

PROBLEMS AND OPINIONS

DOI: [10.26354/bb.8.2.103.2026](https://doi.org/10.26354/bb.8.2.103.2026)

Marcin Bogusz*

ORCID: 0009-0000-2595-8205

bog.marcin1@gmail.com

The Architecture of Development Finance Institutions and the Sovereign-Bank Nexus: A Comparative Study of Poland, Germany and France

ABSTRACT

The study analyzed the process of public debt crowding out private credit activity, as a manifestation of the sovereign-bank nexus. The research covers three banking systems with different institutional models (France, Germany, Poland). In particular, it examined whether the identified patterns correspond to differences in the structure of public investment support. The verification was based on an unbalanced panel model with fixed effects for the period 1Q2018–2Q2025, including interaction variables identifying the effect separately for each country and using a robust variance-covariance matrix. The effect of public debt crowding out private credit activity is statistically significant in Poland and France, and not significant in Germany. However, formal tests of coefficient equality do not allow rejecting the hypothesis of their equality, which suggests a difference in the detectability of the effect rather than in its intensity. The findings are important for the resilience of the credit channel and sector stability.

Due to the number and specificity of the three systems studied, the conclusions are mainly of a hypothesis-generating nature.

Keywords: crowding-out effect, development finance institutions, sovereign-bank nexus, LSDV panel model, strategic investment bankability, first-loss instruments

JEL Codes: E51, G21, G28, H63, H81

* Marcin Bogusz – SGH Warsaw School of Economics.

INTRODUCTION

The Polish economy faces urgent and capital-intensive investment challenges related primarily to the defence industry, the energy transition and the modernisation of infrastructure. By 2040, expenditure on the energy transition alone may reach approximately PLN 2.7 trillion (National Energy and Climate Plan, NECP) under the WEM (with existing measures) scenario. This amount exceeds the capacity of budgetary resources, particularly amid a deepening deficit. Given the shallowness of the domestic capital market, the main burden of mobilising funds for strategic investments¹ must be borne by bank financing.

The classical crowding-out effect (Elmendorf and Mankiw, 1999; Laubach, 2009, p. 858) posits that fiscal expansion raises market interest rates, thereby displacing private investment. The approach adopted in this study concerns not the price channel but a quantity-based balance-sheet substitution akin to financial repression (Becker and Ivashina, 2014, pp. 12–13), that is, a process in which banks shift their assets from corporate credit to sovereign debt. This mechanism is strongly conditioned by the balance-sheet architecture of the sector and by the nature of the linkages between banks and the sovereign (the sovereign-bank nexus). Hauner (2009) and Kumhof and Tanner (2005) show that when public debt accounts for a high share of assets, the effect is directly substitutive and bypasses the interest rate channel. Becker and Ivashina (2014) document measurable crowding out of corporate credit in the euro area in 2010–2013, particularly in countries with high fiscal risk. Popov and Van Horen (2015) describe its strong cross-sectional heterogeneity, while Broner et al. (2014) demonstrate that under fiscal shocks domestic banks become preferred purchasers of sovereign debt.

The existing literature, however, focuses on identifying the effect within homogeneous regulatory areas (the euro area) or analyses advanced systems separately, without systematically examining the extent to which the public support architecture, understood as an integrated system of development banks and funds, moderates the magnitude of this effect. In particular, comparisons of systems with different architectures (the wholesale model vs. the risk-absorption model) within a unified analytical framework typical of econometrics are lacking.

The aim of the article is to examine whether the crowding out of private credit by public debt is empirically detectable in three systems with different institutional models (Polish, German and French), and whether the pattern of its detectability can be identified in light of differences in the support architecture. Given the selection of the systems studied and their small number ($N = 3$), the study takes the form of a pilot comparative study with a hypothesis-generating function. It is assumed that the specific features of the Polish architecture, combined with an asymmetric regulatory-tax wedge, may favour a measurable, supply-side crowding-out effect, whereas the integrated Western European systems possess instruments that neutralise this

¹ At the same time, the category of strategic investments requires modification. Above all, it is evolving from an instrument of infrastructure policy into a tool integrating economic objectives with national security, assessed not only through the prism of return on capital (IRR) but also in terms of its capacity to strengthen resilience and reduce external dependencies.

effect at source. This assumption gives rise to two hypotheses. (H1) In the Polish banking system, the supply-side crowding-out effect is statistically significant and directionally robust. (H2) The pattern of detectability is consistent with the structural properties of the support architecture. The model covers the aggregate supply of corporate credit rather than structured finance volumes in the strict sense. This approach rests on the assumption that if an institutional system fails to protect standard corporate credit from banks' arbitrage in favour of Treasury bonds, it also exhibits a structural inability to absorb risky transformational megaprojects. The macroeconomic crowding-out effect is an aggregate manifestation of the same barriers that, at the micro level, prevent individual projects from reaching financial close. The article consists of six parts. The first addresses the bankability barrier, the second compares the support architectures in France, Germany and Poland, the third is devoted to the panel model together with the results and robustness tests, and the subsequent ones present the conclusions, recommendations and limitations, followed by the concluding remarks.

1. BARRIERS TO THE BANKABILITY OF STRATEGIC INVESTMENTS FROM THE PERSPECTIVE OF THE BANKING SECTOR

An analysis of the banking sector's involvement in financing the transition requires abandoning the perception of credit institutions as passive providers of liquidity, since they operate under a regime of stringent capital, regulatory and fiscal constraints. The bankability of strategic projects is therefore not their inherent attribute, but the resultant of the project's risk profile and of the private sector's capacity to absorb that risk without breaching internal prudential requirements.

1.1. The regulatory-tax wedge as a driver of arbitrage

The fundamental macro-financial barrier is the structural 'regulatory-tax wedge', arising from the accumulation of capital adequacy requirements and asymmetric fiscal burdens, which raises the opportunity cost of allocating capital to the real economy. In the Polish system, the design of the tax on certain financial institutions is crucial. The statutory exclusion of Treasury securities from the tax base creates a strong incentive for balance-sheet arbitrage. At the same time, stringent capital requirements create systemic pressure to reduce risk-weighted assets. Gropp et al. (2019, pp. 267–268) show in a quasi-natural experiment that banks subject to higher requirements respond primarily by curtailing lending rather than by raising capital. Seeking to optimise ROE (return on equity) under elevated fiscal burdens, the sector engages in rational substitution, that is, it reduces its exposure to capital-intensive, long-term transformational investments in favour of risk-free, liquid and untaxed public debt. The problem is compounded by the uncertainty of the legal environment and the need to build multi-billion-zloty provisions for risks in legacy portfolios, which erodes the Tier 1 capital base and lowers risk appetite (Risk Appetite Framework, RAF) in banking organisations.

1.2. Internal prudential filters and the Supervisory Slotting regime

The role of capital buffers as a mechanism filtering risk exposure is well documented empirically. Jiménez et al. (2017) show that a bank's capital position is a key determinant of its capacity and willingness to expand credit supply, with asymmetric effects. Capital constraints under stress conditions restrict credit supply disproportionately. Strategic investments (most often structured as project finance) that pass the initial compliance check against the RAF matrix face a sequence of prudential filters. The first structural barrier is concentration limits, in particular Article 395 of the CRR (Capital Requirements Regulation), which limits exposure to a group of connected clients to 25% of the bank's own funds; in systems dominated by state ownership, this blocks the financing of successive public megaprojects from the balance sheets of domestic institutions. The next filter is risk structuring at the *due diligence* stage, where the robustness of the cash flow model plays a fundamental role. In line with EBA guidelines, bankability requires demonstrating that debt service coverage ratios (including the DSCR) maintain safe buffers even under extreme stress scenarios (demand shocks, construction delays, interest rate increases). The exposure is further complicated by documentation and legal risk, including the need to implement fallback language in connection with the BMR (Benchmarks Regulation). The final barrier materialises at the credit committee stage under the Specialised Lending regime. Owing to the uniqueness of structured assets, which precludes standard estimation of the probability of default (PD), banks allocate capital using the Supervisory Slotting Criteria. If the state does not provide revenue-stabilising mechanisms (e.g. renewable energy auctions, availability payments in public-private partnerships (PPPs)) and does not absorb legal risk, the project is downgraded to the Satisfactory category (risk weight of 115%) or the Weak category (250%). Downgrading to the Weak category implies a capital requirement more than three times higher than for an exposure classified as Strong, which renders the transaction economically unjustified.

1.3. Integrated bankability requirements

In light of the above constraints, bankability conditions should be defined not as flexible commercial guidelines but as hard thresholds of balance-sheet tolerance. For a capital-intensive strategic investment to be financed on market terms, its contractual architecture must guarantee ring-fencing, complete closure of construction risk and the containment of administrative and legal risks at a level that allows them to be insured (e.g. policies of the Export Credit Insurance Corporation (KUKE)). The long maturities of financing for transformational projects (15–20 years) must be fully compatible with the bank's internal asset-liability management (ALM) constraints, funds transfer pricing (FTP) and structural liquidity ratios (net stable funding ratio, NSFR). The extent to which state development institutions are able to neutralise these deficiencies at the outset determines the effectiveness of the entire support system.

2. THE ARCHITECTURE OF PUBLIC INVESTMENT SUPPORT IN A COMPARATIVE PERSPECTIVE: GERMANY, FRANCE AND POLAND

The reference systems were selected using a purposive sampling strategy that maximises institutional variance. The selection criterion was institutional contrast, not statistical representativeness. The typology draws on Mertens, Thiemann and Volberding (2021), who identify two paradigms of public intervention in the EU, namely the model of wholesale liquidity stabilisation (Germany) and the model of centralised risk absorption (France). Germany and France were selected for four reasons. Both have the longest institutional tradition in Europe (KfW since 1948; Bpifrance since 2013, continuing a tradition dating back to the 1980s), enabling the observation of established transmission mechanisms. They represent two opposing variants of the same moderating variable, namely wholesale liquidity stabilisation and centralised risk absorption. They operate within a homogeneous regulatory regime (the euro area, the SSM (Single Supervisory Mechanism), common implementation of International Financial Reporting Standard 9 (IFRS 9)), which eliminates distortion of the results by regulatory differences. Finally, as the two largest euro area economies, both countries have considerably larger banking sectors than Poland. The larger scale of bank balance sheets implies a broader potential for substituting credit with sovereign debt, which makes them a more demanding testing ground for the hypothesis. The differentiation of the Western European models is deliberate, as it allows effects specific to the instruments (wholesale liquidity vs. risk absorption) to be distinguished from effects arising from the mere presence of an efficient system of development institutions. Poland, lacking both of these elements in an integrated form, serves as a natural control group.

2.1. The German model: wholesale liquidity stabilisation and the operationalisation of the Hausbankprinzip

The German architecture, structured around the Kreditanstalt für Wiederaufbau (KfW) group, is a classic example of a system of preventive, wholesale stabilisation of the credit market. In line with the ordoliberal paradigm of complementarity (German: Soziale Marktwirtschaft), the state does not substitute for market mechanisms but corrects their imperfections. Transmission occurs mainly through the liquidity and price channel, operationalised through the house bank principle (German: Hausbankprinzip). KfW does not enter into a direct relationship with the beneficiary; instead, acting as a liquidity aggregator, it issues bonds backed by a federal government guarantee (AAA rating), raising capital at the cost of sovereign debt, and distributes this cheap stream of long-term funding as preferential loans to commercial, cooperative and savings banks (the three-pillar structure of the sector), which take over the relationship with the investor and the initial risk assessment.

The German toolkit combines the provision of targeted liquidity through programme loans (German: Programmkredite) with partial assumption of the credit risk of the house bank (German: Haftungsfreistellung). The bank granting a programme loan refinances it with KfW,

and under the standard formula of the KfW-Unternehmerkredit programme, investment loans could have a maturity of up to 20 years with a fixed rate for the first 10 years (KfW Bankengruppe, 2020). This limits ALM mismatch risk, reduces pressure on the NSFR and LCR ratios and lowers the cost of funds transfer pricing (FTP). The scale of risk assumed depends on the programme and on economic conditions. Under the standard formula, KfW could, at the bank's request, release it from 50% of its liability (KfW Bankengruppe, 2020), whereas in the special programme launched in response to the pandemic the release amounted to 90% for SME financing and 80% for the financing of large enterprises, and for loans of up to EUR 3 million KfW waived its own risk assessment (KfW Bankengruppe, 2022). Since KfW's liabilities are covered by a statutory federal guarantee, exposures to KfW may receive a 0% risk weight under Article 116(4) CRR (KfW, 2024), while the release from liability reduces the house bank's risk-weighted assets in the protected portion. In targeted programmes, the toolkit is complemented by repayment grants (German: Tilgungszuschuss). Under programme No. 295, part of the loan is forgiven once completion of the investment has been demonstrated, and the forgiven amount is applied to the final instalments, which reduces the debt and shortens the loan term without changing the amount of the current instalments (KfW Bankengruppe, 2025). This architecture defines a channel through which the issuance of promotional debt stabilises credit supply and remains neutral with respect to lending to the real economy.

2.2. The French model: centralised absorption of non-linear risks

The French paradigm represents a different approach, oriented towards active market shaping (Mazzucato, 2013). It is characterised by a high degree of centralisation and integration of instruments within a single public entity, Bpifrance, which deliberately combines on a single balance sheet the competences of a development bank, a guarantee agency, an export credit insurer and a public equity fund (private equity/venture capital), which makes it unique. Bpifrance's main task is to assume technological risk (first-of-a-kind innovations), construction risk (CAPEX overruns) and early-stage risk, that is, non-linear and structural risks that the banking sector is unable to price reliably. The provision of senior debt is of secondary importance in its activities. The lack of historical data for novel investments prevents banks from reliably estimating PD, which places the transaction in the Supervisory Slotting regime with risk weights of 115% or 250%, significantly reducing ROE. Bpifrance addresses this problem through equity participation, subordinated (mezzanine) debt and first-loss tranches. By financing the pre-investment phase and taking the highest-volatility risk onto the public balance sheet, it improves the project's cash flow structure and raises the DSCR of senior debt. By the time the project reaches the credit committee, non-linear risk has already been ring-fenced, which allows the exposure to be classified as Strong (risk weight of 70% or 50%). The private sector can safely provide debt financing, as the state eliminates the regulatory wedge and minimises the propensity to reallocate towards government instruments.

2.3. The Polish model: fragmented governance and the transfer of systemic risk to the commercial sector

The Polish model of public support displays a reversal of the logic of the Western European systems. It is characterised by advanced fragmentation of governance and functional isolation of the key organisations (Bank Gospodarstwa Krajowego, the Polish Development Fund, the Export Credit Insurance Corporation). The absence of a coordinated offering for the banking sector means that the instruments operate in parallel rather than forming synergistic risk mitigation packages; bank consortia must assemble collateral on their own, incurring high transaction costs, which delays financial close and heightens decision-making uncertainty. The most important limitation is the functional asymmetry of the toolkit. Polish intervention is dominated by the paradigm of passively remedying the consequences of market failure (market-fixing; Mertens and Thiemann, 2018, p. 198), implemented mainly through *pari passu* guarantees that reduce conventional credit risk *ex post*. The range of instruments absorbing structural and non-linear risks is limited. Demand, technological and regulatory risks remain almost entirely unabsorbed by the state balance sheet. The consequence is ‘shallow bankability’. Public guarantees improve formal collateral ratios but do not remove the barriers embedded in bank balance sheets. Because the state assumes neither demand risk nor regulatory risk, systemic risk is transferred to the commercial sector. Cash flow models incorporating EBA stress-test assumptions then show a decline in DSCR buffers, and the unpredictability of the legal environment (highlighted in the NBP’s financial stability reports) leads credit committees to assign projects to restrictive Supervisory Slotting categories. Institutional dysfunctions overlap here with an asymmetric regulatory-fiscal wedge. Banks in Poland, obliged to maximise ROE and constrained by the concentration limits of Article 395 CRR, engage in rational asset substitution. The existence of the bank tax with a statutory exemption for Treasury securities triggers an arbitrage mechanism, encouraging banks to forgo transition financing in favour of safe, liquid and untaxed public debt (Becker and Ivashina, 2014, pp. 12–13). The institutional shortcomings of the Polish model thus become a supply-side determinant of the macroeconomic crowding-out effect.

A comparison of the regimes discussed suggests that the effective mobilisation of private capital is determined not by the mere presence of public development institutions, but by the degree to which their instruments are integrated with banks’ prudential requirements. This hypothesis forms the basis for the empirical verification in the following section. The differences come down to two axes. In the architectural dimension, the Western European models rely on deliberate coordination, that is, full centralisation in Bpifrance or a precise division of roles around KfW as a wholesale liquidity anchor, whereas the Polish model is an additive structure in which the overlapping mandates of BGK, PFR and KUKE lead to collateral-side constraints (a collateral bottleneck) and inter-creditor conflicts. In the instrumental dimension, France absorbs non-linear risks through subordinated debt (French: *prêts participatifs*) and first-loss components acting as quasi-equity, and Germany limits liquidity and funding cost risk through programme

loans refinanced by KfW on terms matching those of the loan granted to the investor; Polish *pari passu* guarantees, by contrast, leave demand risk, technological risk and early-stage risk, that is, the categories most difficult to absorb, on bank balance sheets. This explains the differing effectiveness of the credit supply channels. In the Western European models, the state uses instruments that relieve pressure on capital (RWA) and liquidity requirements *ex ante*, before the project enters the bank's internal credit assessment procedure, which makes it possible to maintain market discipline without blocking lending. In Poland, the absence of such a hierarchy of instruments means that the state intervenes selectively and at the end of the process, addressing only credit risk (guarantees) without resolving the bankability problem at source. Combined with the asymmetric regulatory-tax wedge, the unabsorbed systemic risk induces banks to shift capital towards sovereign debt.

3. PANEL MODEL AND ESTIMATION RESULTS

To verify the hypotheses, an unbalanced panel model was constructed for three banking systems (Polish, German and French, $N = 3$), comprising 88 quarterly observations (2018Q1–2025Q2). Only the Polish series retains the full time dimension ($T = 30$); the French and German series each comprise 29 observations owing to missing data. The 2018 threshold is not arbitrary: the entry into force of IFRS 9 (the expected credit loss (ECL) model) changed the methodology for impairment allowances and the reporting of NPL and CET1, and the inclusion of earlier observations would introduce a structural break in the variable definitions. Given the differing stochastic properties of the series and the need to eliminate spurious regression, volume variables were transformed into first differences of natural logarithms, and variables expressed in percentage points (CET1, NPL, reference rates) into first arithmetic differences, which is intended to ensure stationarity, stabilise variance and isolate cyclical variability. The GDP and GFCF variables were obtained directly as growth rates and therefore required no further transformation.

The data were obtained from ECB, NBP and KNF statistics (growth of lending to the non-financial sector and of Treasury bond portfolios); the EBA Risk Dashboard (CET1, NPL); Eurostat (GDP and gross fixed capital formation); and the ECB and NBP (reference rates).

The study employed the following panel model:

$$\begin{aligned} \Delta \text{Loans}_{i,t} = & \alpha_i + \rho \Delta \text{Loans}_{i,t-1} + \beta (\Delta \text{Bonds}_{i,t} \times D_{\text{Country}_i}) + \gamma_1 \text{GDP}_{i,t-1} + \gamma_2 \text{GFCF}_{i,t} + \\ & + \gamma_3 \Delta \text{CET1}_{i,t} + \gamma_4 \Delta \text{NPL}_{i,t-1} + \gamma_5 \Delta \text{Rate}_{i,t-1} + \gamma_6 \text{COVID}_t + \varepsilon_{i,t} \end{aligned}$$

where the individual symbols denote:

- $\Delta \text{Loans}_{i,t}$ – the growth of lending to the non-financial sector in country 'i' and quarter 't' (the notation with the index $t-1$ denotes the same variable lagged by one quarter; this convention applies to all variables in the model),

- α_i – individual fixed effects, which allow for control of unobservable, time-invariant structural characteristics of the banking systems studied. The individual fixed effects for Poland, in conjunction with the interaction parameter (β), absorb the long-term, structural impact of the local ‘regulatory-tax wedge’ (including the asymmetric bank tax and the costs of legal risk), eliminating the need to introduce a separate fiscal variable,
- ρ – the autoregressive parameter on the lagged dependent variable,
- β – the parameter measuring the magnitude of the crowding-out phenomenon, estimated for the interaction variable defined as the product of the growth of the Treasury bond portfolio ($\Delta \text{Bonds}_{i,t}$) and a dummy variable (D_{Country_i}) identifying a given institutional system,
- $\gamma_1 \dots \gamma_6$ – parameters on the control variables, which are, respectively: GDP growth, growth of gross fixed capital formation (GFCF), the change in the Common Equity Tier 1 (CET1) ratio, the change in the share of non-performing loans (NPL), the change in the reference rate of the relevant central bank (the European Central Bank or Narodowy Bank Polski), and the binary variable COVID_t , taking the value 1 in quarters affected by the pandemic shock (2020Q1–2021Q2),
- $\varepsilon_{i,t}$ – the idiosyncratic error term.

Two-way fixed effects (TWFE) were deliberately not used, so as not to reduce the number of degrees of freedom excessively; any common macroeconomic shocks are absorbed by the reference rate control variable and the COVID dummy.

3.1. Choice of estimator and methodological justification

The parameters were estimated using the fixed-effects method in the form of least squares dummy variable (LSDV) estimation. The F-test against the pooled model (Pooled OLS) provided no formal grounds to reject the null hypothesis of zero individual effects ($F = 0.161$; $p = 0.852$); however, following the argument of Wooldridge (2010), when units are selected purposively rather than randomly, this test loses its decision-making interpretation. Since the systems analysed were deliberately selected as structurally distinct, the assumption that individual effects are independent of the regressors (which underlies RE (random effects) models) is theoretically unjustified; the deep heterogeneity of the markets therefore justifies the use of LSDV a priori, irrespective of the F-test result. The limited cross-sectional dimension ($N = 3$) rules out GMM (generalised method of moments) estimators, including Arellano-Bond, which are designed for panels with a large cross-sectional dimension and a short time series (large N , small T) and require the number of units to exceed the number of moment conditions; with $N = 3$ the GMM weighting matrix is singular. Under these conditions, LSDV was considered the most appropriate estimator. The inclusion of the lagged dependent variable generates a theoretical risk of bias (Nickell bias), which decreases in proportion to $1/T$ (Judson and Owen, 1999, pp. 11–12). This issue was verified using a parametric bootstrap bias correction (MacKinnon and Smith, 1998; Kiviet, 1995; Bruno, 2005) with 500 replications. The estimated bias of the autoregressive parameter was -0.048 (7.8% of the baseline value), consistent with

the analytical approximation (-0.056). Crucially, the Nickell bias has a negligible impact on the crowding-out parameter for Poland, as β_{PL} changes from -0.0925 to -0.0926 (by 0.07%), and the 95% bootstrap interval after correction [-0.151; -0.029] excludes zero. The parameter retains its significance and sign. The Nickell bias does not distort the conclusions.

3.2. Preliminary diagnostics

Stationarity testing was inconclusive at the level of the national series. The KPSS test yielded borderline results for Germany ($p = 0.086$) and France ($p = 0.064$), which, given the short series, reflects the limited power of the tests. The conclusion was based on the Maddala-Wu panel test, which allowed the unit root hypothesis to be rejected ($\chi^2 = 21.08$; $df = 6$; $p = 0.002$), substantially reducing the risk of spurious regression. The highest normalised values of the generalised variance inflation factor (GVIF), in the form $GVIF^{1/(2 \cdot Df)}$, did not exceed 1.55, which rules out excessive multicollinearity.

3.3. Post-estimation diagnostics: endogeneity, autocorrelation, heteroskedasticity

A key stage was the assessment of endogeneity, in particular simultaneity bias between bond and credit dynamics. The Durbin-Wu-Hausman test in an instrumental variables model estimated by two-stage least squares (IV/2SLS; instrument: the first lag of bond growth) did not allow the exogeneity hypothesis to be rejected at the 0.05 significance level ($p = 0.073$); however, first-stage diagnostics revealed weak instruments (F below the Staiger-Stock threshold: 0.23–0.60), which deprives the test of power and disqualifies the IV/2SLS approach. The result should be interpreted as an absence of strong evidence of endogeneity rather than its exclusion, which justifies the return to LSDV. The negative relationship may also partly reflect a balance-sheet identity (reallocation as a single portfolio decision), which calls for caution in interpreting β as a purely causal effect. This caveat is general in nature and applies to all estimates presented below. The aggregate nature of the data and the short observation period allow inferences about co-occurrence and the direction of the relationship, but not about a causal relationship in the strict sense. Residual analysis revealed no grounds for rejecting the hypothesis of no autocorrelation in the error term (Breusch-Godfrey test, $p = 0.620$); therefore, given the detected heteroskedasticity (Breusch-Pagan test, $p = 0.016$), the final parameters were estimated with a robust heteroskedasticity and autocorrelation consistent (HAC) variance-covariance matrix in the Newey-West variant.

Table 1. LSDV panel model estimation results (dependent variable: $\Delta\text{Loans}_{i,t}$)

Explanatory variable	Coefficient (HAC standard error)
Baseline and control variables	
$\Delta\text{Loans}_{i,t-1}$	0.6215*** (0.1216)
$\Delta\text{CET1}_{i,t}$	-0.8463*** (0.2695)
$\Delta\text{NPL}_{i,t-1}$	-2.9246* (1.4728)
$\text{GFCF}_{i,t}$	-0.2088*** (0.0518)
$\text{GDP}_{i,t-1}$	-0.0247 (0.0482)
$\Delta\text{Rate}_{i,t-1}$	0.0527 (0.2482)
COVID_{-t}	-0.0036* (0.0021)
Interaction effects (crowding out)	
$\Delta\text{Bonds}_{i,t} \times \text{Germany}$	-0.0629 (0.0533)
$\Delta\text{Bonds}_{i,t} \times \text{France}$	-0.0488** (0.0223)
$\Delta\text{Bonds}_{i,t} \times \text{Poland}$	-0.0925*** (0.0316)
Model statistics	
Adjusted R^2	0.619
Number of observations (N $\times$ T)	88

Source: own elaboration. Note: Standard errors estimated using the Newey-West HAC robust matrix are given in parentheses. Significance levels are denoted as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The model includes estimated individual country fixed effects (separate intercepts), whose values are omitted from the table for clarity. The GDP and GFCF variables are expressed as annual growth rates (y/y) of quarterly observations and were therefore not additionally differenced, hence the absence of the Δ symbol.

3.4. Discussion of the estimation results

The estimation results (Table 1) indicate good explanatory power of the model (adjusted $R^2=0.619$), a typical value for differenced data. The control parameters are largely consistent with theory. The significant negative impact of CET1 growth (-0.8463***) is consistent with the finding that banks adjust their capital ratios by reducing risk-weighted assets rather than by raising capital (Gropp et al., 2019, pp. 284–285). An increase in the share of non-performing loans in the previous quarter ($\Delta\text{NPL}_{t-1} = -2.9246^*$) marginally restricts credit supply, although the parameter is unstable (it changes sign in the variant with third-order lags, L3). GDP growth and the lagged change in the reference rate proved insignificant. The pandemic variable is marginally significant and negative ($\text{COVID} = -0.0036^*$). Despite the support of the BGK, KfW and Bpifrance guarantee programmes, demand shocks translated, on net, into lower corporate credit

growth. The negative and significant association between investment expenditure and lending (GFCF = -0.2088***) signals that the growth of investment in the period studied was not linked to an expansion of bank credit; possible explanations include a rising share of internal financing, market issuance or changes in the sectoral structure of investment. The aggregate nature of the data, however, precludes a definitive conclusion. This observation concerns investment undertaken in the period studied, largely replacement investment that could be financed from own funds. It does not, however, determine the sector's capacity to finance capital-intensive transformational projects whose scale rules out internal financing. This parameter disappears in the test with lagged GFCF ($\beta \hat{=} 0.007$; $p = 0.903$), which calls for caution in causal interpretation; in the same specification, the crowding-out parameter for Poland retained its negative sign ($\beta_{PL} = -0.060$) with reduced significance ($p=0.124$).

3.5. The crowding-out effect: analysis of the interaction parameters

The central element of the analysis is the evaluation of the crowding-out effect through the interaction parameters. The effect is statistically significant in Poland and France but insignificant in Germany. It should be noted, however, that this is a difference in the detectability of the effect rather than a statistically confirmed difference in its magnitude. This issue is resolved by the tests of coefficient equality discussed below. Before interpreting cross-country differences, it is necessary to establish whether the discrepancies in the point estimates are statistically significant. Wald tests of the equality of the interaction coefficients (with the HAC robust matrix) provided no grounds for rejecting equality in any pair, i.e. Poland-France ($F = 1.33$; $p = 0.252$), Poland-Germany ($F = 0.24$; $p = 0.628$), Germany-France ($F = 0.05$; $p = 0.816$), or jointly ($F = 0.67$; $p = 0.513$). The data are therefore consistent with a single common crowding-out parameter of the order of -0.06 to -0.07, and the division into country-specific coefficients is not statistically justified. The lack of power to distinguish between them is a direct consequence of the narrow cross-section ($N = 3$) and the short series ($T \approx 29-30$). Since the specification includes a full set of interactions for the three countries without a stand-alone bond growth term, the β parameters have a direct marginal interpretation. An acceleration in Treasury bond portfolio growth of one percentage point is accompanied in the same quarter by a slowdown in lending growth of 0.09 percentage points in Poland and 0.05 percentage points in France. The estimates, however, differ in precision. The 95% confidence intervals based on HAC standard errors are [-0.156; -0.029] for Poland and [-0.093; -0.004] for France, compared with an interval more than twice as wide for Germany.

German banking system

The interaction coefficient proved statistically insignificant (-0.0629; $p > 0.1$). This result is consistent with findings from the sovereign debt crisis period, according to which banks in peripheral euro area countries increased their exposure to domestic public debt in response to rising country risk, which was not observed in core countries (Battistini, Pagano and Simonelli,

2014), and the transmission of sovereign debt market tensions to lending was concentrated in countries under fiscal stress (Altavilla, Pagano and Simonelli, 2017). The point estimate is, however, higher in absolute value than the significant French coefficient, and its insignificance stems mainly from low precision (standard error of 0.053 with $T = 29$). The wide confidence interval $([-0.169; +0.043])$ does not allow the German effect to be distinguished either from zero or from the estimates for Poland and France. The absence of a detectable effect is consistent with the mechanisms discussed in Section 2 (the Hausbankprinzip, the three-pillar architecture), reinforced by the ECB's asset purchase programmes (the asset purchase programme, APP, and the pandemic emergency purchase programme, PEPP), which saturated the sector with liquidity.

French banking system

A moderate negative effect of bond purchases on lending was identified $(-0.0488^{**}; p < 0.05)$, reflecting the hybrid nature of the architecture. Bpifrance partly cushions shocks through equity instruments and first-loss tranches, but the highly consolidated, wholesale-market-oriented sector shows a propensity to substitute risky credit with liquid sovereign assets. The French result is, however, the least robust. It loses significance with L2/L3 lags and with lagged GFCF (where it changes sign), and the bootstrap confidence interval includes zero; its interpretation should therefore be formulated with caution.

Polish banking system

The interaction coefficient is significant and has the highest point estimate among the countries studied $(-0.0925^{***}; p < 0.01)$, although its difference from the French coefficient is not statistically significant. The result is consistent with the institutional diagnosis. Facing the concentration limits of Article 395 CRR and capital allocation under the supervisory slotting regime, and discouraged by the asymmetric regulatory-tax wedge, Polish banks shift capital from the corporate sector towards untaxed public debt, which confirms the thesis of the dysfunctional fragmentation of a model in which the state, as a passive guarantor, does not reduce structural risks at source.

4. CONCLUSIONS AND RECOMMENDATIONS

The nature of the study, which can be described as an exploratory comparative study of three systems, does not allow generalising conclusions to be drawn. The estimation results are consistent with the thesis that the state's capacity to mobilise private capital for strategic investments depends on the support architecture. In Germany, where a countercyclical model based on KfW and the Hausbankprinzip operates, no crowding-out effect was detected, whereas in Poland it proved statistically significant. The barriers arising from the sequence of prudential filters (the supervisory slotting regime, concentration limits under Article 395 CRR),

combined with the asymmetric regulatory-tax wedge, induce the sector to engage in arbitrage in favour of untaxed Treasury bonds. Closing the investment gap requires a shift away from linear forms of support towards advanced risk structuring techniques (de-risking) and the implementation of integrated subordinated mechanisms in two forms. First-loss funded instruments (subordinated debt or quasi-equity contributions from PFR) improve DSCR ratios under stress conditions; first-loss unfunded instruments (credit protection from KUKE or BGK) transfer demand risk from the bank's balance sheet to the public sector, optimising capital requirements and freeing up headroom within concentration limits. The implementation of these instruments must proceed in parallel with the evolution of the mandate of development institutions, from a passive guarantor towards an active market-shaping paradigm and close coordination of public capital, in which the coordinated action of BGK, PFR and KUKE would create a coherent point of contact for commercial banks. In the cases studied, it was the state, by assuming the role of investor of first resort at the early stages of the megaproject life cycle, that was able to stabilise their risk profile to a level acceptable within a standard banking risk assessment. This mechanism is consistent with the French model (Bpifrance); the above recommendations are, however, based primarily on the institutional analysis rather than on the difference in coefficients, the significance of which the data do not confirm.

4.1. Limitations of the study and directions for further research

The conclusions should be interpreted in light of the methodological limitations. One of the main limitations is the small sample size and the resulting lack of statistical power. The three-element set of systems analysed ($N = 3$) may limit the validity of the conclusions for a broader set of systems. Aggregate corporate credit growth served as a proxy for structured finance volumes (project finance), and the horizon covering 30 quarters from 2018 results from a structural change (IFRS 9, finalisation of the CRR/CRD regime). The number of 88 observations for the systems studied results from the overlap of several constraints, namely the minimal set ($N = 3$), the 2018 structural break limiting the horizon, differencing of the series absorbing the initial observations and the dynamic specification with lags (the panel is also unbalanced, 29/29/30). Consequently, the standard errors of the key coefficients are large, particularly for Germany (0.053). The direct consequence is low statistical power with respect to the most important question, namely cross-country differences in the magnitude of the effect. Given the wide confidence intervals, the study does not distinguish effects of the order of -0.05 from -0.09 (joint test $p = 0.51$), so heterogeneity in the magnitude of the effect is a hypothesis rather than an empirical finding. What remains defensible, however, is (i) a measurable, directionally robust effect in Poland; (ii) its non-detectability in Germany; and (iii) the qualitative institutional-comparative analysis (the second and third parts of the article), which is independent of the power of the model. A natural direction for further research is a shift to micro-panel data from credit registers, which would increase identification power and enable an intra-organisational decomposition of risk aversion.

The stability of the results was subjected to sensitivity analysis across five specifications (baseline, with L2 and L3 lags, excluding the pandemic period, and with lagged GFCF). The crowding-out parameter for Poland retains a negative sign in all five specifications, and significance at the $\alpha=0.05$ level in three of them (baseline $p = 0.005$; L2 $p = 0.002$; L3 $p = 0.001$); it loses significance when the pandemic is excluded ($p = 0.108$) and with lagged GFCF ($p = 0.124$). The direction of the effect is stable, but its statistical strength depends on the specification and is most pronounced under abrupt supply shocks of public debt.

CONCLUSION

By combining institutional-comparative analysis with panel modelling, the study provides arguments that the dysfunctionality of the support architecture is a measurable, supply-side determinant of the crowding-out effect. It was not confirmed, however, that the effect differs systematically across institutional models, hence the caution in qualifying the results and describing them as hypothesis-generating.

The institutional analysis conducted in Sections 1 and 2 revealed crowding out as the resultant of the architectural properties of the systems rather than a simple consequence of fiscal expansion. The Western European models pre-emptively neutralise balance-sheet barriers ex ante (maturity mismatch in Germany, unquantifiable technological and demand risk in France, punitive risk weights under the supervisory slotting regime), whereas Polish *pari passu* guarantees, amid the siloed operation of BGK, PFR and KUKE, do not address these deficiencies, shifting risk onto commercial balance sheets. The empirical verification (LSDV, 88 observations) confirmed a significant effect in Poland and France, absent in Germany, but the tests of coefficient equality revealed no differences in its magnitude ($p = 0.51$). Hypothesis H1 was confirmed, with the caveat that the direction of the effect is stable across all five specifications, whereas statistical significance occurs in only three of the five. H2, by contrast, remains an interpretative framework requiring data with greater power.

The article combines two hitherto separate strands of research, namely the analysis of the sovereign-bank nexus and the assessment of the effectiveness of development finance institutions, within a unified econometric framework that accounts for the heterogeneity of the support architecture. The concept of an ‘architecture for absorbing structural risks’ as a variable moderating the crowding-out effect also introduces an analytical category that goes beyond conventional volume indicators (value of guarantees, number of projects) towards a diagnosis of the system’s functional capacity to neutralise banks’ balance-sheet barriers.

The results of the analyses have direct implications for the reform of the Polish support architecture and, at the European level, are consistent with the debate on deepening the Capital Markets Union (European Commission, 2020; Eurogroup, 2024) and on reforming the mandates of national promotional banks towards greater integration with prudential requirements; the

effectiveness of a Bpifrance-type model, posited on the basis of the institutional analysis, may serve as a point of reference for countries reforming their own instruments.

The Polish economy is entering a period of very high demand for transformational capital amid limited fiscal space. The study indicates that the banking sector's capacity to finance this transformation depends not only on macroeconomic and regulatory conditions, but also on the choice between passively remedying market failures and actively shaping conditions in which private capital can take on risks it could not bear on its own, in line with the concept of the entrepreneurial state (Mazzucato, 2013).

REFERENCES

- Altavilla, C., Pagano, M., & Simonelli, S. (2017). Bank exposures and sovereign stress transmission. *Review of Finance*, 21(6), pp. 2103–2139.
- Battistini, N., Pagano, M., & Simonelli, S. (2014). Systemic risk, sovereign yields and bank exposures in the euro crisis. *Economic Policy*, 29(78), pp. 203–251.
- Becker, B., & Ivashina, V. (2014). Financial Repression in the European Sovereign Debt Crisis. Working Paper. Swedish House of Finance Research Paper No. 14–13.
- Broner, F., Erce, A., Martin, A., & Ventura, J. (2014). Sovereign debt markets in turbulent times: Creditor discrimination and crowding-out effects. *Journal of Monetary Economics*, 61, pp. 114–142.
- Bruno, G. S. F. (2005). Approximating the bias of the LSDV estimator for dynamic unbalanced panel data models. *Economics Letters*, 87(3), pp. 361–366.
- Elmendorf, D. W., & Mankiw, N. G. (1999). Government debt. [In:] J. B. Taylor & M. Woodford (Eds.), *Handbook of Macroeconomics* (Vol. 1, pp. 1615–1669). Elsevier.
- Eurogroup. (2024). Statement of the Eurogroup in inclusive format on the future of Capital Markets Union
- European Central Bank. (2023). Statistical Data Warehouse: Banking structural financial indicators. <https://sdw.ecb.europa.eu> [accessed: 23.05.2026].
- Gropp, R., Mosk, T., Ongena, S., & Wix, C. (2019). Banks response to higher capital requirements: Evidence from a quasi-natural experiment. *Review of Financial Studies*, 32(1), 266–299.
- Hauner, D. (2009). Public debt and financial development. *Journal of Development Economics*, 88(1), pp. 171–183.
- Jiménez, G., Ongena, S., Peydró, J.-L., & Saurina, J. (2017). Macroprudential policy, countercyclical bank capital buffers and credit supply: Evidence from the Spanish dynamic provisioning experiments. *Journal of Political Economy*, 125(6), pp. 2126–2177.
- Judson, R. A., & Owen, A. L. (1999). Estimating dynamic panel data models: A guide for macro-economists. *Economics Letters*, 65(1), pp. 9–15.
- KfW Bankengruppe. (2020). Merkblatt KfW-Unternehmerkredit (Produktnummer 037/047, Bestellnummer 600 000 0188, Stand 01.01.2020). KfW.

KfW Bankengruppe. (2022). Merkblatt KfW-Unternehmerkredit, KfW-Sonderprogramm 2020 (Produktnummer 037/047, Bestellnummer 600 000 0188, Stand 01.01.2022). KfW.

KfW Bankengruppe. (2025). Merkblatt Kredit Nr. 295. Bundesförderung für Energie- und Ressourceneffizienz in der Wirtschaft (Bestellnummer 600 000 4389, Stand 12/2025). KfW.

KfW. (2024). KfW Financial Report 2023. Combined Management Report. KfW.

Kiviet, J. F. (1995). On bias, inconsistency, and efficiency of various estimators in dynamic panel data models. *Journal of Econometrics*, 68(1), pp. 53–78.

Kumhof, M., & Tanner, E. (2005). Government debt: A key role in financial intermediation. IMF Working Paper WP/05/57.

European Commission. (2020). A Capital Markets Union for people and businesses: new action plan. Communication COM(2020) 590 final.

Laubach, T. (2009). New evidence on the interest rate effects of budget deficits and debt. *Journal of the European Economic Association*, 7(4), pp. 858–885.

Mackinnon, J. G., & Smith, A. A. (1998). Approximate bias correction in econometrics. *Journal of Econometrics*, 85(2), pp. 205–230.

Mazzucato, M. (2013). *The Entrepreneurial State: Debunking Public vs. Private Sector Myths*. Anthem Press.

Mertens, D., & Thiemann, M. (2018). Market-based but state-led: The role of public development banks in shaping market-based finance in the European Union. *Competition & Change*, 22(2), pp. 184–204.

Mertens, D., Thiemann, M., & Volberding, P. (2021). *The Reinvention of Development Banking in the European Union: Industrial Policy in the Single Market and the Emergence of a Field*. Oxford University Press.

Ministry of Climate and Environment. (2024). Projekt aktualizacji Krajowego planu na rzecz energii i klimatu (KPEiK) na lata 2021–2030. [accessed: 23.05.2026] at: <https://www.gov.pl/web/energia/ministerstwo-energii-opublikowalo-projekt-krajowego-planu-w-dziedzinie-energii-i-klimatu-do-2030-i-2040-roku-to-kluczowy-dokument-dla-polskiej-energetyki-i-polskiej-gospodarki>

Nickell, S. J. (1981). Biases in dynamic models with fixed effects. *Econometrica*, 49(6), pp. 1417–1426.

Popov, A., & Van Horen, N. (2015). Exporting sovereign stress: Evidence from syndicated bank lending during the euro area sovereign debt crisis. *Review of Finance*, 19(5), pp. 1825–1866.

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data* (2nd ed.). MIT Press.

Legal acts

Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 (CRR), OJ L 176, 27.6.2013.

Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC (CRD IV), OJ L 176, 27.6.2013

Regulation (EU) 2016/1011 of the European Parliament and of the Council of 8 June 2016 on indices used as benchmarks in financial instruments and financial contracts or to measure the performance of investment funds and amending Directives 2008/48/EC and 2014/17/EU and Regulation (EU) No 596/2014 (BMR), OJ L 171, 29.6.2016.

Commission Regulation (EU) 2016/2067 of 22 November 2016 amending Regulation (EC) No 1126/2008 adopting certain international accounting standards in accordance with Regulation (EC) No 1606/2002 of the European Parliament and of the Council as regards International Financial Reporting Standard 9 (IFRS 9), OJ L 323, 29.11.2016.