Bank i Kredyt 57(3), 2026, 287-304
DOI: 10.5604/01.3001.0055.7778

BANK I KREDYT
BANK & CREDIT

Is the money supply influenced by the credit supply in Poland?

Krzysztof Łuczka*

Submitted: 18 December 2025. Accepted: 10 February 2026.

Suggested citation: Łuczka K. (2026), Is the money supply influenced by the credit supply in Poland?, *Bank i Kredyt*, 57(3), 287–304, DOI: 10.5604/01.3001.0055.7778.

Abstract

The main research question of the article is whether credit supply dynamics shape the money supply in Poland and thus strengthen the credit channel of Narodowy Bank Polski's monetary policy transmission. The analysis began with stationarity tests (ADF, KPSS, PP), which showed that monetary aggregates are integrated of order 2 (I(2)), while credit is integrated of order 1 (I(1)). The different orders of integration justified the use of the Johansen cointegration test, which confirmed the long-run equilibrium relationship between variables. The Toda-Yamamoto test showed that credit causes changes in M0, M2, and M3, while a weaker feedback relationship also exists in the case of M3. For M1, the opposite relationship was observed – changes in the narrow monetary aggregate precede changes in credit, highlighting the complexity of money classification.

Keywords: monetary aggregates, endogeneity of money, private credit, stationarity of series, cointegration

JEL: C32, E32, E44, E51, E52, E58

* Student at Poznań University of Economics and Business; e-mail: krzysztofluczka@outlook.com; ORCID: 0009-0003-6898-7155.

1. Introduction

Understanding the relationship between credit supply and money supply is a key issue for economists and monetary policymakers. The money supply is not an exogenous phenomenon fully controlled by the central bank; rather, it arises largely endogenously through the lending decisions of commercial banks. Every loan extended by a bank simultaneously generates a deposit on the borrower's side, increasing monetary aggregates such as M2 and M3. Changes in bank lending dynamics therefore directly impact the overall money supply in the economy.

Examining this correlation allows us to identify the extent to which the increase (or decrease) in money supply is driven by credit expansion and the extent to which it is driven by other factors, such as base rate policy or open market operations. This is fundamental for assessing the transmission of monetary policy – whether the central bank controls the money supply through interest rates, or whether credit dynamics operate independently of its decisions. Furthermore, analysing this correlation helps in forecasting inflation, as excessive credit expansion has historically preceded periods of price increases. For Poland, where the mortgage and consumer sectors have been developing dynamically in recent years, examining the relationship between credit and money provides insight into the risk of economic overheating and the potential implications for the financial stability of the banking system. Finally, understanding this mechanism is crucial for correctly interpreting macroeconomic indicators and forecasting the long-term effects of decisions made by central banks and financial supervisory institutions. M0, also known as central bank reserve money, is the narrowest measure of the money supply in Poland. It comprises currency in circulation, including the cash desks of monetary financial institutions (MFIs), and funds held by other domestic MFIs in current accounts, including overnight deposits and required reserve accounts at NBP.[1] M1, in turn, includes currency in circulation, excluding cash held by MFIs, as well as deposits and other current liabilities, both in PLN and foreign currencies, towards domestic entities other than MFIs and central government institutions. M2 money includes M1 and deposits and other time liabilities with an original maturity of up to and including two years owed to domestic entities other than MFIs and central government. M3 money is the broadest measure of the money supply in Poland, encompassing all components of the M2 aggregate plus specific liabilities of domestic MFIs to domestic entities outside the MFI sector and central government. These additional components primarily include repurchase transactions, i.e. transactions involving the sale of securities with a commitment to repurchase them at a specified date, used for short-term liquidity management, and debt securities – such as bonds and Treasury bills – issued by MFIs with original maturity of up to two years. Furthermore, M3 includes shares and units in domestic money market funds sold to entities other than MFIs and central government, making this aggregate a key indicator of broad monetary liquidity used by NBP in its monetary policy analysis. M4 is not a standard monetary aggregate published by NBP. In some analytical contexts, it refers to an extended liquidity indicator, such as the M4 ratio, which shows the ratio of banks' own funds to assets, but it is not widely accepted as a measure of money supply in monetary statistics. It lacks a uniform definition and acceptance among leading institutions such as NBP or the European Central Bank (ECB); therefore, it is omitted entirely from this paper.

[1] Narodowy Bank Polski, Miary pieniądza, https://static.nbp.pl/dane/monetarno-finansowa/DKI-Miary.pdf, retrieved 3 December 2025.

The Narodowy Bank Polski report (Greszta et al. 2023) concludes that the transmission mechanism in Poland is effective: interest rate increases lead (ceteris paribus) to a strengthening of the zloty, and with a delay to a reduction in lending, a slowdown in economic activity, and a decline in inflation. Structural changes (e.g. lower debt but greater price flexibility) have a multifaceted effect – some weaken, others strengthen NBP's influence. The work of Borawski et al. (2024) included an analysis of data from NBP and the Polish Financial Supervision Authority in the period from December 1996 to January 2024. It demonstrated a strong positive correlation between the money supply and Poland's GDP. The Pearson correlation coefficients were 0.9745 for M0, 0.9665 for M1, 0.9903 for M2, and 0.9906 for M3, indicating a very strong relationship between all aggregates and economic growth. Borawski et al. (2024) confirmed the endogenous nature of the money supply – in the short run, the money supply affects GDP, but in the long run, the money supply primarily influences price growth. The GARCH analyses conducted demonstrated statistical significance of the models for all monetary aggregates, which has further practical implications – the development of the Polish economy, like the American economy, is increasingly financed by debt. While 30 years ago, one dollar of credit financed one dollar of GDP growth, today, one dollar of GDP growth requires more than three dollars of debt. The study highlights the importance of government bonds, a key component of M2, as a form of government credit to finance economic growth.

Similar studies have been undertaken previously. Gałecki (2013) examined the long-run hypothesis of money neutrality. In addition to Poland, this study covered 11 Eurozone countries and Denmark. In the Polish context, augmented Dickey-Fuller (ADF) tests were conducted to determine the stationarity of M0–M3 aggregates from January 2001 to December 2012 and then used an SVAR model to analyse the response to a shock. The concept of money neutrality used in this study assumes that economic agents rationally anticipate changes in money supply – monetary shocks cause an increase in nominal demand, which then translates into price increases, restoring real wages to their initial levels without persistent real effects. Gałecki emphasizes that the long run is defined as the maximum length of the modern business cycle (8–12 years), therefore the 11-year horizon adopted in the study meets the criteria for a long run (Gałecki 2013). In Poland, the M1–M3 aggregates were found to be integrated at level I(2) (Gałecki 2013), which is consistent with the later findings in this paper. However, Gałecki's (2013) paper confirms that the long-run money neutrality hypothesis is consistent with data for Poland and the euro area, while emphasizing that the choice of monetary aggregate, i.e. money in the broad sense (M2, M3), shows greater consistency with the neutrality hypothesis than money in the narrow sense (M1).

The topic addressed in this paper concerns the confirmation of the classical endogenous theory of money creation. Benati (2021) examines the long-run dynamics of money and credit multipliers in 42 countries from the gold standard era to the present. According to Benati (2021), traditional banks have not undergone fundamental changes – apart from greater productivity in the creation of money and credit per unit of monetary base, modern banks are not fundamentally different from their 19th-century predecessors. Benati's results support the observed cointegration between M2/M3 levels and credit, suggesting that long-run trends in broad monetary aggregates are driven by the joint process of money and credit creation by commercial banks, and not solely by NBP policy.

"According to advocates of the credit channel, monetary policy affects not only the general level of interest rates, but also the size of the external finance premium. This complementary movement in the external finance premium may help explain the strength, timing, and composition of monetary

policy effects better than is possible by reference to interest rates alone." (Bernanke, Gertler 1995, p. 35). In this case, the external finance premium = the difference between the cost of borrowing externally (debt) and the internal cost (retained earnings). When NBP reduces interest rates, the external premium should decrease and loans should increase. Bernanke and Gertler (1995) show that as the money supply increases, firms' ability to borrow depends not only on interest rate cuts, but also on whether their balance sheets have strengthened and banks are willing to lend. Conversely, when banks increase lending, deposits automatically increase, providing a more direct and mechanical channel. This asymmetry is confirmed by the present work. This study contributes to the post-Keynesian debate on the endogeneity of money. It supports Moore's polemic with structuralists, particularly regarding reverse causality: it is not reserves that create credit (the money multiplier is a myth), but credit that creates deposits, and reserves are acquired *ex post*. The central bank provides these reserves for systemic stability (the role of lender of last resort), which also makes them endogenous (Moore 1988). This contrasts with the approach of Palley (2002), who, while recognizing the endogeneity of money determined by the demand for private credit, also emphasizes the increasing costs and risks that constrain the supply of credit by banks.

2. Aim of the study

"The impact of the adjustment of credit supply accounts for approximately 20% of the decline in the value of loans granted by commercial banks in response to a restrictive monetary policy shock" (Greszta et al. 2023, p. 6). The aim of my paper is not to check the size of the effect, but to confirm the statement above, whether credit dynamics shape the structure and pace of changes in monetary aggregates.

2.1. Hypotheses

The main hypotheses assume that credit affects monetary aggregates:

H0 (main) – the money supply in Poland is endogenous and is co-shaped by the dynamics of private sector credit.

H1 (long-run) – there is a long-run cointegration relationship between credit and the M0–M3 aggregates.

H2 (short-run and its direction) – credit Granger-causes changes in broad monetary aggregates (M2, M3).

H3 (asymmetry) – the direction of causality differs between aggregates.

The main hypothesis H0 is general and theoretical in nature, while hypotheses H1 and H2 serve as empirical hypotheses. Confirmation of H1 and H2 provides empirical support for hypothesis H0, indicating that the endogenous nature of the money supply in Poland is reflected in both long- and short-term relationships. Hypothesis H3, in turn, is complementary and exploratory in nature, aiming to identify potential differences in the adjustment mechanisms between individual monetary aggregates. Confirmation or rejection of H3 does not determine the validity of the main hypothesis H0, but allows for a more in-depth interpretation.

2.2. Methods

Monthly data on the M0–M3 aggregates along with private credit data come from the official NBP website and cover the period from January 1997 to July 2025.[2] Five variables were created for the study: credit – the total value of private credit in Poland, data from the Loans and other receivables from domestic entities section in the Other sectors column,[3] expressed in millions of PLN; M0–M3 are monthly data about money aggregates in Poland, expressed in millions of PLN (as shown in Figure 1). The ADF test, Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test, and Phillips-Perron test (PP) were conducted to determine the stationarity and order of each variable. I chose several methods to increase the certainty of determining the integration order. The number of lags for the ADF test was selected according to the Schwert rule (Schwert 1989), and for the KPSS and PP tests according to the Newey--West rule (Newey, West 1987) due to the simplicity of implementation in the R language. Because of the differences between the orders of stationarity of variables shown later, the Johansen test was used to analyse cointegration. In this case the Johansen test will complement the directionality of potential causality. The results will be used to confirm or refute hypothesis H1. To assess Granger causality (Granger 1969), the idea of Toda and Yamamoto (1995) was applied, which allows the data to be left undifferentiated before the Granger test. The Toda-Yamamoto test will be used to confirm or refute hypotheses H2 and H3. Both Ng and Perron (2001) and Lütkepohl (2004) emphasize that AIC will be a better criterion than BIC for selecting lags, both in terms of the number of samples and the type of data, thus the AIC criterion minimization method was used to select lags for the Johansen test. All tests were performed at a 5% significance level.

3. Results

Before proceeding to formal econometric testing, a preliminary inspection of the data is provided to illustrate their time-series properties, as shown in Figure 1. The series exhibit strong trending behaviour, suggesting non-stationarity. Marking the date of the WHO's announcement of the COVID-19 pandemic with a vertical black dashed line shows a potential breakpoint in M1. Many other breakpoints are visible on the logarithmic scale in the credit variable (as shown in Figure 2). However, verification of breakpoints and structural changes is beyond the scope of this work. In this sense, the use of the entire sample period is not a weakness, but a crucial feature of the analysis: if money is truly endogenous in Poland, the joint dynamics of credit and monetary aggregates should remain consistent across the whole 1997–2025 horizon, despite any structural breaks.

I started with ADF, KPSS, and PP tests to determine the order of integration of the variables. The PP test was performed using the Z-tau statistic because it has a better asymptotic distribution (Phillips, Perron 1988). For the undifferenced series, the PP test with a trend was used; for the first differences, a model with only an intercept was applied. For the ADF test, seven lags were selected and for the KPSS and PP test, five lags were selected.

[2] NBP (2025), Miary pieniądza (dane miesięczne), https://static.nbp.pl/dane/monetarno-finansowa/miarypieniadza_nowe.xlsx, retrieved 3 December 2025.

[3] NBP (2025), Bilans monetarnych instytucji finansowych (dane miesięczne), https://static.nbp.pl/dane/monetarno-finansowa/bilans_bankow.xlsx, retrieved 3 December 2025.

Bold values indicate stationarity – it was assumed that for the ADF and KPSS tests the critical values were -2.860 and 0.463, respectively. For the PP test, the critical value was assumed to be -3.424 for no differentiation and -2.870 for differenced data (due to different models). Interestingly, if I had limited the analysis to the ADF or PP test, all variables would have been first order. However, due to the restrictive combination of the tests, they confirm that M0–M3 aggregates are integrated of order 2 (I(2)), which is consistent with stationarity defined by Gałecki (2013). Credit is integrated of order 1 (I(1)). Next, a test for the long-run relationship between credit and individual monetary aggregates was conducted. Prior to analysis, the first observation was removed from the credit series, and the M0–M3 variables were differenced so that they were all of the same order I(1) and the same length. The Johansen test was performed to examine cointegration between variables; a trace statistic without linear trend and constant in cointegration. The maximum lag was set to 12, which was then optimized using AIC.

In the models for changes in monetary aggregates ΔM3, ΔM2, and ΔM1, a single long-run cointegration relationship with credit was found. In all three cases, the coefficient for credit in the cointegration vector is negative and similar in value (especially for M2 and M3), indicating the structural stability of the relationship between credit and broad monetary aggregates. Differences between the models are revealed primarily in the adjustment mechanism. For ΔM3, the adjustment on the monetary aggregate side is relatively weak, while credit reacts more strongly to deviations from equilibrium. In the case of ΔM2, the adjustment of M2 has the opposite sign than in the M3 model, but the response of credit still dominates. For ΔM1, the adjustment coefficient on the monetary aggregate side is significantly larger, indicating that M1 restores equilibrium more quickly, while the response of credit is weaker.

The model for ΔM0 differs significantly from the others. The very high value of the test statistic for r = 0 clearly confirms strong cointegration. The coefficient for credit remains negative, but its absolute value is significantly smaller. At the same time, the adjustment coefficient for M0 is exceptionally high, suggesting very rapid short-term adjustments. This is consistent with the nature of M0 as the most liquid component of the money supply, strongly responsive to changes in the credit sector. Confirmation of the existence of at least one cointegrative relationship in each case allows us to accept hypothesis H1.

It should be emphasized, however, that the signs of the coefficients in the cointegration vectors result from the adopted normalization and should not be interpreted as indicating the direction of the economic impact. Reversing the signs of the vector does not change the content of the long-run relationship. However, the adjustment coefficients are of key interpretative importance, as they determine which variables respond to deviations from long-run equilibrium and with what force.

Finally, a causality test was performed using the Toda-Yamamoto test. It consists of estimating the extended $VAR(k + d_{max})$ model on the levels of non-stationary data and testing causality with the Wald test only on the first k coefficients on the explanatory variable, ignoring the last d_{max} lags. The test was performed on original, undifferenced data.

Aggregate M3 indicates a feedback loop – of course, as expected, credit has a greater impact on M3, but the inverse relationship is also statistically significant. Similarly, in the case of M2, however, the impact of M2 on credit is borderline statistically significant and cannot be clearly defined as a feedback loop. Aggregate M1 is completely opposite to M3–M1 causes credit, and no bidirectional relationship was found. Finally, aggregate M0 has no statistical impact on credit at all, but credit has quite a strong impact on M0. The fact that causality exists in at least one direction for each aggregate confirms

hypothesis H2, while the existence of feedback loops and the reverse relationship for aggregate M1 confirms hypothesis H3.

4. Discussion

The results for Poland are consistent with the broader post-Keynesian literature. Similar to the study by Özden, Bolkol, and Demirel (2024) for Turkey, they demonstrate the endogeneity of money supply and the key role of bank credit in shaping deposits and monetary aggregates. In the case of Poland, private sector credit significantly contributes to M2, M3, and base money, confirming the practical importance of endogenous money supply for the credit channel of monetary policy. Thus, the results clearly indicate that credit is strongly linked to money in Poland, confirming the hypothesis H0, which is also consistent with the panel results of Nayan et al. (2013) for 177 countries. The fact that the M0–M3 monetary aggregates are integrated of the second order and yet form stable cointegrating relationships with credit is interesting, yet consistent with Gałecki's results for Poland and the Eurozone, where money neutrality prevails in the long run, but in the short and medium term, changes in the money supply are closely linked to credit dynamics and the business cycle.

The existence of a single cointegrating relationship between credit and each of the aggregates suggest that, in the long run, the money supply in Poland is co-shaped by the dynamics of credit extended to the private sector, and not solely by monetary authorities' decisions regarding the monetary base or open market operations. Such a result could be expected. In practice, this may mean that NBP, despite formal control over the reference rate and reserves – largely follows private sector credit demand to maintain banking system liquidity and financial stability. Lopreite's (2012) results also indicate a significant impact of bank credit on the M3 aggregate, but in the Eurozone.

The cointegration between changes in credit and changes in broad monetary aggregates (M2 and M3) may suggest the importance of the credit channel for money supply dynamics in Poland. Heuristically, this suggests that tightening monetary policy through restricting lending may, over time, slow the growth of broad monetary aggregates, while easing conditions may foster their expansion. However, these are tentative interpretations, not causal conclusions.

In turn, the variation in error correction coefficients between M1, M2, M3, and M0 can be treated as a preliminary indication that individual components of the money supply respond to changes in the credit sector at different rates. The most unexpected relationship, however, is that of M0 – the response of the monetary base may reflect the specific characteristics of banks' liquidity management, while the most liquid aggregates appear to adjust more quickly.

The results further suggest that credit plays a key role in shaping broad monetary aggregates (M2 and M3), which is consistent with an endogenous approach to money supply. Particularly in the case of M3, where weaker reciprocal causality also occurs, a feedback mechanism can be observed: credit expansion increases the holding of broad money, and this increase can further support further credit expansion through liquidity and balance sheet effects.

For M1, however, an inverse relationship is observed, where changes in the narrow monetary aggregate precede changes in credit. The observed causality from M1 to credit must not be interpreted as a falsification of the endogeneity theory of money. The narrow monetary aggregate M1 primarily encompasses transaction money, which is strongly linked to current economic activity, income, and

the liquidity preferences of the private sector. An increase in M1 may therefore reflect increased demand for liquidity and the accumulation of credit in current accounts, preceding decisions to incur credit obligations. In this approach, credit does not initiate the money creation process but rather reacts with a delay to earlier changes in the real and transactional spheres. This mechanism is consistent with the post-Keynesian approach to endogenous money, provided that it is recognized that different monetary aggregates perform different functions in the economy and may participate in the adjustment process at different stages of the business cycle. This result suggests a complex, sequential nature of the relationship between money and credit, rather than a simple unidirectional relationship. This is confirmed by Deleidi and Fontana (2020), who prove that in the Eurozone bank loans shape deposits (M1), which then determine monetary reserves. Śliwiński (2023), also demonstrates that credit, as a measure of endogenous money supply, responds to prior changes in the real and financial sectors. In this context, the result where M1 causes credit can also be interpreted as a manifestation of the sequential and demand-side nature of the money-credit relationship.

The unidirectional causality from credit to M0 indicates that changes in bank lending activity lead to subsequent adjustments in the most liquid portion of the money supply. This may reflect the central bank's operational mechanism, which responds to changes in reserve demand resulting from credit expansion by providing liquidity to stabilize short-term interest rates. In this approach, heuristically, M0 probably acts as an adjustment variable rather than an autonomous instrument of credit control. Alternatively, NBP actively adjusts M0 in response to changes in credit to maintain systemic stability, which is consistent with the exogenous theory of money, where NBP controls the base and credit endogenously responds to demand at a given interest rate. Yet this is inconsistent with the above-mentioned Lopreite's (2012) work, which indicates a bidirectional relationship between the monetary base and credit in the Eurozone. This work therefore emphasizes that the issue of money is more complex: while the results provide empirical support for the hypothesis of endogenous money supply in Poland, they do not allow for a definitive resolution of the Moore-Palley debate.

Policymakers should prioritize regulations to prevent excessive credit from overheating the economy. Failure to do so risks inflation and financial instability, as seen during periods of dynamic consumer credit growth. Effectively undermining the exogeneity of money implies that the government cannot rely solely on NBP interest rates. Fiscal-monetary coordination is necessary, for example, by controlling the budget deficit, which fuels demand for bonds (thus the M2 and M3 aggregates). Otherwise, easing policies may exacerbate debt without generating real growth. Changes in transaction money (M1) precede credit, meaning that in the short term, NBP can influence credit via M1, but for broader aggregates, structural interventions, such as bank capital buffers, are necessary. This justifies caution in banking reforms; for example, raising buffers may slow M2/M3 but stabilize the business cycle. The government can use this work to justify credit restrictions during the boom, avoiding crises like those experienced after 2008.

Further research could extend the presented analysis by using impulse response functions and forecast error variance decomposition to more precisely identify the direction of the influence between credit, money supply, and real economic activity. Nevertheless, the Toda-Yamamoto test only measures temporal correlations, not true economic causality, thus requiring additional SVAR models.

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Figure 1
Money aggregates (M0–M3) and credit

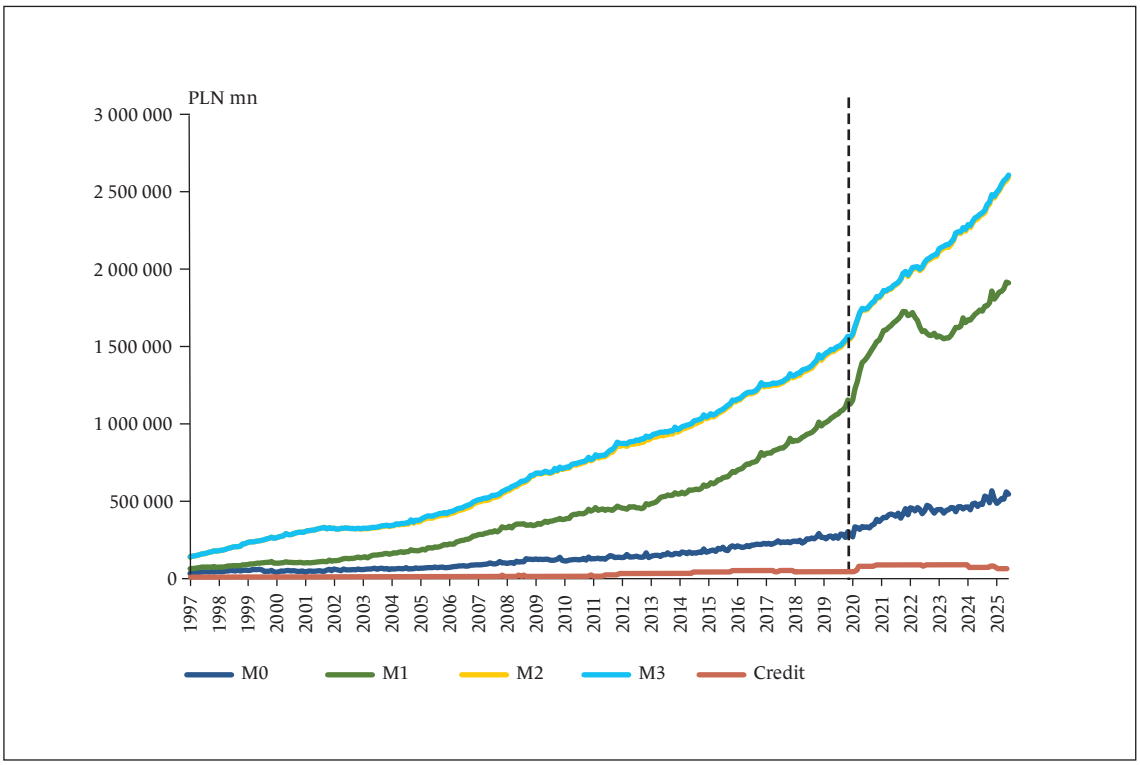


Figure 2
Money aggregates (M0–M3) and credit on a logarithmic scale

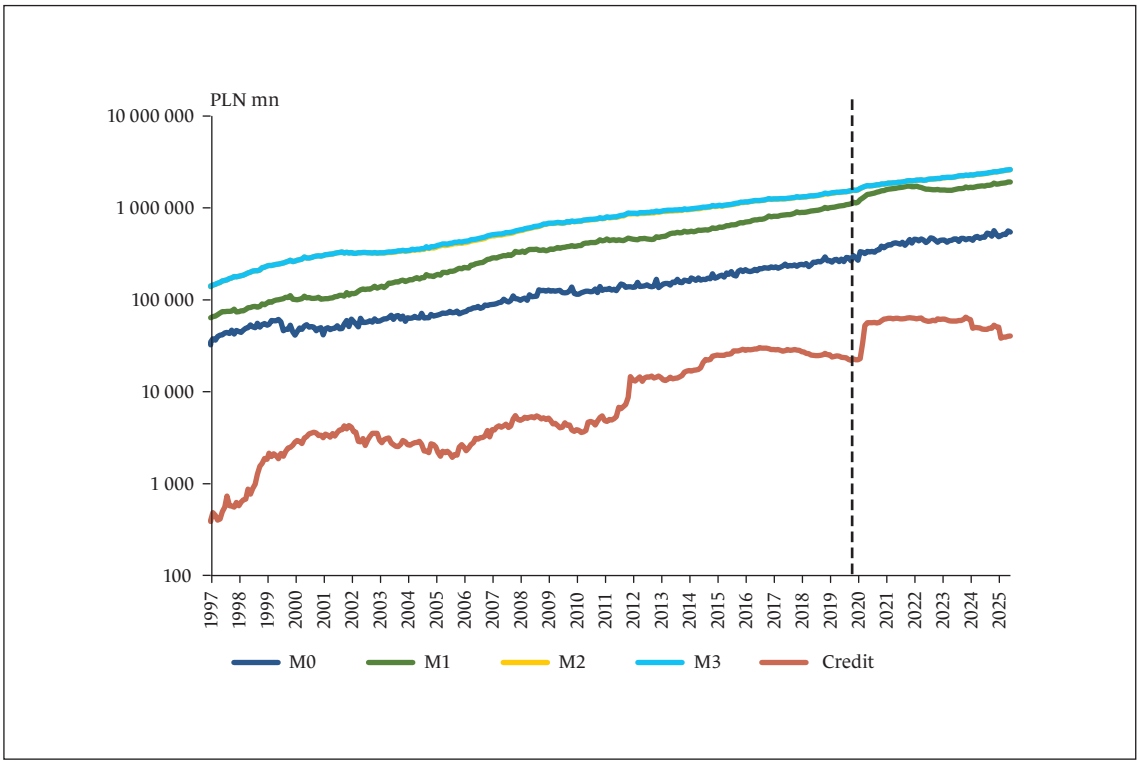


Table 1
ADF results for every variable at given order up to 3 decimal places

	M0	M1	M2	M3	Credit
I(0)	0.805	-1.342	1.953	2.130	-2.194
I(1)	8.315	-4.410	-5.189	-4.996	-4.641
I(2)	-14.025	-9.451	-10.572	-10.623	–

Table 2
KPSS results for every variable at given order up to 3 decimal places

	M0	M1	M2	M3	Credit
I(0)	5.129	5.217	5.454	5.467	5.891
I(1)	1.008	1.371	3.364	3.424	0.298
I(2)	0.011	0.014	0.015	0.015	–

Table 3
PP results for every variable at given order up to 3 decimal places

	M0	M1	M2	M3	Credit
I(0)	-0.275	-0.398	3.075	3.273	-1.788
I(1)	-34.814	-17.348	-17.564	-17.901	-16.764
I(2)	-80.235	-61.749	-63.595	-64.212	–

Table 4
Johansen test results for ΔM3 and credit (with 12 lags)

Hypothesis	Test statistic	Critical value
$r = 0$	23.03	19.96
$r \leq 1$	9.45	9.24
Equilibrium relation (normalized to ΔM3)	$\Delta M3_{t-12} \approx -0.01044493 credit_{t-12} - 25672.63$	
Loading coefficients	ΔM3	-0.003146875
	credit	-0.071618427

Table 5
Johansen test results for ΔM2 and credit (with 12 lags)

Hypothesis	Test statistic	Critical value
$r = 0$	22.54	19.96
$r \leq 1$	9.29	9.24
Equilibrium relation (normalized to ΔM2)	$\Delta M2_{t-12} \approx -0.01039155 credit_{t-12} - 49971.52$	
Loading coefficients	ΔM2	0.001915118
	credit	-0.036444122

Table 6
Johansen test results for ΔM1 and credit (with 12 lags)

Hypothesis	Test statistic	Critical value
$r = 0$	22.12	19.96
$r \leq 1$	8.95	9.24
Equilibrium relation (normalized to ΔM1)	$\Delta M1_{t-12} \approx -0.01121083 credit_{t-12} - 17473.57$	
Loading coefficients	ΔM1	-0.09093993
	credit	-0.07581491

Table 7
Johansen test results for ΔM0 and credit (with 6 lags)

Hypothesis	Test statistic	Critical value
$r = 0$	87.92	19.96
$r \leq 1$	16.62	9.24
Equilibrium relation (normalized to ΔM0)	$\Delta M0_{t-6} \approx -0.002485415 credit_{t-6} + 532.46$	
Loading coefficients	ΔM0	-2.26253211
	credit	-0.06052765

Table 8
Toda-Yamamoto test results up to 3 decimal places

Direction of causality	F-stat	p-value
M0 → credit	0.023	0.880
Credit → M0	8.328	0.004
M1 → credit	3.928	0.048
Credit → M1	2.025	0.156
M2 → credit	3.487	0.063
Credit → M2	12.84	0.000
M3 → credit	3.906	0.049
Credit → M3	11.795	0.001

Czy podaż kredytu wpływa na podaż pieniądza w Polsce?

Streszczenie

Relacja pomiędzy podażą kredytu a podażą pieniądza stanowi jedno z kluczowych zagadnień współczesnej makroekonomii oraz polityki pieniężnej. Dotychczasowe badania empiryczne dla Polski koncentrowały się głównie na neutralności pieniądza, transmisji polityki pieniężnej oraz relacji między podażą pieniądza a wzrostem gospodarczym. W długim okresie pieniądz jest neutralny, natomiast w krótkim i średnim horyzoncie czasowym pozostaje silnie powiązany z cyklem koniunkturalnym i aktywnością kredytową. W literaturze brakuje jednak pogłębionych badań empirycznych, które w sposób systematyczny analizowałyby kierunek zależności pomiędzy kredytem a poszczególnymi agregatami pieniężnymi (M0–M3) w Polsce, z wykorzystaniem nowoczesnych metod ekonometrycznych odpornych na różne rzędy integracji zmiennych.

Niniejszy artykuł wypełnia tę lukę badawczą, dostarczając kompleksowej analizy relacji długookresowych (kointegracja) oraz krótkookresowych zależności przyczynowych (test Tody-Yamamoto) pomiędzy kredytem sektora prywatnego a agregatami pieniężnymi w Polsce w długim okresie obejmującym lata 1997–2025.

Główne pytanie badawcze artykułu brzmi: czy dynamika podaży kredytu kształtuje podaż pieniądza w Polsce, a tym samym wzmacnia kredytowy kanał transmisji polityki pieniężnej Narodowego Banku Polskiego? Artykuł opiera się na hipotezie, że podaż pieniądza w Polsce ma w dużej mierze charakter endogeniczny, a jej dynamika – zwłaszcza w przypadku szerokich agregatów M2 i M3 – jest determinowana między innymi przez podaż kredytu udzielanego przez sektor bankowy. Hipoteza ta wynika z postkeynesowskiej teorii pieniądza oraz z obserwacji empirycznych wskazujących na rosnącą rolę finansowania wzrostu gospodarczego długiem. W badaniu wykorzystano miesięczne dane dotyczące agregatów pieniężnych M0–M3 oraz kredytu sektora prywatnego w Polsce. Analiza rozpoczęła się od testów stacjonarności (ADF, KPSS, PP), które wykazały, że agregaty pieniężne są zintegrowane rzędu drugiego, natomiast kredyt – rzędu pierwszego. Zróżnicowanie rzędów integracji stanowiło uzasadnienie zastosowania testu kointegracji Johansena, pozwalającego na identyfikację długookresowych relacji równowagi pomiędzy zmiennymi. W celu zbadania kierunku zależności przyczynowych zastosowano procedurę Tody-Yamamoto, która umożliwia testowanie przyczynowości Grangera bez konieczności różnicowania danych i bez ryzyka błędnej specyfikacji modelu. Metody te pozwalają jednocześnie analizować długookresowe współzależności strukturalne oraz krótkookresowe relacje dynamiczne.

Wyniki wskazują na istnienie stabilnych długookresowych relacji pomiędzy kredytem a wszystkimi analizowanymi agregatami pieniężnymi, przy czym relacje te są najsilniejsze dla M2 i M3. Analiza tzw. *error correction terms* ujawniła, że szerokie agregaty pieniężne dostosowują się wolniej do odchyleń od długookresowej równowagi, natomiast M0 reaguje bardzo szybko, co jest zgodne z jego rolą operacyjną w systemie bankowym. Test Tody-Yamamoto wykazał, że kredyt jest przyczyną zmian w M0, M2 i M3, a w przypadku M3 występuje także słabsza zależność zwrotna. Dla M1 zaobserwowano odwrotną relację – to zmiany w wąskim agregacie pieniężnym są wcześniejsze niż zmiany kredytu, co

świadczy o bardziej skomplikowanej naturze pieniądza w Polsce. Autor wskazał to jako potencjalny kierunek przyszłych badań. Uzyskane wyniki potwierdzają, że podaż pieniądza w Polsce – zwłaszcza w szerokim ujęciu – jest współkształtowana przez dynamikę kredytu oraz że M0 może pełnić funkcję zmiennej dostosowawczej, a nie autonomicznego instrumentu kontroli kredytu. Autor podkreśla, że zastosowane testy przyczynowości pozwalają zidentyfikować jedynie zależności czasowe, a nie prawdziwą przyczynowość ekonomiczną. Ponadto analiza nie uwzględnia strukturalnych szoków polityki pieniężnej i z tego względu wyniki należy interpretować ostrożnie, a dalsze badania powinny obejmować modele SVAR czy funkcje odpowiedzi na impuls.

Słowa kluczowe: agregaty pieniężne, endogeniczność pieniądza, kredyt prywatny, stacjonarność szeregów, kointegracja