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Luca Gattini,
Angeliki Zagorisiou

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Luca Gattini* and Angeliki Zagorisiou**

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Abstract

This study contributes to the analysis of cross border banking behavior in CESEE (Central Eastern and South Eastern Europe). It detects potential transmission channels from parent to subsidiary banks based on a newly constructed database (323 banks operating in the region and 84 parent banks over the period 2000-2014), which allows for the identification of ultimate ownership over time. On the whole, we find that subsidiary banks provide an extra boost to credit growth at the domestic level. However we detect that domestic and subsidiary banks contracted credit similarly after the financial crisis. Moreover, subsidiaries' ability to extend credit is dependent on home country macroeconomic and financial conditions as well as parent banks' characteristics such as asset quality. Finally, an excessive credit expansions coupled with reductions of capital ratios at the parent bank level jeopardizes subsidiaries' lending capacity. Our findings call for home and host actors to continue to foster cross-border coordination and dialogue.

JEL classification: C23, E44, F23, G21

Keywords: Cross border banking, Parent and subsidiary banks, Central and Eastern Europe, Asset quality

* Luca Gattini – European Investment Bank, 98-100 Boulevard Konrad Adenauer, 2950 Luxembourg, Luxemburg, e-mail: l.gattini@eib.org
** Angeliki Zagorisiou – Universitat Jaume I; zagorisiou@gmail.com

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1 Introduction

Some years after the breakout of the global crisis we are in a perfect moment to conduct an overarching analysis of the parent-subsidiary relationship in a multi-year perspective starting from early 2000. Our study focuses on Central Eastern Southern Eastern Europe (CESEE) banking sector because it is characterized by a large presence of foreign owned banks. Therefore it is an ideal perimeter for the study of the parent-subsidiary nexus. For example, foreign banks issued 85% of new credit in New Member States[1] during the period 1998-2005 (Sirtaine and Skamnelos, 2007). Moreover the existence of internal capital markets within international banking groups (Houston and James, 1998; De Haas and Van Lelyveld, 2010; Jeon et al., 2013) was a fundamental vehicle to spur growth throughout the network as well as to possibly transmit financial weaknesses. By and large, foreign owned banks fostered convergence and economic growth in CESEE; contributed to raise living standards; supported increasing investment levels; and possibly generated the emergence of localized imbalances. Today the share of foreign ownership is exceptionally high in CESEE, making most subsidiary banks systemically important at local level (host country). The global financial crisis imposed severe capital and liquidity constraints to some parent banks. This has possibly contributed to the transmission of shocks from home to host countries, thus threatening host countries' financial stability. The Vienna Initiative (a public-private coordination mechanism) was established to avoid disruptive behaviors in five emerging Europe economies at the early stages of the financial crisis, for instance.

Several studies analyzed the role of cross-border banking on host economies as well as the effect of foreign ownership on subsidiaries' performance as well as their financial stability and credit growth. A strand of literature employed highly aggregated data to examine the lending behavior of banks. For example, Cetorelli and Goldberg (2010) investigated the transmission of the global financial crisis across borders. Their analysis is based on highly aggregated data, sourced from the Bank for International Settlements' (BIS) Consolidated International Banking Statistics. An alternative approach employed bank level data and examined the effect of ownership on subsidiaries' lending behavior over time. Cull and Martinez Peria (2013) examined the impact of bank ownership on credit growth in Latin America and Eastern Europe immediately before and during the 2008/2009 crisis. Dinger (2009) builds on a database structured along a relatively extended time period (1994-2004), while focusing on ten CEE countries. De Haas and Van Lelyveld (2006) sample the CEE region for the period 1993-2000. De Haas and Van Lelyveld (2010) develop the previous analysis employing a worldwide sample of 45 multinational for the period 1991-2004. De Haas and van Lelyveld (2014) include also the period of the global financial crisis (i.e. 1992-2009). Allen et al. (2015) study the effect of ownership in

[1] Estonia, Latvia, Lithuania, Hungary, Czech Republic, Poland, Slovakia, Slovenia, Bulgaria, Croatia, Romania

11 CEE countries over the period 1994-2010, comparing foreign owned banks (subsidiaries) to domestic owned banks. Jeon et al. (2013) employs a worldwide sample of 68 large multinational banks with subsidiaries in emerging economies for the period 1994-2008. They find that subsidiaries' lending behavior is strongly influenced by parents' financial conditions, particularly in Central and Eastern Europe.

Our study addresses several interrelated and key questions. Did subsidiaries extend credit more than domestic banks? And was this effect the same before and after the crisis? Have parents' characteristics had an influence on subsidiaries' capability to extend credit? Have health and risk-taking attitude of parent banks impacted on subsidiaries credit growth?

To answer to these questions, we constructed a unique and new database. It includes a sample of 323 banks (domestic and subsidiary banks) operating in 18 countries[2] of Central Eastern and Central Eastern Europe (CEESE) and 84 ultimate owner banks (parents). It complements the empirical literature in different ways. First, it combines a wide geographical coverage of the CESEE region. Second, it identifies the ultimate owner of each subsidiary bank over time, instead of focusing only on the direct ownership as done in previous studies (e.g. Claessens and Van Horen, 2015; De Haas and Van Lelyveld, 2006). This definition of ownership helps capturing the cross border relationships at full extent. Third, it covers the ownership structure of a very large amount of banks operating in the CESEE region; whilst earlier studies focused the attention on some major multinational banking networks.

We find that subsidiaries owned by foreign financial groups provided an extra boost to credit growth at the domestic level. The global financial crisis clearly brought about a large negative effect across the board. To internalize this result we tested the behavior of domestic and subsidiaries before and after the crisis. We found that subsidiaries extended credit more robustly than domestic banks before the crisis (Cull and Martinez Peria, 2013). However this effect ceased to exist after the crisis, whereby subsidiaries and domestically owned banks curtailed credit similarly. Therefore, this result suggests that subsidiaries have not been asource of sharper credit tightening when assessed against the control group of domestic owned banks (De Haas et al., 2012).

Moreover we pin down empirically why we should control for parent level characteristics. To our knowledge, this paper is the first to do so in this stream of literature. We find that banks operating across different countries in the region are

[2] Albania, Armenia, Bosnia Herzegovina, Bulgaria, Czech Republic, Estonia, Hungary, Croatia, Kosovo, Lithuania, Latvia, Montenegro, FYROM, Poland, Romania, Serbia, Slovak Republic and Slovenia.

very much similar in the way they extend credit if they belong to the same parent bank within a same year. This calls for the inclusion of time-varying parent banks' characteristics as well as home markets features. We find that host and home country's economic growth has a significant and positive effect, whilst interests rates at home country level, as well as host country level, exert a negative effect on subsidiaries credit extensions. This reflects a transmission channel of lending costs from home to host economies, thus confirming a result established in the literature (e.g. Jeon et al., 2013; Popov and Udell, 2010).

Parent bank's asset quality is one of the most important and consistent predictors of subsidiaries credit growth. Also past profitability at consolidated level is an important determinant of subsidiary's credit growth. We find that banks manage their profit and losses at consolidated level. Indeed we found that a risky behavior at parent level has a negative impact on subsidiary capability to extend credit. Specifically, we established a negative relationship between excessive credit expansion combined with a deterioration of the parent banks' capital ratios and a decline of subsidiaries' credit growth after three years. Last but not least, subsidiaries' size and asset quality have a negative impact on credit growth, while liquidity has a positive effect. To the contrary subsidiaries' deposit ratio, economic capital and profitability are irrelevant for credit growth. This suggests a longer-term expansion strategy of parents in the region, whereby key domestic characteristics are secondary parameters (Cull and Martinez, 2013; Haas and Van Lelyveld, 2006).

The paper is structured as follows. Section 2 describes our database, its construction and some statistical properties of the employed variables. Section 3 presents the estimation methodologies. Section 4 reports and discusses the main results. Section 5 presents some robustness checks. Section 6 concludes.

2 Data

The empirical analysis is based on a sample of 323 banks operating in 18 countries[3] of Central Eastern and Central Eastern Europe (CEESE). We explore this region because it shows a very high presence of foreign owned banks. Therefore, this geographical area serves as an ideal environment to analyze cross border banking behavior and the effects of parent banks' health and characteristics on subsidiaries capabilities to extend credit. We have included and matched in our database a set of relevant statistics for the 84 ultimate owner banks (parents) of the 323 banks operating in CESEE. The database covers the period 2000-2014. To avoid double counting we examined carefully the merger history of each parent and subsidiary bank. We also selected carefully the accounting regime. Details on the selection and data cleaning process are reported in Appendix A.1. The baseline for the construction of our

[3] Albania, Armenia, Bosnia Herzegovina, Bulgaria, Czech Republic, Estonia, Hungary, Croatia, Kosovo, Lithuania, Latvia, Montenegro, FYROM, Poland, Romania, Serbia, Slovak Republic and Slovenia.

dataset, including bank balance sheets and ownership information, was Bureau van Dijk's Bankscope. We have heavily complemented it with a wide variety of additional sources[4]: Amadeus by Bureau van Dijk, published financial statements, S&P IQ capital, Bloomberg, Central bank reports, Ministries' reports, stock exchanges and news.

Following previous literature (Allen et al., 2015; de Haas and van Lelyveld, 2006; Jeon et al., 2013), we defined a bank as foreign owned if foreigners hold at least 50% of its shares. Moreover, we have identified the ultimate owner of each subsidiary bank, instead of focusing only on the direct ownership definition utilized in previous studies[5]. Practically this means that we have extended our research into the ownership structure of the parent entity, instead of stopping it once the first (direct) owner of a bank was identified. On the one hand, the ultimate ownership definition is more difficult to identify thus requiring more research efforts. On the other hand, it allows capturing the actual cross border economic and financial relationships between owners and owned entities. To better gauge the difference between ultimate and direct ownership, we have constructed a randomly selected example (Figure 1) for two banks operating in Bosnia-Herzegovina. It exemplifies the effect of applying the ultimate ownership definition versus direct owner definition. The latter is also compatible with another publicly available dataset[6]. In example 1 we show how the ultimate owner definition identifies more precisely the actual foreign owner of a bank (example 1). In this case, the direct ownership definition would have correctly detected this bank as being foreign owned. However the direct foreign owner is a different entity and belongs to a different country than the ultimate owner. In example 2 we identify a bank as foreign owned otherwise categorized as domestic applying a direct ownership definition. As a result we have constructed an original and unique dataset, which includes time series information on ultimate ownership, parent as well as subsidiary banks balance sheet data. Therefore, we are able to capture the time varying nature of subsidiaries' ownership. Foreign owned banks constitute 66% of the total observations in our regional sample.

Table 1 reports the detailed list of variables included in our analysis and the related descriptive statistics. In line with the literature (Allen et al., 2015; Bertay et al., 2015; De Haas and van Lelyveld, 2014) we include individual bank characteristics such as capital ratio, liquidity, size, profitability, deposit ratio and asset quality. Capital is defined as economic capital or the ratio of equity to total assets. Liquidity is the ratio of liquid assets to total assets. Size is included as the natural logarithm of total assets.

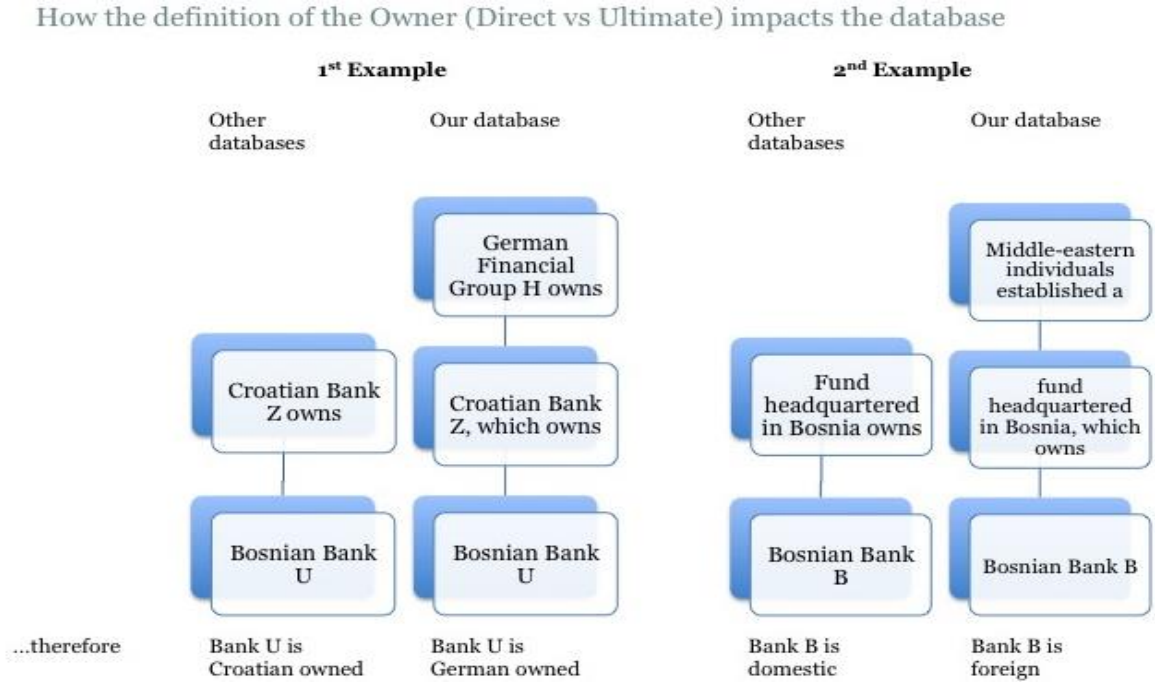
[4] In each case we would assess the reliability of the source available and determine the number of additional sources we had to look for in order to cross check our data. For example we would always consider audited financial statements to be superior to information sourced from commercial databases.

[5] Allen et al., 2015; Claessens et al., 2008; de Haas and van Lelyveld, 2006; Jeon et al., 2013

[6] The database constructed by Claessens et al. (2008) has been made available by the National bank of Netherlands. It reveals the nationality of the direct owner but not its name.

Profitability is measured as return on assets. In general, high profitability should create incentives to expand activities thus support credit growth. The deposit ratio is defined as the ratio of customer deposits to total funding. A high deposit ratio provides a stable funding source for banks thus backing credit growth. We have also included loan impairments as a proxy for asset quality; specifically we use loan impairment charges[7] to average gross loans.

Figure 1



Impairments are losses incurred if there is on objective evidence that impairment of a loan or portfolio of loans has occurred. These are flow variables. For example, the loan amount recorded in the loan book may be above the present value of the estimated future cash flows of the financed asset. As a result, this difference must be

[7] We did not utilise non-performing loan figures for two reasons. First, there was no apparent consensus among the regulatory authorities of the countries under scrutiny on the exact categorization of NPLs. This obviously affects also write-offs definition and amounts. Moreover write-offs are the outcome of decisions taken even a decade or more before the actual write-off action is undertaken. Therefore this does not allow us to draw any direct inference on the credit expansion policy of current owners. Second, the employed data sources reveal an ample number of missing values for NPL figures and write-offs. To the contrary loan impairments data are available with a much higher frequency across time and counterparts.

recognized as expense in the income statement. The present value of the estimated future cash flows can fall below the book value due to several events[8]. For example the obligor can be[9] in severe financial difficulty (e.g. realized losses, cancelled purchased agreements from customers, inventory increase, deterioration of profitability) without having defaulted on his loan payments yet. As a result impairment charges capture asset quality deterioration at its very early stages. We prefer this measure to loan loss provisions because the latter refers also to future events. Therefore its nature could be speculative, allowing the management of a bank to shift provisions from one year to another. Moreover, provisions can be utilized as a tool to reduce the tax burden, thus maximize profits instead of accounting for actual asset deterioration[10].

Table 1. Data descriptive statistics

Subsidiary & Host Country charachteristics

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
Credit	The natural logarithm of loans	3555	13.0	2.0	2.0	17.7
Economic Capital ratio	Equity to assets, %	3572	13.7	10.0	0.0	100.0
Liquidity ratio	Liquid assets to total assets, %	3569	30.0	19.2	0.0	99.9
Size	The logarithm of assets	3572	13.7	1.8	8.4	18.1
Profitability	Return on assets, %	3561	0.8	2.8	-33.6	52.7
Deposit ratio	Customer deposits to total funding, %	3540	74.5	22.1	0.0	100.0
Loan Impairments	Loan impairment charges to loans, %	3354	7.5	18.9	-76.9	100.0
Real GDP growth		3572	3.4	4.1	-16.0	22.9
Inflation rate		3572	5.5	8.9	-2.4	95.0
Interest rate		3572	8.2	5.8	0.2	45.6

Parent & Home country charachteristics

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
Parent Profiability	Return on assets, %	2033	0.4	1.7	-13.5	19.9
Paren Liquidity	Liquid assets to total assets, %	2032	21.8	11.5	0.4	83.7
Parent solvency	Equity to assets, %	2033	6.0	3.9	-5.5	82.4
Parent loan impairments	Loan impairment charges to loans, %	1991	1.2	1.5	-6.3	21.2
Home country: Real GDP growth		2042	1.2	3.1	-16.4	11.1
Home country: Inflation rate		2043	2.8	3.6	-1.3	54.9

We control for macroeconomic and financial factors of host and home countries. We employ real GDP growth, interest rates and inflation rate. Real GDP growth controls for aggregate economic growth. It is expected to exert a positive impact on credit growth. Inflation rate is measured as the year-to-year change of the consumer price index. A rise in prices is expected to increase demand for loans and also inflate the value of banks' loan portfolios. However the inflation rate may also reflect instability thus forcing banks to ration credit (Boyd et al., 2001). Therefore, the effect of this

[8] These events however are not necessarily enough to render a loan non-performing
[9] Until 2014 impairment charges referred only to material events and would strictly exclude future/expected events.
[10] Similarly, banks might provision less after a year sparked with low profitability to inflate earnings.

variable can run in both directions. Finally, we also control for interest rates. High interest rates can create an incentive for banks to lend more while reducing clients' demand for credit. Moreover, high interest rates may reflect high funding costs. The latter may in turn signal higher costs of inter-bank arrangements and intra-group lending, thus limiting credit growth. As a result, also the sign of this variable can be positive or negative depending on the prevailing effect.

3 Empirical methodology

We have divided our investigation into three empirical and methodological steps. First, we want to gain insight on the impact of foreign ownership on host countries' banks capabilities to extend credit. Second, we investigated the heterogeneity of loan growth across subsidiaries belonging to different international financial groups (parents), operating in different markets and across time. Third, we analyze the nexus parent-subsidiaries, accounting for parent bank characteristics as well as home country factors.

3.1 Dynamic credit growth accounting for foreign ownership

In order to gain insight into the impact of ultimate ownership, we run a first set of regressions capturing the effect of ownership with a dummy variable. Following Bertay et al. (2015), Cull and Martínez Pería (2013) and de Haas and van Lelyveld (2006), we model credit growth as a function of ownership and individual bank characteristics. We also control for macroeconomic effects on credit growth (Bertay et al., 2015; de Haas and van Lelyveld, 2006). To account for a possible persistence of credit growth we employ a dynamic framework (Bertay et al., 2015), specifically the following model:

$$\Delta L_{i,t} = \alpha_0 + \alpha_1 \Delta L_{i,t-1} + \beta X_{c,t} + \gamma Z_{i,t-1} + \varphi_1 Own_{i,t} + k_1 Crisis + \varepsilon_{it} \qquad (1)$$

where the error component is decomposed into: $\varepsilon_{it} = v_i + u_{it}$, i denotes each individual bank, c identifies the host country and t the year. $\Delta L_{i,t}$ is credit growth of bank i during year t. $X_{c,t}$ is a vector of host country macroeconomic variables, namely: inflation rate, interest rate and real GDP growth. $Z_{i,t-1}$ is a vector of bank specific characteristics, namely economic capital ratio, liquidity, size, profitability and loan impairments. Crisis is a dummy variable for Global financial crisis, which equals 1 for the year 2008. Finally $Own_{i,t}$ is a dummy variable for the type of ownership of bank i during year t, taking value one if bank i is foreign owned.

Our panel dataset is unbalanced and any regressor can be correlated to some extent with the lagged dependent variable. Therefore their coefficients can be seriously biased too. A fixed effects estimator is inappropriate to make reliable inferences on the coefficients of all regressors (Flannery and Hankins, 2013) when a panel is unbalanced and in the presence of endogenous variables. To exclude simultaneity, bank characteristics enter the regression with a lag, similarly to Jeon et al. (2013) and Cull and Martinez (2013). However endogeneity concerns are not fully mitigated. To address any endogeneity[11] concerns, we employ GMM

[11] To address potential endogeneity of bank financials and avoid instrument proliferation, we instrument bank characteristics with their second, third and the fourth lag and apply the backward orthogonal deviations transformation to the instruments for the transformed equation. We also report in our results the difference GMM estimation for reference.

estimation methodologies. We selected a system GMM as our preferred method (Flannery and Hankins, 2013; Roodman, 2006). We employ a two-step estimator since it is asymptotically more efficient than the respective one-step estimator. However this procedure introduces a downward bias in the standard errors. To correct for this we are using Windmeijer's correction. Moreover we use robust standard errors. Estimation results of a Fixed Effects model and difference GMM model are also conducted for reference.

A system GMM estimator estimates a two-equation system: i) a levels' equation instrumenting it with first differences of variables and ii) first differences the panel and instruments this equation with the lagged variables' levels (Blundell and Bond, 1998). Instead of the first differences we employ forward orthogonal deviations from the sample mean, a modification introduced by Arellano and Bover (1995) and we subtract the average of all available future observations, which eliminates the fixed effect from the error term, instead of subtracting the past observation. This method performs better than first differences (Hayakawa, 2009).

3.2 Crossed Random Effects Models

We want to investigate the origins of the heterogeneity of loan growth across subsidiaries belonging to different international financial groups (parents), operating in different markets and across time. The ultimate owner of a subsidiary may change over time. Moreover a parent bank can own several subsidiaries each year. As a result there are many combinations of bank-year, financial group-year and bank-financial group occurring multiple times. We choose a Crossed Random Effects Model (Rabe-Hesketh and Skrondal, 2008) to conduct our analysis. Parent characteristics as well as regional market developments common to all banks may affect subsidiaries' credit growth. A crossed random effects model allows for a clear distinction between parent bank and market effects and for a quantification of the relative importance of those effects. We also add controls for the country of operation of the subsidiary and the country of residence of the parent bank.

Initially we assume that all subsidiaries are affected similarly by some events each year. Therefore we treat years as crossed with the observations. Moreover we assume that each subsidiary owned by the same parent is affected in the same way, irrespectively of the market of operation. These assumptions can be tested through the estimation[12] of the following model:

For the latter we employed second to fifth lags as instruments as well as backward and orthogonal deviations. We are applying the combination of backward orthogonal deviations for the instruments and forward for the regressors, which is less biased and more stable than traditional transformation especially for difference GMM estimations (Hayakawa, 2009). Macroeconomic conditions and ownership variables are treated as exogenous. We are always conforming to the rule of thumb to maintain the number of instruments below the number of individual banks (Roodman, 2006). Two test are available to check the joint validity of the instruments, Sargan and Hansen J. Sargan's statistic is inconsistent when non sphericity is suspected in the errors (Roodman, 2006). The global crisis introduces a deviation from sphericity in the form of heteroscedasticity in our data. Moreover whenever ownership changes, shocks to individual banks are also a reason to avoid reliance on Sargan's statistic. Therefore we employ Hansen's J statistic to check our selection of instruments.

[12] The estimation of equation 2 requires the assumption that the error term has a zero mean and is independent across banks and years. Moreover the random intercepts ζ_{1t} & ζ_{2p} have zero means, are independent of each other, across years and across financial groups, independent of all right hand variables and uncorrelated with ε_{itp}. These assumptions force us to omit the lagged dependent variable from the regressors. ζ_{2p} represents the combined effect on credit growth of all unobserved parent specific variables that do not change over time. It is a determinant both of credit growth and of lagged credit growth. Once the lagged dependent variable is included ζ_{2p} ceases to be statistically independent of it.

$$\Delta L_{i,t} = \underbrace{\alpha_0 + \beta X_{c,t} + \gamma Z_{i,t-1} + k_1 Crisis}_{\text{fixed components}} + \underbrace{\zeta_{1t} + \zeta_{2p} + \varepsilon_{itp}}_{\text{random components}} \quad (2)$$

i denotes subsidiary, c host country, t year and p the parent. ζ_{1t} is a random intercept for years, ζ_{2p} is a random intercept for parents and ε_{itp} is a residual error term. α_0 is the mean intercept. The random variables ensure that the intercept $(\alpha_0 + \zeta_{1t} + \zeta_{2p})$ is unique and random to every parent and year. The random intercept for years ζ_{1t} is shared across all subsidiaries for a given year, whereas the random intercept for parents ζ_{2p} is shared by all years for a given parent. $X_{c,t}$ and $Z_{i,t-1}$ are vectors of macroeconomic variables and bank specific control variables respectively as defined in section 2.2. Crisis is a dummy variable capturing the global financial crisis.

A second Model relaxes the assumption of parents and years exerting independent effects. It accounts for the possibility that some events during year t may be more detrimental or beneficial to a certain bank and less to another. Therefore the model in equation 2 becomes:

$$\Delta L_{i,t} = \underbrace{\alpha_0 + \beta X_{c,t} + \gamma Z_{i,t-1} + k_1 Crisis}_{\text{fixed components}} + \underbrace{\zeta_{1t} + \zeta_{2p} + \zeta_{3tp} + \varepsilon_{itp}}_{\text{random components}} \quad (3)$$

where ζ_{1t} is a random intercept for years, ζ_{2p} is a random term for parents and ζ_{3tp} is a random term for parents interacted with years. ζ_{3tp} is assumed independent of the other random terms ζ_{1t} and ζ_{2p} as well as across combinations of years and parents. The residual term ε_{itp} represents the deviation of a subsidiary's response from the mean for year t and financial group p.

The intra-class correlation (ρ) is a way to interpret the relative magnitude of the random variance components. It measures the total variance attributable to the random components and this metric increase under positively correlated events[13]. See Appendix A.4 for a full computation of the whole set of intra-class correlations.

3.3 Dynamic credit growth with controls for parent's financials

To investigate further the nexus parent-subsidiaries, we add time variant parent characteristics. Conceptually we substitute the dummy for ownership included in equation 1 with a set of parent banks' balance sheet characteristics. Finally, we also control for home country factors. As a result, our dynamic model becomes:

$$\Delta L_{i,t} = \alpha_0 + \alpha_1 \Delta L_{i,t-1} + \beta X_{c,t} + \gamma Z_{i,t-1} + \delta PX_{\eta t} + \psi PZ_{p,t-1} + k_1 Crisis + \varepsilon_{it} \quad (4)$$

where *i* indicates subsidiary banks and c the host country of operations whilst p refers to the parent bank and η the home country where bank *p* is headquartered. In addition to the variables employed in equation 1, $PX_{\eta,t}$ is a vector of home country macroeconomic variables (Inflation rate, Interest rate and real GDP growth). $PZ_{i,t-1}$ is a vector of parent specific

[13] Its value can range between 0% and 100%. 0% means that observations in a certain cluster have nothing in common. Therefore the grouping makes no sense. 100% means absolute agreement and no variance across individual observations.

characteristics, namely: economic capital, liquidity, profitability and loan impairments. As in section 3.1, system GMM with forward orthogonal deviations is the preferred[14] estimation methodology. However, we also employ fixed effects and difference GMM methods.

We include financial characteristics of the parent banks with one year lag. Parent's credit extension policy is steered by the conglomerates' strategic decisions, which are unobservable and may generate endogeneity concerns. Following previous literature (de Haas and van Lelyveld, 2010; Jeon et al., 2013) we exclude endogeneity issues because the average subsidiary balance sheet is significantly smaller than its parent bank balance sheet. If a subsidiary is small relative to the parent bank, the omitted variable bias is considered to have an immaterial effect on the results. In our case the average subsidiary accounts for about 2.3 per cent of its parent bank's assets[15], which is way smaller than in previous studies[16] applying the same logic.

4 Empirical results

4.1 Dynamic credit growth and ownership

The first set of regressions investigates the effect of ownership on credit growth. We estimate equation 1 using different methods to check the robustness of our findings. Results are reported in Table 2. We find that being member of a foreign financial group on average generates more robust credit growth. This is in contrast with Allen et al. (2015), which found ownership structure to be insignificant. De Haas and van Lelyveld (2006) also show ownership to matter only during periods of financial crises. On the other hand, Cull and Martínez Pería (2013) find that ownership matters in the CEESE region. Bakker et al. (2013) also find that foreign ownership fosters credit growth. Moreover economic growth in the host country correlates positively with bank credit growth. On the other hand interest rates have a negative effect on credit growth. As expected the global financial crisis of 2008 had a negative impact on credit expansions.

Past credit growth has a positive effect on current credit growth. Bank's size has a negative impact, suggesting that large banks expand their loan portfolio at a slower pace. Large banks have better access to capital markets and tend to raise less expensive capital. This may increase their profit margins and improves their lending position (Brissimis and Delis, 2009). However, a large bank may have fewer incentives[17] than a small bank to increase further its market share. Therefore, its

[14] We treat subsidiaries' balance sheet variables as potentially endogenous and we instrument them with their second lag. When we are employing a Difference GMM estimator we are instrumenting those variables with their second and third lag. We employ a two-step system GMM estimator with Windmeijer's correction and robust standard errors.

[15] For full transparency, 72 observations (out of 2775) in our dataset are above 10% and below 20% of the parent; whilst [13] observations are above 20% share of the parent bank balance sheet

[16] For example, in De Haas and Van Lelyveld (2010) the average subsidiary is 10 per cent of parent bank

[17] These may be related to internal strategic decisions as well as external regulatory and competition constraints.

balance sheet does not need to grow as fast as other smaller competitor banks to achieve a substantial amount of new lending, also given the ample size of the existing portfolio. As a result, its average credit growth can be less than the average credit of the market.

Table 2 – Factors affecting loan growth - estimations based on Equation 1 – and effect of foreign ownership

	Loan Growth				
Dependent variable: Loan Growth	(1) FE	(2) sys GMM	(3) Diff GMM	(4) sys GMM year dummies	(5) diff GMM year dummies
Loan growth, 1st lag	0.154***	0.262***	0.173***	0.181***	0.094*
	(0.026)	(0.027)	(0.027)	(0.046)	(0.049)
Economic Capital, 1st lag	0.121	-0.442**	0.167	-0.200	0.880
	(0.163)	(0.179)	(0.299)	(0.658)	(0.693)
Liquidity, 1st lag	0.488***	0.475***	0.632***	0.430***	0.560***
	(0.050)	(0.085)	(0.132)	(0.165)	(0.163)
Size, 1st lag	-16.268***	-5.364***	-15.898***	-7.814**	-26.958***
	(1.362)	(1.147)	(2.575)	(3.549)	(8.835)
Profitability, 1st lag	1.096***	1.568***	0.944	1.259	0.804
	(0.400)	(0.553)	(0.680)	(0.886)	(0.752)
Deposit ratio, 1st lag	-0.004	-0.016	-0.160	0.054	-0.585***
	(0.065)	(0.054)	(0.118)	(0.144)	(0.185)
Loan Impairments, 1st lag	-0.115***	-0.097	-0.443***	-0.328**	-0.106
	(0.040)	(0.090)	(0.155)	(0.154)	(0.169)
GDP growth	0.878***	1.149***	0.838***	0.377	0.650**
	(0.148)	(0.169)	(0.163)	(0.332)	(0.277)
Inflation rate	0.521**	0.493***	0.467**	0.615**	0.165
	(0.210)	(0.188)	(0.211)	(0.306)	(0.279)
Interest rate	-0.984***	-0.351	-0.838***	-0.921*	-0.959***
	(0.256)	(0.216)	(0.284)	(0.500)	(0.357)
Member of a foreign financial group	**14.295*** **	**6.013*** **	**12.826*** **	**9.421** **	**13.270*** **
	(3.835)	**(1.724)**	**(4.421)**	**(4.143)**	**(3.425)**
Global financial crisis	-1.365	-7.543***	-3.470**		
	(1.398)	(1.569)	(1.705)		
Constant	219.891***	75.031***		93.691	
	(22.388)	(19.095)		(57.049)	
Observations	2,775	2,775	2,465	2,775	2,465
R-squared	0.433				
No of banks	310	310	292	310	292
No of instruments		306	271	101	93
AR-2		0.527	0.674	0.145	0.458
Hansen J		0.435	0.312	0.156	0.501

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1;
FE refers to panel estimation controlling for individual bank fixed effects with robust standard errors. sys GMM refers to estimation using the Arellano-Bover/Blundell-Bond estimator. diff GMM refers to estimation using the Arellano - Bond difference panel data estimator with robust standard errors.'AR-2' is the p-value of the Arellano - Bond test. The H0 is that the average autocovariance in the residuals is of order 2. 'Hansen J' is the p-value of the Hansen J test for overidentifying restrictions, which is asymptotically distributed as chi2 under the null of instrument validity. Economic Capital is the ratio of equity to total assets. Liquidity is the ratio of liquid assets to total assets. Size is the natural logarithm of total assets. Loan Impairments is the ratio of loan impairment charges to gross loans. Deposit ratio is the ratio of customer deposits to total funding. Global financial crisis is a dummy for year 2008; All ratios are expressed in %.

Finally higher liquidity levels and partially profitability have a positive effect on credit growth. To the contrary, the quality of assets (loan impairment charges ratio) affects negatively credit extensions. Moreover economic growth in the host country correlates positively with bank credit growth. On the other hand interest rates have a negative effect on credit growth. As expected the global financial crisis of 2008 had a negative impact on credit expansions.

Members of foreign financial groups (subsidiaries) may require a different level of fundamentals due to their financial ties with their parent banks. To assess this possibility, we compare subsidiary banks to domestic banks. We employ a Wilcoxon-Mann-Whitney test - a

non-parametric analog to the t-test - because the distribution of some variables violates the normality assumptions[18] (Schmider et al., 2010). Results are reported in Table 3. With the exception of profitability, domestic banks differ in all other financial fundamentals from subsidiary banks. Specifically domestic banks show higher levels of capital, higher deposit ratios as well as higher liquidity ratios (thus keeping their portfolio in more liquid assets) and higher loan impairments. These results substantiate even more the need to investigate further the parent-subsidiary nexus.

Table 3 – Statistical test on difference in the level of characteristics between foreign owned banks and domestic banks

Wilcoxon-Mann Whitney test results						
	Economic Capital	**Profitability**	**Liquidity**	**Size**	**Loan Impairments**	**Deposit ratio**
z - statistic	7.914	1.557	9.822	-20.588	5.571	12.147
P-value	0.0000	0.1195	0.0000	0.0000	0.0000	0.0000
Result:	Domestic banks exhibit significantly higher economic capital	Not significant differences between the two bank categories	Domestic banks exhibit significantly higher liquidity rates	Members of foreign financial groups are significantly larger	Domestic banks have a higher loan impairment rate	Domestic banks have a higher deposit ratio

4.2 Subsidiary interdependence assumptions: relevance of time-varying parent characteristics and home markets

The existence of subsidiary interdependences has been explicitly or implicitly suggested in some empirical studies. De Haas and van Lelyveld (2010) find that a subsidiary's credit supply is positively influenced by the relatively high profitability of other subsidiaries' belonging to the same parent. Moreover, the operation of internal capital markets within financial conglomerates (de Haas and van Lelyveld, 2010; Joel F. Houston and James, 1998; Jeon et al., 2013) might signal a resemblance in credit dynamics among subsidiaries owned by the same parent bank. Subsidiaries owned by the same parent bank share the same resources; have to conform to the same systems and policies; and are part of the same global strategic approach. Their resemblance can derive from fixed or time varying characteristics of the parent bank. This study is the first to test empirically these features. We estimate a Cross Random effects Model. The empirical findings will help us decide on the inclusion of parent bank variables/controls as well as home country factors.

We test the changing (or not) nature of the relationship between parent and subsidiaries. In other words, we test whether a time varying parent bank strategy has an effect on subsidiaries' credit extension. In addition, we also attempt to quantify the relative relevance of this component vis-à-vis other factors. To do so, we have estimated Equation 2, where we account for time invariant parent level effects and year effects common across all banks in our sample - Model (1) in Table 4. We have also estimated Equation 3 where we account for a parent bank-year interaction on top of the effects in Model (1). The latter allows for changing factors to affect differently each parent - Model (2) Table 4. We chose as best model the one that optimizes the Bayesian and Akaike information criteria (Burnham and

[18] Particularly capital ratio, profitability and loan impairment ratio violate the cut-off rule of skew<|2.| and kurtosis<|9.0| according to Schmider et al (2010)

Anderson, 2004). Model (2) results satisfy these criteria. Moreover, a likelihood ratio test indicates that the parent-year interaction should be included in the model[19]. In addition the estimated model confirms also the results reported in section 3.1. Notably, liquidity, profitability and economic growth support credit expansion. Subsidiary's economic capital is positive and significant. The global financial crisis, although with a negative sign, ceases to be significant compared to the results in the previous section. The reason is that its effect is picked up by the random part, where we have allowed a parent effect and time to have a different impact for each parent (i.e. interaction year-parent). The constant represents the average propensity of subsidiaries to extent credit. The random effects component defines by how much subsidiaries deviate from this average. All variances in the random component are significantly different from zero. Specifically $\sigma_{\zeta_{1t}} \neq 0$ implies that the average credit growth varies across years. The non-zero estimate for parent ($\sigma_{\zeta_{2p}} \neq 0$) indicates that there is a significant variation in average credit growth across subsidiaries owned by different parent banks. Last but not least, $\sigma_{\zeta_{3p}} \neq 0$ indicates that the latter variation is time varying.

To quantify the relative importance of factors at parent level, we employ intra-class correlation statistics. As a result, differences across years account for 17% of credit growth variation in the sample, whilst intra-class correlation of subsidiaries owned by the same parent operating in a given year amounts to 42% (Table 5). This points to a large impact of parent bank characteristics on subsidiaries' credit growth. However the intra-class correlation drops to 18% for subsidiaries owned by the same parent, but operating in different years. This implies that subsidiaries belonging to the same parent over the whole period bear less resemblance with each other than subsidiaries of the same parent operating in the same year. Therefore time invariant parent specificities are less crucial than time varying parent characteristics. As a result, subsidiaries of the same parent resemble very much each other in terms of credit growth within a given year. The majority of the subsidiaries falling into this category are operating in different countries, under different regulatory regimes, face different macroeconomic policies and different market conditions. Still they exhibit a surprising similarity in their credit growth. Therefore, it is crucial to allow for time varying parent bank characteristics.

We have also investigated the home country[20] influence on subsidiaries' credit growth. To do so, we slightly amended Equation 2 and Equation 3, introducing an extra level: the home country. Parent banks normally belong to a single home country across their whole history in our sample; therefore parents are treated as nested within their home countries. In the random component we are gradually introducing several effects (Table 6). Model (1) is estimated with a crossed random effect of time and crossed home country effect. Model (2) incorporates a crossed random effect of time, a crossed home country effect and accounts for a random

[19] The chi2 statistic is 14.67 and the p-value is 0.0001

[20] We have also investigated the host country effects. To do so, we have replaced in Equation 2 and Equation 3 the random effect of parent banks with a random effect of host country and the interaction of this random effect with years. We found that time invariant host country effects can be ignored, while time varying effects are statistically relevant. Such a result can be attributed to the fact that those countries are still in a transitory period, with a still changing institutional, legislative and regulatory frameworks. Their economic situation seems to vary across the years thus impacting on credit growth. Moreover subsidiaries operating in the same country and across different years bear absolutely no similarity, while banks belonging to the same financial group across different years resemble each other by 18%. While it is crucial to address the parent - subsidiary relationship, it is also important to control for country specific time varying effects at the host country level.

effect of parent, which is nested within home country. Models (3) and (4) repeat the above estimations and also allow for an interaction between time and either home country or parent. Once the parent effect is added the variance at home country level approaches zero. Therefore, in our sample we can ignore the home country fixed effect. These results are also summarized in Table 7. The largest and dominating effect derives from belonging to the same parent with a changing impact every year. The time varying home country effect, once we omit the parent level effect, is also sizable.

Table 4 - Crossed Random Effects Models - estimations of Equations 3 and 4

Dependent variable: Loan Growth	(1)	(2)
Economic Capital, 1st lag	0.303**	0.327**
	(0.108)	(0.107)
Liquidity, 1st lag	0.309***	0.311***
	(0.0457)	(0.0452)
Size, 1st lag	-4.472***	-4.302***
	(0.573)	(0.558)
Profitability, 1st lag	1.141***	1.069**
	(0.328)	(0.326)
Deposit ratio, 1st lag	0.0191	0.0163
	(0.0327)	(0.0319)
Asset Quality, 1st lag	0.0232	0.00996
	(0.0334)	(0.0328)
GDP growth	1.328***	1.331***
	(0.239)	(0.243)
Inflation rate	0.676**	0.687**
	(0.250)	(0.246)
Long term Interest Rate	-0.448*	-0.467*
	(0.215)	(0.211)
Global financial crisis	-4.115	-4.307
	(9.623)	(9.821)
Constant	66.26***	64.00***
	(9.971)	(9.793)
Random effects		
Year effect ($\sigma_{\zeta_{1t}}$)		
sd(constant)	12.34***	12.52***
	(2.459)	(2.518)
Parent effect ($\sigma_{\zeta_{2p}}$)		
sd(constant)	13.01***	12.82***
	(2.011)	(2.042)
Parent * year ($\sigma_{\zeta_{3tp}}$)		
sd(constant)		7.787***
		(1.381)
Residual, Standard Deviation *year* ($\sigma_{\varepsilon_{itp}}$)		
	23.68***	22.61***
	(0.421)	(0.497)
N	1747	1747
Log Likelihood	-8093.8	-8086.4
AIC	16215.5	16202.8
BIC	16292.0	16284.8

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5 - Intra-class Correlations based on estimates of Equation 3

% resemblance between subsidiaries due to:	
a) operating in the same year while belonging to different parents	17%
b) belonging to the same parent (not time varying parent effect)	18%
c) belonging to the same parent (allowing for time varying effects)	42%

Table 6 – Expanded cross random effects model including home country effect

Dependent variable: Loan Growth	(1)	(2)	(3)	(4)
Economic Capital, 1st lag	0.121	0.302**	0.170	0.326**
	(0.0965)	(0.108)	(0.0954)	(0.106)
Liquidity, 1st lag	0.299***	0.309***	0.297***	0.311***
	(0.0440)	(0.0456)	(0.0438)	(0.0452)
Size, 1st lag	-3.941***	-4.476***	-3.632***	-4.308***
	(0.499)	(0.573)	(0.492)	(0.558)
Profitability, 1st lag	1.014**	1.140***	0.939**	1.069**
	(0.333)	(0.328)	(0.331)	(0.326)
Deposit ratio, 1st lag	0.0158	0.0189	0.0197	0.0164
	(0.0308)	(0.0327)	(0.0304)	(0.0319)
Loan Impairments, 1st lag	0.0618	0.0233	0.0434	0.0102
	(0.0337)	(0.0334)	(0.0332)	(0.0328)
GDP growth	1.389***	1.328***	1.514***	1.331***
	(0.242)	(0.239)	(0.249)	(0.243)
Inflation rate	0.739**	0.676**	0.402**	0.688**
	(0.251)	(0.250)	(0.135)	(0.246)
Interest rate	-0.466*	-0.448*	-0.00275	-0.467*
	(0.216)	(0.215)	(0.156)	(0.211)
Global financial crisis	-4.662	-4.118	-2.459	-4.294
	(9.495)	(9.621)	(9.203)	(9.818)
Constant	60.37***	66.28***	52.50***	64.01***
	(8.982)	(9.967)	(8.894)	(9.792)
Random Effects				
Year effect				
sd(constant)	12.16***	12.34***	11.60***	12.52***
	(2.426)	(2.458)	(2.384)	(2.517)
Home Country effect				
sd(constant)	3.764***	5.49e-10***	3.464**	0.000000104**
	(1.274)	(2.44e-09)	(1.430)	(0.000000516)
Home Country * year effect				
sd(constant)			6.597***	
			(1.185)	
Parent effect				
sd(constant)		12.95***		12.77***
		(2.000)		(2.032)
Parent * year				
sd(constant)				7.755***
				(1.405)
Residual, Standard Deviation				
	24.71***	23.68***	24.03***	22.62***
	(0.423)	(0.421)	(0.441)	(0.500)
N	1747	1747	1747	1747
Log Likelihood	-8114.6	-8093.8	-8105.3	-8086.7
AIC	16257.2	16217.7	16240.5	16205.3
BIC	16333.7	16299.7	16322.5	16292.8

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7 - Intra-class Correlations based on estimates of all models reported in Table 6

% resemblance between subsidiaries due to:	(1)	(2)	(3)	(4)
a) operating in the same year while belonging to different parents	19.14%	17.29%	17.53%	17.58%
b) Home country effect (derived from parent ownership) fixed over time	1.83%	0.00%	1.56%	0.00%
c) Home country effect (derived from parent ownership) time dependent/varying	-	-	24.77%	-
d) belonging to the same parent (not time varying parent effect)	-	19.14%	-	18.29%
e) belonging to the same parent (time varying parent effect)	-	-	-	42.61%

4.3 Parent bank fundamentals, healthy balance sheets and credit growth

Many conventional panel estimators lead to misleading inferences and inconsistent estimations (Chudik and Pesaran, 2015) under certain data configurations. For example, Sarafidis and Robertson (2009) show that the generalized method of moments (GMM) produces inconsistent estimates when the cross-sectional dimension (N) grows large for a fixed number of years (T) and cross-sectional dependence in the disturbances is detected. Unfortunately, we are unable to implement any of the available tests for cross-sectional independence in panel data (De Hoyos and Sarafidis, 2006). Our panel of foreign financial group members lacks sufficient common observations across the panel to perform them. Nevertheless, the contemporaneous independence assumption should be relaxed. Reports on the modus operandi of financial groups in the region, i.e. Bakker et al. (2013), and some limited empirical findings i.e. Jeon et al. (2013), de Haas and van Lelyveld (2010), point in this direction. Once this assumption is removed it must be replaced with others concerning the nature of the dependence between our observations. To this end, we employ the established results in section 3.2, thus adding time-varying parents' financial characteristics and macroeconomic conditions of parents' home country. At the same time we have retained time-varying subsidiaries' characteristics as well as host country macroeconomic factors.

Lagged credit growth is found to have a persistent effect on today's outcomes (Table 8); whilst the global financial crisis clearly had a large negative effect on subsidiaries capabilities of extending credit. Economic growth both at host and home country level had a significant and positive effect. Interest rates at the home country level are also significant with a negative sign, thus reflecting a transmission channel of lending costs from home to host economies. Large subsidiaries exhibit lower credit growth rates on average. Subsidiaries' profitability has been found significant in only one out of the three estimation methods. Therefore we do not detect substantial evidence on subsidiaries funding their loan growth through their own profits. This indicates a longer-term expansion strategy of parents in the region, whereby current profitability at the domestic level is of minor relevance. This is not a surprising result, as it has been documented in previous empirical literature, Cull and Martinez (2013) and Haas and Lelyveld (2006).

Subsidiary's funding structure, notably the deposit ratio, does not affect significantly[21] credit growth in line with Cull and Martinez (2013). Therefore, foreign subsidiaries did not rely heavily on local deposits as a source of funding for their credit expansion. In addition, subsidiaries expand credit irrespectively of their capital ratio. This result must be seen in comparison with parents' economic capital, which is significant and negative in two out of the three model estimations. This is an indication of a rather centralized management of capital levels within Groups. Our findings contrast de Haas and van Lelyveld (2010, 2006). They found capital ratios at subsidiary level significant; however, they did not include parent bank's capital ratio. Yet, our findings are in line with Cull and Martínez Pería (2013). Subsidiary's liquidity is consistently significant and positive. On the other hand parent liquidity is found significant only once and with a negative sign.

[21] It is significant with a negative sign only in one regression – see Table 8 column 3.

Table 8 – Determinants of subsidiaries credit extensions - including parent banks' fundamentals

Dependent variable: Loan Growth	(1) FE	(2) sys GMM	(3) diff GMM
Loan growth, 1st lag	0.133***	0.224***	0.150***
	(0.039)	(0.043)	(0.038)
Economic Capital, 1st lag	0.225	0.104	0.404
	(0.221)	(0.250)	(0.293)
Liquidity, 1st lag	0.427***	0.602***	0.318***
	(0.093)	(0.089)	(0.089)
Size, 1st lag	-17.955***	-6.414***	-12.108***
	(1.644)	(1.252)	(2.557)
Profitability, 1st lag	1.245**	1.186	0.056
	(0.604)	(0.730)	(0.713)
Deposit ratio, 1st lag	-0.055	-0.126	-0.230**
	(0.054)	(0.082)	(0.110)
Loan Impairments, 1st lag	-0.154***	-0.041	-0.170***
	(0.050)	(0.051)	(0.057)
GDP growth	0.958***	1.017***	0.924***
	(0.209)	(0.254)	(0.242)
Inflation rate	0.278	0.387	0.030
	(0.314)	(0.256)	(0.358)
Interest rate	-0.727**	-0.513*	-0.251
	(0.368)	(0.260)	(0.384)
Parent: Profitability, 1st lag	**1.079**	**1.269**	**2.507**
	(0.714)	**(0.871)**	**(1.690)**
Parent: Liquidity, 1st lag	**-0.152**	**-0.163***	**0.251**
	(0.104)	**(0.089)**	**(0.202)**
Parent: Economic Capital, 1st lag	**-1.018****	**-0.493**	**-3.892*****
	(0.415)	**(0.472)**	**(0.985)**
Parent: Loan Impairments, 1st lag	**-2.436****	**-2.951*****	**-9.739*****
	(1.029)	**(0.889)**	**(2.356)**
Global financial crisis	0.035	-6.890***	-8.850***
	(2.361)	(2.276)	(2.576)
Home country: GDP growth	0.811***	0.645*	0.342
	(0.274)	(0.332)	(0.391)
Home country Inflation rate	-0.650	-1.109**	-0.621
	(0.562)	(0.466)	(0.518)
Constant	277.052***	107.735***	
	(25.590)	(21.363)	
Observations	1,569	1,569	1,355
R-squared	0.496		
No of banks	193	193	181
No of instruments		185	177
AR-2		0.794	0.447
Hansen J		0.235	0.261

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1;
FE refers to panel estimation controlling for individual bank fixed effects with robust standard errors. sys GMM refers to estimation using the Arellano-Bover/Blundell-Bond estimator. diff GMM refers to estimation using the Arellano - Bond difference panel data estimator with robust standard errors.'AR-2' is the p-value of the Arellano - Bond test. The H0 is that the average autocovariance in the residuals is of order 2. 'Hansen J' is the p-value of the Hansen J test for overidentifying restrictions, which is asymptotically distributed as chi2 under the null of instrument validity. Economic Capital is the ratio of equity to total assets. Liquidity is the ratio of liquid assets to total assets. Size is the natural logarithm of total assets. Loan Impairments is the ratio of loan impairment charges to gross loans. Deposit ratio is the ratio of customer deposits to total funding. Global financial crisis is a dummy for year 2008; All ratios are expressed in %.

Parents' asset quality is a relevant determinant of subsidiaries' credit growth. This finding is consistently significant across models. A lower quality of loan portfolios at parent level triggers lower loan growth at subsidiary level. Specifically this variable is the rate of loan impairment charges to total loans. Loan impairments are the result of the project screening intelligence at consolidated level.

The global financial crisis determined losses for banks and a deterioration of their loan portfolio. It could be argued that loan impairments are capturing the effect of time and of the crisis. To control for this, we re-estimate our model including year dummies (Table 9, columns 1, 2 and 4). Moreover, for robustness we also include country dummies (Table 9, columns 3 and 4). As a result, parent health (asset quality) remains consistently significant

across the several model specifications. Therefore, our measure of loan impairments captures intrinsic characteristics of parents such as their ability to manage their portfolios and their choice to finance profitable projects across their network of banks. Liquidity at the parent level is significant but not consistently across all estimations. All other results stay the same with the exception of home country inflation rate, which is a significant negative determinant of credit growth at the subsidiary level.

Table 9 – Determinants of subsidiaries credit extensions - including parent banks' fundamentals and controlling for year fixed effects and host country fixed effects

	Sys GMM year dummies	Diff GMM year dummies	Sys GMM country dummies	Sys GMM country & year dummies
Dependent variable: Loan Growth	(1)	(2)	(3)	(4)
Loan growth, 1st lag	0.187***	0.090**	0.290***	0.197***
	(0.053)	(0.037)	(0.056)	(0.052)
Economic Capital, 1st lag	0.284	-0.192	-0.023	0.133
	(0.332)	(0.275)	(0.319)	(0.366)
Liquidity, 1st lag	0.298**	0.472***	0.612***	0.294**
	(0.122)	(0.110)	(0.124)	(0.119)
Size, 1st lag	-5.917***	-28.176***	-7.534***	-6.385**
	(2.235)	(6.353)	(1.583)	(3.145)
Profitability, 1st lag	0.087	0.050	3.132***	0.019
	(0.685)	(0.402)	(1.097)	(0.682)
Deposit ratio, 1st lag	0.026	-0.080	-0.015	0.005
	(0.088)	(0.107)	(0.089)	(0.085)
Loan Impairments, 1st lag	-0.097*	-0.186***	-0.237*	-0.096*
	(0.052)	(0.055)	(0.127)	(0.051)
GDP growth	0.465	0.238	0.702***	0.603**
	(0.307)	(0.307)	(0.264)	(0.275)
Inflation rate	0.266	-0.342	0.046	0.271
	(0.268)	(0.412)	(0.324)	(0.301)
Interest rate	-0.596**	-0.180	-0.250	-0.326
	(0.290)	(0.412)	(0.391)	(0.370)
Parent: Profitability, 1st lag	**0.574**	**-1.325**	**0.462**	**0.184**
	(0.655)	**(1.443)**	**(0.761)**	**(0.584)**
Parent: Liquidity, 1st lag	**-0.086**	**-0.435****	**-0.209****	**-0.084**
	(0.092)	**(0.212)**	**(0.088)**	**(0.083)**
Parent: Economic Capital, 1st lag	**0.014**	**-1.407***	**-0.196**	**0.172**
	(0.421)	**(0.837)**	**(0.400)**	**(0.408)**
Parent: Loan Impairments, 1st lag	**-1.883****	**-5.213***	**-2.268****	**-1.605****
	(0.785)	**(2.954)**	**(0.918)**	**(0.795)**
Global financial crisis			-8.486***	
			(2.532)	
			(5.496)	(7.565)
Home country: GDP growth	0.674***	0.365	0.684**	0.658***
	(0.240)	(0.360)	(0.321)	(0.237)
Home country Inflation rate	-1.125**	-0.162	-1.046**	-0.978**
	(0.522)	(0.538)	(0.459)	(0.487)
Constant	88.761**		112.977***	91.350*
	(39.232)		(25.389)	(47.103)
Host Country dummies	**NO**	**NO**	**YES**	**YES**
Year Dummies	**YES**	**YES**	**NO**	**YES**
Observations	1,569	1,355	1,569	1,569
No of banks	193	181	193	193
No of instruments	119	105	194	136
AR-2	0.253	0.802	0.877	0.251
Hansen J	0.109	0.265	0.196	0.129

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1;
FE refers to panel estimation controlling for individual bank fixed effects with robust standard errors. sys GMM refers to estimation using the Arellano-Bover/Blundell-Bond estimator. diff GMM refers to estimation using the Arellano - Bond difference panel data estimator with robust standard errors. 'AR-2' is the p-value of the Arellano - Bond test. The H0 is that the average autocovariance in the residuals is of order 2.
'Hansen J' is the p-value of the Hansen J test for overidentifying restrictions, which is asymptotically distributed as chi2 under the null of instrument validity. Economic Capital is the ratio of equity to total assets. Liquidity is the ratio of liquid assets to total assets. Size is the natural logarithm of total assets. Loan Impairments is the ratio of loan impairment charges to gross loans. Deposit ratio is the ratio of customer deposits to total funding. Global financial crisis is a dummy for year 2008; All ratios are expressed in %.

We run a second robustness check. Our sample includes Greek banks with operations in the region. These banks operated with negative economic capital in some years, because they

incurred huge losses at consolidated level derived primarily from their home country operations. These extreme cases might be driving our results, especially those concerning parent health (asset quality). To account for this effect we re-estimate our models excluding those banks operating with negative capital. The results are reported in Table 10. Overall our results are confirmed, with parents' health remaining an important determinant of credit growth at subsidiary level. An interesting exception is the profitability of the parents, which turns significant. On the other hand, subsidiaries' profitability is only partially significant. Consequently, those parents not facing extreme adverse conditions sustain credit growth through their own profitability and transfer some of their resources to the subsidiaries.

Table 10 – Subsidiaries' credit growth - including parent banks' fundamentals, home country macro and excluding subsidiaries with parent banks operating with negative capital ratio

	Parent Financials excluding parents with negative Capital ratio				
	(1)	(2)	(3)	(4)	(5)
Dependent variable: Loan Growth	FE	sys GMM	diff GMM	sys GMM year dummies	sys GMM country dummies
Loan growth, 1st lag	0.132***	0.222***	0.146***	0.181***	0.283***
	(0.039)	(0.041)	(0.039)	(0.052)	(0.056)
Economic Capital, 1st lag	0.221	0.015	0.358	0.089	-0.084
	(0.221)	(0.242)	(0.313)	(0.330)	(0.326)
Liquidity, 1st lag	0.421***	0.570***	0.272***	0.287**	0.591***
	(0.093)	(0.095)	(0.091)	(0.122)	(0.124)
Size, 1st lag	-17.800***	-6.423***	-11.443***	-6.110***	-7.096***
	(1.632)	(1.245)	(2.788)	(2.199)	(1.710)
Profitability, 1st lag	1.132*	0.955	-0.042	0.012	2.763**
	(0.603)	(0.705)	(0.621)	(0.674)	(1.128)
Deposit ratio, 1st lag	-0.058	-0.146*	-0.233**	0.027	-0.037
	(0.054)	(0.079)	(0.106)	(0.086)	(0.088)
Loan Impairments, 1st lag	-0.159***	-0.050	-0.159***	-0.098*	-0.233*
	(0.049)	(0.046)	(0.056)	(0.053)	(0.118)
GDP growth	0.877***	0.997***	0.943***	0.422	0.702**
	(0.212)	(0.255)	(0.249)	(0.289)	(0.270)
Inflation rate	0.288	0.358	0.205	0.326	0.151
	(0.313)	(0.255)	(0.374)	(0.266)	(0.314)
Interest rate	-0.730*	-0.423	-0.442	-0.559**	-0.247
	(0.371)	(0.256)	(0.459)	(0.279)	(0.384)
Parent: Profitability, 1st lag	**3.595*** **	**3.473*** **	**8.195*** **	**1.385**	**1.942***
	(1.050)	**(1.089)**	**(2.106)**	**(0.924)**	**(1.054)**
Parent: Liquidity, 1st lag	**-0.113**	**-0.150**	**0.451** **	**-0.089**	**-0.183** **
	(0.107)	**(0.091)**	**(0.214)**	**(0.093)**	**(0.085)**
Parent: Economic Capital, 1st lag	**-1.173*** **	**-0.617**	**-4.564*** **	**0.039**	**-0.266**
	(0.424)	**(0.436)**	**(1.156)**	**(0.424)**	**(0.429)**
Parent: Loan Impairments, 1st lag	**-2.013***	**-3.002*** **	**-7.209*** **	**-1.892** **	**-2.458** **
	(1.054)	**(1.003)**	**(2.377)**	**(0.897)**	**(1.016)**
Global financial crisis	-0.847	-8.279***	-11.531***		-9.405***
	(2.432)	(2.201)	(2.990)		(2.653)
Home country: GDP growth	0.742**	0.443	-0.137	0.601**	0.516
	(0.296)	(0.335)	(0.435)	(0.288)	(0.333)
Home country Inflation rate	-0.725	-1.196***	-1.048**	-1.148**	-1.076***
	(0.493)	(0.400)	(0.446)	(0.468)	(0.404)
Constant	274.563***	111.267***		109.122***	101.674***
	(25.629)	(21.405)		(38.600)	(28.728)
Observations	1,541	1,541	1,328	1,541	1,541
R-squared	0.494				
No of banks	193	193	181	193	193
No of instruments		185	177	119	194
AR-2		0.760	0.720	0.246	0.928
Hansen J		0.246	0.197	0.104	0.150

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; FE refers to panel estimation controlling for individual bank fixed effects with robust standard errors. sys GMM refers to estimation using the Arellano-Bover/Blundell-Bond estimator. diff GMM refers to estimation using the Arellano - Bond difference panel data estimator with robust standard errors. 'AR-2' is the p-value of the Arellano - Bond test. The H0 is that the average autocovariance in the residuals is of order 2. 'Hansen J' is the p-value of the Hansen J test for overidentifying restrictions, which is asymptotically distributed as chi2 under the null of instrument validity. Economic Capital is the ratio of equity to total assets. Liquidity is the ratio of liquid assets to total assets. Size is the natural logarithm of total assets. Loan Impairments is the ratio of loan impairment charges to gross loans. Deposit ratio is the ratio of customer deposits to total funding. Global financial crisis is a dummy for year 2008; all ratios are expressed in %.

4.4 Direct effects of past excessive credit growth on future credit extensions

Previous empirical studies found a relationship between excessive credit expansion and problem loans. Jiménez and Saurina (2006) model problem loan ratios as a function of macro- and micro-variables (loan portfolio characteristics). Their sample consists of loans to non-financial firms granted by Spanish banks over the period 1984-2002. They find a robust statistical relationship between rapid credit growth and ex post credit risk measures, suggesting risks materialize after four years as a consequence of rapid credit growth.

So far, in our entire set of estimations, loan impairment charges at parent level are a significant determinant of credit growth at subsidiary level. Higher loan impairment charges consistently deteriorate credit growth at subsidiary level. Loan impairments reflect poor selection of project financing, for instance. If a bank engages into an aggressive expansionary policy, then it might follow lenient screening standards. If that is the case, then the probability of having financed bad projects increases along with higher loan impairments the following years. This determines a decline of credit growth. We investigate this channel analyzing the effect of past excessive loan growth on current loan growth.

We re-estimate our model (Equation 4) adding a variable capturing excessive credit expansion at parent and subsidiary level. This variable is a dummy that equals one if a bank expanded credit more than the yearly average of its peer group. At the parent level, the peer group consists of all international banks that operate in the region in a given year. At the subsidiary level, we compare each subsidiary's credit growth with the annual average of all banks operating in the same host country in a given year. We compute this variable accounting for up to four lags following previous literature (Jiménez and Saurina, 2006).

Results are reported in Table 11. Estimations at parent and subsidiary level fail to indicate any connection between past excessive credit growth and current credit growth. This may imply that banks in our region do not necessarily undermine their pre-screening policies when they extend credit aggressively or that excessive credit per se is not an indicator of exuberance in banks' risk taking attitude.

Table 11 - Effects of excessive loan growth at parent and subsidiary level

	Parent Level			Subsidiary Level		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: Loan Growth	FE	sys GMM	diff GMM	FE	sys GMM	diff GMM
Credit growth, 1st lag	0.132***	0.224***	0.147***	0.105***	0.287***	0.181***
	(0.039)	(0.042)	(0.039)	(0.033)	(0.039)	(0.035)
Economic Capital, 1st lag	0.198	0.040	0.322	-0.092	-0.188	-0.310
	(0.229)	(0.256)	(0.286)	(0.191)	(0.198)	(0.439)
Liquidity, 1st lag	0.437***	0.601***	0.336***	0.462***	0.442***	0.425***
	(0.097)	(0.093)	(0.090)	(0.085)	(0.091)	(0.136)
Size, 1st lag	-18.389***	-6.496***	-13.093***	-21.663***	-3.890***	-20.172***
	(1.632)	(1.243)	(3.034)	(2.757)	(1.273)	(2.622)
Profitability, 1st lag	1.280**	1.195	0.090	1.675***	1.606**	1.728**
	(0.611)	(0.744)	(0.639)	(0.527)	(0.727)	(0.852)
Deposit ratio, 1st lag	-0.060	-0.116	-0.246**	0.018	-0.116*	-0.334***
	(0.055)	(0.081)	(0.111)	(0.061)	(0.062)	(0.101)
Loan Impairments, 1st lag	-0.151***	-0.038	-0.170***	-0.144***	-0.055	-0.119
	(0.050)	(0.053)	(0.057)	(0.052)	(0.095)	(0.131)
GDP growth	0.942***	1.007***	0.940***	0.828***	1.186***	0.823***
	(0.207)	(0.251)	(0.248)	(0.156)	(0.250)	(0.201)
Inflation rate	0.261	0.417	-0.018	0.595***	0.518**	0.405*
	(0.315)	(0.259)	(0.363)	(0.220)	(0.210)	(0.231)
Interest rate	-0.692*	-0.464*	-0.186	-0.714**	-0.562**	-0.717**
	(0.370)	(0.267)	(0.439)	(0.342)	(0.248)	(0.352)
Parent: Profitability, 1st lag	1.172	1.390	2.742			
	(0.748)	(0.948)	(1.668)			
Parent: Liquidity, 1st lag	-0.157	-0.159*	0.194			
	(0.102)	(0.089)	(0.201)			
Parent: Economic Capital, 1st lag	-1.002**	-0.531	-3.999***			
	(0.420)	(0.481)	(0.985)			
Parent: Loan Impairments, 1st lag	-2.427**	-2.831***	-9.465***			
	(1.020)	(0.941)	(2.467)			
Parent: Excessive growth, 1 year before	**0.460**	**-0.122**	**-0.958**			
	(1.475)	**(1.535)**	**(1.671)**			
Parent: Excessive growth, 2 years before	**-2.773***	**-1.371**	**-2.896***			
	(1.515)	**(1.483)**	**(1.742)**			
Parent: Excessive growth, 3 years before	**-0.864**	**-1.149**	**-1.448**			
	(1.323)	**(1.413)**	**(1.380)**			
Parent: Excessive growth, 4 years before	**0.910**	**-0.816**	**-0.746**			
	(1.285)	**(1.219)**	**(1.215)**			
Global financial crisis	-0.059	-6.825***	-8.347***	-0.627	-7.233***	-3.364*
	(2.301)	(2.234)	(2.889)	(1.785)	(1.845)	(1.878)
Home country: GDP growth	0.793***	0.657**	0.331			
	(0.279)	(0.329)	(0.389)			
Home country Inflation rate	-0.616	-1.045**	-0.491			
	(0.567)	(0.476)	(0.532)			
Member of a foreign financial group				19.779***	4.267**	18.146***
				(3.778)	(1.821)	(3.931)
Excessive growth, 1 year before				**2.455***	**-0.757**	**-0.013**
				(1.437)	**(1.537)**	**(1.638)**
Excessive growth, 2 years before				**1.577**	**1.307**	**0.661**
				(1.067)	**(1.204)**	**(1.098)**
Excessive growth, 3 years before				**-0.032**	**-0.545**	**-0.670**
				(0.961)	**(1.077)**	**(1.151)**
Excessive growth, 4 years before				**-1.420**	**0.595**	**-1.224**
				(1.032)	**(1.188)**	**(1.136)**
Constant	284.483***	109.737***		293.594***	59.286***	
	(25.341)	(21.255)		(42.135)	(22.330)	
Observations	1,569	1,569	1,355	2,143	2,143	1,863
R-squared	0.498			0.437		
No of banks	193	193	181	280	280	264
No of instruments		189	181		255	219
AR-2		0.802	0.400		0.486	0.120
Hansen J		0.228	0.271		0.108	0.219

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; FE refers to panel estimation controlling for individual bank fixed effects with robust standard errors. sys GMM refers to estimation using the Arellano-Bover/Blundell-Bond estimator. diff GMM refers to estimation using the Arellano - Bond difference panel data estimator with robust standard errors. 'AR-2' is the p-value of the Arellano - Bond test. 'Hansen J' is the p-value of the Hansen J test for overidentifying restrictions. Economic Capital is the ratio of equity to total assets. Liquidity is the ratio of liquid assets to total assets. Size is the natural logarithm of total assets. Loan Impairments is the ratio of loan impairment charges to gross loans. Deposit ratio is the ratio of customer deposits to total funding. Global financial crisis is a dummy for year 2008; All ratios are expressed in %.

4.5 Risky attitude and credit growth

Fabrizio et al. (2006) observed that weak banks were expanding credit with the same pace as sound banks, examining credit growth in the region during the years 2001-2004. The authors point out that prudential risk materializes at later stages, and they warn of the possible negative effects of too much risk taking. Theory also predicts that less solvent banks tend to respond to moral hazard incentives by undertaking more portfolio risk, gambling for a jump in future earnings (Marcus, 1984). Our sample allows us to investigate the effects of such behavior linking past excessive risk taking to subsequent credit growth.

To do so, we construct a variable that combines two elements, namely: excessive credit growth and negatively misaligned capital ratio. We create a dummy variable that equals one if a bank expanded credit more than the annual average of its peer group while at the same time having a capital ratio lower than the annual average of its peer group. Peers are defined as in section 3.4. This variable is constructed both at parent and at subsidiary level.

Results are reported in Table 12. Subsidiary level estimates do not produce consistent results across the three models. On the other hand, results are more consistent across the deployed models when looking at excessive risk taking at parent level. Excessive credit expansion combined with a deterioration of the capital ratio at parent level predicts a decline of credit growth at subsidiary level in the following periods, after three years specifically. These findings give us a more complete perspective on the role of parent capital. We found that subsidiaries owned by more capital intensive parents have a lower credit growth on average. The result is confirmed in this set of new estimations. In addition, excessive credit growth associated with an excessively low capital ratio at parent level reduces subsidiaries' capacity to extend credit. This empirical finding confirms the general theory of excessive risk taking potentially triggered by moral hazard incentives.

Table 12 - Excessive risk taking and credit growth

	Parent Level			Subsidiary Level		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: Loan Growth	FE	sys GMM	diff GMM	FE	sys GMM	diff GMM
Loan growth, 1st lag	0.132***	0.218***	0.145***	0.118***	0.284***	0.181***
	(0.040)	(0.042)	(0.038)	(0.030)	(0.034)	(0.035)
Economic Capital, 1st lag	0.226	0.117	0.362	-0.073	-0.573***	-0.669*
	(0.222)	(0.245)	(0.278)	(0.193)	(0.208)	(0.395)
Liquidity, 1st lag	0.427***	0.582***	0.324***	0.448***	0.488***	0.446***
	(0.093)	(0.085)	(0.088)	(0.085)	(0.090)	(0.139)
Size, 1st lag	-17.516***	-6.030***	-12.230***	-21.132***	-4.977***	-24.105***
	(1.698)	(1.151)	(2.959)	(2.759)	(1.222)	(2.817)
Profitability, 1st lag	1.269**	1.179	0.146	1.673***	1.581**	1.757**
	(0.613)	(0.726)	(0.671)	(0.531)	(0.703)	(0.795)
Deposit ratio, 1st lag	-0.059	-0.135	-0.248**	0.019	-0.055	-0.342***
	(0.055)	(0.084)	(0.114)	(0.061)	(0.065)	(0.107)
Loan Impairments, 1st lag	-0.155***	-0.045	-0.162***	-0.146***	-0.098	-0.170
	(0.049)	(0.051)	(0.058)	(0.053)	(0.098)	(0.147)
GDP growth	0.983***	1.064***	0.974***	0.817***	1.017***	0.569***
	(0.207)	(0.254)	(0.247)	(0.155)	(0.227)	(0.214)
Inflation rate	0.308	0.433*	0.089	0.583***	0.626***	0.311
	(0.314)	(0.261)	(0.361)	(0.221)	(0.210)	(0.231)
Interest rate	-0.716*	-0.465*	-0.264	-0.722**	-0.574**	-0.953**
	(0.367)	(0.259)	(0.445)	(0.345)	(0.253)	(0.386)
Parent: Profitability, 1st lag	0.978	1.098	2.254			
	(0.734)	(0.840)	(1.727)			
Parent: Liquidity, 1st lag	-0.154	-0.150*	0.180			
	(0.104)	(0.087)	(0.207)			
Parent: Economic Capital, 1st lag	-0.996**	-0.586	-3.625***			
	(0.416)	(0.419)	(0.972)			
Parent: Loan Impairments, 1st lag	-2.444**	-2.841***	-9.060***			
	(1.043)	(0.908)	(2.417)			
Global financial crisis	-0.399	-7.325***	-8.159***	-1.008	-7.684***	-2.608
	(2.336)	(2.237)	(3.038)	(1.751)	(1.694)	(1.870)
Home country: GDP growth	0.755***	0.573*	0.345			
	(0.271)	(0.312)	(0.400)			
Home country Inflation rate	-0.587	-0.987**	-0.575			
	(0.590)	(0.444)	(0.529)			
Parent: Risky, 1st lag	**1.888**	**2.631***	**0.245**			
	(1.667)	**(1.574)**	**(1.750)**			
Parent: Risky, 2nd lag	**-1.113**	**-2.167**	**-1.538**			
	(1.587)	**(1.487)**	**(1.635)**			
Parent: Risky, 3rd lag	**-2.477***	**-4.025*****	**-3.244****			
	(1.367)	**(1.460)**	**(1.514)**			
Parent: Risky, 4th lag	**-0.269**	**-2.341***	**-1.138**			
	(1.264)	**(1.346)**	**(1.420)**			
Member of foreign financial group				19.844***	5.402***	23.032***
				(3.860)	(1.883)	(4.558)
Risky, 1st lag				**1.334**	**-1.752**	**-8.979*****
				(1.443)	**(1.535)**	**(2.024)**
Risky, 2nd lag				**1.970***	**2.191**	**-3.406****
				(1.168)	**(1.381)**	**(1.534)**
Risky, 3rd lag				**-0.368**	**-0.688**	**-4.049*****
				(1.128)	**(1.324)**	**(1.290)**
Risky, 4th lag				**-1.151**	**-2.332***	**-8.395*****
				(1.186)	**(1.366)**	**(2.510)**
Constant	271.051***	104.064***		286.504***	74.422***	
	(26.187)	(19.751)		(42.420)	(22.080)	
Observations	1,569	1,569	1,355	2,143	2,143	1,861
R-squared	0.498			0.436		
No of banks	193	193	181	280	280	264
No of instruments		189	181		259	219
AR-2		0.890	0.464		0.433	0.0746
Hansen J		0.264	0.241		0.148	0.306

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; FE refers to panel estimation controlling for individual bank fixed effects with robust standard errors. sys GMM refers to estimation using the Arellano-Bover/Blundell-Bond estimator. diff GMM refers to estimation using the Arellano - Bond difference panel data estimator with robust standard errors. 'AR-2' is the p-value of the Arellano - Bond test. The H0 is that the average autocovariance in the residuals is of order 2. 'Hansen J' is the p-value of the Hansen J test for overidentifying restrictions, which is asymptotically distributed as chi2 under the null of instrument validity. Economic Capital is the ratio of equity to total assets. Liquidity is the ratio of liquid assets to total assets. Size is the natural logarithm of total assets. Loan Impairments is the ratio of loan impairment charges to gross loans. Deposit ratio is the ratio of customer deposits to total funding. Global financial crisis is a dummy for year 2008; All ratios are expressed in %.

4.6 Pre-post crisis effects

We examine whether and how the impact of foreign ownership changes after the global financial crisis. To do so, we estimate equation 1 for the periods 2000-2007 and 2008-2013 controlling for membership in a financial groups and time effects. Results are reported in table 13 (columns 1 to 6). Before the global financial crisis, subsidiaries consistently expanded credit more than domestic banks. This is the same result for the overall sample. The situation changes after the global financial crisis. On average subsidiaries cease to exhibit any significant difference in their propensity to extent credit compared to domestically owned banks.

Table 13 - Loan growth of members of foreign financial groups vis-à-vis domestic banks before and after crisis

Dependent Variable – Loan Growth of subsidiary *i*									
	Before the 2008 crisis (2000-2007)			**After the 2008 crisis (2008-2013)**			**Pooled with pre-post crisis dummies interacted with ownership**		
	(1) FE	(2) sys GMM	(3) diff GMM	(4) FE	(5) sys GMM	(6) diff GMM	(7) FE	(8) sys GMM	(9) diff GMM
Subsidiary bank (owned by a financial group)	24.278***	8.136***	11.708***	-8.265	2.380	-4.800			
	(7.349)	(2.694)	(4.424)	(10.047)	(1.709)	(22.338)			
Before the crisis: subsidiary bank							23.827*** (4.945)	9.227*** (2.556)	15.783*** (5.543)
After the crisis: domestic bank							-7.206*** (2.472)	-17.153*** (2.630)	-20.000*** (4.452)
After the crisis: subsidiary bank							8.294 (5.128)	-14.920*** (3.063)	-12.313* (7.051)
Observations	1,160	1,160	1,122	1,391	1,391	1,145	2,551	2,551	2,267
R-squared	0.301			0.302			0.468		
Number of banks	258	258	245	253	253	237	293	293	275
No of instruments		147	112		186	136		279	244
AR(3) p_value		0.998	0.905		0.629	0.504		0.709	0.815
p-value Hansen		0.386	0.377		0.177	0.249		0.441	0.321

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; year dummies included in estimations from (1) to (6); models from (7) to (9) include a crisis dummy taking value 1 for years 2008-2013. This dummy is interacted with the financial group dummy variable to generate the sub-period effects. FE refers to panel estimation controlling for individual bank fixed effects with robust standard errors. The whole set of regressors is omitted as the interest is focused on the pre-post crisis effects. Sys GMM refers to estimation using the Arellano-Bover/Blundell-Bond estimator. Difference GMM refers to estimation using the Arellano - Bond difference panel data estimator with robust standard errors. 'AR-3' is the p-value of the Arellano - Bond test. The H0 is that the average autocovariance in the residuals is of order 3. 'Hansen J' is p-value of the Hansen J test for overidentifying restrictions, which is asymptotically distributed as chi2 under the null of instrument validity. In models (2), (3), (5) and (6) we instrument bank characteristics with their third to fifth lag and we apply forward orthogonal deviations to the instruments for the transformed equation; in model (8) we instrument bank characteristics with their third to fifth lag and we apply both forward and backward orthogonal deviations. Finally, in model (9), we instrument bank characteristics with their third to sixth lag and we apply both forward and backward orthogonal deviations.

We also try to capture the same effect employing an alternative modeling approach. We estimate Equation 1 across all the years and we add a new set of variables generated by the interaction between a crisis dummy and an ownership variable identifying membership of a bank in an international financial group. The crisis dummy equals 1 for the years 2008-2013

and 0 for all the other years. As a result, we obtain four categories namely: subsidiary banks before the crisis, domestic banks before the crisis, subsidiary banks after the crisis and domestic banks after the crisis. In columns 7-9 of Table 13 the estimated coefficients should be interpreted as a deviation from the baseline of being a domestic bank before the crisis. Before the crisis subsidiaries boosted local credit growth more than domestic owned banks. However both groups of banks contributed to a contraction of credit after the crisis. This confirms the previous findings. In addition, the negative reaction of domestic banks was more pronounced than subsidiaries on average. Therefore we still detect some sort of divergence in behavior between domestically owned and foreign owned banks, whereby foreign owned banks (on average) contracted credit less than domestic banks after controlling for macroeconomic and bank balance sheet characteristics.

5 Robustness checks

We have conducted two sets of robustness checks. First, we tested the robustness of the results to a broader definition of foreign ownership. Second, we relaxed the exogeneity assumption imposed on parent bank balance sheet vis-à-vis changes in subsidiaries' balance sheet items.

Our database allows testing for alternative ownership definitions. So far, the definition of foreign ownership identifies a subsidiary when the largest shareholder is a foreign financial institution and it controls the subsidiary bank with at least 50% of the total shares, thus excluding other foreign entities or foreign minority shares. We re-estimate the model in equation 1 using two additional definitions of ownership. For these purposes, we have created a dummy variable that equals 1 if the largest shareholder is foreign (irrespectively of the percentage owned and of the identity of the shareholder). For example, the largest foreign shareholder may hold 10% of shares and not a controlling stake. Moreover we have defined another ownership variable, whereby the largest shareholder is foreign and controls the bank with 50% or more of total shares. For the latter two definitions, the identity of the owner can be diverse: a commercial entity, an individual or another financial institution.

Table 14 reports the estimation results. All types of foreign ownership are significant and exert a positive effect on subsidiaries' credit growth. Foreign participated banks tend to extend credit more than their domestically owned competitors. Consequently, foreign ownership matters. Members of financial groups constitute the vast majority[22] of the banks with foreign participation. Therefore, we can conclude that our results in the previous sections are robust to alternative ownership definitions.

The second set of robustness checks tests the effect generated by the inclusion of relatively large subsidiaries into our sample, whereby the subsidiary size is defined in relation to parent bank balance sheet. Following previous literature (de Haas and van Lelyveld, 2010; Jeon et al., 2013) we have excluded endogeneity issues because the average subsidiary balance sheet is significantly smaller than its parent bank balance sheet in our database. If a subsidiary is small relative to the parent bank, the omitted variable bias is considered to have an immaterial

[22] 67% of our total observations are banks whose largest shareholder is foreign and 57% are banks controlled by foreign financial groups

effect on the results. In our case the average subsidiary accounts for about 2.3 per cent of its parent bank's assets, well below the average detected in other previous studies[23]. However some subsidiaries in our sample have a balance sheet size higher than 10% of the total balance sheet of the parent bank. These represent roughly 4% of the total observations in our dataset.

Table 14 - Estimations of Equation 1 for different categories of ownership

Dependent variable: Loan Growth	(1) The majority shareholder is a foreign entity	(2) A foreign entity owns at least 50% of shares
Loan growth, 1st lag	0.259***	0.261***
	(0.026)	(0.027)
Economic Capital, 1st lag	-0.425**	-0.422**
	(0.181)	(0.178)
Liquidity, 1st lag	0.477***	0.478***
	(0.087)	(0.085)
Size, 1st lag	-5.170***	-5.187***
	(1.113)	(1.110)
Profitability, 1st lag	1.532***	1.539***
	(0.553)	(0.567)
Deposit ratio, 1st lag	-0.015	-0.016
	(0.054)	(0.055)
Loan Impairments, 1st lag	-0.088	-0.092
	(0.089)	(0.087)
GDP growth	1.159***	1.159***
	(0.163)	(0.162)
Inflation rate	0.504***	0.496***
	(0.188)	(0.188)
Interest rate	-0.321	-0.326
	(0.214)	(0.213)
Global financial crisis	-7.492***	-7.490***
	(1.559)	(1.553)
Owner: largest shareholder foreign	7.740***	
	(1.739)	
Owner: at least 50% of shares foreign owned		7.383***
		(1.691)
Constant	69.975***	70.578***
	(19.177)	(18.917)
Observations	2,775	2,775
Number of id	310	310
No of instruments	306	306
AR-2	0.539	0.506
Hansen J	0.401	0.406

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; The Arellano-Bover/Blundell-Bond estimator (system GMM) was used to produce the results above. 'AR-2' is the p-value of the Arellano - Bond test. The H0 is that the average autocovariance in the residuals is of order 2. 'Hansen J' is the p-value of the Hansen J test for overidentifying restrictions, which is asymptotically distributed as chi2 under the null of instrument validity. Economic Capital is the ratio of equity to total assets. Liquidity is the ratio of liquid assets to total assets. Size is the natural logarithm of total assets. Loan Impairments is the ratio of loan impairment charges to gross loans. Deposit ratio is the ratio of customer deposits to total funding. Global financial crisis is a dummy for year 2008; All ratios are expressed in %. In models (1) and (2) we instrument bank characteristics with their second to fourth lag and we apply forward and backward orthogonal deviations to the instruments for the transformed equation.

To test for a potential bias introduced by these relatively large subsidiary banks, we have conducted an additional analysis excluding all subsidiaries with a balance sheet above 10% of the parent's bank balance sheet from the sample. Table 15 reports the results. The estimation

[23] De Haas and van Lelyveld (2010) have considered an average size of 10% for a subsidiary as being small enough

procedure and model are the same as in Table 8. A full reading of the estimation results suggests that our estimation methods and sample are robust, thus confirming by and large our findings.

Table 15 – Subsidiaries' credit growth controlling for parent banks' fundamentals and excluding subsidiaries with assets exceeding 10% of financial group's total assets

	(1)	(2)	(3)
Dependent variable: Loan Growth	FE	sys GMM	diff GMM
Loan growth, 1st lag	0.132***	0.215***	0.138***
	(0.039)	(0.041)	(0.038)
Economic Capital, 1st lag	0.274	-0.025	0.419
	(0.221)	(0.211)	(0.271)
Liquidity, 1st lag	0.411***	0.545***	0.315***
	(0.100)	(0.090)	(0.092)
Size, 1st lag	-17.760***	-7.534***	-12.531***
	(1.730)	(1.234)	(2.855)
Profitability, 1st lag	1.097*	0.880	0.147
	(0.601)	(0.732)	(0.648)
Deposit ratio, 1st lag	-0.047	-0.056	-0.192*
	(0.056)	(0.083)	(0.102)
Loan Impairments, 1st lag	-0.152***	-0.064	-0.155***
	(0.052)	(0.049)	(0.050)
GDP growth	1.012***	1.029***	1.027***
	(0.204)	(0.236)	(0.218)
Inflation rate	0.266	0.357	0.100
	(0.326)	(0.261)	(0.374)
Interest rate	-0.738*	-0.476*	-0.441
	(0.376)	(0.263)	(0.441)
Parent: Profitability, 1st lag	0.684	0.874	1.309
	(0.717)	(0.821)	(1.534)
Parent: Liquidity, 1st lag	-0.135	-0.107	0.244
	(0.105)	(0.092)	(0.215)
Parent: Economic Capital, 1st lag	-1.149***	-0.415	-3.466***
	(0.408)	(0.454)	(0.903)
Parent: Loan Impairments, 1st lag	-2.951***	-3.061***	-9.781***
	(1.114)	(0.941)	(2.618)
Global financial crisis	0.306	-5.649***	-6.799**
	(2.469)	(2.135)	(2.672)
Home country: GDP growth	1.024***	0.855**	0.673*
	(0.302)	(0.331)	(0.383)
Home country: Inflation rate	-1.107**	-1.483***	-1.177**
	(0.492)	(0.429)	(0.467)
Constant	274.944***	121.237***	
	(26.602)	(21.878)	
Observations	1,494	1,494	1,294
R-squared	0.504		
No of banks	191	191	179
No of instruments		185	177
AR-2		0.760	0.379
Hansen J		0.271	0.327

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1;
FE refers to panel estimation controlling for individual bank fixed effects with robust standard errors. sys GMM refers to estimation using the Arellano-Bover/Blundell-Bond estimator. diff GMM refers to estimation using the Arellano - Bond difference panel data estimator with robust standard errors. 'AR-2' is the p-value of the Arellano - Bond test. The H0 is that the average autocovariance in the residuals is of order 2. 'Hansen J' is the p-value of the Hansen J test for overidentifying restrictions, which is asymptotically distributed as chi2 under the null of instrument validity. Economic Capital is the ratio of equity to total assets. Liquidity is the ratio of liquid assets to total assets. Size is the natural logarithm of total assets. Loan Impairments is the ratio of loan impairment charges to gross loans. Deposit ratio is the ratio of customer deposits to total funding. Global financial crisis is a dummy for year 2008; All ratios are expressed in %.

6 Conclusions

Our research investigates the determinants of credit growth in CESEE. We find that subsidiaries credit behavior cannot be viewed in isolation and needs to be framed into the operating landscape, including the linkages to foreign owner banking groups and their

economies. We constructed a unique and new database. It allows for a very wide geographical coverage of the CESEE region (i.e. 18 CESEE countries over 14 years). We identify the ultimate owner of each subsidiary bank, instead of focusing only on the direct ownership as done in previous studies. We have looked into the ownership of all banks operating in the CESEE region; whilst earlier studies examined the behavior of some major multinational banks operating in the same perimeter.

Subsidiaries owned by foreign financial groups provide an extra boost to credit growth at the domestic level. The global financial crisis of 2008 clearly brought about a large negative effect. However domestic banks and subsidiary banks contracted credit equally after the financial crisis, with subsidiary banks less on average than domestic banks. At the same time, parent banks' balance sheet composition continued to play a prominent role and affect the capacity of subsidiaries to extend credit. We also detect that banks operating across different countries in the region are very much similar in the way they extend credit in a given year if they belong to the same parent bank.

Parent banks' economic capital position matters more than subsidiaries' own domestic capital position. This is an indication of a rather centralized management of capital levels within Groups. Moreover, parents' asset quality (loan impairment charges) is a relevant determinant of credit growth at subsidiary level. A peer group analysis unveils that risky behaviors at the parent bank level jeopardize credit growth at the subsidiary level. Specifically an excessive credit expansion and a reduction of economic capital ratios lead to a decline in subsidiaries' lending capacity after three years.

Economic growth at both the host country and the home country level had a significant and positive effect. Interest rates at home country level are significant with a negative sign thus reflecting a transmission channel of lending costs from home to host economies. Also interest rates at the host country level exert a negative impact on credit growth as expected, suggesting that demand effects at work.

Our findings have strategic and policy implications. First, the ownership structure cannot be ignored, given the systemic role of foreign banks in the CESEE region. Second, the performance of subsidiaries is heavily dependent on the composition and quality of the parent banks' balance sheet. Therefore a consolidated approach should be considered when looking at lending conditions in any of the countries of the CESEE region. Third, negative and positive cross border externalities drive domestic credit. This implies that home and host country regulators should internalize the implications of their decisions on host countries banking sectors. On the other hand, host country actors need to consider the relevance of elements beyond their control when taking decisions, including parent banks' balance sheet health as well as home countries cyclical position. As a result, a continuous and open cross border collaboration and coordination among home and host regulators is warranted. Therefore cross border access to information and continuous dialogue is fundamental for the stability of the regional banking sectors.

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Appendix

A.1 Details on the construction of our sample

We have constructed a unique dataset capturing the ownership structure of banks in the CESEE region. To construct our dataset we dropped duplicates iteratively favoring consolidated accounts (Duprey and Le, 2014). We have also excluded banks with a data history of less than three consecutive years. We have also eliminated banks with market share less than 1% in all years between 2000 and 2014, whereby each single country identifies the relevant market playing field.

A.1.1 Ownership

To construct the ownership variable we researched a wide variety of sources, namely Bankscope, Amadeus, banks' specific financial statements, S&P IQ capital, Bloomberg, Central bank reports, Ministries' reports, stock exchanges information and news. In each case we assessed the reliability of the available source and subsequently cross checked our data (i.e. we would always consider audited financial statements to be superior to data from commercial databases).

A.1.2 Imputations

When constructing the database of characteristics of banks, we wanted to obtain the longest and most uniform possible time series. Bankscope includes data sourced from financial statements based on consolidated and unconsolidated accounting standards. Each accounting standard includes several sub-categories. Bank balance sheet characteristics can be available in one or multiple standards. Moreover the length of the time series varies depending on the accounting standards. Duprey and Lé (2014) suggest an iterative procedure when dealing with Bankscope data. First the level of consolidation should be chosen. We gave preference to consolidated accounts (e.g. C). Second the available companion data should be employed (C*), otherwise an alternative standard of data should be considered to cover for missing data. We computed the growth rate of the companion consolidated accounts (C*) and applied it to the time series imputing forward and backward the missing values. If this procedure was still leaving some missing values, we checked for the availability of an alternative time series - based on unconsolidated accounts (U) in our case. Ultimately we filled data gaps still emerging applying the growth rates of companion unconsolidated statements[24] (U*). This procedure removed[25] the shift effects between one year and another due to the employment of different accounting rules, which a data replacement approach would have generated.

[24] After this last step in the data cleaning processes few breaks were still detected for 19 banks or 31 observations out of 3700. We reconstructed the missing observations applying a compound growth rate to the available data - Compound annual growth rate $= \frac{\text{Ending Value}}{\text{Beginning Value}}^{\frac{1}{\#\text{ of years}}} - 1$

[25] However the employment of unconsolidated data growth rates to extend consolidated data relies on the assumption that a bank maintains the same level of operations over time. A bank may sell part of its operations. Therefore it has no obligation to keep consolidated accounts because the aggregate level of its operations has changed. To avoid this issue we prefer to apply backdating growth rates based on consolidated accounts to extend unconsolidated data series. Whenever this has led to do more imputations than the number of observations available, we employed growth rates of unconsolidated accounts to extend the time series of consolidated accounts. All in all the latter form of imputation concerns only 48 observations out of 3700.

A.2 Distribution of banks and aggregate market shares

Table A.2.1 - The list of financial groups with subsidiaries in CESEE during the period 2000-2014

Financial Group	Home Country	Host Country
Volksbanken Holding regGenmbH	AT	BA, CZ, HR, HU, RO, RS, SI
Raiffeisen	AT	AL, BA, BG, CZ, HR, HU, KV, PL, RO, RS, SI, SK
BAWAG P.S.K. AG	AT	CZ, SI, SK
Steiermarkische Bank und Sparkassen AG-Bank Styria	AT	BA, MK
Oesterreichische Volksbanken AG	AT	BA, CZ, HR, HU, RO
Heta Asset Resolution AG - Former Hypo Alpe-Adria Bank International AG	AT	BA, HR, ME, RS, SI
Erste Group Bank AG	AT	CZ, HR, HU, RO, RS, SK
Creditanstalt AG	AT	SI
BNP Paribas Fortis SA/ NV	BE	RO
KBC Groep NV/ KBC Groupe SA-KBC Group	BE	CZ, HU, PL, RS, SK
Dexia SA	BE	SK
Central Cooperative Bank AD	BG	MK
Cyprus Popular Bank Public Co Ltd	CY	RS
Bayerische Landesbank	DE	CZ, HR, HU
Commerzbank AG	DE	HU, PL
Deutsche Bank AG	DE	CZ, PL
Dresdner Bank AG	DE	CZ
LHB Aktiengesellschaft	DE	BA, RS
Norddeutsche Landesbank Girozentrale NORD/LB	DE	LT, LV, PL
Portigon AG	DE	HU
Landesbank Berlin Holding AG-LBB Holding AG	DE	CZ
DZ Bank AG-Deutsche Zentral-Genossenschaftsbank	DE	HU
ProCredit Holding AG & Co. KGaA	DE	AM
UniCredit Bank AG (Proforma)- former Bayerische Hypo-und Vereinsbank AG	DE	BA, BG, CZ, HR, HU, PL, RO, RS, SI, SK
Landesbank Baden-Wuerttemberg	DE	CZ
Danske Bank A/S	DK	EE, LT, LV
Banco Santander SA	ES	PL
Sampo Plc	FI	EE, LT, LV
SociÈtÈ GÈnÈrale SA	FR	AL, BG, CZ, HR, ME, MK, PL, RO, RS, SI, SK
BNP Paribas SA	FR	BG, HU, KV, PL
CrÈdit Agricole S.A.	FR	AL, CZ, HU, PL, RS, SK
Le CrÈdit Lyonnais (LCL) SA	FR	HU, SK
HSBC Holdings Plc	GB	AM
Royal Bank of Scotland Group Plc (The)	GB	RO
National Bank of Greece SA	GR	AL, BG, MK, RO, RS
Emporiki Bank of Greece SA	GR	AL
Alpha Bank AE	GR	AL, BG, MK, RO, RS
Eurobank Ergasias SA	GR	BG, RO, RS
Piraeus Bank SA	GR	AL, BG, RO, RS
Zagrebacka Banka dd	HR	BA
MKB Bank Zrt	HU	BG
OTP Bank Plc	HU	BG, HR, ME, RO, RS, SK
Cassa di Risparmio di Firenze SpA-Banca CR Firenze SpA	IT	RO
Banca Commerciale Italiana SpA, COMIT	IT	HR, HU

(Table A.2.1 continued form the previous page)

Financial Group	Home Country	Host Country
UniCredit SpA	IT	BA, BG, CZ, HR, HU, PL, RO, RS, SI, SK
SANPAOLO IMI	IT	HU, RO
Intesa Sanpaolo	IT	AL, BA, HR, HU, RO, RS, SK
Veneto Banca scpa	IT	AL
CreditBank SAL	LB	AM
Byblos Bank S.A.L.	LB	AM
AB Bankas Snoras	LT	LV
AS Reverta	LV	LT
AS Citadele Banka	LV	LT
Demir-Halk Bank (Nederland) N.V-DHB Bank	TR	MK
Cooperatieve Centrale Raiffeisen-Boerenleenbank B.A-Rabobank Nederland	NL	PL
ING Bank NV	NL	BGPL
Credit Europe Bank N.V.	NL	RO
PPF Group N.V.	NL	CZ
DnB ASA	NO	EE, LT, LV, PL
Banco Comercial PortuguÍs, SA-Millennium bcp	PT	PL
Komercijalna Banka A.D. Beograd	RS	BA, ME
VTB Bank, an Open Joint-Stock Company (JSC)	RU	AM
Sberbank of Russia OAO	RU	BA, CZ, HR, HU, RS, SI
MDM Bank	RU	LV
Gazprombank Open Joint-Stock Company	RU	AM
Joint Stock Commercial Bank - Bank of Moscow	RU	EE, LV
SMP Bank, Limited Liability Company-Commercial bank Severniy morskoy puts	RU	LV
Swedbank AB	SE	EE, LT, LV
Skandinaviska Enskilda Banken AB	SE	EE, LT, LV
Nordea Bank AB (publ)	SE	PL
NLB dd-Nova Ljubljanska Banka d.d.	SI	BA, KV, ME, MK, RS
Nova Kreditna Banka Maribor d.d.	SI	RS
Fiba Holding AS	TR	RO
T.C. Ziraat Bankasi A.S.	TR	BA, MK
Turkiye Halk Bankasi A.S.	TR	MK
Turkiye Garanti Bankasi A.S.	TR	RO
Finansbank A.S.	TR	RO
Birlesik fon Bankasi AS	TR	AL
Kentbank A.S.	TR	AL
Public Joint Stock Company Commercial Bank "PrivatBank"	UA	LV
Pivdennyi Joint-Stock Bank	UA	LV
Ukrprombank LLC-Ukrainsky Promyslovy Bank LLC	UA	AM
General Electric Capital Corporation-GE Capital	US	CZ, HU, PL
Citigroup Inc	US	CZ, HU, PL, RO, SK

Notes: The codes denote countries as below: AL = Albania, AM = Armenia, AT = Austria, BE = Belgium, BA = Bosnia and Herzegovina, BG = Bulgaria, CZ = Czech Republic, DE = Germany, DK = Denmark, CY = Cyprus, EE = Estonia, ES = Spain, FI = Finland, FR = France, GB = UK, GE = Georgia, GR = Greece, HR = Croatia, HU = Hungary, IT = Italy, KV = Kosovo, LB = Lebanon, LT = Lithuania, LV = Latvia, ME = Montenegro, MK = FYROM, NL = Netherland, NO = Norway, PL = Poland, PT = Portugal, RO = Romania, RS = Serbia, RU = Russia, SE = Sweden, SK = Slovakia, SI = Slovenia, TR = Turkey, UA = Ukraine, US = United States

A.3 Variable Descriptions and Sources

Table A.3.1

Variables			
Indicator	**Measure**	**Unite**	**Source**
Credit Growth	The first difference of the natural logarithm of loans multiplied by 100	%, Initial values in th USD	Bankscope
Economic Capital, both at subsidiary & parent level	Equity to total assets	%, Initial values in th USD	Bankscope
Liquidity, both at subsidiary & parent level	Liquid assets to total assets	%, Initial values in th USD	Bankscope
Size	The natural logarithm of total assets	Logarithm, initial values in th USD	Bankscope
Profitability, both at subsidiary & parent level	Return to total assets	%, Initial values in th USD	Bankscope
Deposit ratio	Customer deposits to total funding	%, Initial values in th USD	Bankscope
Loan Impairments, both at subsidiary & parent level	Loan impairment charges to total loans	%, Initial values in th USD	Bankscope
Real GDP Growth, both in the host and home country	Host country's growth rate of real GDP	%	National Sources, IMF and IHS
Inflation, both in the host and home country	Host country's Consumer price index, year on year change	%	IHS
Interest rate	Host country's interest rate	%	National Sources, IMF and IHS
Global Financial Crisis	Equals 1 for the year 2008	Dummy	
Largest shareholder foreign	1 if the largest shareholder is of foreign origin no matter the percentage it holds	Dummy	In-house constructed ownership database
Foreign bank	1 if the largest shareholder is foreign and holds over 49.9% of shares	Dummy	In-house constructed ownership database
Member of a foreign financial group	1 if the major shareholder is a financial group holding over 49.9 % of shares	Dummy	In-house constructed ownership database

A.4 Computation of the intra-class correlation (ρ)

The models described in section 3.2 allow us to calculate the following intra-class correlations[26]:

Subsidiaries operating during the same year but belong to different parents

Equation A.9.5.1

$$\rho(\text{year}) = \frac{\sigma^2_{\zeta_{1t}}}{\sigma^2_{\zeta_{1t}} + \sigma^2_{\zeta_{2p}} + \sigma^2_{\zeta_{3tp}} + \sigma^2_{\varepsilon_{itp}}}$$

Subsidiaries belonging to the same parent but operate during different years

[26] Chapter 11.6, page 485 in Rabe-Hesketh & Skrondal,2008

Equation A.9.5.2

$$\rho(\text{parents}) = \frac{\sigma^2{}_{\zeta_{1t}}}{\sigma^2{}_{\zeta_{1t}} + \sigma^2{}_{\zeta_{2p}} + \sigma^2{}_{\zeta_{3tp}} + \sigma^2{}_{\varepsilon_{itp}}}$$

Subsidiaries belonging to the same parent and operating during the same year

Equation A.9.5.3

$$\rho(\text{year}, \text{parent}) = \frac{\sigma^2{}_{\zeta_{1t}} + \sigma^2{}_{\zeta_{2p}} + \sigma^2{}_{\zeta_{3tp}}}{\sigma^2{}_{\zeta_{1t}} + \sigma^2{}_{\zeta_{2p}} + \sigma^2{}_{\zeta_{3tp}} + \sigma^2{}_{\varepsilon_{itp}}}$$

Economics Department
economics@eib.org
www.eib.org/economics

Information Desk
+352 4379-22000
+352 4379-62000
info@eib.org

European Investment Bank
98-100, boulevard Konrad Adenauer
L-2950 Luxembourg
+352 4379-1
+352 437704
www.eib.org