them to know the steps to take for further growth. It should be noted that the growth of countries differ from one another.

There are many studies on the effects of government efficiency and corruption on economic growth in Africa, but few studies have been able to examine the four SSA countries in this research.

Research Objective

The objective of the research is to find out how government effectiveness and control of corruption impacts economic growth in the selected SSA countries.

Research Questions

1. What impact does government effectiveness have on the economy of the selected SSA countries?
2. Does control of corruption impact economic growth in SSA countries?
3. What impact does rule of law have on the economy of SSA countries?

2. Literature Review

Brewer, Choi and Walker (2007) found in their study that factors such as voice and accountability, wealth and income, and control of corruption influence the effectiveness of the government. The study was about the impact government effectiveness has on economic growth in Asia, both regionally and across sub-regions using World Bank Governance Indicators.

Ishola Mobolaji and Omoteso (2009) picked some transitional economies to find out how economic growth is affected by corruption and some other institutional factors from 1990 to 2004. For the analysis, the panel data framework, random effect, fixed effect, and maximum likelihood estimation techniques were used. The results of the study show that corruption has a negative effect on the selected economies, which supports Mauro's (1995) hypothesis. However, the hypotheses of Leff (1964) and Huntington (1968) could not be supported because there was no robust statistical evidence to back them up.

Omoteso and Ishola Mobolaji (2014) carried out a study on some sub-Saharan African countries for the period 2002 to 2009, to find out how economic growth has been impacted by governance indices, focusing on

the control of corruption using the panel data, random effect, fixed effect, and maximum likelihood estimation methods for the analysis. The result of the study suggests that regulatory quality and political stability significantly impact the region, while government effectiveness negatively affects the region. Also, the effect of control of corruption is not obvious, even though several anti-corruption policies have been implemented. In addition, the study noted that economic growth in the region will be significantly affected if accountability and rule of law indicators are implemented simultaneously.

Nwankwo (2014), using granger causality and regression techniques, examined the effect of corruption on growth in the economy of Nigeria and discovered that the effects of corruption on economic growth are negatively significant. The variables used were the Transparency International Corruption Perceptions Index and gross domestic product.

Bayar (2016) carried out a study on transitional economies in the European Union from 2002 to 2013 using the panel data framework, fixed effects method, chow test, OLS, BP test, and random effects technique to examine the impact of public governance on economic growth. The study estimates that corruption control had a negative impact on the SSA countries' economies and all governance indicators caused a significant positive impact on economic growth. Weak effects were observed on political stability.

Using the bootstrap panel Granger causality approach, Huang (2016) examined whether economic growth was negatively impacted by corruption in 13 Asia-Pacific countries from 1997 to 2013. The result shows that corruption had positive causality on economic growth in South Korea. Positive causality from economic growth to corruption in China was also observed. A positive causal relationship between corruption and economic growth was observed in the remaining countries. They assumed that corruption brought some benefits to economic growth.

For a sample of 130 countries, Montes and Paschoal (2016) analysed the impact corruption had on government effectiveness and found out that countries that are less corrupt have a better quality of public service, better quality of policy formulation and adoption, and the governments of such countries are more credible and committed to such policies. Also, in developed countries, the effect of corruption on government effectiveness is higher. It was also observed that countries that had higher debts and inflation were less efficient in governance. The result also suggests that the rule of law helps improve the efficiency of the government and that

developing countries with more democratic regimes have a higher degree of efficiency of government.

Alam, Kiterage and Bizuayehu (2017) investigated the impact government effectiveness had on the economic growth of a panel of 81 countries using the system generalised moments method (system GMM) technique. The paper finds that the effectiveness of government has a significant positive effect on economic growth.

Pacific, Ramadhan and Gabriella (2017) used the autoregression model (VAR) to investigate the effects of tackling corruption on the economy of Botswana from 1996 to 2014. The results show that government effectiveness and exports of goods and services have a positive relationship with growth in gross domestic product. The control of corruption, though not significant, had a positive relationship with economic growth.

Awan *et al*. (2018) carried out a study on five selected SAARC countries using panel data from 1996 to 2014. The purpose of the research was to find out the association between governance, corruption, and economic growth. Panel regression was run using the fixed effects method of estimation based on Hausman specification test results. The fixed-effects model was also used with a specific cross-section coefficient. The findings show that two institutional governance indicators, namely government effectiveness and political stability, have a positive and substantial impact on the economy of the selected SAARC countries. Economic growth was negatively impacted by corruption. Corruption has an adverse effect on economic growth. In addition, the results show that the efficiency of the government has a greater influence than other governance indicators on GDP growth in selected SAARC countries. The results of the education index appeared to be important predictors of the growth of selected SAARC countries in the given period.

3. Data and Methodology

The data used for this study are sourced from World Governance Indicators of the World Bank from 2002 to 2017.

The econometric model used is similar to that of Pacific, Ramadhan and Gabriella (2017), and Montes and Paschoal (2016). Economic growth is proxied by Annual GDP Growth Rate (*GDPGR*) and it is expected to be impacted positively by Control of Corruption (*CONC*), Government Effectiveness (*GEFF*) and Rule of Law (*RLAW*). Corruption is proxied by

World Governance Indicators Control of Corruption (*CONC*). The model is simply stated below:

$$GDPGR = f(CONC, GEFF, RLAW). \quad (1)$$

The model therefore will be:

$$GDPGR = \beta_0 + \beta_1 CONC + \beta_2 GEFF + \beta_3 RLAW + \varepsilon_t. \quad (2)$$

Annual GDP Growth Rate is the dependent variable while the independent variables are Control of Corruption, Government Effectiveness and Rule of Law. From our model above, we expect that Control of Corruption (β_1) will impact economic growth positively and significantly, Government Effectiveness (β_2) and Rule of Law (β_3) are also expected to impact economic growth positively and significantly. However, if economic growth is negatively impacted by Control of Corruption, that will mean that the efficient grease hypothesis is present. ε is the error term while β is the coefficient. All the independent variables are measured in terms of estimates ranging from –2.5 to 2.5.

4. Model Estimation and Results

4.1. General Remarks

In this study, the effects of Control of Corruption, Government Effectiveness and Rule of Law on Annual GDP Growth Rate are examined. We analyse whether the estimated pooled OLS model is significant for the regression.

4.2. Descriptive Statistics

When normal skewness equals zero, then it is mesokurtic. When kurtosis equals three, then it is positively skewed. *GDPGR* is positively skewed and leptokurtic. *CONC* is negatively skewed and platykurtic. *GEFF* is negatively skewed and platykurtic while *RLAW* is also negatively skewed and platykurtic. *GDPGR* is not normally distributed while *CONC*, *GEFF*, and *RLAW* are normally distributed. The mean explains the average value for each of the variables. The median explains the middle value of each of the variables while the maximum and minimum explain the highest and the lowest values of each of the variables and the standard deviation explains the deviation from the sample mean (Table 1, Fig. 1).

Table 1. Descriptive Statistics

Specification	*GDPGR*	*CONC*	*GEFF*	*RLAW*
Mean	6.423739	–0.045543	–0.205461	–0.223738
Median	6.173016	–0.048127	–0.098069	–0.035065
Maximum	33.73578	1.216737	0.725896	0.730522
Minimum	–7.652310	–1.431231	–1.214644	–1.427206
Standard Deviation	4.864018	0.8012400	0.590132	0.683849
Skewness	2.382295	–0.139898	–0.265048	–0.228484
Kurtosis	17.68389	1.772017	1.803736	1.751787
Jarque-Bera	635.5142	4.229940	4.565467	4.711611
Probability	0.000000	0.120637	0.102005	0.094817
Sum	4,111.193	–2.914731	–13.14952	–14.31925
Sum Sq. Dev.	1,490.496	40.56231	21.94010	29.46191
Observations	64	64	64	64

Source: authors' estimation.

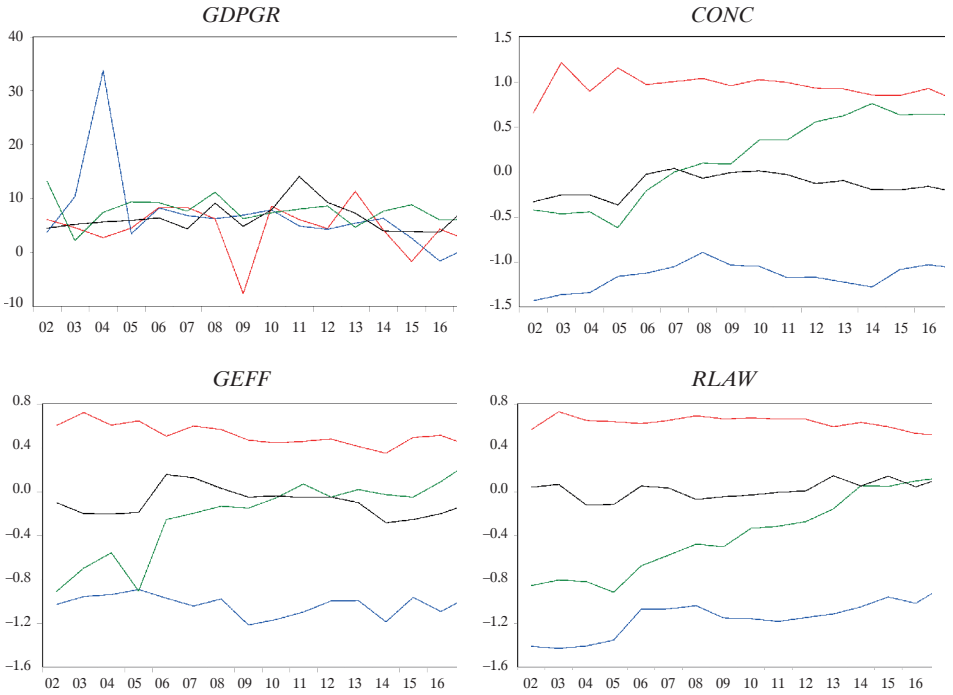

Fig. 1. Trend of the Variables

Source: authors' estimation.

4.3. Unit Root (Trend and Intercept)

All parameters become stationary after the first difference; see Table 2.

As seen in Table 2, all variables became stationary after taking the derivative. The results of unit root tests are shown in Table 3, and the probability values for ADF, PP, P/S for the variables considered in this study were at almost zero level and the test statistics provided the desired values. In this case, the null hypothesis will be rejected and the alternative hypothesis that the variables become stationary will be accepted.

Table 2. The Unit Root Analysis Becomes Significant for Considered Parameters

Variables	Levin, Lin & Chu *t**		ADF – Fisher Chi Square		Im, Pesaran and Shin W-stat		Stationary
	t-statistics	Prob.	*t*-statistics	Prob.	*t*-statistics	Prob.	
GDPGR	–9.69361	0.0000	40.5582	0.0000	–6.16659	0.0000	I(1)
CONC	6.27742	1.0000	17.3172	0.0270	–1.89030	0.0294	I(1)
GEFF	–2.26685	0.0117	17.9053	0.0219	–2.10442	0.0177	I(1)
RLAW	–0.05632	0.4775	15.9065	0.0437	–1.70435	0.0442	I(1)

Source: authors' estimation.

4.4. Unit Root (Trend)

Table 3. Unit Root

Variables	Levin, Lin & Chu *t**		ADF – Fisher Chi Square		Im, Pesaran and Shin W-stat		Stationary
	t-statistics	Prob.	*t*-statistics	Prob.	*t*-statistics	Prob.	
GDPGR	–3.15838	0.0008	20.9010	0.0074	–2.60839	0.0045	I(0)
CONC	5.11083	1.0000	21.6268	0.0057	–2.68109	0.0037	I(1)
GEFF	–1.80525	0.0355	8.73646	0.3650	–0.65285	0.2569	I(0)
RLAW	–1.83140	0.0335	23.6812	0.0026	–2.99219	0.0014	I(1)

Source: authors' estimation.

4.5. Pooled Regressions

We analyse whether the estimated pooled OLS model is significant for the regression. Regarding the test results given in Table 4, *t*-statistics, which measure variance in the dependent variables explained by independent variables. From the table we observe that only the Rule of Law becomes

significant and Control of Corruption is not statistically significant, however, it affects the economy negatively, while Rule of Law is statistically significant and it also affects the SSA countries negatively. It can be observed from *t*-statistics that the intercepts are all significantly distant from zero.

Table 4. Pooled Regression Results

Dependent Variable	*GDPGR*			
	Coefficient	Standard Error	*t*-statistic	Probability
C	6.330701	0.827384	7.651467	0.0000
CONC	–0.624065	2.485501	–0.251082	0.8026
GEFF	7.710114	4.405212	1.750225	0.0852
RLAW	–7.369082	2.975379	–2.476687	0.0161

Source: authors' estimation.

The pooled regression assumes that all the countries are the same.

4.6. Fixed Effect Model

The estimation of the fixed effect model is given in Table 5. In particular, only the Rule of Law variable becomes significant. The other variables' probability values are not significant.

Table 5. Fixed Effect Model

Dependent Variable	*GDPGR*			
	Coefficient	Standard Error	*t*-statistic	Probability
C	4.426707	1.591774	2.780990	0.0073
CONC	5.106013	5.602257	0.911421	0.3659
GEFF	4.406333	4.871293	0.904551	0.3695
RLAW	–14.01148	5.953665	–2.353420	0.0221

Source: authors' estimation.

4.7. Random Effect Model

Similarly, the results of the random effects model, as shown in Table 6, are relevant only in terms of Government Effectiveness, while the other variables remain insignificant. Notably, the coefficients for Rule of Law and Control of Corruption are negative, indicating a negative impact across the model. In contrast, Government Effectiveness exhibits a positive impact on

the model. Therefore, it can be concluded that Government Effectiveness positively influences RGDP, whereas the other variables have negative effects within the model.

Table 6. Random Effect Model

Dependent Variable	*GDPGR*			
	Coefficient	Standard Error	*t*-statistic	Probability
C	6.330701	0.826626	7.658484	0.0000
CONC	–0.624065	2.483224	–0.251313	0.8024
GEFF	7.710114	4.401176	1.751830	0.0849
RLAW	–7.369082	2.972653	–2.478958	0.0160

Source: authors' estimation.

In the above two tables, random and fixed effects are interpreted. This investigation has two estimators with different properties depending on the correlation between individual-specific effects (αi) and the regressors. If the effects do not interact with the explanatory variables, the random effects (RE) estimator is consistent and efficient. In contrast, the fixed effects (FE) estimator is consistent, but not efficient in this model. Again, if effects are associated with explanatory variables, the FE estimator is consistent and efficient, but the RE estimator is now inconsistent. Therefore, we need to calculate the Hausman test to determine which estimator is correct.

4.8. Hausman Test

The Hausman test helps to pick the preferred method to use either a fixed effect model or a random effect model (Table 7). The preferred method to use after carrying out the Hausman test is the random effect model.

Table 7. Hausman Test

Dependent Variable *GDPGR*			
Test Cross-section Random Effects			
Test summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Probability
Cross-section random	3.110092	3	0.3750

Source: authors' estimation.

5. Conclusion

Using the pooled regression method, the result shows that Control of Corruption is not statistically significant, however it affects the economy negatively, while Rule of Law is statistically significant and it also affects the SSA countries negatively.

Considering that management corruption is widespread, this study is important in this regard. Although the Control of Corruption is not statistically significant in terms of explaining the Annual Gross Domestic Product Growth Rate variable, the Control of Corruption negatively affects the SSA region.

Likewise, Government Effectiveness is not statistically significant in terms of explaining the Annual Gross Domestic Product Growth Rate variable. However, although it is not very important, it affects the economy positively.

Rule of Law is the only statistically significant variable that contributes to the growth rate of SSA countries and it negatively affects SSA countries. Control of Corruption negatively impacts the economy due to weak institutions in SSA countries.

6. Recommendations

In this context, this study shows that, from a global perspective, the problem of corruption is a widespread problem and that both individuals and institutions can be more efficient and effective in the fight against corruption. We would like to draw particular attention to the importance of legal regulations and the judiciary in this regard.

The conclusion is that governments of the SSA countries must strengthen institutions so that the variables considered can impact the economy of the SSA countries significantly and positively.

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