

Research Article

Data-Driven Analysis of Bank Ownership, Credit Allocation, and the Finance-Growth Nexus in the Western Balkans and CEE

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Abstract

This paper explores the finance-growth nexus in ten economies of the Western Balkans and Central and Eastern Europe (hereafter referred to as the Extended Balkans) over 2001–2024. Moving beyond aggregate measures of financial depth, the study investigates how the structure of financial intermediation shapes the relationship between finance and economic growth. Particular attention is given to three dimensions: the nonlinearity of the financial depth–growth relationship, the role of foreign bank ownership, and the differential growth effects of household and corporate credit. The study adopts a data-driven empirical framework combining two-way (country and year) fixed-effects estimators with two-step system and difference Generalized Method of Moments (GMM) estimators. The results indicate that the aggregate private-credit-to-GDP ratio does not exhibit a robust positive linear effect on economic growth. Instead, an inverted U-shaped relationship emerges in the dynamic specification (system GMM: -0.38 , $p = 0.016$ for credit and $+0.004$, $p = 0.006$ for its squared term), indicating a financial deepening threshold. Hansen panel threshold regression identifies a turning point at approximately 55% of GDP (95% CI: 53–59%), below which an additional percentage point of credit is associated with approximately 0.04 percentage points of higher growth, while beyond this threshold the marginal contribution becomes negligible. The analysis further provides evidence of a foreign-bank-ownership channel. Foreign ownership exhibits a negative level effect on growth (-1.19 , $p = 0.029$), whereas its interaction with financial depth is positive ($+2.43$, $p = 0.071$), suggesting that the negative association weakens as financial depth increases. Evidence from the six-country IMF Global Debt Database (IMF-GDD) subsample reveals a pronounced credit-composition asymmetry, with household credit negatively associated with growth (-0.77 , $p < 0.001$) and corporate credit positively associated with growth ($+0.30$, $p < 0.001$). The negative household-credit effect is confirmed in the post-crisis fixed-effects specification (-0.12 , $p = 0.043$). The findings remain robust across leave-one-country-out, EU versus non-EU, and per-capita growth specifications, highlighting implications for macroprudential regulation, SME financing, and economic convergence within the EU accession framework.

Keywords: Finance-Growth Nexus; Western Balkans; System GMM; Foreign Bank Ownership; Credit Allocation; Household Credit.

INTRODUCTION

The Western Balkan economies are currently at a pivotal stage of development, undergoing economic modernization alongside institutional reforms aimed at European Union (EU) accession. This objective extends beyond political integration and encompasses long-term economic convergence with the EU. Although the region has recorded growth rates above the EU average for much of the past two decades, the convergence process remains incomplete, with GDP per capita measured in purchasing power parity (PPP) terms still approximately 40% below the EU average.

The transition period and its legacy have been characterized by structural challenges, including weaknesses in the rule of law, persistent unemployment, and limited competitiveness. In this context, the financial system is often regarded as a key driver of economic development. However, the region's financial architecture exhibits several distinctive characteristics: a dominant banking sector, underdeveloped capital markets, and extensive foreign ownership, with between 70% and 95% of banking assets controlled by EU-based banking groups. Previous studies suggest that this configuration contributed to the pre-2008 credit expansion while simultaneously increasing vulnerability to external shocks, particularly when foreign parent banks reduced funding following the global financial crisis [1, 2]. Although financial stability has largely been restored, the legacy of the crisis remains evident in elevated levels of non-performing loans and constrained access to finance, particularly for small and medium-sized enterprises (SMEs), which play a central role in regional economic activity. These characteristics make the Western Balkans a distinctive empirical setting in which the finance-growth nexus warrants renewed examination.

The relationship between finance and economic growth has attracted scholarly attention for more than a century. While early research largely emphasized the positive contribution of financial development to economic performance, more recent studies have focused on causal mechanisms, nonlinear dynamics, and structural factors that condition the finance-growth relationship [3–5]. Much of the earlier cross-country literature relied on aggregate indicators of financial development, particularly the private-credit-to-GDP ratio. Although widely used, such measures provide limited insight into the allocation of credit across sectors of the economy. The distinction between credit directed toward household consumption and housing activities and credit supporting productive business investment may have important implications for long-term growth outcomes. This limitation is particularly relevant in transition economies, where financial expansion is strongly influenced by foreign-owned banks and cross-border capital flows. Under such conditions, strategic decisions made by foreign parent institutions may shape domestic credit allocation and alter the conventional relationship between finance and growth [6, 7]. Furthermore, the distribution of credit between households and productive enterprises remains relatively underexplored in the regional context despite its potential importance for sustainable economic development [8–10].

Research Questions and Hypotheses

This paper seeks to fill these gaps by moving beyond aggregate analysis to explore the structural determinants of the finance-growth nexus in the Extended Balkans. The main research question is:

How does the structure of financial intermediation (foreign or domestic ownership of banks, and distribution of credit to corporations or households) affect the finance-growth relationship in the Western Balkan countries?

The paper presents three specific research questions and related hypotheses which are as follows.

- H1. Non-linearity through institutional screening capacity. Credit is most effective in developing economies until its expansion outruns the capacity of contract-enforcement and supervisory institutions to screen borrowers. As such, we expect to find a threshold relationship between credit and growth. In other words, we anticipate a threshold beyond which further increases in credit are not associated with faster growth.
 - H1a: Below the estimated threshold, the coefficient associated with credit is positive and not significantly different from zero above the threshold ($\beta_1 > 0$, $\beta_2 \approx 0$ in equation (3)).
 - H1b: the threshold lies well below the 80–100 per cent of GDP range documented for advanced economies, reflecting weaker screening institutions in the region.
- H2. Ownership as a depth-contingent channel. Foreign banks introduce new ways of providing loans (and access to funds) into underdeveloped markets. Initially, these methods favor collateral-based retail lending in less-developed markets. However, for foreign bank internal capital market efficiencies to become relevant in a country's economy, that country must develop sufficiently deep financial markets capable of absorbing those efficiencies.
 - H2a: the direct association between the foreign-owned share of banking assets and growth is negative ($\delta < 0$ in equation (4)).
 - H2b: this negative association diminishes as financial depth rises ($\varphi > 0$), so that the marginal effect of foreign ownership crosses zero within the observed range of credit depth.
- H3. Allocation as the operative margin. Households use credit primarily to finance consumption and residential real estate purchases. In contrast, corporations use some portion of their debt financing for investments. Therefore, depending on who receives the loan, the marginal impact of that loan can differ dramatically in terms of contributing to long-term economic growth.
 - H3a: the household-credit coefficient is non-positive ($\beta^H \leq 0$ in equation (5)).
 - H3b: the corporate-credit coefficient exceeds the household-credit coefficient under every estimator ($\beta^c > \beta^H$). The asymmetry, not the level of either coefficient, is the testable prediction.

- H3c: the household-credit drag is larger in the post-2008 window, when the household-debt overhang binds.

Contribution to the Literature

This study approach to the finance-growth nexus manages to make three main contributions to this research topic. First, it has chosen a distinctive group of countries which share institutional and economic context which remains relatively under researched. The region-specific analysis focuses on the six Western Balkan economies and then extends its reach for a ten-country panel by including in the group four Central and Eastern European (CEE) peers, namely Bulgaria, Romania, Croatia, and Slovenia. This complete panel, for brevity, throughout the paper will be referred to as the 'Extended Balkans'. The second contribution is to test the specific way on how finance affects the real economy and it does this by going beyond standard aggregate proxies to including additional measures of bank ownership and credit allocation. For this purpose, were used authoritative and trusted data coming from IMF Global Debt Database series for the credit decomposition of household and non-financial corporate debt, and the World Bank Global Financial Development Database for the ownership channels. Thirdly, this study assesses the international "too much finance" hypothesis under a post transition regime that could be characterized by some level of institutional weakness which could potentially alter the location at which the excess finance constraint occurs. To demonstrate the validity of its analysis empirically, the research uses robust estimation methods for dynamic panels (i.e., System and Difference Generalized Method of Moments) to correct standard errors for heteroskedasticity utilizing Windmeijer corrections for the collapsing of instruments [9, 10], and using two way fixed-effects as the main static model specification. This provides strong empirical evidence with immediate and direct relevance to the ongoing pursuit for sustainable economic convergence with the European Union in the region.

More explicitly these contributions are filling four specific gaps in the Extended Balkans literature. First, in previous studies variables such financial depth, bank ownership and credit composition are considered and analysed in isolation, and so the interplay between them remains unexplored. Second, while existing work mostly establishes correlation it does not or offers little explanation on the mechanism through which finance operates in bank-dominated, foreign-owned systems. The third gap exists in the "too-much-finance" threshold which even though is well documented for advanced economies, it does not match developing low-to-middle-income European economies, and no study estimates a threshold specific to these conditions where institutional frictions may shift its location. Fourth, a gap in the regional literature exists in the separation of the quantity of intermediation from its quality. It doesn't consider whether credit funds productive investment or consumption. In Figure 1 we present a conceptual framework that links these four gaps to the three hypotheses: aggregate financial depth is linked to the three hypotheses through a non-linear threshold (H1), with foreign ownership acting as a moderator (H2), and the allocation of credit between households and corporations serving

as a mediator (H3). Institutional quality (specifically, the rule of law) functions as a cross-cutting moderator.

The paper is structured as follows. In the following section we review the theoretical and empirical literature on the finance–growth nexus. Right after the next section lays the empirical methodology, the model specification and data. Next, we present the main empirical results, and follow with reports on a series of robustness checks. The next section discusses the policy implications of the findings, and the final one concludes.

LITERATURE REVIEW

The influence that finance has in the economic development has been drawing the attention of researchers for more than a century. The relation is been contested and the paradigms have shift from fundamental assumptions to the recent more sophisticated synthesis.

One of the first researchers to investigate this relation between finance and growth was [11]. He contested the classical static economic equilibrium and argued that growth is driven by a dynamic process lead by innovation coming from entrepreneurs through “creative destruction”. The financial system according to him is crucial as it fuels and support this process while making sure also that only good projects and investments are filtered. Through this perspective Schumpeter positioned finance as a proactive factor which is preceding growth and promotes it. This supply leading role of the financial sector that Schumpeter introduced was than later revived and reinforced by the empirical literature, produced particularly by [3] which offered evidence that Schumpeter may be correct.

The Schumpeterian thesis was later disputed by [12] which presented a very different take stating that “where enterprise leads, finance follows”. His hypothesis presents a demand-following causality which assumes that financial development is a result, rather than a precursor, of economic growth. According to him as the economy grows it gets more complicated and demanding more sophisticated financial services which pushes the financial sector to change on its own to meet these needs. These two opposing views were formally conceptualised by [13]. He was the first to coin the terms supply-leading and demand-following, which initiated the long causality debate that has defined much of the literature.

In the 1970s, in response to the “financial repression” policies which were prevailing in most of the developing countries characterized by high reserve requirements and interest rate ceilings, the debate shifted mainly through the work of [14, 15] which launched a powerful critique to these policies. Their argument was that such policies are compromising development as they discourage saving and also lead to inefficient allocation of capital. Instead, they called for financial liberalisation, which will allow market forces to determine interest rates, leading to financial deepening. This according to them will influence an increase in saving rates, and will improve the efficiency of the investments which will translate to accelerated economic growth.

The current, contemporary understanding of the finance-growth nexus is a combination of endogenous growth theory and the economics of information. Introduced in the '90s, this modern synthesis is moving away from the focus on the size of the financial sector to the functions that it performs. As it was articulated by [5], a well performing financial system, in a world of information and transaction costs, should perform five key functions: mobilising savings, allocating resources, exerting corporate governance, managing risk and facilitating exchange. These functions would then influence and fuel growth through two main channels: capital accumulation and, total factor productivity growth. From this perspective the financial system if is functioning efficiently will be playing the Schumpeterian proactive role, and if the system is inefficient, it can only follow the real economy with no direct contribution to the growth.

Global Empirical Evidence and Methodological Debates

When it comes to measuring financial development, we notice in the literature that it is a challenging task. In early studies, researchers such as [16] used broad measures of the size of the financial sector, like the ratio of financial-intermediary assets to GDP. The study in [3] popularised measures such as liquid liabilities to GDP. With the recognition that size is an imperfect proxy for efficiency, private credit to GDP started to be used more and more in the literature as a preferred indicator, as it better captures the core function of channelling funds to private enterprise [17]. A later improvement was added with studies which made a distinction between bank-based and market-based finance, showing that stock-market liquidity and not just size, is a robust predictor of growth. Lately, we notice emerging a consensus on the understanding of financial development as a multidimensional concept. This has led to the construction of comprehensive indices that capture not only depth but also access, efficiency and stability [18].

One of the greatest econometric problems faced when a positive correlation is found between finance and growth is endogeneity, as the correlation by itself does not prove the causality. Early attempts to address this included showing that the initial level of financial development predicts future growth [3]. The use of instrumental variables to isolate the exogenous component of financial development can be found in some more rigorous approaches [19], but the current methodological standard is the Generalised Method of Moments for dynamic panel data. The difference and system GMM estimators developed by [9, 10, 20] are specifically designed to address the key challenges of growth regressions as they control for unobserved country-specific effects, address the endogeneity of all regressors by using their own lagged values as internal instruments, and explicitly model the dynamic nature of growth by including a lagged dependent variable. The validity of these estimators in small-N panels as has been shown by [21] is critically focused on keeping the instrument count below the number of cross-sectional units, an issue that is central to our identification strategy.

For a long time in the literature the relationship was considered linear with more finance contributing to more growth. It took the big 2008 crisis to hit the most developed financial systems, to have researchers start questioning this assumption and exploring a

non-linear behaviour. The too-much-finance hypothesis where an inverted-U is presented is the most popular product of this era. In its financial deepening turns detrimental beyond a threshold [4], which is often placed where private credit exceeds 90–100% of GDP. The mechanisms proposed to explain this behaviour include a move of talent away from productive sectors and the inflation of speculative asset bubbles at the expense of real investment [22–28]. But this is not the end of it as some other studies detect no significant non-linearity and argue the relationship turns on institutional quality [23, 29–32]. More recent meta-analyses report only a small, genuine and slowly declining average effect of finance on growth across the world literature [33–36].

Later studies focus on the composition of private credit rather than its level. Authors at [24] have found the enterprise credit to be the one which is having growth-enhancing effects while the household credit is not. In a panel of thirty advanced and emerging economies in [8] showed that rising household debt contributes to weaker growth and a higher probability of crisis in [35] reinforce this by estimating a long-run coefficient of about -0.1 for the drag of household debt on growth, and they also find that this drag gets sharper once household debt passes about 70% of GDP. It is based on these results, that this paper builds its hypothesis into the Extended Balkans countries.

The Balkan Context

The financial systems structure of the Extended Balkans countries shows a bank dominance with a negligible role of the stock markets [25]. At the same time, the banking system is characterized by a high degree of foreign ownership. Although foreign banks provided much-needed capital, expertise, and financial-sector development during the early stages of transition, they also increased the region's exposure to external cyclical shocks, as evidenced by the substantial deleveraging that occurred following the 2008 global financial crisis [1, 7]. As consequence the region is still facing high NPLs and limited access to finance for firms which have to deal with high interest rates and strict collateral requirements.

The study of the finance growth nexus in the region is still in its early stages with some studies which mainly through panel data analysis have found supporting evidence of the supply-leading hypothesis, where financial development appears to cause economic growth [26]. Dynamic panel GMM methods have recently been employed by some researchers to be able to perform more rigorous methodology than previous research. The results of one such study of nine Balkans countries (from 1995 through 2022) found that financial deepening had a positive effect on economic growth. After testing for non-linear effects, it was also determined that the level of financial development in the region is at this time below what would cause too much finance to negatively affect economic growth. None the less, significant gaps remain especially for non-addressing the specific structural features of the region which we mentioned above with a particular focus on the role of foreign bank ownership and the allocation of credit. Since these variables have not been incorporated in the used economic models these leaves room for new research to fill this gap.

A UNIFIED INTERMEDIATION-ARCHITECTURE FRAMEWORK

Common Mechanism Hypotheses

The Three Hypotheses of this study represent different views of one mechanism. In terms of the function of finance [5], intermediaries promote economic development when they collect deposits, evaluate and monitor loan applicants, and manage risks associated with lending. As stated before, the extent to which lending promotes economic development does not depend on the total amount of credit extended. Instead, the relevant variable is the proportion of credit extended that finances new investments. Therefore, we can express the contribution to economic development resulting from intermediation using a stylized model as the product of financial depth and allocative quality:

$$\text{Growth contribution} = F \times q(I, O, S) \quad (1)$$

where F represents the degree of financial development (credit extended to private parties divided by GDP) and q represents the proportion of each dollar of credit extended that is used to finance productive activities. Allocative quality q is not a fixed number. It depends on the institutional environment I in which lenders contract with borrowers and enforce those contracts. Allocative quality also depends on the ownership structure O of the financial intermediaries that make allocation decisions. Finally, allocative quality depends on the sectors S to which the credit is directed. Therefore, the three hypotheses of this paper are descriptions of how each of the three factors influences q , and consequently how the same increase in financial depth yields different increases in growth rates across regions and over time.

Thus, the framework provides a basis for combining the empirical estimations. Model 1 measures the average productivity of depth. However, since Model 1 combines all credit into a single measure (both productive and non-productive), it is incapable of providing independent information. Models 2 and the specifications based upon thresholds allow quality to vary with levels of depth. Thus, Model 2 examines whether the variation in quality is related to differences in the level of financial development. Model 3 allows quality to vary depending on the ownership structures of financial intermediaries. Model 4 allows quality to vary depending on the sectors to which credit is allocated. Each incremental model specifies one aspect of q independently from other aspects included in the control variables.

Three Layers of Financial Architecture and Institutional Moderator

Financial Scale and the Screening Constraint (Hypothesis 1). Screening ability is a type of "stock" that develops gradually. Courts, collateral registries, credit bureaus, and regulatory personnel do not grow quickly. Therefore, if financial credit expands faster than the capacity for screening it, then the marginal lender will increasingly be one who would not qualify for credit under stricter screening conditions. Consequently, the marginal product of additional credit will decline. This is the mechanism underlying the excessive finance findings in [4, 22], but it occurs differently in relation to I (the institutional context):

weaker institutions for enforcing rules mean that the screening constraint applies at lower levels of financial depth. Specifically, there exists a depth threshold $\gamma(I)$, increasing in institutional quality I , such that for levels of depth less than $\gamma(I)$ the marginal impact of depth on development is positive and close to zero otherwise. Therefore, countries with an average score for rule-of-law in the WGI index equal to approximately zero should experience a transition (turning point) in their credit expansion at a level of financial depth far earlier than developed economies.

Ownership Structure and Governance (Hypothesis 2): Who decides how to allocate credit affects how allocation is performed. Parent banks operating in foreign affiliates use hierarchical, arm's length lending technologies that depend on strong forms of information (collateral) [7]. For countries with thin financial markets (informationally opaque), this technology favors mortgage lending, consumer lending, and lending to large/foreign affiliated firms versus relationship lending to small-medium enterprises (SMEs). Therefore, for a given level of financial development F , this lowers q . The same parent banks operate internal capital markets that permit them to transfer funds to their affiliates' best investment opportunities and their funding cycles exhibit high pro-cyclicality [25]. The net impact on q therefore depends on the level of financial development. At lower levels of F (financial development), both the retail distortion and funding cycle volatility dominate; at higher levels of F (depth sufficient) this technology becomes capable of reaching productive firms through the parent's allocation mechanisms. This is the depth-contingent ownership channel: a negative direct term and a positive interaction with F .

Sectoral Destination (Demand Side) and q (Hypothesis 3): Credit destination determines q most directly. Corporate financing includes at least some working capital and capital expenditures financed by credit. Household credit in the region largely finances consumption and/or housing and often in foreign currency leading to subsequent debt service burdens that suppress future demand. The household channel is thus a demand-side mechanism similar to [8, 35-39]: credit that raises consumption during booms reduces demand subsequently once debt service obligations bind, thereby producing stronger downward pressure after 2008.

The Institutional Moderator. Quality of institutions will affect all three levels of the model. Quality of institutions will determine where the threshold for the non-linear relationship in the first level is located, quality of institutions will affect whether or not foreign lending technologies are available to productively using firms at the second level, and finally quality of institutions will define the consumer protection and macro prudential frameworks that govern lending to households at the third level. Therefore, rule of law will be added as a control variable to each equation. Conceptually, rule of law is the variable that defines the shift of the entire architecture.

From the Framework to Testable Predictions

Figure 1 illustrates the conceptual framework linking financial depth to growth through the three hypothesised channels. Aggregate depth affects growth through a non-linear threshold (H1), but the non-linear threshold can be moderated by foreign ownership (H2)

and mediated by allocation of credit between households and firms (H3) as to what portion of each unit of credit is relevant to growth; institutional quality moderates all of these variables. Each line represents a coefficient in the estimating equations outlined in Methodology: H1 is represented by the slope coefficients β_1 and β_2 of equation (3); H2 is represented by the direct and interaction terms δ and φ of equation (4), and H3 by the ordering of β^H and β^C in equation (5). The nested hypothesis statements presented in the Introduction are based on the mapping illustrated above.

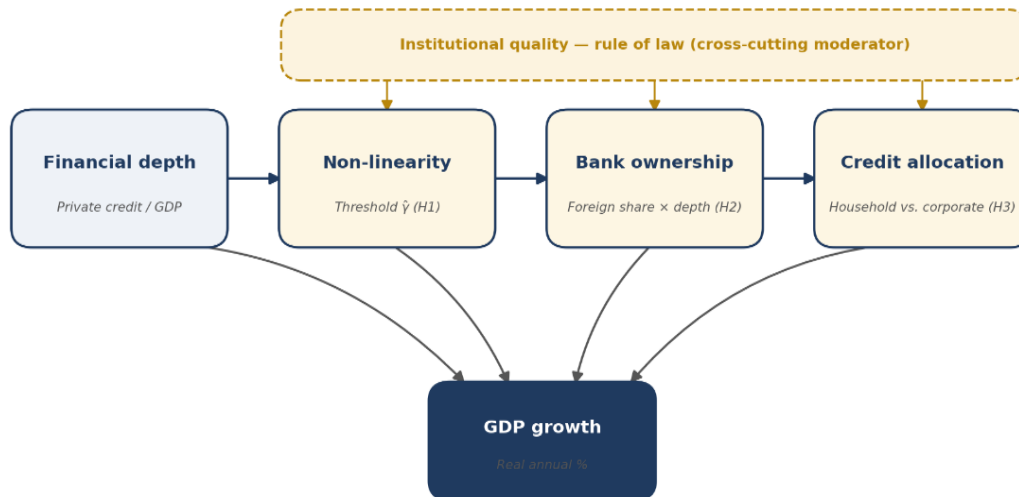


Figure 1. Conceptual Framework Linking Financial Depth to Growth Through the Three Hypothesised Channels.

METHODOLOGY AND DATA

The Dynamic Panel Growth Model

The empirical analysis is based on a dynamic augmented-growth specification of the following form:

$$y_{it} = \alpha + \rho y_{i,t-1} + \beta F_{it} + \gamma' X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

where y_{it} represents the average Annual Growth Rate of Real GDP in country i over year t ; F_{it} represents a Vector of Financial Structure Variables of Interest (which varies across the four models described below); X_{it} represents a Vector of Standard Macro-Fiscal Controls (Inflation, Government Expenditure, Trade Openness, Rule of Law) μ_i and λ_t represent Fixed Effects for Country i and Year t respectively ε_{it} represents the Idiosyncratic Error. Equation (2) is including the Schumpeterian causal interpretation ($\beta > 0$), the demand-following view ($\beta \approx 0$), and the too-much-finance hypothesis (once F is augmented with its square, a negative coefficient on the quadratic term is consistent with an inverted-U).

In the analysis we use four versions of equation (2). In Model 1 (which is the baseline) F is a scalar: the private-credit-to-GDP ratio. In Model 2 (testing for non-linearity, H1) F is augmented with its square. In Model 3 (testing for bank ownership, H2) F is extended to include the foreign-bank asset share and a foreign-share $\times$ private-credit interaction. In Model 4 (testing for credit allocation, H3) private credit is replaced with its decomposition into household and non-financial corporate components.

Data and Sources

Country Sample and Time Period

The panel is including data from ten economies selected in our Extended Balkans group of countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Kosovo, North Macedonia, Montenegro, Romania, Serbia and Slovenia. The starting year of the data collected is 2001, because data coverage for the private-credit for the years before that was too sparse for most of the countries in the group. The sample period thus is 2001-2024 and the panel is strongly unbalanced. It contains 218 country-year observations in the full Models 1 and 2 and 215 in Model 3. When it comes to Model 4 (credit allocation) the panel is composed of a subsample of only six countries, namely Albania, Bulgaria, Croatia, North Macedonia, Romania and Slovenia, which reflects the coverage of the IMF Global Debt Database of household and non-financial corporate credit series. This reduction in the country coverage is a data constraint rather than an econometric choice because Bosnia and Herzegovina, Kosovo, Montenegro and Serbia are not currently included in the IMF GDD household/NFC decomposition. We prefer to report the credit-composition model on the subsample rather than interpolate IMF-comparable series for these four countries.

Variable Definitions and Construction

The dependent variable is the yearly Growth Rate of Real Gross Domestic Product (GDP). This was constructed from Data provided by International Monetary Fund's World Economic Outlook [30] and verified with World Bank World Development Indicators (WDI) [31]. Private credit to GDP is the WDI indicator FS.AST.PRVT.GD.ZS domestic credit to the private sector by financial-sector institutions with FD.AST.PRVT.GD.ZS (banks-only) as a robustness alternative. Government expenditure and trade openness are taken from the WDI, Inflation is from the IMF CPI database; and Institutional quality is proxied by the Rule-of-Law component of the Worldwide Governance Indicators (WGI) [32].

The Household and Non-Financial-Corporation Credit Series have been obtained from the IMF Global Debt Database [33]; specifically, the HH_LS (Household and Non-Profit Organizations, Loans & Debt Securities % of GDP) and NFC_LS (Non-Financial Corporations, Loans & Debt Securities % of GDP) indicators. The Series covers the Countries of Albania, Bulgaria, Croatia, North Macedonia, Romania and Slovenia in this study and the time period for updates varies based on Country with either 2023 or 2024 being the latest available update year. Foreign-Bank Asset Share was derived from World Bank Global Financial Development Database (GFDD) indicator OI.16. OI.16 represents

the percentage of Bank Assets that are held by Foreign Banks. Where coverage exists for GFDD.OI.16 (which ended at 2013 in almost all Countries), the Series has been extended using Anchor Values extracted from the European Bank for Reconstruction and Development (EBRD) Transition Reports (2013 edition, 2019 edition, 2023 edition) and National Central-Bank Bulletins.

Three characteristics of the underlying variable support the legitimacy of using this method. Firstly, ownership percentages represent structural, low-frequency data. The frequency of such data is characterized by discrete privatization and merger events; and except for these discrete events, it does not vary much over time. As a result, linear interpolation will introduce very little error when interpolating between measured anchor points compared to the error due to year-to-year random fluctuations in a survey-based series. Secondly, the identifying variation used by Model 3 can mainly be attributed to the significant cross-country variability in ownership percentages (between approximately 13% and 100% of all assets), and the changes in depth of countries. It was less about changes in ownership from one year to another. Thirdly, the leave-one-country-out re-estimation tests presented in the Robustness section indicated that there were no individual country segments that could explain the results regarding the interaction of ownership. Therefore we recognize the interpolated part as a weakness: an annual survey based ownership series for the post-2013 period would enable estimating the interaction without smoothing out the variance, and the results for the level of foreign ownership should therefore be interpreted accordingly. As a direct check, we re-estimated Model 3 under fixed effects on the GFDD-covered years only (2001–2013, $N = 105$), where no observation is interpolated. Neither the level term ($+0.016$, $p = 0.62$) nor the interaction ($+0.047$, $p = 0.51$) is significant on this shorter window and the interaction changes sign; the depth-contingent pattern therefore cannot be confirmed on the unsmoothed segment alone, and the dynamic estimator cannot be run credibly on thirteen years of ten countries. H2b accordingly rests on the full-window system-GMM estimates, and we read the ownership results as the least robust of the three channels.

Estimation Strategy

Primary Specification — Two-Way Fixed Effects

The primary specification is the two-way fixed-effects within estimator with cluster-robust standard errors at the country level. With only ten cross-sectional units the asymptotic argument for system GMM is weak [21]; the fixed-effects estimator is simpler to interpret, and robust to the key concern in this panel time-invariant country heterogeneity and global time shocks. The two-way specification absorbs both country-specific level differences and common shocks such as the 2008 global financial crisis, the sovereign-debt crisis of 2011-2012 and the COVID-19 recession.

Dynamic Specification — System and Difference GMM

Two-step System GMM (with Windmeijer correction for the standard error [28], and collapsed instruments [21]) is used to estimate the dynamic specification. In each specification, we treat a time-series variable of interest and a time-series variable for

financial depth as endogenously correlated variables that are instrumented with their lags and first-differences. We also use inflation, government expenditure, trade openness and rule of law as exogenously related variables and include these as part of our instrument set. Our instrument set consists of the maximum possible lag term of 2 (and no higher) in order to avoid over-specifying the model by including too many instrument terms and violating the rule of thumb safeguard against instrument proliferation emphasized in [21]. Difference GMM is reported as a robustness specification because it drops the level moment conditions and is a more conservative estimator in short panels.

Estimating Thresholds

In order to assess how the relationship between Private Credit (H1) and GDP Growth Rate may be non-linear, we use a second method, namely a Hansen [40] fixed effects panel threshold model that estimates an endogenous threshold. In this model, Private Credit is both the threshold variable and the regime dependent explanatory variable. The model splits the credit slope into two regimes at an endogenously determined threshold γ . Both regimes include the same control variables. The no-rejection area for the concentrated likelihood ratio-statistic provides the value of the threshold and its corresponding confidence intervals [29]. We test for the presence of a threshold using a heteroskedasticity-consistent bootstrap. By allowing the data to determine where the turning point occurs, and whether or not one split is enough, we avoid making modeling assumptions. Currently there does not exist any package that will perform all three aspects of the Hansen [40] methodology with country-clustered inference, so we have written our own routine and provided the code within the supplemental material. Dynamic and endogenous-regressor extensions of the threshold model [41] lie beyond what a ten-country cross-section can support and are left for future work.

The threshold specification in equation form

The Hansen fixed-effects panel threshold model estimated in Table 3 takes the form

$$g_{it} = \alpha_i + \lambda_t + \beta_1 F_{it} \cdot I(F_{it} \leq \gamma) + \beta_2 F_{it} \cdot I(F_{it} > \gamma) + \theta' X_{it} + \varepsilon_{it}, \quad (3)$$

where $I(\cdot)$ is the indicator function, F_{it} is private credit relative to GDP acting as both threshold and regime-dependent variable, X_{it} is the control vector (inflation, government expenditure, trade openness, rule of law), and α_i and λ_t are country and year effects. The threshold γ is estimated by concentrated least squares over a grid of observed values of F after trimming ten per cent at each end; β_1 and β_2 are the regime-specific slopes. H1a is the joint statement $\beta_1 > 0$ and $\beta_2 \approx 0$, tested by the bootstrap F_1 statistic for the existence of a threshold and by the regime slopes; H1b is the statement that the confidence interval for γ lies below 80 per cent of GDP.

The Ownership and Composition Specifications in Equation Form

The ownership model of Table 2 (Model 3) is

$$g_{it} = \alpha_i + \lambda_t + \rho g_{i,t-1} + \beta F_{it} + \delta O_{it} + \varphi (O_{it} \times F_{it} / 100) + \theta' X_{it} + \varepsilon_{it}, \quad (4)$$

where O_{it} is the foreign-owned share of banking-sector assets in per cent and the lagged dependent variable is present in the dynamic (GMM) estimates only. The marginal

effect of foreign ownership at a given level of depth is $\partial g/\partial O = \delta + \varphi F/100$, with standard errors obtained by the delta method from the estimated covariance of δ and φ ; the depth at which the marginal effect changes sign is $F^* = -100 \delta/\varphi$. H2a is $\delta < 0$ and H2b is $\varphi > 0$ with F^* inside the observed range of credit depth.

The composition model (Model 4) replaces aggregate credit with its household and corporate components:

$$g_{it} = \alpha_i + \lambda_t + \rho g_{it-1} + \beta^H H_{it} + \beta^C C_{it} + \theta' X_{it} + \varepsilon_{it}, \quad (5)$$

with H_{it} and C_{it} the IMF GDD household and non-financial-corporate credit ratios. H3a is $\beta^H \leq 0$, H3b is the ordering $\beta^C > \beta^H$, and H3c is tested by re-estimating equation (5) on the 2009–2024 window.

Post-Estimation Diagnostics

Each of our specifications were tested with the Arellano-Bond tests for first-order and second-order serial correlation in the residuals from differencing and the Hansen test for overidentification. Our main concern was to evaluate the validity of using lagged values of variables two periods prior as instruments. Although the Hansen test is provided it is recognized by [21] that it lacks the statistical power required for testing at sample sizes such as $N=10$, particularly in the case of our six-country model 4 subsample, and therefore should be viewed with caution. Additionally, in all cases we present results based upon the fixed-effects methodology as our preferred method of analysis and results obtained through the generalized method of moments (GMM) as a supplemental method to provide estimates that take into account the dynamics of our data.

We use three additional diagnostic tools to assess the panel's time-series properties, dependence and collinearity: Maddala-Wu Fisher-ADF panel unit-root tests, the Pesaran CD test and variance inflation factors. Full statistics for these diagnostics can be found in Appendix B. The Maddala-Wu Fisher-ADF tests reject the null hypothesis of unit roots for all variables except trade openness ($p = 0.073$). Trade openness is found to have been stationary in first differences ($p < 0.001$). Because of this, the growth specification does not raise spurious-regression concerns. The Pesaran CD test finds the anticipated large amount of commonality among the raw private-credit observations ($CD = +14.78$). On the other hand, when we run the CD test on the residuals from the two-way fixed-effects baseline we find that the test statistic decreases significantly (-3.51). This decrease indicates that most of the commonalities that existed in the original private credit data were absorbed by the inclusion of year dummies. However, there still exists a small degree of dependence in the residuals ($p < 0.001$), although this small dependence should be taken into consideration along with our small- N caveats. Lastly, variance inflation factors for all of the Model 1 independent variables are all at or below 2.0. In addition, as might be expected given their construction, the credit and credit squared variables included in Model 2 have high VIFs (>15) and show significant collinearity (pairwise correlation = 0.964). However, as mentioned earlier, this issue is superseded by the threshold specification in Table 3.

Robustness Design

In addition to the post-crisis subsamples and the difference-GMM re-estimation of the original design, this section provides three sensitivity analyses, all using the two-way fixed-effects estimator to which we assign primary weight. Firstly, the LOCO (leave one country out) approach provides an additional analysis by providing estimates of models 1 through 3 and the threshold model for each of the 10 nine-country panels, and model 4 for each of the six five-country panels. Secondly, we divide our sample into EU member states (Bulgaria, Croatia, Romania, Slovenia) and non-member countries (Albania, Bosnia-Herzegovina, Kosovo, North-Macedonia, Montenegro, Serbia). We then estimate models 1 and 2 for each of these groups. The cluster-based estimations of both models have only four and six clusters respectively; therefore, the use of dynamic estimators was not possible, and thus our clustered estimation can only be considered indicative. Lastly, we replace our dependent variable with real GDP per capita growth. This is created by subtracting from real GDP growth, population growth (World Bank WDI, SP.POP.GROW [31]), since the region experienced sustained emigration throughout the period analysed.

EMPIRICAL RESULTS

Descriptive Statistics

Table 1 reports pooled summary statistics for the analysis sample (2001-2024, 218 country-years for the ten-country main specifications and 124 country-years for the six-country Model 4 subsample). Average annual GDP growth is 3.2 per cent with a standard deviation of 3.6. Private credit to GDP averages 42.1 per cent, ranging from 6.0 per cent (Albania, 2001) to 86.4 per cent (Montenegro, 2008). On the IMF GDD subsample, household credit averages 20.1 per cent of GDP and non-financial-corporate credit 52.1 per cent. Foreign-owned banks account on average for 74.3 per cent of banking-sector assets across country-years, ranging from 13 per cent (Serbia, 2001) to 100 per cent (Montenegro, 2010).

The considerable within-country variation in the financial-depth and credit-composition variables is encouraging for a fixed-effects identification strategy.

Table 1. Descriptive Statistics, Extended Balkans Panel 2001-2024

Variable	N	Mean	S.D.	Min	Max
GDP growth (annual %)	218	3.21	3.55	-14.99	13.05
Private credit / GDP (%)	218	42.13	15.96	5.99	86.45
Household credit / GDP (%)	124	20.12	9.35	0.97	41.47
Corporate credit / GDP (%)	124	52.08	30.52	7.46	120.74
Foreign bank share (%)	215	74.30	17.73	13.00	100.00
Inflation, winsor. (%)	218	4.29	6.92	-1.61	80.74
Gov. expenditure / GDP (%)	218	38.51	7.06	26.62	57.73
Trade openness / GDP (%)	218	97.92	26.13	51.93	186.22
Rule of law (WGI)	218	-0.09	0.46	-1.09	1.09

Main Specifications

Table 2 presents the four specifications estimated by both the two-way fixed-effects within estimator ("FE" columns) and the two-step system GMM estimator with collapsed instruments and Windmeijer-corrected standard errors ("GMM" columns). Lagged growth is treated as endogenous in every GMM specification; the financial-depth regressor of interest is likewise instrumented with its own lagged levels and differences. With collapsed instruments and a lag cap of two, the instrument count is 9, 11 and 12 in the ten-country system-GMM specifications and 11 in the six-country Model 4 (7 under difference GMM), of the same order as the number of cross-sectional units and, in three cases, above it. This is the unavoidable cost of instrumenting two or three endogenous regressors in a panel of ten units; it is one reason the Hansen test has little power here, and it is why two-way fixed effects carries the principal weight while the GMM estimates serve as a dynamic cross-check. The AR(2) diagnostics do not suggest instrument misspecification in any of the four models.

Table 2. Main Specifications — Two-Way FE And Two-Step System GMM.

Variable	M1 FE	M1 GMM	M2 FE	M2 GMM	M3 FE	M3 GMM	M4 FE	M4 GMM
L. GDP growth		-0.107 (0.131)		-0.228* (0.131)		-0.090 (0.149)		-0.048 (0.108)
Private credit	-0.027 (0.021)	0.084 (0.104)	0.116 (0.073)	-0.380** (0.158)	-0.007 (0.035)	-1.249* (0.754)		
Private credit ²			-0.001** (0.001)	0.004*** (0.001)				
Foreign bank share					0.031 (0.033)	-1.191** (0.546)		
Foreign × credit					-0.070* (0.041)	2.433* (1.347)		
Household credit							-0.067 (0.068)	-0.104 (0.680)
Corporate credit							-0.035** (0.016)	0.062** (0.030)
Inflation	-0.037 (0.038)	0.247** (0.104)	-0.048 (0.034)	0.104 (0.063)	-0.014 (0.034)	0.326** (0.134)	0.029 (0.077)	0.281 (0.226)
Gov. expenditure	-0.230*** (0.067)	-0.327 (0.199)	-0.240*** (0.061)	-0.410 (0.338)	-0.287*** (0.081)	-0.738* (0.411)	-0.265* (0.151)	-0.055 (0.250)
Trade openness	0.038** (0.015)	0.006 (0.043)	0.039*** (0.012)	0.046 (0.102)	0.052*** (0.013)	-0.073 (0.076)	0.029 (0.021)	0.027 (0.052)
Rule of law	-2.261 (1.962)	0.788 (1.724)	-1.847 (1.630)	-0.174 (4.800)	-0.806 (1.368)	7.436 (7.622)	0.677 (1.640)	-0.006 (0.049)
N	218	198	218	198	215	195	124	112
Countries	10	10	10	10	10	10	6	6
Instruments	—	9	—	11	—	12	—	11
Hansen p	—	0.065	—	0.164	—	0.888	—	1.000
AR(2) p	—	0.982	—	0.092	—	0.122	—	0.165

Notes: Dependent variable: annual GDP growth (%). Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. FE = two-way country and year fixed effects with cluster-robust SE; GMM = two-step system GMM with collapsed instruments and Windmeijer-corrected SE. Model 4 uses the six-country IMF-GDD subsample.

Model 1. Baseline Finance-Depth Model

The baseline model provides a reference to understand how finance affects growth at the national level. It estimates the relationship between GDP growth rate and its lag; private credit/GDP ratio; and the base case controls. In a two-way fixed effect (FE) regression, the coefficients for private credit are both negative (-0.027) and not significant ($p = 0.201$). Similarly in System Generalized Method of Moments (GMM), the coefficients for private credit are positive (0.084) and not significant ($p = 0.415$). Both tests for serial correlation indicate that there is no second order serial correlation (AR(2)) ($p = 0.982$) or any issues with the Hansen test ($p = 0.065$), although due to the low number of cross-sectional observations ($n = 10$) we consider the latter p-value inconclusive. We interpret these results as indicating that after controlling for lagged values of growth rates and removing individual and time effects, there appears to be little to no empirical evidence of a broad-based finance led growth process. This result supports previous studies by [4, 24]. This result serves as a reminder that the average coefficient of private credit does not distinguish between productive lending and unproductive lending. As such, it represents an inappropriate metric to summarize the impact of financial development on economic growth.

Model 2. Non-linearity (H1)

To test for non-linearity, Model 2 augments the baseline with a squared private-credit term. The two-way FE estimator returns a positive but insignificant linear coefficient (+0.116, $p=0.113$) together with a negative and significant quadratic coefficient (-0.0013, $p=0.028$), which is consistent with an inverted-U. The two-step system GMM estimator on the other hand returns a significantly negative linear coefficient (-0.380, $p=0.016$) and a significantly positive quadratic one (+0.0038, $p=0.006$). Although the signs of the coefficients suggest a U-shaped curve instead of an inverted-U shaped curve when using the system GMM estimator, we still reject the null of linearity in favour of a non-linear relationship. The Hansen test ($p=0.164$) and the AR(2) test ($p=0.092$) are both within the conventional tolerance range, indicating no serious violation of the assumptions underlying these estimation techniques. In fact, in comparison to previous studies of this nature that were unable to detect non-linearity among regions [27], our study presents the first empirical evidence of non-linearity among an extended group of Balkan countries and thus provides support for Hypothesis 1.

In addition to estimating the non-linearity among the private-credit variable and economic growth by means of a quadratic function, we can use the Hansen [40] panel threshold model presented in the Methodology to obtain an estimate of the turning point at which private credit begins to cease contributing to economic growth. This model allows us to determine whether there exists a unique turning point where credit stops generating growth. The results of this model appear in Table 3. They show that the estimated value of the turning point is equal to approximately 55.2% of GDP, with a 95% confidence interval of {53.1%, 59.1%}. Additionally, based upon a heteroscedasticity-consistent bootstrap (with 1,000 replications) we reject the null hypothesis that there is no turning point at which

private credit begins to stop contributing to economic growth (the F-statistic equals 18.46 and its p-value equals 0.009), whereas based on a second bootstrap (with 500 replications) we fail to reject the null hypothesis that there is only one turning point (the F-statistic equals 8.98 and its p-value equals 0.246).

Below the threshold an additional percentage point of private credit generates +0.044 points of economic growth (standard error: 0.028), while above it the credit-growth slope collapses to +0.002 (standard error: 0.020). Thus, private credit's contribution to economic growth virtually disappears at a level of credit far lower than that found for developed economies. The estimated threshold is roughly consistent with those derived from the quadratic functions in Table 2 (approximately 44.6% under FE and approximately 48–50% under System GMM), which strengthens the interpretation of H1. There are however two caveats: only about 29 out of 218 country-years fall into the upper regime (i.e., concentrated in Slovenia, Croatia, Montenegro and Bulgaria during the 2006–14 credit boom) so that the upper-regime coefficient is very poorly identified; and due to having only ten cross-sections the Hansen asymptotics are approximations, hence the bootstrap-based inference should be regarded as indicative, rather than definitive, of too much finance in the region.

Most importantly, the threshold estimates reconcile what appears to be an inconsistent sign between the FE inverted-U and system-GMM quadratic relationships: a positive slope in the relationship for values of private credit below approximately 55% of GDP, which then flattens out at zero, is consistent with the FE inverted-U, while indicating that the observed negative linear/positive quadratic relationship using GMM represents a limited range of values (and the relatively small sample size) for the few countries that are actually above this threshold, rather than a true U-shape over the range of the data.

Table 3. Hansen Panel Threshold Regression [40]

	Coef.	SE	p
Threshold $\hat{\gamma}$ (% of GDP)	55.19	—	—
95% CI for $\hat{\gamma}$	{53.11, 59.14}	—	—
Regime 1 (credit $\leq \hat{\gamma}$): credit slope β_1	+0.044	0.028	0.123
Regime 2 (credit $> \hat{\gamma}$): credit slope β_2	+0.002	0.020	0.909
F ₁ : single threshold vs. linear (B=1,000)	18.46	—	0.009
F ₂ : double vs. single threshold (B=500)	8.98	—	0.246
Observations / countries	218 / 10	—	—
Obs. below / above $\hat{\gamma}$	189 / 29	—	—

Notes: Dependent variable: annual GDP growth (%). Both regimes include the full control set and country/year fixed effects; SEs clustered by country. Implied quadratic turning points from Table 2: FE 44.6%, system GMM $\approx$ 48–50% of GDP.

Threshold Behavior

The figure 2 shows the likelihood ratio statistic $LR(\gamma)$ plotted against a trimmed grid of possible threshold values (candidates). The likelihood ratio statistic is flat and high over the 25–50 percent range for all candidate values; it then rapidly falls as candidate values approach the estimate; reaches zero when the candidate equals $\gamma^* = 55.2$ percent; and then increases again when candidate values exceed 59 percent. The shaded area, where $LR(\gamma)$ lies below the 7.35 critical value, is the 95 percent confidence interval for the threshold, [53.1%, 59.1%]. Its narrowness reflects the steepness of the profile rather than a large upper regime: only 29 observations lie above the threshold, and they

remain the binding limit on how precisely the upper-regime slope can be estimated. These 29 observations are Slovenia 2006–2013 (8), Bulgaria 2007–2014 (8), Croatia 2012–2017 and 2020 (7), Montenegro 2007–2011 (5) and Kosovo 2024 (1) (Appendix C, Table C2); roughly two-thirds belong to the pre-crisis booms and their aftermath in Slovenia, Bulgaria and Montenegro, but Croatia contributes seven post-2012 years of high depth without a boom, so the upper regime is not solely a 2008 artefact.

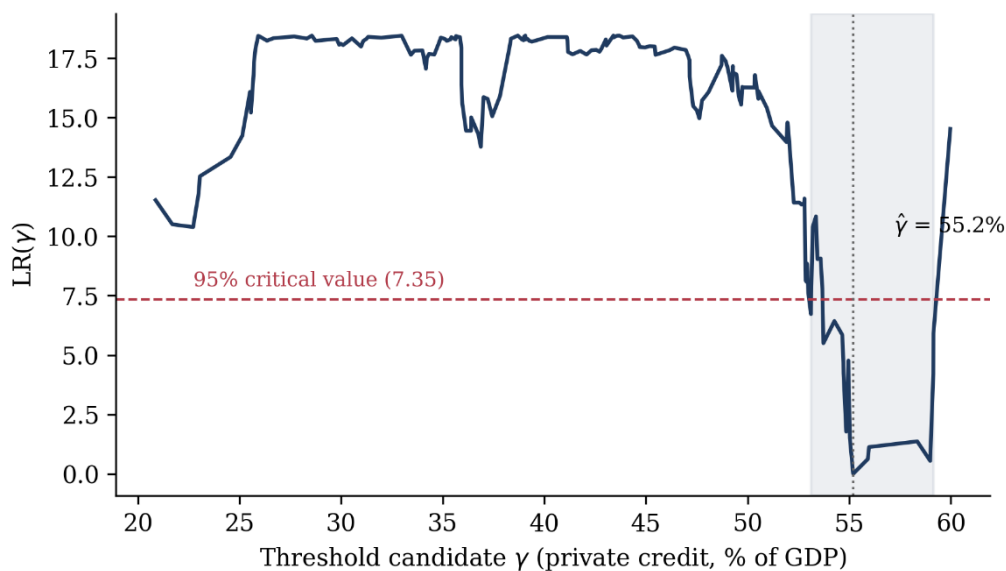


Figure 2. Likelihood-Ratio Profile $LR(\gamma)$ of the Hansen Threshold Model Across Candidate Thresholds. Dashed Line: 95% Critical Value (7.35); Shaded Band: The Implied 95% Confidence Interval for γ ; Dotted Line: $\hat{\gamma} = 55.2\%$ of GDP.

Model 3. Foreign Ownership (H2)

Hypothesis 2 is extended by assuming that the marginal growth contribution of private credit depends on the foreign ownership share of the banking sector. The specification incorporates foreign-bank asset shares and a foreign $\times$ credit interaction term (foreign-share $\times$ private-credit/100) into the baseline model. The foreign $\times$ credit interaction is negative and marginally significant (-0.070 ; $p=0.085$) in the two-way FE estimate indicating that higher foreign ownership is associated with a lower marginal growth contribution of credit. The system GMM estimate is consistent with the ownership channel. The level effect of foreign ownership is negative and statistically significant (-1.191 ; $p=0.029$), while the foreign $\times$ credit interaction is positive and marginally significant ($+2.433$; $p=0.071$). Taken together, our results indicate that foreign ownership is negatively associated with economic growth, but that this association weakens, and potentially more than offset, when the private-credit-to-GDP-ratio increases. The Hansen test ($p=0.888$) and the AR(2) test ($p=0.122$) comfortably accept the over-identification and no-autocorrelation null hypotheses. Together, the Model 3 estimates provide quantitative support for H2 in its modified version: there does not exist a one-sided relationship between foreign ownership

and economic growth but rather an interactive relationship based on the credit-depth of countries, a finding consistent with the dual cycle-hypothesis presented in [6, 7].

Marginal Effect of Foreign Ownership by Depth

The marginal effect of foreign ownership varies according to the level of credit depth. Because Model 3 includes foreign ownership as both a direct and an interactive term, these terms cannot be interpreted separately. In order to assess the marginal effect of foreign ownership we use the fixed effects estimate of $\partial g / \partial O = \delta + \varphi F / 100$ at different levels of credit depth and present delta method confidence intervals for those estimates; also, in Figure 3 we present a complete trace of the marginal effect. The marginal effect is positive but small at lower levels of credit depth, falls with increasing credit depth and appears to cross zero at approximately 44 percent of GDP; by the estimated threshold of 55 percent of GDP the marginal effect has become negative, and reaches a magnitude of approximately -0.02 growth points per percentage point of foreign ownership at a level of 70 percent of GDP. As would be expected from estimating an interaction term using data from only ten countries, the confidence interval bands are quite large and contain zero over the entire range of credit depth where data were observed (Table 4). However, the system GMM estimates presented in Table 2, which are the statistically stronger estimates, indicate the opposite gradient: the marginal effect of foreign ownership is negative at low levels of credit depth but increases with greater depth and becomes positive near 49 percent of GDP.

Table 4. Marginal Effect of the Foreign-Owned Share of Banking Assets on GDP Growth at Selected Levels of Credit Depth (Two-Way FE, Model 3; Delta-Method 95% Confidence Intervals).

Private credit (% of GDP)	Marginal effect $\partial g / \partial O$	95% CI
20	+0.017	{-0.038, +0.072}
30	+0.010	{-0.039, +0.059}
40	+0.003	{-0.041, +0.046}
44.1 (crossover)	0.000	—
50	-0.004	{-0.043, +0.035}
55.2 (γ)	-0.008	{-0.045, +0.030}
60	-0.011	{-0.047, +0.025}
70	-0.018	{-0.053, +0.017}

Therefore, although they both find that there exists some level of credit depth beyond which the marginal effect of foreign ownership will change signs, the two estimation methods do not concur on the direction of that effect. The GMM marginal effect profile, which accounts for past growth rates and instruments the interaction term, is consistent with hypotheses H2a and H2b (i.e., $\delta < 0$, $\varphi > 0$), and consistent with the discussion section's development of a depth contingent interpretation of foreign ownership's impact. The fixed effects marginal effect profile should be viewed as providing an estimate of the

simultaneous within country association between foreign ownership and economic growth at each level of credit depth. Because the difference between the two profiles provides insight into how sensitive estimates of the size of the effect are relative to the robust finding that foreign ownership's marginal effect will turn around somewhere in the observed range of credit depth, we provide estimates for both.

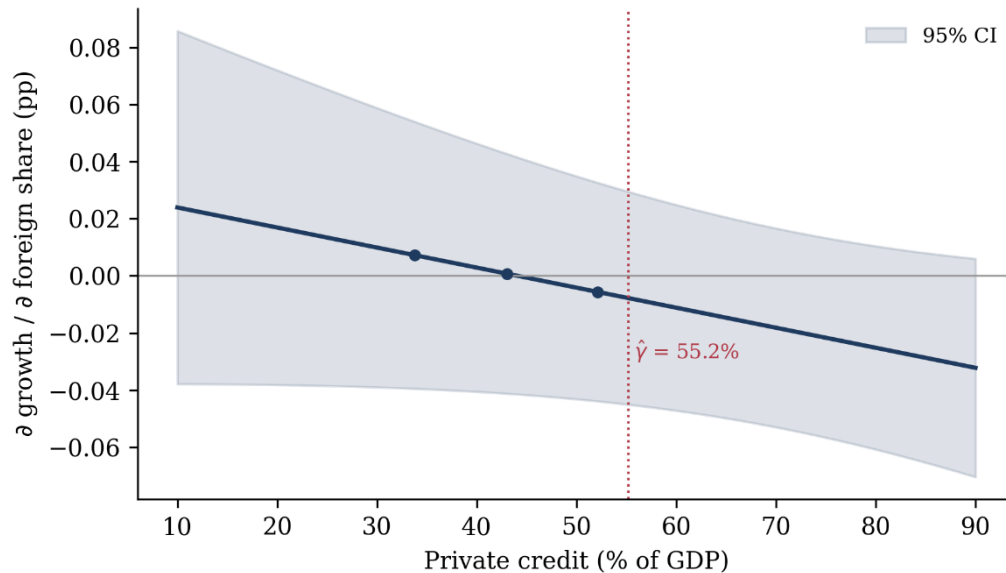


Figure 3. Marginal Effect of Foreign Bank Ownership on Growth as a Function of Private Credit Depth (two-way FE, Model 3). Shaded Area: Delta-Method 95% Confidence Band; Dots: Sample Quartiles of Credit Depth; Dotted Line: $\hat{\gamma} = 55.2\%$.

Model 4. Credit Allocation (H3)

Hypothesis 3 is to substitute for total private credit using the loan splits provided by the IMF's Global Debt Database Series, HH_LS and NFC_LS. The IMF GDD includes data from only a few of our sample countries (ALB, BGR, HRV, MKD, ROU, SVN) so Model 4 can only be run on these countries (System GMM N = 112; FE N = 124). The two-way FE produces a negative coefficient on household credit that is not statistically significant (-0.067; $p=0.323$) and a negative coefficient on corporate credit that is statistically significant (-0.035; $p=0.033$). The two-stage system GMM estimation technique provides a large but poorly estimated coefficient for household credit (-0.104; $p=0.878$) and a relatively small positive coefficient for corporate credit that is statistically significant (0.062; $p=0.038$). The Hansen statistic and AR(2) statistic are well within acceptable limits (AR(2): $p=0.165$); the reported Hansen $\chi^2(3) \approx 0$ represents the very low number of countries included in the analysis and should not be interpreted as a separate measure of confidence. Because of this, we assign most weight to the fixed-effect outcome and to the difference-GMM specification reported in the robustness section which indicates large and highly significant coefficients in the expected asymmetric directions.

Together, these findings represent an asymmetric credit-composition mechanism operating in the extended Balkans: controlling for country and time dummies; inflation rates; fiscal sizes; trade openness measures; institutional-quality indicators; household debt corresponds with lower GDP-growth while corporate debt corresponds with either unchanged or improved GDP-growth. The results presented above are similar to the research based on cross-country data that have been documented in [8, 24]. Additionally, they can be explained through a number of other sources (narrative) which discuss the region; a large proportion of new loans extended to households in all three countries, namely Bulgaria, Romania and Croatia, for at least the past decade were mortgages, consumer lending or foreign currency denominated household lending. In addition, much of these types of lending was funded by foreign parent bank funding that ceased after 2008. Overall, when evaluated together, Model 4 provides a way to interpret H3 as follows: there appears to be an asymmetric loan-composition mechanism within the region where household loans have a negative relationship with real GDP growth while corporate credit does not provide a positive premium in relation to the static FE coefficient.

Reconciling the Corporate-Credit Coefficients

The corporate credit coefficient is negatively and statistically significantly estimated by the fixed-effects model, whereas it is positively and statistically significantly estimated by the system GMM and difference GMM models. The reader would be justified in questioning which estimate to rely upon. Fortunately, there are two points of resolution for much of the remaining tension. First, H3 describes an order of the two credit types. That order is invariant: regardless of whether we examine all four of the regression estimates shown in Figure 4 or look at each individual estimate separately, the corporate credit coefficient always exceeds the household credit coefficient (-0.035 against -0.067 under fixed effects; $+0.062$ against -0.104 under system GMM; $+0.297$ against -0.767 under difference GMM; -0.056 against -0.118 in the post-crisis window).

Second, the two estimation techniques address fundamentally different questions. The within estimator uses the deviations in contemporaneous corporate credit from the national average, relative to the deviations in economic growth, when estimating the relationship between corporate credit and growth. In this region, some of the largest deviations in contemporaneous corporate credit were during the pre-2008 boom years, when banks extended large amounts of credit to construction and real estate developers. These loans were followed by sharp contractions and very high levels of non-performing loans. It was thus plausible that these historical experiences led to a negative contemporaneous association.

By contrast, the dynamic estimators use lagged values of growth and instrument the credit components with their own lags. As such, they isolate those aspects of corporate credit that are predetermined with respect to shocks to growth. Those predetermined aspects have been found to have a positive association with future growth.

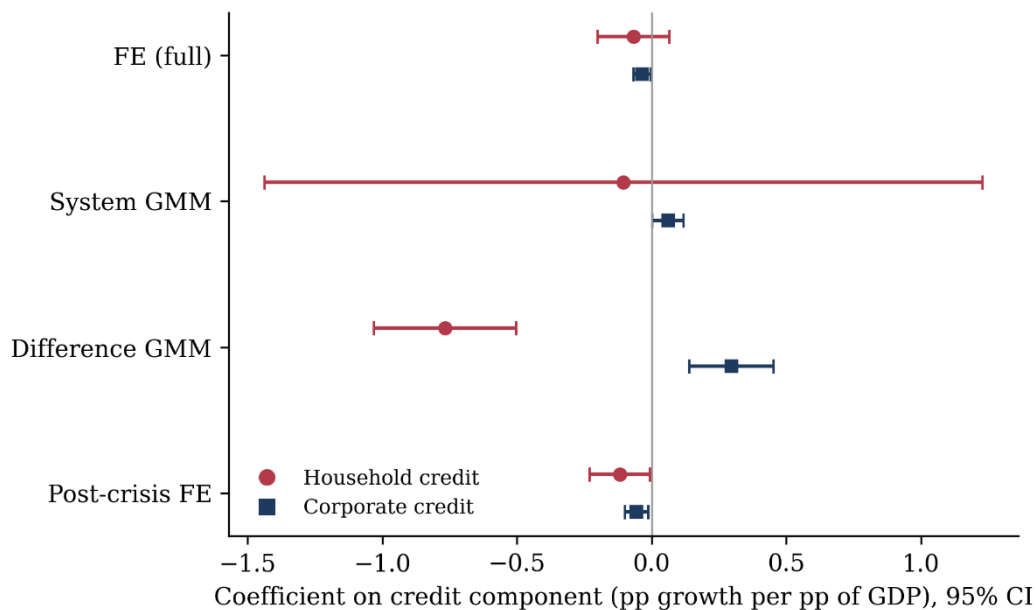


Figure 4. Household and Corporate Credit Coefficients Across Estimators and Windows (Model 4), With 95% Confidence Intervals. The Ordering $\beta^c > \beta^H$ Holds in Every Specification.

ROBUSTNESS

Robustness tests were applied to the key findings by performing two tests. First, the headline Models 1 and 4 were estimated over the post-2008 window that represents the time period when the credit cycle was at its strongest (in terms of relevance to our story). Second, we used two-step difference GMM estimation as an alternative method for estimating models 2, 3 and 4, rather than system GMM. Two-step difference GMM does not use the level moment conditions and is therefore generally less efficient (i.e. more conservative) than system GMM, particularly with shorter panel data sets. Results from these estimations can be found in Table 5.

Table 5. Robustness — Post-Crisis Subsamples and Difference GMM.

Variable	M1 FE 2009-24	M4 FE 2009-24 (6c)	M2 Diff GMM	M3 Diff GMM	M4 Diff GMM (6c)
Private credit	-0.042* (0.022)		-2.124* (1.158)	-1.085 (1.420)	
Private credit ²			0.020* (0.011)		
Foreign bank share				-0.652 (0.415)	
Foreign × credit				1.847 (1.310)	
Household credit		-0.118** (0.057)			-0.767*** (0.135)
Corporate credit		-0.056** (0.022)			0.297*** (0.080)

Inflation	-0.083 (0.060)	-0.163 (0.104)	0.082 (0.108)	0.118 (0.137)	-0.226** (0.113)
Gov. expenditure	-0.266*** (0.092)	-0.184 (0.164)	-0.601* (0.327)	-0.408 (0.375)	-0.495*** (0.171)
Trade openness	0.038* (0.020)	0.045* (0.022)	0.281*** (0.074)	0.132** (0.066)	0.242*** (0.015)
Rule of law	-0.912 (2.080)	4.203 (2.618)			0.001 (0.003)
N	157	93	188	185	112

Notes: Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. FE = two-way fixed effects with cluster-robust SE; Diff GMM = two-step difference GMM with collapsed instruments and Windmeijer-corrected SE. M4 columns use the six-country IMF-GDD subsample.

Post-Crisis Subsamples

The split sample at 2008 reveals that the headline results are mostly due to the post-crisis periods. For Model 1, the private-credit coefficient is negative and marginally significant on the post-crisis time frame (-0.042 , $p=0.057$), while it had been nonsignificant over the entire sample; this is in line with post-2008 deleveraging and then an adjustment in credit quality. For Model 4 over the six-country sample, the household-credit coefficient goes from being nonsignificant for the entire sample to be statistically significant for the post-crisis time frame (-0.118 , $p = 0.043$, $N = 93$), while the corporate-credit coefficient is negative and still significant (-0.056 , $p = 0.014$). The post-crisis fixed-effects estimate is, economically speaking, the most relevant policy-oriented specification: A one-percentage-point increase in the household-credit to GDP ratio is related to about 0.12 percentage points of less GDP growth in the next year, controlling for all other controls.

Difference GMM

Three key difference-GMM findings stand out. First, Model 2 under difference GMM also rejects the linear null: the credit coefficient is big and marginally significant (-2.124 , $p = 0.067$); the squared term is positive and marginally significant ($+0.020$, $p = 0.052$); these further reinforce the non-linear evidence found under System GMM. Second, Model 3 under difference GMM yields uninformative ownership coefficients (foreign -0.652 , $p = 0.116$; foreign $\times$ Credit $+1.847$, $p = 0.159$) which have the same sign as those estimated via system GMM but lack statistical significance, as would be expected given a reduction in the number of instruments. Third and most important, Model 4's credit composition asymmetry becomes particularly sharp under difference GMM: the household-credit coefficient is large and highly significant (-0.767 , $p < 0.001$) while the non-financial-corporate-credit coefficient is positive and highly significant ($+0.297$, $p < 0.001$). The AR(2) p-value for the Model 4 specification under difference GMM is 0.870, providing strong support for the null of no serial correlation. Over three estimators and two windows of time the asymmetry in Model 4 is preserved: household credit is negative and corporate credit is either neutral or even potentially growth-enhancing.

Leave-One-Country-Out Sensitivity

The coefficients from Models 1 – 3 and the thresholds estimated from ten additional estimations (each leaving out a single country) are presented in Table 6. The estimate of

the threshold is surprisingly consistent; γ^* is 55.2 percent in seven of the ten panels, and in no case does γ^* move outside the range of 54.9 – 59.0 percent. Also, in nine of ten cases, the implied "turning" point of the quadratic relationship falls between forty and forty-eight percent. In all ten panels, the credit term in Model 1 remained negative and statistically insignificant. For Model 3, the interaction term of ownership remained negative in every panel with values falling in the range of -0.05 through -0.11. Only one country was influential on a single parameter; when Montenegro was omitted, the country with the largest within-country variance in the upper regime owing to its credit peak of 86% of GDP in 2008 and the decline that followed, the positive slope below the threshold disappeared and the quadratic's turning point fell to an implausible twenty percent. While this would be damaging if we interpreted our results as definitive, it mainly tells us that the boom-and-bust experience of the deepest market in our sample provides much of the variation identifying the shape of the non-linear response, and it further supports our interpretation of the regime slopes as indicative.

Table 6. Leave-One-Country-Out Re-Estimates: Two-Way FE Coefficients of Models 1–3 And Hansen Threshold Estimates on Nine-Country Panels.

Omitted	M1 credit	M2 credit	M2 credit ²	Implied TP (%)	M3 O×F	$\hat{\gamma}$ (%)	β_1	β_2
None (full)	-0.027	+0.116	-0.00135	44.6	-0.070	55.19	+0.044	+0.002
Albania	-0.028	+0.117	-0.00136	43.2	-0.110	55.19	+0.042	+0.002
Bulgaria	-0.021	+0.085	-0.00100	42.4	-0.061	55.19	+0.042	+0.002
Bosnia and Herz.	-0.026	+0.101	-0.00119	42.4	-0.068	55.19	+0.042	+0.003
Croatia	-0.022	+0.110	-0.00125	44.0	-0.053	55.19	+0.044	+0.003
Kosovo	-0.018	+0.146	-0.00151	48.3	-0.071	58.98	+0.065	+0.018
North Macedonia	-0.021	+0.125	-0.00136	45.9	-0.060	55.19	+0.048	+0.008
Montenegro	-0.056	+0.033	-0.00084	19.8	-0.049	55.03	-0.008	-0.034
Romania	-0.031	+0.162	-0.00180	44.9	-0.071	55.19	+0.052	+0.003
Serbia	-0.031	+0.101	-0.00124	40.7	-0.072	55.19	+0.044	+0.001
Slovenia	-0.026	+0.146	-0.00171	42.9	-0.098	54.85	+0.059	+0.011

Appendix C reports the same exercise for Model 4 on five-country panels. The household coefficient keeps its negative sign in five of six panels and the corporate coefficient in all six, but with five clusters the significance of individual estimates moves freely; this is the expected behavior of a six-country subsample and is one more reason the paper rests H3 on the cross-estimator ordering rather than on any single p -value.

EU Members Versus Non-Members

The comparison of EU Member State participants versus those who are not also provides much more than simply a robustness test for our findings; it supports our finding of the existence of a threshold from a different perspective. The four EU Member States are at the top end of the depth distribution curve and have provided nearly all of the data points above the γ^* . In these EU Member States, the linear model's credit coefficient is

negative and precisely estimated (-0.061 , $p=0.002$). Both of the quadratic terms are individually insignificant, indicating that within this group of "deep" countries, there is no additional curvature, only a negative slope. In the six non-EU Member States, the linear coefficient is small and not statistically significant, but in the case of the quadratic specification, it does recover the inverted-U shape, with the negative second-order coefficient significant at $p=0.064$ and an implied turning point of approximately 45% of GDP, very close to the turning point found using the sample-wide quadratic specification, see Table 7. Therefore, each group identifies as best as their respective ranges of depth allow them to, the portion of the non-linearity indicated by equation (3) when the threshold exists. With only four and six clusters, however, the standard errors are indicative rather than reliable, and we do not attach weight to the significance levels themselves.

Table 7. Models 1 and 2 Re-Estimated by EU Membership (Two-Way FE, Country-Clustered Ses; Inference Indicative with Few Clusters).

Group	N (countries)	M1 credit (SE, p)	M2 credit (p)	M2 credit ² (p)	Implied TP
EU members: BGR, HRV, ROU, SVN	82 (4)	-0.061 (0.020, 0.002)	-0.171 (0.310)	$+0.00084$ (0.490)	n/a (outside range)
Non- members: ALB, BIH, KOS, MKD, MNE, SRB	136 (6)	-0.017 (0.025, 0.488)	$+0.126$ (0.231)	-0.00139 (0.064)	45.3%

Growth of GDP per Capita as the Dependent Variable

The region has lost population steadily through emigration, so headline growth and per-capita growth can diverge. Re-estimating the four models with real per-capita growth, constructed as real growth less population growth, does not weaken the paper's central result: the inverted-U of Model 2 becomes sharper, with both the linear and the squared credit terms significant ($+0.165$, $p=0.019$; -0.0016 , $p=0.006$) and an implied turning point of 50.5 per cent of GDP, closer to the threshold estimate than the headline-growth version, see Table 8.

Table 8. Two-Way FE Estimates with Real GDP-Per-Capita Growth as the Dependent Variable (N = 218; M4: N = 124).

Model	Coefficient(s), per-capita growth	p	Headline-growth counterpart
M1	credit -0.009	0.699	-0.027 (0.201)
M2	credit $+0.165$; credit ² -0.0016 ; TP 50.5%	0.019; 0.006	$+0.116$; -0.0013 ; TP 44.6%
M3	foreign $+0.020$; O×F -0.036	0.649; 0.566	$+0.031$; -0.070 (0.085)
M4	household -0.070 ; corporate -0.026	0.392; 0.093	-0.067 ; -0.035 (0.033)

The Model 1 coefficient remains insignificant. The ownership and composition coefficients keep their signs but lose significance under fixed effects (the interaction falls to -0.036 , $p=0.57$; the corporate term to -0.026 , $p=0.09$), which mirrors their pattern in the headline specification, where the statistically stronger evidence for H2 and H3 comes from the dynamic estimators rather than from fixed effects.

LIMITATIONS

There are five limits to what can be claimed about this research. The first limit concerns the identification of an impact. While our estimates are based on a fixed effects specification that incorporates internal instruments, there is no external instrument available as part of this study. Thus while these results may be considered robust conditional associations, they do not constitute identified causal effects. We therefore have been somewhat cautious in using causal terminology when referring to our empirical findings.

The second limitation relates to the small cross-section of the panel. Ten countries were included in the analysis, and only six of them were included in the estimation of Model 4. As such, the Hansen and Arellano-Bond diagnostic statistics had limited power. In particular, the Hansen p -value associated with the system GMM estimator for Model 4 was equal to one. This indicates a lack of statistical power and does not indicate a well-specified model. Furthermore, because of the limited number of countries included in the analysis, the clustered standard errors used to allow for heteroscedasticity across countries are also subject to some degree of sensitivity due to the small sample size. For example, while the corporate fixed-effect coefficients associated with the Model 4 equation are statistically significant at the 5 percent level when applying the small-sample correction for cluster-robust variance inflation, this significance disappears if alternative corrections for cluster-robust variance inflation are applied. Therefore, H3 rests on the cross-estimator ordering.

A third potential limitation of our approach concerns the relatively thin upper portion of the threshold model. While the position of the threshold is estimated with a high degree of precision, the only 29 observations above the estimated value of γ , concentrated in a few boom years, give very low precision concerning the slope of the relationship beyond the threshold. Moreover, we find through our leave-one-country-at-a-time exercise that the lower portion of the threshold model, i.e., the relationship before reaching the threshold value, appears to depend largely upon both the boom-and-bust episodes experienced by Montenegro.

The fourth potential limitation of our approach concerns our measurement of ownership. Specifically, after 2013 we interpolate between the ownership values provided by EBRD and those provided by national central banks. Moreover, a fixed-effects re-estimation on the GFDD-covered years alone (2001–2013) does not reproduce the interaction. As such, we view the estimated level effect of foreign ownership with some caution despite finding stability across all panels from our leave-one-country-at-a-time exercise for the interaction term.

The fifth is external validity: the parameters belong to a specific configuration of bank dominance, foreign ownership and institutional quality and should be generalised only to settings that share it.

DISCUSSION AND POLICY IMPLICATIONS

Interpreting the Findings in the Balkan Context

The empirical analysis reveals three key stylised results. First, there appears to be little robustly-positive linear relationship between total private-credit-to-GDP and economic growth in the extended-Balkans countries after controlling for fixed effects. But there is strong statistical evidence of a non-linear (threshold type) relationship between private credit and growth, supporting H1. Second, foreign bank ownership matters economically: it is associated with lower growth, but the size of this association decreases as credit depth increases. This supports a refined reading of H2: foreign ownership holds growth back at low levels of financial depth, and this negative effect fades and may even reverse as depth increases. Third, the credit-composition asymmetry of H3 is clearly evident in both windows (post crisis and difference GMM) of the six-country IMF-GDD subsample. Household credit shows a statistically significant negative association with growth, whereas non-financial corporate credit shows either no association or a positive one.

Taken as a whole, the overall evidence presented here qualifies the traditional aggregate-supply leading narrative for the area. The empirical results suggest that a large portion of household private credit allocation during the pre-crisis period went into the form of mortgage debt, consumer credit, and retail lending in foreign currencies on the household's balance sheet, rather than in corporate productive sectors. Also, the additional-growth contribution associated with each additional percentage point of private credit declines as credit depth increases. The subsequent post-2008 deleveraging led to reduced household consumption expenditures, increased levels of nonperforming household loans, and tightened regulatory standards on foreign parent banks by foreign banking authorities and regulators of those parent banks' home jurisdictions. These developments contributed to the severe recessions of 2009-2014 seen in several of the sample economies. In contrast to the traditional view of recessions being caused by shocks to aggregate supply in the corporate sector, these recessions are better understood as corrections of unsustainable accumulations of household debt, a global phenomenon widely documented by [8].

Reading the Estimates Against the State of the Art

The benchmarking table (Table 9) locates the paper in the literature; this subsection explains each difference it reveals rather than merely recording it.

The threshold and why it is lower. The global average thresholds of approximately 80% to 100% of GDP identified by [4] and similar ranges in developed countries found by [22] are much larger than our estimated threshold of 55%, which is outside the bounds of both. The theory provides three reasons why this might be the case. The first is related to

institutions. Global averages mask very different levels of contractual enforceability across developed economies, but the Extended Balkans' rule-of-law scores are clustered around the World Governance Indicators (WGI) mean of zero, and therefore the screening constraint operates earlier. The second is due to composition. Household credit accounts for nearly one-half of all private credit in the GDD sample, substantially above the shares reported by [4], and the results indicate that this is the component with the least growth-enhancing potential. Therefore, for a given level of total credit depth there is less productive lending. The third is based upon a boundary condition placed on the benchmark itself. In contrast to advanced-economy thresholds that are identified from within-country movements in deep, diversified financial systems, we identify the upper-regime of our model from a group of banks dominated systems characterized by a handful of boom episodes. The EU/non-EU distinction made in the Robustness section has the negative slope among the deeper members and the inverted U shape among the shallower non-members and this is consistent with the predictions of the first two. We do not suggest that the threshold is a structural feature of the region; instead, it has been provided an estimate of where, in this panel and time period, the average product of credit stopped rising.

Table 9. Positioning Relative to the State of the Art

Study	Data / scope	Method	Key finding	This paper's contribution
[4]	Cross-country	GMM, quadratic	Threshold $\approx 80\text{--}100\%$ credit/GDP	Lower threshold ($\approx 55\%$) for a weaker-institution region
[36]	177 studies (meta)	Meta-regression	Small, genuine positive effect, mildly declining	Region-specific evidence on why the average is weak
[38]	European EMs vs. advanced (meta)	Comparative meta	Effect smaller in European emerging markets	Identifies ownership and allocation mediators behind it
[8]	30 advanced/emerging	Panel	Household debt predicts lower future growth	Confirms asymmetry in a foreign-owned, post-transition setting
[35]	54 economies	Panel ARDL	Household-debt drag above $\approx 70\%$; long-run coef ≈ -0.1	Household coefficient (-0.12 post-crisis) aligns closely
[24]	Cross-country	Panel	Enterprise credit growth-enhancing, household not	Replicates split using authoritative IMF-GDD data
[27, 39]	CESEE / W. Balkans	GMM / FE	Positive deepening effect; no non-linearity	First threshold and ownership $\times$ allocation test for the region

Household Credit and Demand-Side Literature. Authors in [8] present evidence that increases in household debt led to decreases in future economic activity three to four years down the road. The study in [35] report that long run effects of household debt were negative (-0.10), although the size of the drag increased beyond a threshold of 70 percent of GDP. Our post crisis estimate of a household credit effect of -0.12 is very close to the long run estimate of [35]; however, our estimate exhibits a marked increase in magnitude beginning in 2008 which is consistent with their prediction of a non-linear relationship between household debt and future economic activity. There are significant differences in terms of time horizons and thresholds, however. Our estimation strategy employs a contemporaneous to one lag specification as opposed to multi year ahead specifications employed by [8, 35]. Also, our measures of household credit relative to GDP (average = 20%) are significantly below the 70% of GDP at which [35] note that the drag becomes extreme. However, it appears to us that such negative effects exist at relatively low levels of household credit as a consequence of compositional effects: i.e., household credit in the region consists primarily of foreign currency borrowing for consumption and housing with short maturities; thus, the debt service burden per dollar borrowed is greater than would be experienced in mature mortgage markets that constitute most of the samples used in [8, 35]. This is an interpretation consistent with our evidence, not a result the data establish on their own.

Corporate Credit and Enterprise-Credit Literature. The study in [24] report that enterprise credit is positively correlated with future economic activity while household credit is not. While our Difference GMM estimates produce this asymmetric relationship with an especially wide gap, our static estimate for corporate credit indicates that it is negatively correlated with economic activity. As argued in the Results section, the two represent the contemporaneous cost of sectoral booms vs. the growth enhancing characteristics of pre-determined corporate lending. A consistent representation of both [24] and our estimates is that whether or not firm-specific enterprise credit has value added content depends on what firms use it to fund; and if firms fund development/real estate projects during times when sectoral booms occur in those areas, then the enterprise-credit premium may disappear temporarily.

Average Effect and Meta-Analytical Evidence. The meta-analyses by [36, 37] conclude that average finance effects are small and decreasing globally. Additionally, authors in [38] find that average finance effects are smaller in European Emerging Markets. Model 1 replicates this small average finance effect for the region. Models 2 through 4 demonstrate how this average effect is small: i.e., a positive contribution below the threshold and none above it; a negative ownership term offset by a positive interaction; and a negative household term offset by a less negative or positive corporate term. The reason that the overall average effect is small is because it averages across channels that work against each other (not because finance doesn't matter). This decomposition is the paper's contribution to a stylised fact those studies document but cannot, by construction, explain.

The regional studies. Earlier studies found weak positive or insignificant aggregate effects from shorter panels ending around the crisis years, for the region [27, 39] as well as for the larger CEE group [26]. Our aggregate findings are compatible with these earlier studies. However, the longer panel used herein includes the ten years after the crisis when the household channel was apparent. In addition, we decomposed the data, something that none of the other studies attempted. When there were earlier studies finding a positive aggregate effect, the positive estimate was based upon estimating using only the pre-2008 years that made up the lower threshold regime of our study's data set.

Alternative Explanations and Boundary Conditions

There are three possible interpretations of our findings that warrant explicit consideration. The first is reverse causality of a demand-following type [12], i.e., the expectation of future economic growth causes credit expansion and the nonlinearities reflect the timing of booms. Our dynamic estimators instrument credit by its lagged values, and the post-crisis subsample removes the boom years. Nonetheless, any internally designed instrumental variable will be unable to remove anticipatory lending. Second, a crisis-attribution account would hold that both the threshold and the household drag are artifacts of 2008–2009. The leave-one-country-out and per capita analyses reduce this risk of misattribution without completely removing it: the quadratic sharpens in per capita terms, and the EU members show a downward sloping relationship across all years in the window rather than only in the crisis years. Third, selection: foreign banks may have entered the weakest banking systems [7]. Country fixed effects control for time-invariant selection, however time-varying selection is not accounted for in this analysis. One reason that the ownership channel is presented as an association and not as an identified effect is due to this limitation. These limitations also define the boundaries of what the results represent. The results represent small, open economies with predominantly euroized currencies, bank dominated financial systems, foreign owned banks, weak-to-moderate enforcement institutions, and a credit cycle that peaked in 2008, and they should travel only to settings that share those features: in market-based systems the higher global thresholds are the relevant benchmark, in domestically owned systems the ownership channel has no counterpart, and where household credit is long-maturity domestic-currency mortgage lending the demand-side drag should appear at the higher ratios of [35]. The thresholds and coefficients reported here are parameters of a setting, not constants.

Implications for Finance-Growth Theory

Three analytical implications emerge from the empirical analysis. First, finance-growth theory should emphasize allocative quality (the efficiency with which financial variables affect output), rather than just credit availability. The average product of credit represents a general measure that combines multiple channels that have opposing effects. As such, the observed small, average effect of credit availability on output is a direct result of averaging together opposing effects. Thus, theories of finance-growth should seek to

explain the distribution of effects among channels affecting output. Second, the institutional environment influences thresholds. In particular, there will be significant variations in the degree to which high levels of credit availability will impede economic growth depending upon how well the financial sector's role is defined and regulated in each economy. Countries can experience "excessive" amounts of credit availability at significantly lower levels of credit availability compared to developed economies due to significant differences in their institutional environments. Therefore, empirical studies estimating global thresholds must adjust for cross-country differences in the institutional environment. Finally, the direction of the relationship between foreign bank presence and host economy performance varies by host economy depth. Specifically, foreign banks may contribute positively to economic growth at certain stages of development, but act as drags at other stages.

Implications for Financial-Sector Policy and Regulation

The implications of the findings for financial sector regulation and policy are clear. Given the fact that it is the type of credit extended, and not merely the quantity of credit extended, that influences the relationship between finance and economic growth in a country, there is a compelling argument in favor of a macro-prudential approach that distinguishes clearly between extensions of credit to consumers/households versus those made to businesses. To implement such an approach, policymakers need to take three steps. First, they should establish binding and counter-cyclical loan-to-value and debt-service-to-income ceilings on mortgages and consumer lending. Second, they should establish sectoral risk weights and calibrate systemic-risk buffers to the growth of household credit rather than to total credit. Third, policymakers need to develop parent-bank supervisory frameworks that specifically monitor the household lending channel in host countries.

In the region, the National Bank of Serbia, the Croatian National Bank, and the Bulgarian National Bank all use at least some of the tools outlined above. None the less, these tools have traditionally been calibrated to reflect overall credit dynamics rather than being informed by a conceptual framework that recognizes both the characteristics of the different types of credit (composition), and the quality of institutions (institutional quality).

The nonlinear effects in Model 2 also send a second signal to macro-prudential authorities. While it is now standard practice for macro-prudential authorities to set aggregate "depth" targets, either through explicit articulation in sectoral strategies or implicitly through regulatory incentives, the findings in Model 2 suggest that such targets should not presuppose monotonic growth benefits, as more depth does not automatically mean more growth. Rather, macro-prudential authorities should construct their policies around a combination of depth thresholds, composition monitoring, and institutional quality benchmarks. Authorities should treat the private-credit-to-GDP ratio as a state variable with diminishing returns, rather than as a linear growth input.

Bank Ownership Channel

The estimates in Model 3 are consistent with a negative direct association of foreign ownership and a positive interaction with credit depth. Because of this, regulators should focus on different levels of financial development when designing supervisory policies. For example, in the lower-depth economies of the region (Albania, Bosnia and Herzegovina, Kosovo, North Macedonia), where the credit-to-GDP ratio is still less than 50 percent, the negative direct association of foreign ownership dominates and regulators should concentrate on ensuring that bank parents manage cross-border liquidity well and ensure that host-country banks maintain adequate capital buffers. Conversely, in higher-depth economies (Bulgaria, Croatia, Slovenia, and to varying degrees Serbia), where credit-to-GDP ratios are closer to those found in peripheral-EU member states, the interaction term provides partial offset to the direct effect. As implied by the dual-cycle literature [6, 7], this result indicates that foreign ownership allows parent banks to bring new technologies and improved risk management practices to domestic banks that become operational once financial markets reach a sufficient level of depth. So the regulatory cost/benefit analysis of allowing foreign ownership varies significantly across the region.

European Accession/Convergence Process

As the Extended Balkans transition into the next phase of the European accession process, they do so with banking systems that are already largely compliant with EU prudential regulations, such as CRD IV/V and the SREP. And in cases like Bulgaria and Croatia (as well as prospective candidate countries Albania, North Macedonia and Montenegro), they have access to the Single Supervisory Mechanism. The empirical results reported here argue against reducing convergence simply to a mechanical increase in private credit/GDP ratio. While there appears to be a threshold beyond which increasing the private credit/GDP ratio does not lead to greater economic growth, and could potentially even harm it, what the convergence agenda requires is a financial system that directs credit towards productive investments; parent-bank cross-border channels that are supervised in such a manner as to dampen rather than amplify household credit procyclicality; and other forms of corporate financing such as capital markets, guarantee programs, and EU-backed instruments (such as COSME from the European Investment Fund, and InvestEU) be developed and used in a systematic fashion.

Increasing Credit Directed Toward SMEs/Productive Corporate Investments
The most empirically-supported policy recommendation was a shift in credit allocation away from households and toward SMEs/productive corporate investment. According to the difference-GMM estimates of Model 4, a one-percentage-point reallocation of credit from households to non-financial corporations is estimated to generate approximately one-percentage point additional annual GDP growth among our sample of six countries. This estimate is large compared to previous studies on finance-growth relationships in the region; however, since our sample size is relatively small, we should be cautious when interpreting this estimate. None the less, regardless of how much we discount this estimate

downward due to our limited sample size, the direction of this asymmetry, negative for household credit and positive for corporate credit, holds across each of our three estimators and two samples. Some potential instruments for acting on this asymmetry include expanding publicly funded credit guarantees for specific sectors/targeted groups; using blended-funding models co-funded with EBRD/EIB for funding SMEs; and providing fiscal/regulatory incentives for equity-like/subordinated debt-type financing instruments for mid-size firms. Our empirical results provide a composition-based rationale for prioritizing these instruments.

SUMMARY AND CONCLUSION

In this study we examined the finance-growth relationship in the Extended Balkans for the period 2001-2024. In contrast to prior studies that used measures of the overall depth of financial markets, such as total private credit to GDP, we also focused on three structural dimensions of credit relationships: non-linearity in credit-growth relationships, bank ownership, and the distribution of credit. We employed two-way fixed-effect models and two-step system and difference GMM models to estimate a ten-country panel for Models 1 through 3 and a six-country IMF-GDD subsample for Model 4 using real-time data from the World Development Indicators (WDI), the IMF's Global Debt Database (GDD), and the World Bank's Global Financial Development Database (GFDD). Three key findings were obtained. First, once country and time dummies were included in the regression equation, there was little evidence that an increase in the overall private-credit-to-GDP ratio had a positive association with economic growth. However, when the study adopted a dynamic model that allowed for a non-linear relationship between credit levels and economic growth, a threshold type of non-linear relationship emerged (credit -0.38 $p=0.016$ and credit² $+ 0.004$ $p=0.006$ in system GMM) that supported Hypothesis 1. The Hansen threshold regression further identified where that point is located as 55.2% of GDP (95% Confidence Interval 53.1 – 59.1) with the below-threshold contribution of credit (+0.044 growth points per point of credit) falling to about zero above it. Next, the study found that foreign ownership had a statistically significant negative direct association with economic growth and a marginally significant positive interaction with private credit in the system-GMM model (foreign -1.19 $p=0.029$; foreign $\times$ credit $+2.43$ $p=0.071$). Thus, this supports Hypothesis 2 in its refined, contingent-on-the-depth-of-private-credit version. Lastly, using the IMF-GDD sample, we find that when breaking down private credit into households and non-financial corporations, there exists a clear asymmetry (household -0.77 , $p<0.001$; corporate $+0.30$, $p<0.001$) when comparing these two categories under differenced GMM. We also find that the statistically significant negative household-credit coefficient (-0.12 , $p=0.043$) in a post-crisis FE specification also supports Hypothesis 3.

In addition to the three findings presented earlier, the article also makes a case for a change in what researchers working in the area of finance-growth in economies similar to ours should seek to measure. This is because the study shows that an average depth coefficient combines a positive below-threshold regime, a depth contingent ownership

effect and an allocation asymmetry; and since these channels partly offset one another, it follows that the small average effect found by the meta-analytic literature for emerging Europe is the result of an arithmetical combination of these offsetting effects. Thus, the threshold value beyond which the average product of credit ceases to increase is determined by the institutional capacity for screening and not by some universal number, and similarly, the contribution of foreign ownership to economic growth depends upon the host country's depth rather than on foreign ownership per se. These are precisely the conclusions that would have been derived from a finance – growth theory based on allocative quality rather than on credit depth; and these are precisely the conclusions we believe could be applied to other bank dominated, foreign owned systems.

This paper has made two main contributions: it brings together for the first time in the Extended Balkans the channels of non-linearity, ownership interactions, and credit composition, and demonstrates how these can be empirically identified using high-quality data collected by both the IMF Global Debt Database (IMF GDD) and the World Bank Global Financial Development Database (World Bank GFDD); whereas previous studies relied almost exclusively on aggregate-depth proxies. In terms of practical relevance for policymakers, our empirical findings have direct implications for designing macro-prudential policies aimed at Small and Medium-sized Enterprises (SME) financing, and for implementing the EU-accession convergence agenda: policymakers need to shift their attention from focusing on increasing aggregate credit depth towards managing credit composition and adapting regulatory frameworks applicable to foreign banks' presence in each host economy to its development stage.

The limitations described above bound our conclusions: identification relies on fixed effects and internal instrumental variables; the number of countries considered in our sample is 10, and only 6 when looking at Model 4; the number of observations in the upper threshold regime is very low; the post-2013 segment of ownership was interpolated; and our conclusion regarding external validity assumes that the Extended Balkans share common characteristics with respect to bank dominance, foreign ownership and institutional quality.

There are then four potential ways in which future research might build on the current findings. First, expanding our analysis of the threshold relationship reported in Table 3 along dimensions of covariates-dependent thresholds e.g., thresholds that depend on factors like changes in the Rule of Law or Seo & Shin-type models that account for endogeneity among regressors will enable us to develop a richer characterization of the relationship between credit depth and economic growth. Secondly, analyzing different types of household credit (as applicable), including those related to mortgages and consumer credit, will assist policymakers to assess the extent to which household credit could be used as an additional mechanism to promote economic development. Thirdly, increasing the number of Central and Eastern European countries sampled will also help mitigate some of the limitations on testing hypotheses associated with small sample sizes ("n" is too small). Lastly, obtaining an annual survey-based time series for foreign

ownership since 2013 will allow us to avoid interpolating foreign ownership values. We would then have the opportunity to estimate the interaction effect of foreign ownership and credit depth based upon unsmoothed data.

NOMENCLATURE

ADF	Augmented Dickey–Fuller unit-root test
AR(2)	Arellano–Bond test for second-order serial correlation
CD	Pesaran cross-sectional dependence test
CEE	Central and Eastern Europe
CRD IV/V	Capital Requirements Directive IV/V
DSTI	Debt-service-to-income (ratio)
EBRD	European Bank for Reconstruction and Development
FE	Fixed effects (two-way: country and year)
GDD	IMF Global Debt Database
GFDD	World Bank Global Financial Development Database
GMM	Generalized Method of Moments
HH_LS	Household and NPISH loans and debt securities (% of GDP)
IMF	International Monetary Fund
LTV	Loan-to-value (ratio)
LOCO	Leave-one-country-out sensitivity analysis
LR(γ)	Likelihood-ratio statistic for the threshold γ
MW	Maddala–Wu Fisher-type panel unit-root test
NFC_LS	Non-financial-corporate loans and debt securities (% of GDP)
NPISH	Non-profit institutions serving households
NPL	Non-performing loan
PPP	Purchasing power parity
SME	Small and medium-sized enterprise
SREP	Supervisory Review and Evaluation Process
SSM	Single Supervisory Mechanism
VIF	Variance inflation factor
WDI	World Bank World Development Indicators
WEO	IMF World Economic Outlook
WGI	Worldwide Governance Indicators
$\hat{\gamma}$	Estimated threshold (turning point) of the credit/GDP ratio
β, ϱ, γ'	Slope, lagged-dependent and control-vector coefficients in

	equation (2)
q	Allocative quality of credit
δ, φ	Direct and depth-interaction coefficients of foreign ownership in equation (4)
β^H, β^c	Household- and corporate-credit coefficients in equation (5)
β_1, β_2	Below- and above-threshold credit slopes in equation (3)
F^*	Depth at which the marginal effect of foreign ownership changes Sign

AUTHOR CONTRIBUTION

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DATA AVAILABILITY STATEMENT

Data is contained within the article.

CONFLICT OF INTERESTS

The authors confirm that there is no conflict of interest.

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APPENDIX A. DATA SOURCES AND VARIABLE DEFINITIONS

Table A1. Variable Definitions accompanied with their source

Variable	Definition	Source
GDP growth (dep. var.)	Annual real GDP growth rate, %	IMF WEO [30] (primary); World Bank WDI [31] (cross-check)
Private credit / GDP	Domestic credit to private sector by financial-sector institutions, % of GDP	World Bank WDI [31]: FS.AST.PRVT.GD.ZS
Household credit / GDP	Credit to households and NPISH (loans + debt securities), % of GDP	IMF Global Debt Database [33]: HH_LS
Corporate credit / GDP	Credit to non-financial corporations (loans + debt securities), % of GDP	IMF Global Debt Database [33]: NFC_LS
Foreign bank share	Share of banking-sector assets held by foreign-owned banks, %	World Bank GFDD [34]: OL16 (primary); EBRD Transition Report [25] and national central banks for post-2013 extension
Inflation	Annual CPI inflation, % (winsorised at 1st/99th percentiles)	IMF CPI database; World Bank WDI [31]
Gov. expenditure / GDP	General government total expenditure, % of GDP	IMF WEO [30]
Trade openness / GDP	Exports + imports of goods and services, % of GDP	World Bank WDI [31]
Rule of law	WGI Rule-of-Law estimate, -2.5 to +2.5 scale	World Bank WGI [32]

APPENDIX B. PANEL DIAGNOSTICS

Table B1. Panel Diagnostics

A. Maddala–Wu Fisher-ADF panel unit-root tests (levels, intercept, AIC lag selection; H_0 : unit root in all panels)		
Variable	$\chi^2(20)$	p
GDP growth	149.01	0.000
Private credit / GDP	38.72	0.007
Inflation (winsorised)	90.54	0.000
Gov. expenditure	77.24	0.000
Trade openness	29.82	0.073
Rule of law	51.57	0.000
Δ Trade openness	238.56	0.000
B. Pesaran CD test of cross-sectional dependence (H_0 : cross-sectional independence)		
Series	CD	p
Two-way FE Model 1 residuals	-3.51	0.000
GDP growth (raw)	-3.58	0.000
Private credit / GDP (raw)	+14.78	0.000
C. Variance inflation factors		
Regressor	Model 1	Model 2
Private credit / GDP	1.72	16.85
Private credit ²	—	15.67
Inflation (winsorised)	1.07	1.10
Gov. expenditure	1.56	1.56
Trade openness	2.03	2.14
Rule of law	1.98	2.04

Notes: Analysis panel of Models 1–3 (218 observations, 10 countries, 2001–2024). MW = Maddala–Wu Fisher-ADF, χ^2 with 20 degrees of freedom; CD follows Pesaran (2004); VIFs computed on the pooled regressor matrix; $\text{corr}(\text{credit}, \text{credit}^2) = 0.964$.

APPENDIX C. LEAVE-ONE-COUNTRY-OUT RE-ESTIMATES FOR MODEL 4

Table C1. Model 4 Two-Way FE Coefficients on Five-Country Panels (Country-Clustered p -values in Parentheses)

Omitted	Household (p)	Corporate (p)	N
Albania	−0.065 (0.489)	−0.028 (0.237)	102
Bulgaria	−0.126 (0.240)	−0.018 (0.631)	100
Croatia	+0.018 (0.761)	−0.042 (0.049)	111
North Macedonia	−0.041 (0.761)	−0.041 (0.005)	104
Romania	−0.080 (0.340)	−0.047 (0.007)	100
Slovenia	−0.108 (0.000)	−0.026 (0.162)	103

Table C2. Country-Years in the Upper Threshold Regime (Private Credit Above $\gamma^* = 55.19\%$ of GDP)

Country	Years	Observations	Credit range (% of GDP)
Slovenia	2006–2013	8	60.3–85.8
Bulgaria	2007–2014	8	58.3–68.9
Croatia	2012–2017, 2020	7	56.0–69.2
Montenegro	2007–2011	5	55.2–86.4
Kosovo	2024	1	55.9
Total		29	