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Fiscal Dependence on Kazakhstan's National Fund: Macroeconomic Determinants and Scenario Assessment

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Abstract
The National Fund of the Republic of Kazakhstan is essential to stabilizing public finances and ensuring oil revenues for future generations of Kazakhstan. The aim of this study is to identify the key macroeconomic determinants of transfers from the National Fund of the Republic of Kazakhstan and to assess their sensitivity to external and domestic macroeconomic shocks using econometric modeling and scenario analysis. The empirical base covers 2001-2024 and includes annual data from the Ministry of Finance of the Republic of Kazakhstan, the National Bank of Kazakhstan, the Bureau of National Statistics, and the World Bank. The study uses regression analysis with lagged explanatory variables, diagnostic tests (Breusch–Godfrey, Zharko, and Breusch–Pagan), and scenario modeling. The results of the extended model showed that the price of Brent crude oil is negatively related to the volume of transfers: the coefficient was -9.152 at p = 0.002. Receipts to the National Fund, the cost of oil production, and inflation have a positive, statistically significant relationship with transfers: the corresponding coefficients were 1,047, 8,306, and 21,651. Scenario calculations showed that a 10% decrease in the Brent price increases the forecast value of the transfer logarithm from 14.465 to 15.430, while a 10% increase in the price reduces it to 13.593. The findings emphasize that better fiscal rules should be implemented to address procyclical withdrawals, transparency should be increased, and Kazakhstan's sovereign wealth management system should be maintained over time.

KEYWORDS
Macroeconomic, Emerging Economy, Fiscal Sustainability, Fiscal Policy, Oil Production, Oil Price, Transfer Policy

1 | INTRODUCTION

Amid current global economic instability, countries with abundant natural resources must ensure the sustainable management of resource rents. With oil prices at record highs, geopolitical tensions, inflation, and the risk of recession increasing the vulnerability of commodity exporters, the importance of sovereign wealth funds as macroeconomic stabilizers and for redistributing natural resources across generations is heightened. The National Fund of the Republic of Kazakhstan, established in 2000, performs two principal functions: stabilization and savings. Its stabilization function is intended to mitigate the effects of external economic shocks and support the stability of the state budget, while its savings function seeks to preserve a share of oil and gas revenues for future generations. In recent years, however, Kazakhstan's fiscal policy has increasingly relied on transfers from the National Fund to finance current budget expenditures. Although these transfers can mitigate the short-term consequences of external and domestic shocks, their continued expansion may weaken the Fund's capacity to accumulate financial assets and fulfill its long-term savings function.

Questions about the rational management of oil revenues are traditionally considered in the context of the "resource curse" concept, according to which a significant economic concentration on the extraction and export of raw materials can be accompanied by structural imbalances, weakened institutions, increased corruption risks, and increased macroeconomic vulnerability. For countries in which oil and gas revenues constitute a significant portion of budget revenues, the development of fiscal mechanisms capable of mitigating the impact of price volatility in commodity markets, limiting the procyclical nature of fiscal policy, and ensuring a more balanced distribution of resource rents between current consumption and long-term accumulation is of paramount importance.

Despite extensive research on sovereign wealth funds and resource income management, the macroeconomic implications of transfers from the National Fund of the Republic of Kazakhstan have not been sufficiently studied. In practice, transfers have become an important source of financing for the state budget, and their volume depends on both the external conjuncture of commodity markets and internal fiscal and inflationary conditions. This problem is of particular importance for Kazakhstan, since oil revenues remain an essential component of public finances and the budget continues to depend heavily on the National Fund's resources.

Changes in world oil prices, oil production volumes, revenues to the National Fund, inflation rates, and the state budget can influence decisions on the amount of transfers and, consequently, the fund's ability to perform stabilization and savings functions. However, the influence of these factors on the dynamics of transfers has rarely been considered within a comprehensive empirical framework for Kazakhstan.

The aim of this study is to identify the key macroeconomic determinants of transfers from the National Fund of the Republic of Kazakhstan and to assess their sensitivity to external and domestic macroeconomic shocks using econo-

metric modeling and scenario analysis. The empirical base of the study covers the period 2001-2024 and includes annual data from official national and international sources. The study uses regression analysis, diagnostic tests, and scenario modeling, which allows not only to determine the statistical relationship between transfers and macroeconomic indicators, but also to assess possible changes in the volume of transfers under various scenarios of oil price dynamics, inflation, and oil production. The scientific contribution of the study consists of a comprehensive analysis of external raw materials and internal macroeconomic factors affecting transfers from the National Fund of Kazakhstan, as well as an assessment of their sensitivity to alternative economic scenarios.

2 | LITERATURE REVIEW

The most well-known hypothesis in the economic literature is the resource curse hypothesis, which suggests that resource-rich economies tend to experience slower economic growth, weaker institutions, and greater macroeconomic instability than economically diversified ones (Sachs & Warner, 2001). Resource-rich economies that depend on commodity exports in global markets tend to have lower long-run growth rates, so resource abundance is likely to create structural distortions rather than long-term prosperity. Van der Ploeg (2011) further rejects a deterministic interpretation of the resource curse. In fact, Mehlum et al. (2006) demonstrated that countries with strong institutions can transform resource wealth into long-term economic development, whereas weak institutions tend to promote rent-seeking, corruption, and inefficient public spending.

Gelb (1988) showed that many oil-exporting countries were unable to transform resource windfalls into sustainable long-term development because of procyclical public spending, weak institutions, and excessive dependence on commodity revenues. Similarly, Collier and Goderis (2012) found that positive commodity-price shocks may generate substantial short-term economic gains but do not necessarily support long-term growth when economies remain highly concentrated in resource-based sectors. These findings suggest that the developmental effects of resource abundance depend not only on the volume of available resources but also on the quality of fiscal and institutional arrangements. In this context, fiscal policy plays a central role in reducing the vulnerability of resource-rich economies to commodity-price fluctuations. Frankel et al. (2013) showed that countries with stronger institutions were more likely to shift from procyclical toward countercyclical fiscal policies, thereby improving macroeconomic stability. Sovereign wealth funds are among the main institutional mechanisms for managing natural resource revenues, intended to support macroeconomic stabilization, promote intergenerational savings, and reduce fiscal dependence on volatile commodity markets.

According to Balding (2012), sovereign wealth funds are often confronted with the tension between short-term fiscal needs (and long-term asset accumulation plans) and long-term asset purchase goals. When political pressures dominate economic considerations, funds can gradually evolve from savings to financing

current expenditures. Similarly, Bagnall and Truman (2013) showed that transparency, accountability, and institutional independence are among the strongest determinants of sovereign wealth fund effectiveness.

However, the literature does not provide a consensus on the effectiveness of sovereign wealth funds. Ossowski et al. (2001) and Barnett and Ossowski (2002) argued that resource funds can mitigate fiscal volatility and provide temporary financing during periods of revenue shortfalls. In contrast, Balding (2012) emphasized that political pressure and weak institutional constraints may transform sovereign wealth funds from savings mechanisms into instruments for financing current government expenditures. Consistent with this concern, Humphreys et al. (2007) found that the establishment of a sovereign wealth fund does not by itself guarantee the effective management of resource revenues. These differing perspectives suggest that the long-term performance of sovereign wealth funds depends not only on their financial capacity but also on governance quality, fiscal discipline, and institutional independence.

Bems and de Carvalho Filho (2009) emphasized the precautionary role of sovereign wealth funds as savings mechanisms in resource-exporting countries. By accumulating part of resource revenues during favorable periods, these funds can help smooth consumption, mitigate the effects of commodity price shocks, and enhance macroeconomic stability. Accordingly, the performance of sovereign wealth funds should be assessed not only in terms of their short-term stabilization effects but also in terms of their capacity to preserve national wealth across economic cycles.

A significant body of literature has also examined the role of fiscal rules in limiting the procyclicality of public spending in resource-dependent economies. Lopez-Murphy et al. (2010) showed that many commodity-exporting countries increase public expenditure during periods of high commodity prices and subsequently experience fiscal pressures during downturns. Such behavior may increase reliance on sovereign wealth fund transfers and weaken long-term fiscal sustainability. Sugawara (2014) found that fiscal rules can reduce expenditure volatility in resource-rich countries, particularly when supported by strong institutional oversight and effective enforcement mechanisms. Similarly, Lledó et al. (2017) argued that fiscal rules are more effective when they are transparent, legally binding, consistently enforced, and monitored by independent institutions.

More recent research has highlighted ESG-oriented investment strategies and portfolio diversification. Environmental, social, and governance considerations may contribute to the long-term resilience of investment portfolios amid geopolitical uncertainty and the global energy transition (Kansoy & Stasiulaitis, 2025). From this perspective, sovereign wealth funds serve not only as stabilization and savings mechanisms but also as strategic instruments for preserving and diversifying national wealth.

World oil prices are usually considered one of the main external factors determining sovereign fund receipts and the volume of withdrawals. Lopez-Murphy et al. (2010) have shown that fluctuations in commodity prices directly affect public

finances and can lead to adjustments in sovereign fund operations. Sugawara (2014) also noted that oil price volatility remains a significant source of fiscal instability in resource-dependent countries. Balasundharam et al. (2023) showed that pensions, social assistance benefits, and public-sector wages are formally or informally indexed to inflation in many countries. Such indexation may increase nominal budgetary obligations during periods of sustained price growth. Consequently, higher inflation may intensify fiscal pressures and increase the government's reliance on sovereign wealth fund resources to finance additional expenditures.

The volume of oil production is also an important factor, as it determines the basis for the state's resource revenues. Van der Ploeg (2011) points out that an increase in production can expand government financing opportunities but, with weak institutional constraints, can also increase budget dependence on commodity revenues. In oil-producing economies, increased production is often accompanied by increased government spending and increased use of sovereign wealth funds.

Inflation is an internal macroeconomic risk that can increase pressure on the state budget. Rising prices increase costs across the public sector, social benefits, public procurement, and budget program implementation. In periods of high inflation, the government can more often draw on the sovereign fund's resources to cover additional costs and maintain fiscal sustainability. Lopez-Murphy et al. (2010) noted that during periods of macroeconomic instability, increased budgetary pressures may be accompanied by increased withdrawals from stabilization funds. According to Ossowski et al. (2001), persistent budget deficits are among the main reasons for increased withdrawals of non-renewable resources, especially in countries with weak cost-control mechanisms. Barnett and Ossowski (2002) also noted that budget deficits often directly lead to the use of oil and stabilization funds. If fiscal imbalances persist, the sovereign wealth fund may gradually lose its savings function and become a permanent source of financing for current expenses.

Thus, an analysis of the literature makes it possible to identify oil prices, oil production, fund receipts, inflation, and the state budget as the main macroeconomic factors related to the dynamics of transfers from sovereign funds. These indicators form the theoretical basis for constructing the econometric models used in this study. Accordingly, the selection of explanatory variables for the econometric model is directly derived from previous studies. Oil prices represent the primary external determinant of fiscal revenues in resource-exporting economies (Lopez-Murphy et al., 2010; Sugawara, 2014). Oil production reflects the scale of resource extraction and the potential expansion of fiscal capacity (Van der Ploeg, 2011). National Fund revenues capture the accumulation of resource rents and their potential influence on public spending decisions (Frankel et al., 2013). Inflation reflects internal macroeconomic pressures that may increase fiscal expenditures (Lledó et al., 2017), while the budget balance serves as an indicator of fiscal stress and the need for additional financing (Barnett & Ossowski, 2002). Consequently, these variables provide the theoretical and empirical foundation for

the econometric specification employed in this study.

By contrast, Norway's Government Pension Fund Global is widely used as a benchmark for resource revenue management. The Norwegian model is based on strict fiscal rules, high transparency standards, and strong institutional independence, enabling resource revenues to be converted into long-term financial assets rather than short-term budget financing (NBIM, 2026). Kazakhstan, unlike Norway, depends much more on transfers from its sovereign wealth fund to finance budget expenditures. While the Norwegian model is primarily focused on the preservation and smooth intergenerational consumption of wealth, the National Fund of the Republic of Kazakhstan also serves stabilization, savings, and fiscal financing functions. Because of this institutional difference, transfer determinants are the key to assessing long-term fiscal sustainability and the preservation of National Fund assets.

Several studies have examined the formation and use of Kazakhstan's National Fund. The country's fiscal response to external shocks shows that transfers from the Fund were essential during the crisis of the global financial system in 2008-09, the oil price collapse of 2014-2016, and the COVID-19 pandemic. A number of studies are devoted to the formation and use of funds from the National Fund of Kazakhstan. Dodonov (2021) investigated the impact of devaluation and the National Fund's investment income on the formation of Kazakhstan's state budget, emphasizing the special role of transfers from the fund in the public finance system. Daribekova and co-authors (2024) reviewed the specifics of the formation and use of the National Fund's funds and proposed measures to improve the mechanism for managing its resources. Papyrakis and Parcero (2022) found that public attitudes toward resource wealth in Kazakhstan may reinforce expectations of increased government spending, thereby providing additional political incentives to use oil revenues to support the economy rather than accumulate them in the long run. This is consistent with a wider international trend of nations like Nigeria and Venezuela, where large resource revenues are often associated with increased fiscal dependence on commodity markets and less diversification efforts. These studies provide important evidence on the accumulation, investment income, use, and institutional management of the National Fund. However, they do not pay sufficient attention to the macroeconomic factors that determine the volume of transfers from the fund to the state budget, as well as to the sensitivity of these transfers to external and internal shocks.

Despite extensive research on sovereign wealth funds and resource-dependent economies, several important limitations remain in the existing literature. First, most studies focus more on institutional design, governance quality, transparency, and fiscal rules than on the mechanisms underlying withdrawal. Second, most empirical work on Kazakhstan concentrates on legal and policy aspects of the National Fund and very little on the actual reasons for transfers. Third, many studies do not consider oil prices, oil production, inflation, National Fund revenues, and fiscal conditions within a single empirical framework. Hence, the mechanisms by which external commodity-market shocks and internal macroeconomic pressures

interact to drive the transfer process are not well understood.

The present study addresses this gap by developing an integrated econometric framework that links the theoretical insights of the resource curse literature, sovereign wealth fund research, and fiscal policy studies to empirical evidence from Kazakhstan. Transfers from the National Fund are treated as dependent variables, and Brent oil prices, oil production, National Fund revenues, inflation, and the budget balance are also considered relevant factors in this study. By combining econometric estimation and scenario analysis, the study provides new evidence on how external commodity market shocks and domestic macroeconomic pressures jointly impact the sustainability of National Fund operations.

3 | RESEARCH METHODS

The research methodology combines theoretical analysis, econometric modelling, and scenario analysis. This approach makes it possible not only to identify the statistical relationships between transfers from the National Fund of the Republic of Kazakhstan and selected macroeconomic factors, but also to assess the sensitivity of transfers to external and domestic macroeconomic shocks. The results are subsequently interpreted in terms of their possible implications for the stabilization and savings functions of the Fund.

The aim of the empirical analysis is to identify the key macroeconomic determinants of transfers from the National Fund of the Republic of Kazakhstan. The study focuses on two groups of explanatory factors. The first group comprises external resource-related factors, including Brent crude oil prices, National Fund revenues, and oil production. The second group includes domestic macroeconomic and fiscal factors, represented by inflation and the budget balance.

The empirical analysis covers the period from 2001 to 2024. This period makes it possible to examine the dynamics of the National Fund since the early stage of its operation and includes several major episodes of external and domestic economic instability: the global financial crisis of 2008–2009, the decline in oil prices in 2014–2016, the COVID-19 pandemic in 2020, and the period of elevated global inflation and energy-market instability in 2022–2024.

The study uses data from official national and international sources, including the Bureau of National Statistics of the Republic of Kazakhstan, the National Bank of Kazakhstan, and the World Bank. The data were harmonized by period, measurement unit, and transformation procedure to ensure consistency across variables. Table 1 presents the variables used in the study, their measurement units, data sources, observation period, and transformation procedures.

All monetary indicators included in the analysis, namely transfers from the National Fund, National Fund revenues, and the value of oil production, are measured in current thousand U.S. dollars. Brent crude oil prices are measured in real U.S. dollars per barrel. Natural logarithms were applied to the monetary and oil-sector variables to reduce scale differences, mitigate heteroscedasticity, and interpret the coefficients of the log-transformed variables as elasticities. Inflation is measured as the annual percentage change in the consumer price index, while the

budget balance is expressed as a percentage of GDP. These variables are included in the model in their original form.

Table 1. Description of variables

Variable	Symbol	Unit of measurement	Data source	Period	Transformation
Transfers from the National Fund (dependent variable)	ln(Transfer)	Thousand USD, current prices	Ministry of Finance of the Republic of Kazakhstan	2001–2024	Natural logarithm
National Fund revenues	ln(Revenue)	Thousand USD, current prices	Ministry of Finance of the Republic of Kazakhstan	2001–2024	Natural logarithm
Brent crude oil price	ln(Brent)	Constant U.S. dollars per barrel	World Bank	2001–2024	Natural logarithm
Oil production	ln(Production)	Thousand USD, current prices	Bureau of National Statistics	2001–2024	Natural logarithm
Inflation	Inflation	Annual change in the consumer price index, in percentage	National Bank of Kazakhstan, Bureau of National Statistics	2001–2024	Original values
Budget balance	Balance	Percentage of GDP	Ministry of Finance of the Republic of Kazakhstan	2001–2024	Original values

Note: compiled by the authors based on Bureau of National Statistics (2025), Ministry of Finance of the Republic of Kazakhstan (2025), National Bank of Kazakhstan (2025), World Bank (2025)

The empirical analysis was conducted in several stages. First, annual data for 2001–2024 were collected from official national and international databases. Second, the data were checked for consistency, missing values, and measurement differences, after which selected variables were transformed into natural logarithms. Third, the time-series properties of the variables were examined using unit-root tests. Fourth, alternative econometric specifications were estimated to identify the determinants of transfers from the National Fund. Fifth, diagnostic tests were applied to assess residual autocorrelation, heteroscedasticity, normality, multicollinearity, and model specification. Finally, scenario analysis was conducted to evaluate the sensitivity of transfers to alternative changes in oil prices, inflation, and oil production.

Based on the variables presented in Table 1, the volume of transfers from the National Fund of the Republic of Kazakhstan was selected as the dependent variable. This variable reflects the actual intensity of the fund's resources used to finance the state budget. Because the absolute values of transfers exhibit a strong upward trend and are highly variable, the indicator was logarithmically transformed. The following indicators were used as independent variables: the real price of Brent crude oil, revenues to the National Fund, oil production volume, inflation, and budget balance. Monetary indicators were log-transformed so that the model's coefficients can be interpreted as elasticities. This is especially important when

analyzing macroeconomic data because percentage changes in indicators are more informative than changes in absolute values.

The general logic of the model can be expressed as follows (1):

$$\ln(Transfer_t) = f(\ln Brent_{t-1}, \ln Revenue_{t-1}, \ln Production_{t-1}, Inflation_{t-1}, Balance_{t-1}) \quad (1)$$

where:

$\ln(Transfer_t)$ – the natural logarithm of transfers from the National Fund to the state budget in year (t);

$\ln Brent_{t-1}$ – the natural logarithm of the real Brent crude oil price in the preceding year;

$\ln Revenue_{t-1}$ – the natural logarithm of National Fund revenues in the preceding year;

$\ln Production_{t-1}$ – the natural logarithm of the value of oil production in the preceding year;

$Inflation_{t-1}$ – the annual consumer price inflation rate in the preceding year;

$Balance_{t-1}$ – the state budget balance as a percentage of GDP in the preceding year.

The basic econometric specification is as follows (2):

$$\ln(Transfer_t) = \beta_0 + \beta_1 \ln(Brent_{t-1}) + \beta_2 \ln(Revenue_{t-1}) + \beta_3 \ln(Production_{t-1}) + \beta_4 Inflation_{t-1} + \beta_5 Balance_{t-1} + \varepsilon_t \quad (2)$$

where:

$\ln(Transfer_t)$ – the natural logarithm of transfers from the National Fund to the state budget in year (t);

$\beta_0 \dots \beta_5$ – the estimated coefficients reflecting the effects of the explanatory variables on transfers;

ε_t – the error term.

Lagged values of the independent variables were selected for several reasons. First, decisions on transfers from the National Fund are made as part of the budget process rather than instantaneously; therefore, responses to changes in oil prices, inflation, or the budget balance may be delayed. Second, the use of lagged variables may partially reduce, although not eliminate, the problem of reverse causality, because macroeconomic conditions may influence transfers, while transfers themselves may also affect fiscal and inflation indicators. Third, lagged variables allow the model to account for the inertia of fiscal decision-making.

For the study, two model specifications were constructed. The first, parsimonious Model A, includes a limited set of explanatory variables and is used to estimate the relationships among transfers, oil production value, and the budget balance. This model avoids specification overload with a limited number of observations.

The second, extended model B, includes a broader set of factors: Brent oil prices, fund receipts, oil production volumes, and inflation. This specification allows for a more comprehensive assessment of the balance between risk and opportunity factors. The second, extended Model B, includes a broader set of variables: Brent crude oil prices, National Fund revenues, the value of oil production, and inflation. This specification provides a more comprehensive assessment of external resource-related and domestic macroeconomic factors. Model B was subsequently used for scenario analysis because it provides greater explanatory power and a clearer interpretation of the simulated shocks.

The choice of the different specifications was motivated by three criteria. The first is the statistical significance of the coefficients. The second is the economic interpretability of the parameter signs. The third is the model's quality, assessed using R^2, AIC, and BIC. This approach allows consideration not only of formal statistical indicators but also of the substantive logic of economic relationships.

Particular attention was paid to the expected signs of the coefficients. Inflation was expected to be positively associated with transfers, as higher inflation may increase nominal budget expenditures and create a need for additional financing. A deterioration in the budget balance, reflected in a larger deficit, was also expected to increase the demand for transfers. Changes in oil prices may have a dual effect. On the one hand, higher oil prices increase resource revenues and strengthen the National Fund's financial base. On the other hand, under effective fiscal rules, favorable oil-market conditions may reduce the need for transfers and create greater opportunities for asset accumulation.

Several diagnostic tests were applied to evaluate the statistical adequacy of the estimated models. The Jarque–Bera test is used to assess the normality of the residual distribution. Normality of residuals is important for the correct interpretation of t-statistics and confidence intervals, especially with small sample sizes. The Breusch–Pagan test is used to check for heteroscedasticity. The presence of heteroscedasticity may indicate that the error variance depends on the explanatory variables, which reduces the reliability of the model's standard errors.

The next step involves scenario modeling. This aims to assess how changes in key factors affect the projected volume of transfers from the National Fund. The model forecast with constant factor values is used as the baseline scenario. Alternative shocks are then modeled: a 10% increase in the Brent price, a 10% decrease in the Brent price, a 2-percentage-point increase in inflation, a 3% increase in oil production, and a 3% decrease in oil production.

Scenario analysis has important practical implications because it allows us to assess the fund's resilience to various types of shocks. An increase in oil prices is viewed as a positive external shock, creating opportunities for accumulation. A decrease in oil prices is interpreted as a negative external shock, increasing pressure on the fund. Increased inflation is viewed as an internal macroeconomic risk, increasing the need for budget financing. Changes in oil production reflect the resource and production channels of influence on the fund. The scenario simulations also enable comparison of the magnitudes of projected responses to

favorable and adverse shocks. If a decline in oil prices produces a larger simulated increase in transfers than the reduction from an equivalent favorable shock, this may indicate an uneven response of transfers to changes in oil-market conditions. However, such differences in scenarios do not, by themselves, constitute a formal econometric test of asymmetry or fiscal procyclicality.

Thus, the chosen methodology allows us to address several research objectives. First, it identifies the key factors influencing the use of the National Fund's resources. Second, it allows us to separate these factors into risks and opportunities. Third, it enables us to quantitatively assess the sensitivity of transfers to macroeconomic shocks. Finally, the results provide an empirical basis for recommendations to reduce fiscal dependence on transfers and to preserve the stabilization and savings functions of the National Fund.

A limitation of the methodology is the relatively small sample size, due to the annual frequency of data collection and the relatively short history of the National Fund's operations. Furthermore, the use of annual data does not fully account for short-term fluctuations in oil prices and operational budget decisions. Nevertheless, the chosen approach is justified for the initial assessment of long-term relationships and for identifying key patterns in the use of the fund's resources.

4 | RESULTS

An econometric analysis of the factors affecting the use of funds from the National Fund of the Republic of Kazakhstan revealed a stable relationship between the volume of transfers and key macroeconomic indicators that reflect both the economy's resource capacity and fiscal risks. The study constructed two model specifications: a parsimonious model, A, and an extended model, B. Using two specifications allowed us to assess the robustness of the results under different factor structures and to avoid overcomplicating the model, given the limited number of observations.

Parsimonious model A includes the minimum required set of variables: the oil resource base indicator and the budget balance. The estimation results indicate that both variables are statistically significant predictors of transfers from the National Fund (Table 2).

Table 2. Results of model A

Variable	Coefficient	Standard Error	t-statistic	p-value
const	−42.694	8.583	−4.975	0.001
$\ln(Production_{t-1})$	3.243	0.517	6.271	0.001
$Balance_{t-1}$	−95.13	29.87	−3.185	0.005
Model statistics:				
R^2 = 0.827				
Adjusted R^2 = 0.809				
AIC = 84.939				
BIC = 88.345				
Observations = 23				

Note: compiled by the authors

The positive coefficient on the cost of oil production indicates that an increase in this indicator is associated with greater use of funds from the National Fund. The result obtained may reflect the peculiarities of Kazakhstan's fiscal model, in which the expansion of the resource base is not always accompanied by a proportional accumulation of funds, but may instead be associated with an increase in government spending and budget transfers. However, this dependence should not be interpreted as direct evidence of the causal effect of oil production on the volume of transfers.

The coefficient for the budget balance indicator is negative and statistically significant. This means that an improvement in the state budget is associated with a decrease in the volume of transfers, while a deterioration in the fiscal position is accompanied by a greater dependence on funds from the National Fund. The result is consistent with the National Fund's role as a fiscal buffer during periods when current budget revenues are insufficient to finance government spending. In general, the results of model A indicate that the use of National Fund funds is related to both the state of the oil sector and the state's fiscal position. However, the identified dependencies should not be interpreted as direct cause-and-effect relationships.

The extended model B includes Brent crude oil prices, revenues to the National Fund, oil production volume, and inflation. This specification allows for a more comprehensive assessment of the interaction of risk factors and the potential use of the fund's resources (Table 3).

Table 3. Results of model B

Variable	Coefficient	Standard Error	t-statistic	p-value
const	−108.252	20.456	−5.292	0.000
$\ln(Brent_{t-1})$	−9.152	2.591	−3.532	0.002
$\ln(Revenue_{t-1})$	1.047	0.491	2.133	0.047
$\ln(Production_{t-1})$	8.306	2.007	4.138	0.001
$Inflation_{t-1}$	21.651	8.408	2.575	0.019
Model statistics:				
R^2 = 0.885				
Adjusted R^2 = 0.859				
AIC = 79.542				
BIC = 85.220				
Observations = 23				

Note: compiled by the authors

The model results show that Brent crude oil prices have a statistically significant negative impact on the volume of transfers. This means that rising global oil prices reduce the need to use the fund's resources. Economically, this can be interpreted as the formation of an "accumulation window" in which increased export revenues partially alleviate budget pressure and enable the fund to retain a larger share of oil revenues.

The negative coefficient on the Brent price has important practical significance, as it confirms the fund's stabilization function. During periods of high oil prices, the

government can limit withdrawals and increase the fund's assets, thereby creating reserves for future crises.

At the same time, the model results show that higher National Fund revenues are associated with larger transfers to the state budget. This finding should not be interpreted as evidence of improved fund sustainability. On the contrary, it may indicate a stronger dependence of fiscal policy on resource revenues. Rather than being fully accumulated within the Fund, additional oil-related revenues appear to create incentives for increased budget expenditures and higher withdrawals. Such a pattern is characteristic of procyclical fiscal behavior, whereby periods of favorable commodity market conditions are accompanied by an expansion of public spending. Consequently, the positive relationship between Fund revenues and transfers suggests that a significant share of resource revenues is directed toward current fiscal needs rather than long-term savings, potentially weakening the accumulation function and the National Fund's long-term sustainability.

The coefficient for the value of oil production proved particularly significant. Increased oil production statistically significantly increases the volume of transfers from the National Fund. This result confirms that an increase in the resource base expands the state's ability to finance expenditures and implement investment programs. However, it also increases the budget's dependence on the oil sector and may limit incentives for economic diversification.

The positive impact of inflation on the volume of transfers confirms the hypothesis that inflationary pressure increases the budget burden and stimulates the use of the Fund's resources. Rising inflation leads to increased government spending, the need to index social benefits, and higher costs for implementing government programs. As a result, the budget's dependence on transfers from the National Fund increases.

These results are particularly important in the context of recent years, when Kazakhstan, like many other countries, has faced accelerating inflation, rising global food and energy prices, and increased external economic instability. Under these conditions, the National Fund effectively becomes an instrument for compensating for internal macroeconomic imbalances. All coefficients in model B are statistically significant at the 5% level, indicating the high robustness of the results.

A comparison of model quality indicators further supports selecting model B as the preferred specification. The extended model demonstrates higher explanatory power, with an R^2 of 0.885 and an adjusted R^2 of 0.859, compared to 0.827 and 0.809 for model A, respectively. In addition, model B exhibits lower AIC and BIC values, indicating a better balance between goodness of fit and model parsimony. These results suggest that the inclusion of additional macroeconomic variables improves the model's explanatory capacity without introducing excessive complexity. Therefore, model B was selected as the preferred specification for the scenario simulations.

To assess the validity of the constructed model, diagnostic tests for autocorrelation, normality of residual distribution, and heteroscedasticity were conducted (Table 4).

Table 4. Specification validity tests for the extended model B

Test	Statistic	p-value
Breusch-Godfrey (lag=1)	0.187	0.665
Breusch-Godfrey (lag=2)	0.203	0.903
Jarque-Bera	2.442	0.295
Breusch-Pagan	1.781	0.776

Note: compiled by the authors

The Breusch–Godfrey tests show no autocorrelation of the residuals at either the first or second lag. This means that the model residuals do not exhibit a systematic time dependence, and therefore the model coefficients can be considered statistically reliable. The Jarque–Bera test revealed no significant deviations from normality in the residuals. Normality is especially important in the context of a relatively small sample, as it allows for the correct interpretation of t-statistics and confidence intervals. The Breusch–Pagan test results indicate the absence of heteroscedasticity. This means the model's error variance remains stable and independent of the explanatory variables' levels.

Further evidence of the model's adequacy is provided by the comparison of actual and fitted values presented in Figure 1.

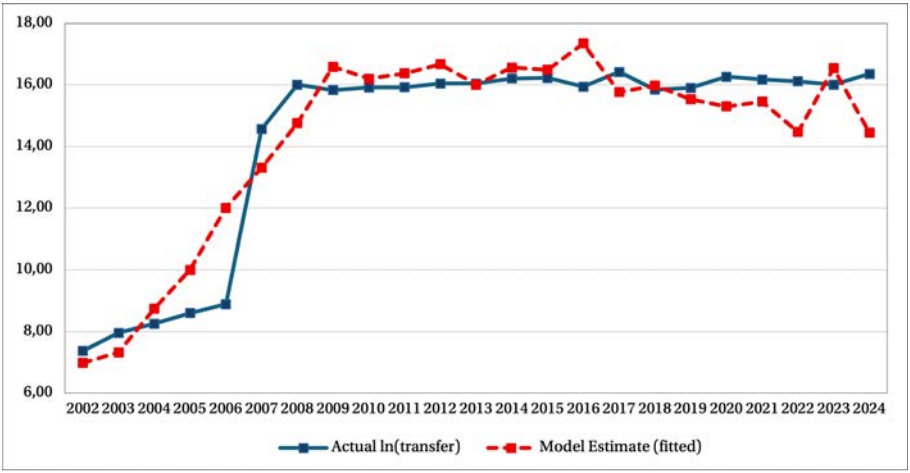

Figure 1. Actual and fitted values of the logarithm of transfers from the National Fund based on model B

Overall, the model successfully captures the main long-term dynamics of transfers from the National Fund and reproduces the general trend observed in the data. At the same time, several years exhibit noticeable deviations between actual and fitted values, reflecting the influence of extraordinary economic events, policy decisions, or other factors not explicitly included in the model specification. These discrepancies are expected, given the complexity of fiscal policy and the limited number of explanatory variables. Nevertheless, the overall correspondence

between actual and predicted values, together with the diagnostic test results, suggests that the model provides a reasonable representation of the key determinants of transfer dynamics.

Thus, the diagnostic tests confirm the adequacy of the model specification and enable the use of its results for further scenario analysis.

At the final stage of the study, scenario modeling was conducted to assess the sensitivity of transfer volumes to changes in key macroeconomic factors (Table 5).

Table 5. Alternative scenarios

Scenario	**Forecast** $\ln(Transfer)$	**% of baseline**
Brent +10%	13.593	−87.22
Brent −10%	15.430	96.42
Inflation +2 p.p.	14.623	15.72
Oil production +3%	14.711	24.55
Oil production −3%	14.212	−25.30

Note: compiled by the authors

The baseline scenario was the model forecast under constant macroeconomic factors, yielding a predicted $ln(Transfer)$ of 14.465. Alternative scenarios for changes in oil prices, inflation, and oil production were then simulated.

The results of the scenario analysis show that a 10% increase in the Brent price reduces the predicted value of $ln(Transfer)$ to 13.593, corresponding to a deviation of -87.22% relative to the baseline scenario. This indicates that a favorable external oil market environment significantly reduces the need to use the National Fund and creates conditions for asset accumulation. A high increase in oil prices opens up new fiscal space and reduces the budget's dependence on transfers from the Fund.

The strongest impact is observed with a negative oil price shock. With a 10% decrease in the Brent price, the predicted value increases to 15.430, representing a 96.42% increase relative to the baseline scenario. The obtained result indicates the high sensitivity of Kazakhstan's budget system to deteriorating external commodity prices. A fall in oil prices almost automatically increases pressure on the National Fund and increases the need for additional transfers to maintain fiscal sustainability.

A 2-percentage-point increase in inflation raises the projected value of $ln(Transfer)$ to 14.623, corresponding to a 15.72% increase relative to the baseline scenario. This confirms that inflationary processes are a key internal risk factor for the fund's sustainability. Accelerating inflation increases government spending, increases the budget burden, and stimulates additional use of National Fund resources to finance the state's social and economic obligations.

Changes in oil production demonstrate a dual effect. If oil production increases by 3%, the predicted value of $ln(Transfer)$ rises to 14.711, representing a 24.55% increase relative to the baseline scenario. This is due to the economy's expanding resource base and the government's greater ability to finance expenditures and investments. But this is also a sign of the high dependence of fiscal policy on the

oil-sector-dependent budget, and it remains very strong.

If oil production decreases by 3%, the predicted value of $ln(Transfer)$ drops to 14.212, a deviation of -25.30% from the baseline. This shows that a reduction in production threatens the fund's resource base and the use of oil and gas revenues to finance government spending.

The scenario deviation graph in Figure 2 shows that transfers respond differently to different types of oil shocks. It is particularly clear that negative oil shocks affect the fund more than positive ones.

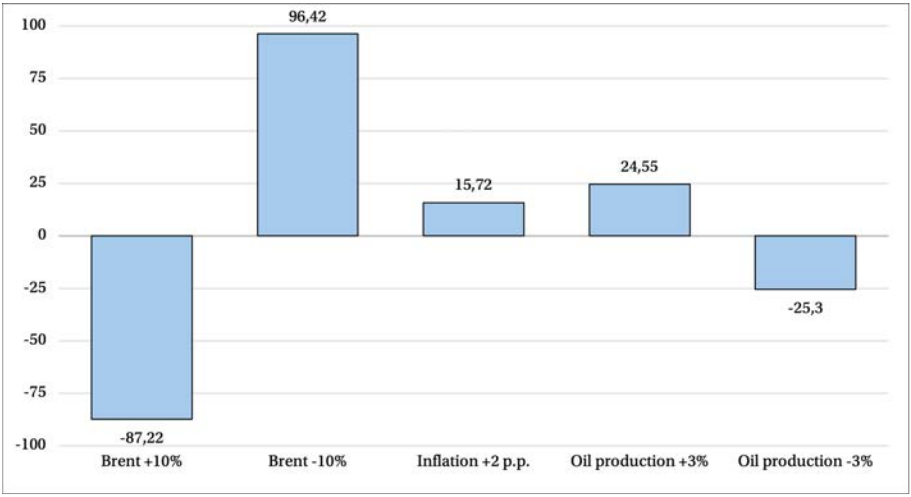

Figure 2. Scenario deviations of the forecast according to Model B

Figure 2 provides an additional insight into the importance of the shocks we have analyzed by showing their effects on transfer dynamics. We see that external oil market conditions are much more important than domestic macroeconomic factors for projected transfers. Changes in oil prices are much more significant than inflation and production changes driven by oil prices, so commodity market developments play a very important role in the National Fund's fiscal dependence.

The figure shows that external shocks are much more negative for fiscal pressure than positive ones. This pattern indicates that the National Fund is primarily a stabilization mechanism during economic stress, whereas it is relatively difficult to accumulate funds during economic prosperity.

Overall, the numerical results show that the sustainability of National Fund operations remains closely tied to volatility in the external commodities market. It is therefore imperative for us to strengthen countercyclical fiscal policies and reduce the budget's dependence on oil revenues to improve long-term fiscal resilience.

5 | DISCUSSION

The results are generally in line with the international literature on resource dependence and sovereign wealth fund management. As Sachs & Warner (2001) have

shown, a high level of budget dependence on commodity revenues is a source of macroeconomic instability and exacerbates external shocks. The results of this study confirm that Kazakhstan is still heavily dependent on the oil market. The procyclicality in the use of the fund's resources is consistent with Van der Ploeg (2011), who noted that resource revenues, without rigid institutional controls, can spur increased government spending as long as oil prices are high. The results of the study show that increased Fund revenues are accompanied by larger transfers, which may limit the National Fund's accumulation capacity and reinforce fiscal dependence on resource revenues.

Also, from an institutional economics perspective, the study's results confirm the necessity of resource rent management, as explained by Mehlum et al. (2006). The effective use of oil revenues depends on the state's ability to relieve short-term political pressure and focus on the long-term sustainability of fiscal policy in Kazakhstan. So the fund does both stabilization and expenditure functions.

Compared with international experience, the National Fund's management model differs significantly from the Norwegian approach. In Norway, the use of oil revenues is strictly limited by the fiscal rule, and the majority of assets are invested abroad. In Kazakhstan, the fund is primarily used to cover current budget needs. This increases the risk of a decline in the fund's assets during periods of unfavorable oil prices.

The study's results are also consistent with recent research by the IFSWF and ESG-oriented sovereign wealth funds, which finds that the stability of sovereign wealth funds is largely determined by asset diversification, management transparency, and institutional independence. In the context of the global energy transition, Kazakhstan increasingly needs to gradually reduce the fund's dependence on the oil and gas sector and expand the share of alternative investment instruments.

The identified impact of inflation on the volume of transfers is particularly significant. The obtained results demonstrate that domestic macroeconomic risks can have an equally strong impact on the fund as external oil shocks. This means that the stability of the National Fund depends not only on global oil price dynamics but also on the quality of domestic monetary and fiscal policies.

The findings of the study suggest that the National Fund of the Republic of Kazakhstan remains a key part of macroeconomic stability. However, the budget's heavy dependence on transfers, procyclical use of oil revenues, and sensitivity to external shocks increase the risk that the fund's long-term stability will be compromised. This is why budget rules need to be strengthened, unscheduled transfers to be limited, management transparency increased, and mechanisms for long-term asset accumulation developed.

6 | CONCLUSION

Econometric analysis and scenario modeling were conducted in depth to establish the risks and opportunities for the National Fund of the Republic of Kazakhstan in the context of global economic instability and for the country. The study demonstrated that the National Fund remains a major pillar of macroeconomic stability

in the face of external and domestic shocks, as it maintains stability and remains central to Kazakhstan's budget system. To the extent that the National Fund is a macroeconomic stabilizer, given its dependence on oil and gas revenues and transfers from the Fund, the study demonstrated the structural risks of Kazakhstan's budget system in general.

The econometric analysis showed that the quantity of transfers from the National Fund was statistically linked to macroeconomic factors. Oil and gas production and spending on the budget increased, and funds were transferred to the Fund, so Kazakhstan's economy remains quite heavily dependent on the commodity sector. At the same time, a higher oil price means less need for transfers and more opportunities to accumulate Fund assets.

Beyond this statistical relationship, the results indicate that higher resource revenues do not necessarily strengthen the National Fund's sustainability. Instead, they might increase the budget's dependence on oil, thereby increasing the procyclical use of National Fund resources. We found that much of the additional resource revenues is used for immediate fiscal needs rather than long-term savings, which may reduce the Fund's accumulation function and long-term sustainability.

Higher inflation puts pressure on the state budget, increases the state's debt burden, raises state spending, and increases the need for more transfers in the future. This means that, in the end, the sustainability of the fund depends not only on oil and external shocks but also on the quality of domestic monetary and fiscal policies.

Diagnostic tests confirmed the model's validity and the statistical robustness of the results. The absence of autocorrelation, heteroscedasticity, and significant deviations from the normal distribution of residuals suggests that the econometric specification is reliable.

Of particular importance is the scenario analysis, whose results demonstrated a pronounced asymmetry in the impact of macroeconomic shocks on the volume of transfers from the fund. A favorable oil market creates opportunities for asset accumulation and reduces fiscal pressure, while falling oil prices and rising inflation significantly increase the burden on the National Fund. This confirms the highly procyclical nature of the fund's use and the continued vulnerability of Kazakhstan's budget system to external shocks. A comparison of the study's results with international experience revealed that the governance model of the National Fund of the Republic of Kazakhstan differs significantly from the practices of countries with more stringent budget constraints and high institutional independence of sovereign wealth funds. In Kazakhstan, the Fund is mainly used as a tool to meet current budget needs, weakening its accumulation function and increasing the risk of a decline in the long-term sustainability of assets.

The study findings have theoretical, methodological, and practical consequences across the three dimensions. From a theoretical perspective, the paper contributes to research on sovereign wealth funds and resource-dependent economies by showing that higher resource revenues do not necessarily imply stronger fund sustainability. Rather, increased revenues may be accompanied

by larger transfers in line with the persistence of procyclical fiscal policy and the continuing reliance of public finances on commodity-related income.

From a methodological perspective, the study develops an integrated econometric and scenario-based framework for assessing the determinants of National Fund transfers. The combination of regression analysis, diagnostic testing, and scenario modeling enables evaluation not only of the statistical significance of key macroeconomic factors but also of the sensitivity of transfers to alternative external and internal shocks.

From a practical policy perspective, the results suggest several specific measures to strengthen the long-term sustainability of the National Fund. First, fiscal rules should impose stricter limits on discretionary and unscheduled withdrawals during periods of favorable oil market conditions. Second, a larger share of additional oil revenues should be directed toward asset accumulation rather than current budget financing. Third, transparency can be enhanced through more detailed public disclosure of asset allocation, investment performance, and transfer decisions. Finally, continued diversification of the Fund's investment portfolio, including a broader range of international and non-resource-related assets, would reduce exposure to oil market volatility and improve long-term resilience.

A limitation of the study is the reliance on annual data and a relatively short time series for the historical functioning of the National Fund. Future research may benefit from applying more advanced dynamic models, using quarterly data, and including institutional and global financial variables that may further influence the dynamics of National Fund transfers.

AUTHOR CONTRIBUTIONS

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