



Bank net interest margin related to risk, ownership and size: an exploratory study of the Serbian banking industry

Srđan Marinković & Ognjen Radović

To cite this article: Srđan Marinković & Ognjen Radović (2014) Bank net interest margin related to risk, ownership and size: an exploratory study of the Serbian banking industry, Economic Research-Ekonomska Istraživanja, 27:1, 134-154, DOI: [10.1080/1331677X.2014.952114](https://doi.org/10.1080/1331677X.2014.952114)

To link to this article: <http://dx.doi.org/10.1080/1331677X.2014.952114>



© 2014 The Author(s). Published by Taylor & Francis



Published online: 11 Sep 2014.



Submit your article to this journal [↗](#)



Article views: 1450



View related articles [↗](#)



View Crossmark data [↗](#)

Bank net interest margin related to risk, ownership and size: an exploratory study of the Serbian banking industry

Srđan Marinković^{a*} and Ognjen Radović^b

^a*Banking and Finance, Faculty of Economics, University of Nis, Niš, Republic of Serbia;*

^b*Informatics and Cybernetics, Faculty of Economics, University of Niš, Niš, Republic of Serbia*

(Received 17 April 2012; accepted 27 October 2012)

The article empirically explores bank-specific, industry-specific and macroeconomic determinants of the net interest margin (NIM) in the Serbian banking industry. The baseline regression results suggest that banks with an above-average equity-to-asset ratio tend to report higher NIMs. The chosen proxy for loan default risk also appears statistically significant, but contrary to what is suggested by theory, indicates that the relation between default risk and the NIM is inverse. Amongst industry-specific determinants, only the proxy for concentration appears significant, as expected, and carries the prefix envisaged. Despite its narrow focus, this article does not ignore other possible determinants of the bank NIM. The type of bank ownership, as well as size effects, are explored further in order to gain insights into the influence of those variables on the NIM. The approach we follow does not include proxies for such determinants, but rather involves testing differences in regression results for banks that belong to different groups (proposed by Angbazo, 1997). Where size is taken into account, results indicate that large banks are better able to insulate books against interest rate risk by managing liabilities, while the superior performance of foreign banks could be attributed to their conservative lending practices and better access to foreign finance.

Keywords: net interest margin (NIM); transition banking; risk exposure; ownership

JEL classifications: G21, P34

1. Introduction

The net interest margin (NIM) is computed by comparing net interest income, which put simply, is the difference between interest revenue and interest expense, with average earning assets. It is in and of itself a measure of bank efficiency. A bank can reach its target level of efficiency by following a number of strategies. One approach is to maximise the spread between loan and deposit rates. However, the potential for boosting efficiency following this strategy is constrained by the competitive efforts of other banks. Bearing this in mind, it follows that the optimisation of the NIM is nothing other than each bank's partial response to market conditions. The NIM reflects both pricing policy and the available mix of assets and liabilities. There is also mutual interdependence between pricing policy and asset structure. A more aggressive asset structure should lead to greater interest revenues. This is an immediate effect, which may gradually weaken, and eventually, even turn into its opposite. Also well documented is an inverse

*Corresponding author. Email: srdjan.marinkovic@eknfak.ni.ac.rs

relationship between the level of the loan rate and the average quality of the loan portfolio, due either to a sorting effect or an incentive effect of the loan rate on loan quality (Stiglitz & Weiss, 1981). Therefore, this study covers a number of bank financial ratios that we see as able to reflect the effects of both pricing policy and asset/liability management on the NIM.

This is a single-country study and explores variations across banks that operate in the same single legal, regulatory and macroeconomic environment. The legal and regulatory framework for the Serbian banking industry was set at the beginning of the new millennium and underwent little change in the following years.

Consolidations in the banking industry and new entries and closures have all had some impact on the structure of the sector, but this has had more to do with shifts between individual banks' rankings than with meaningful changes to any concentration ratios.

There are also possible macroeconomic determinants that affect the NIM. Among the most frequently studied ones are changes in the intermediating role of banks, and inflation. We take the bank-asset-to-gross domestic product (GDP) ratio as the proxy for bank intermediation. This ratio started rising at the beginning of the period and kept up the same pace almost until its end. The inflation rate has changed little with time, so that we do not expect to see those variables impact the NIM substantially.

This article is structured as follows: the first section provides a review of the literature on margin determinants, and proceeds to cover methodology, data-set, description of variables, and descriptive statistics. In the remainder of the article we present baseline empirical results and continue with a discussion on the effects of bank ownership and size on differences between banks. The final section summarises the main conclusions.

2. Review of literature on bank net interest margin determinants

The NIM is set by banks to cover all the risks and costs of intermediation. 'Adequate net interest margin should generate sufficient income to increase the capital base as risk exposure increases' (Angbazo, 1997, p. 56). Therefore, many risk-related determinants are expected to prove their explanatory power. Although the pioneering work done by Ho and Saunders (1981) ignored all risks other than interest rate risk for the sake of simplicity, further empirical research has proven the significance of credit risk (Wong, 1997; Angbazo, 1997), liquidity risk, as well as leverage, for differences in the NIM (Carbó & Rodríguez Fernández, 2007; Fungáčová & Poghosyan, 2011). The most recent empirical studies of NIM determinants all experimented with a broader range of bank-specific explanatory variables (operational costs, size, non-interest revenue) as well industry-specific and macroeconomic determinants (for a recent and most complete review see Chen & Liao, 2011). These studies explore both developed and developing industries, with either a regional or a fully global focus.

The NIM reflects the pure operational efficiency of a bank and the competitive nature of the two traditional banking markets: the credit and the deposit markets. 'For traditional banking, which reduces banking business to making loans funded with deposits, net interest income appears to be "bread and butter"' (Sinkey, 2002, 119). However, for banking industries that have become more involved in non-traditional (fee-generating) activities, the NIM ceases to be a reliable indicator of overall bank profitability. Rogers and Sinkey (1999) stressed the fact that this was particularly the case with larger banks, which have smaller NIMs, more diverse revenue sources and greater ability to reduce risk. Lepetit et al. (2008) found a weak correlation between bank interest margins and

loan default risk, assigning the regularity to cross-subsidisation of traditional and fee-based services. This is due to banks driving business out of traditional intermediation by mispricing loans to boost the sales of other services, offsetting lower interest income with higher fees. This is a retreat to more information-intensive lines of business, or a refuge of last resort from fierce competition from non-bank lenders. Similarly, Carbó and Rodríguez Fernández (2007) examined the possible influence of specialisation/diversification on bank interest spreads and pointed out that revenue from non-traditional business may offset the lower interest margin. The authors underline that the effect is fully observed only if more sophisticated measures (Lerner index, price mark-up over marginal costs) substitute for accounting measures (NIM). Though the proposed influence of the degree of diversification (of revenue sources and assets) doubtlessly merits scrutiny, the measures available are rather deficient. Some researchers use the loan-to-asset ratio, or the share of fee income in total income, to represent different levels of diversification. In and of itself, diversification reduces shocks to the NIM arising from idiosyncratic risk. However, the proposed measures inherently ignore the role of diversification of the core (lending) business, which is more important for traditional banking, and concentrate only on diversification into non-lending activity. Moreover, contemporary banking regulations directed at adequate loan loss provisioning is tailored to catch not only idiosyncratic lending risk, but also concentration risk.

Fortunately, Serbian banking seems to be a suitable laboratory for testing bank efficiency based solely on the NIM, because the non-traditional business arena is less active than in most well-developed banking markets, or, to put it otherwise, banks do not differ significantly in the portfolios of products they offer their customers. For instance, financial derivatives have the greatest potential to change the risk profile of banks (see Angbazo, 1997), but the derivatives market is still at an early stage of development, while traditional off-balance sheet substitutes for loans (credit lines, guarantees, etc.) do not challenge a bank's relative position built upon the bank's share in the (on-balance-sheet) loan market.

In papers addressing banking in transition, the NIM is often used to test the success of overall transition efforts. For instance, Drakos (2003) found the NIM significantly decreased over time in transition for Central and Eastern European countries. The same trend is underlined in Claeys and Vennet (2008), which found the NIM of Central and Eastern European countries responsive to increases in efficiency induced by transition, but slightly less susceptible to changing market structure.

The relationship between bank margins and industry-specific and macroeconomic variables also appears to be informative. Demirgüç-Kunt, Laeven, and Levine (2003) examined the influence of bank regulations, concentration, and institutional development on bank margin across 72 countries, while controlling for bank-specific determinants and cross-country differences in macroeconomic and financial sector developments. They found NIM positively related to inflation and tighter regulations on bank entry, with the latter exerting its influence through industry concentration. Furthermore, differences in bank regulatory frameworks become insignificant when indicators of economic freedom or protection of property rights are controlled for.

Contemporary econometric research on determinants of the NIM relies on different methodology. Researchers most often opt for either of the multiple regression models, Ordinary Least Squares (OLS) or Generalised Least Squares (GLS). There are also differences in the composition of the samples used. Some studies are multi-country oriented, but there is also single-country research (Angbazo, 1997; Fungáčová & Poghosyan, 2011; Maudos & Solís, 2009). Although the single-country framework often

suffers from small-scale sample issues, and offers less scope for studying industry-specific and macroeconomic determinants, it is beneficial in a number of ways. It is not critically susceptible to data inconsistency, differences in taxation policy, and various price-setting peculiarities. López-Espinosa, Moreno, and Pérez de Cracia (2011) found that the introduction of International Financial Reporting Standards decreased the explanatory power of standard accounting variables. If the date of introduction differs across countries sampled, it may bias the estimation of the relation. Albertazzi and Gambacorta (2010) stress that differences in corporate income tax rates must be taken into account. However, the authors doubted that such variations in taxation policy could explain cross-country differences in bank profitability when banks are able to shift the tax burden onto end-users. Some differences in loan cost structure also challenge the robustness of the results. Although the differences remain persistent even amongst banks in the same industry, they are definitely more significant internationally: Brock and Rojas Suarez (2000) have drawn attention to the practice, common amongst banks, of increasing their revenues from loans by charging fees and commissions. Current reporting methodology excludes this income from the NIM, making multi-country studies less viable.

Almost all the papers examined deal with the issue within a dealership model setting (Ho & Sounders, 1981; Ho & Stoll, 1981; with extensions by Angbazo, 1997 and Maudos & Fernández de Guevara, 2004) where banks are viewed as risk-averse dealers that provide immediacy by assuming the inventory risk that comes from asynchronous arrivals of funds buyers and sellers. The model belongs to the intellectual tradition of market microstructure literature, known as ‘inventory models’ (O’Hara, 2004).

3. Research methodology and data set

We here follow mainstream literature and apply the intuition of the dealership model, using the OLS approach to estimate the parameters of the models. We estimate regressions of the following basic form:

$$NIM_{i,t} = \alpha + \sum_{k=1}^K \beta_k B_{i,t} + \sum_{l=1}^L \beta_l I_t + \sum_{n=1}^N \beta_n M_t + \varepsilon_{i,t} \quad (1)$$

where i,t indexes bank-year observation, i stands for the bank, and t stands for the reporting year. $NIM_{i,t}$ is the NIM for bank i in period t , α is the fixed effect intercept, and $\varepsilon_{i,t}$ stands for the regression residual (disturbances), or the i.i.d. error term. B is a vector of bank-specific determinants, I is a vector of industry-specific determinants, and M is a vector of macroeconomic explanatory variables where K is either 5 or 2 (fourth specification), while L and N are 2 (as per the number of variables included).

The data-set on bank-specific variables comes in its entirety from the BankScope database (Bureau van Dijk). The data are ratios directly selected from the database or recalculated from annual financial statements that come from the same data source. The data cover the majority of banks that operate in the Serbian market. The sample contains data for 29 out of a total of 33 banks that operated at the end of 2010 and held over 97% of the banking industry’s total assets. Two missing banks operate in the territory of Kosovo (Dunav Bank of Zvečan and Jugobanka Jugbanka of Kosovska Mitrovica), while no full data-set is available for the other two banks (Moskovska and Credy Bank).

The time horizon spans the period from 2003 to 2010. Many banks have not operated that long, meaning that their series are somewhat shorter. Moreover, data on chosen variables are not available for all years for some banks. The sample used was formed by an unbalanced panel of data obtained from a maximum of 160 annual (bank-year) observations corresponding to at most 29 commercial banks. Data on industry-specific and macroeconomic variables come from official local sources (see Table A1).

4. Selection of explanatory variables

Our choice of explanatory variables has been significantly influenced by theoretical and empirical contributions from a broad range of literature on bank efficiency determinants. The choice of possible determinants inclines mostly to that of Angbazo (1997), which is the most quoted study in this field of research. However, since the reference paper is mostly oriented towards bank-specific determinants, it is not a comprehensive evaluation of all possible determinants, but rather covers those most amenable to measurement. We deliver four baseline regressions. The first regression model is a slightly changed reproduction of Angbazo's model, but the other two regressions are significantly extended, with some new proxies added for the same types of risk.

The implicit assumption is that banks cope with the various types of risk simply by pricing it – by setting the spread between loan and deposit rates wide enough to absorb adverse consequences arising from risk exposure. Therefore, the spread between rates, and consequently the NIM, are expected to mirror any type of risk that banks face. Several types of risk are found to be the most important throughout banking literature: default risk, liquidity risk, interest rate risk, and exchange rate risk.

There are a number of variables that a researcher can use in order to estimate the *quality of the asset portfolio* in terms of default risk. Several items are usually available from income statements, such as net charge-offs or loan loss provisions. The first alternative was not available because of the lack of data, since Serbian banks do not report on charge-offs. The second alternative, although the data available do not seriously constrain analysis, was ruled out because of inconsistency and the numerical nature of the variable. The variable is extremely volatile, since it depends mostly on managerial discretion. Moreover, this is the only variable that may be reported even in negative figures. The frequency distribution of data on this variable was not normal, and, being negative, is not suitable for normalising by taking logarithms using raw data. We therefore had to look for other measures. The loan loss reserve is a balance sheet item. The amount of the reserves indicates how risky the loan portfolio is at the time of reporting. The variable is significantly less prone to management 'window-dressing' since managers have to reserve a share of the value of each asset according to rules imposed on them by the regulator. It also does not reflect a bank's ability to allow reserves because the reserves are included into the balance sheet in the required amount. In the event that a bank is unable to set aside a portion of the reserves required, it should report the missing amount as a contra item on its balance sheet. Thus, the default risk of the loan portfolio is measured by the ratio of loan loss reserves to gross loans. Deflated by gross loans, the loan loss reserve ratio indicates the relative contamination of the crucial bank asset component, i.e. its loan portfolio.

Choosing the right indicator for financial *leverage* is a straightforward task. If banks hold equity significantly above the level required under capital adequacy regulations, the equity-to-asset ratio could also serve as a proxy for the degree of risk aversion

(Maudos & Fernández de Guevara, 2004). The more equity a bank uses to finance operations, the more risk averse it is assumed to be, and as such will quote a higher interest rate spread. Some researchers (e.g. Kasman et al., 2010) offer 'bankruptcy treats' as a plausible explanation for the opposite direction of influence, in the sense that banks whose solvency is endangered shift to risky investment alternatives and increase the accounting measures of performance.

By *bank liquidity* we take the ability of a bank to meet its financial obligations as they become due. Understood thus, liquidity is a concept that depends on adequate liquid assets (liquidity reserves) and borrowing capacity. We appraise the extent to which the actual level of liquid assets is adequate by comparing liquid assets with the sum of deposits and short-term funds. The ratio largely ignores the influence of borrowing capacity (conditional borrowing) on bank liquidity, since the Serbian interbank market remains rather shallow, with an average turnover that lends it marginal importance for bank liquidity management. Moreover, the central bank generally stays clear of direct financing of troubled banks. Of course, cross-border credit lines open for liquidity support make it easier for some banks to meet their liquidity needs.

Exchange rate (or currency) risk can be hugely important for banks that operate in an environment of widespread and pervasive financial dollarization, both in the deposit and the credit market. However, due to the restrictive influence of currency mismatch regulations on overall balance-sheet exposure to this type of risk, banks' net open positions in various currencies are rather negligible. However, while direct (balance-sheet) exposure to currency risk can be avoided by matching the currency composition of assets with that of liabilities, it does not mean that lending (indexing loans) in foreign currency does not change a bank's risk profile. Currency risk tends to turn into default risk. Fortunately, national provisioning and capital adequacy regulations recognise this threat and charge banks with additional regulatory costs if they lend (or index) in foreign currencies. Therefore, any currency-induced default risk (so-called indirect exposure) is captured with loan loss provisions and mirrored in the default risk proxy. This is the reason why no measure of direct balance sheet exposure to currency risk enters any econometric specification.

Management quality, for the purpose of such an analysis, is often taken in a somewhat narrower sense than usual. Some researchers use the ratio of average earning assets to total assets to represent the management's capability for improving earning potential. We here suggest another approach, more direct than the one outlined above. We test the above ratio, but supplement it by also testing the cost-to-income ratio in different specifications. The cost-to-income ratio is widely used by banks and belongs to the operating efficiency category. Despite its name, this ratio does not include the total cost in the numerator, but rather includes only non-interest costs known as 'overheads' (mostly wages and fixed asset depreciation), while excluding loan loss provisions, with interest cost being deducted from the ratio denominator. Overheads are perceived as the part of total cost that is the most controllable and the most responsive to management actions. A bank will be more efficient if it is able to cover overhead costs by net interest income and other operating income, which make up the ratio denominator. Banks that operate in Serbia differ substantially in their reported cost-to-income ratios. Cost-to-income ratios fluctuate in the range from 10% to 419%, probably reflecting the length of a bank's presence in the local market. Banks that set up their operations a few years ago have not reached the level of activity (economy of scale) needed to fully cover overheads. Some researchers (Maudos & Fernández de Guevara, 2004) used different proxies to capture the influence of operation costs on the dependent variable, i.e. the

quotient between operating expenses and total assets. The pure (operational) costs of intermediation are expected to have a ‘positive’ effect on the NIM, since a bank covers them by increasing the loan rate and/or decreasing the deposit rate.

The greatest challenge was choosing the right *interest rate risk proxy*. The re-pricing (funding) gap is a method imposed on banks by the regulator. However, as with much regulatory data, this information is not available to the public. Moreover, many banks do not report data regularly on the maturity composition of their books. Some of them report on asset composition in great detail, while others report on the composition of their liabilities; we were thus unable to recalculate the missing data.

We deliver two alternative proxies for interest rate risk. The first is the absolute difference between short-term assets and short-term liabilities, divided by equity. Short-term assets are taken to be the sum of liquid assets and loans maturing in one year. Short-term funding is the sum of short-term deposits and short-term borrowings. Because many banks do not report on the maturity composition of their assets and liabilities, this data-set has the fewest observations. The second proxy is computed as the ratio of the absolute difference between total earning assets and the sum of deposits and short-term funding, and equity. Both ratios use the same denominator. The numerator for the second ratio is the absolute difference between total earning assets and deposits plus short-term funding. This is not a flawless representation of the maturity mismatch, since a significant portion of earning assets matures inside the one-year horizon. Nonetheless, it still captures the difference between the average maturities of assets and liabilities, because, as opposed to loans and other earning assets, deposits are more sensitive to interest rate changes regardless of their contractual maturity. Banks widely offer depositors the ability to withdraw deposits before they mature.

Contrary to Angbazo (1997), who assumes that interest rate exposure comes solely from long net open positions, we believe that both long and short open positions matter. Regardless of how books stay unmatched in terms of residual maturity, the mismatch will bring interest rate risk into the equation. As underlined in Saunders and Schumacher (2000), in a slightly different analytical framework, the bank faces *refinancing risk* if longer-term assets are financed with shorter-term deposits, while it is exposed to *reinvestment risk* if the opposite is the case, with both risks being different varieties of genuine interest rate risk. The bank would either have to go to the money market and borrow the missing funds (in the first case), or invest excess funds (in the second case), but in both cases it has to do it at the prevailing market rates. In monetary policy studies, a strongly held assumption is that the money market (and official) rate drives the bank loan rate. This was the rationale behind introducing a proxy for market interest rate variability into the set of regressors in some studies (Maudos & Fernández de Guevara, 2004). However, elasticity, time lag, and heterogeneity across banks are a matter of empirical tests. Some facts led us not to include this variable from our analysis. Firstly, it is indicated (Gambacorta, 2008) that this pass-through effect depends on various bank-specific indicators (equity-to-asset ratio, liquid-to-total-assets) that have already been incorporated into the model. Secondly, this is a study on the NIM (rather than on spread), which in and of itself includes the impact of all interest rates on bank income. Thirdly, the possibly lagged influence makes it difficult to assess the right dynamic specification.

The proxies chosen for interest rate risk take into account only balance sheet data. Off-balance-sheet items are ignored here, but the potential for those items to blur the whole picture is rather irrelevant because this line of business is still at an early stage of development in Serbia.

Financial theory suggests that some variables that describe the industry itself could also be beneficial in assessing bank efficiency and the NIM. Firstly, although competition alone does not mean improved performance, oligopolistic banking is likely to undermine the efficiency of banks and the banking system (Clarke, Cull, & Shirley, 2005). Consequently, two more variables enter the explanatory variable set: the Herfindahl-Hirschman index of concentration and the bank-asset-to-GDP ratio. This approach to expressing industry competition is less straightforward than using indicators tailored to capturing market power. Maudos and Fernández de Guevara (2004) and Maudos and Solís (2009) experimented with a more explicit proxy for the degree of competition. They used the Lerner index of market power as the difference between price and total marginal costs (taken as the sum of operating and financial costs).

Two macroeconomic determinants also enter the set: annual rate of inflation (CPI) and real GDP growth rate. The rationale for adding the first variable is the so-called Fisher equation. The equation states that nominal rates are adjusted for market expectations of future inflation, further influencing the spread between rates and the difference between interest revenue and expenses.

The real GDP growth rate is expected to influence the NIM since it affects loan demand, supply of deposits, as well as the loan default rate. Gambacorta and Albertazzi (2009) examined the influence of a wide range of business cycle indicators on different bank profitability indicators, and found a strong and positive correlation between the GDP growth rate and the interest rate spread that may be the result of both increased loan demand and greater borrower creditworthiness. It is worth noting that the study covers only developed area (the eurozone and Anglo-Saxon countries), and that the period covered ends with 2003. As such, it covers no single episode of rapidly deteriorating economic conditions that may support a different conclusion, i.e. that the response of interest rates to economic conditions is asymmetrical. High economic activity is expected to drive (loan) rates up, while unfavourable economic conditions often do not drive them down. This could explain why macroeconomic and financial development indicators sometimes fail to prove any explanatory power (see Naceur & Omran, 2011).

5. Descriptive statistics and baseline empirical evidence

A closer look at the descriptive statistics (Table 1) indicates the high variability of many bank-specific explanatory variables. We also see that the average NIM differs across the ownership and size subsamples. Foreign-owned banks operate with the lowest margin. These are followed by domestic privately-held banks, with domestic state-owned banks coming last. The same rankings hold true in respect of default risk proxy and equity-to-asset ratio. Foreign banks lend more conservatively and are less capitalised, meaning that they lead in using financial leverage to boost their profitability.

Concerning the proposed regularity between bank size and the value of different bank-specific indicators, we see that larger banks operate with the lowest margins, least risky loan portfolios, and smallest shares of equity. The regularity also holds when comparing medium-sized and small banks. Large banks have greater potential to cover overheads, while the different equity-to-asset ratio may be responsible for the differences in interest rate risk exposure, since equity is used to deflate the variable (see Table A1 for the definition of variables).

Table 2 presents parameters estimated by multiple linear regressions of the NIM and a chosen set of bank-specific, industry-specific, and macroeconomic variables. Depending

Table 1. Summary descriptive statistics for total sample by variable (2002–2010).

	Mean									
	St. dev	Max	Min	All	Foreign	Private	State	Large	Medium	Small
Financial ratio (%)	4.499	26.008	1.628	9.416	7.723	10.075	11.849	7.817	7.978	12.664
<i>Dependent variable</i>										
Net interest margin	16.626	97.951	0.675	13.038	6.424	11.322	27.362	9.887	11.680	17.876
<i>Independent variables</i>										
Loan loss reserves/gross loans	14.531	91.440	5.032	25.239	19.717	30.323	29.875	20.023	22.403	33.867
Equity to total assets	25.800	164.608	15.855	56.661	52.352	52.115	69.857	53.462	50.549	66.585
Liquid assets/deposits and short-term funding	12.030	96.176	34.246	68.479	69.271	70.673	64.527	71.732	69.884	63.485
Earnings to total assets	59.618	419.844	10.543	85.485	103.927	65.072	73.868	69.436	96.147	91.502
Cost to income ratio	74.914	297.237	3.425	78.394	87.031	37.042	93.834	71.678	92.299	76.873
(Short term assets – short term funding)/equity	85.529	553.898	0.317	73.771	94.841	48.196	63.035	97.801	76.347	51.598
Earning assets –(deposits and short-term funding)/equity										

Source: Authors calculation.

Table 2. Estimation multiple linear regression results for total sample.

Variable	Regression 1	Regression 2	Regression 3	Regression 4
Intercept	-0.284 (-0.546)	-0.256 (-2.958)***	-0.029 (-0.351)	0.024 (0.423)
Default risk	0.039 (0.355)	-0.051 (-2.946)***	-0.064 (-4.129)***	-0.053 (-3.497)***
Capitalisation	0.159 (1.753)*	0.213 (9.687)***	0.217 (11.115)***	0.222 (12.661)***
Liquidity	0.019 (0.600)	0.021 (1.766)*	0.007 (0.674)	-
Management quality 1	-0.113 (-2.221)**	-	-0.141 (-6.486)***	-0.137 (-6.964)***
Management quality 2	-	-0.004 (-0.764)	-	-
Interest rate risk 1	-0.006 (-0.677)	-	-	-
Interest rate risk 2	-	0.003 (0.863)	-0.001 (0.244)	-
Concentration	0.045 (0.824)	0.041 (3.011)***	0.029 (2.402)**	0.019 (2.057)**
Bank intermediation	15.664 (0.663)	4.474 (1.884)*	-2.237 (-0.982)	-
Inflation	0.011 (0.044)	-0.022 (-0.212)	-0.001 (-0.010)	-
Growth	0.625 (1.089)	0.394 (2.752)***	0.192 (1.474)	-
R^2	0.502	0.498	0.607	0.572
Adjusted R^2	0.277	0.468	0.583	0.561
F	2.239	16.556	25.708	51.841
N	30	160	160	160

Figures in parenthesis are t -statistics.

*Significant at 10% level.

**Significant at 5% level.

***Significant at 1% level.

Source: Authors calculation.

on data availability for different explanatory variables, there are between 30 and 160 bank-year observations.

In Table 2 above we present regression results for four alternative econometric specifications. When F statistics are used, the fourth specification dominates all others, but the third specification appears superior according to the value of adjusted R^2 . The fourth specification is a four-variable profile, while the remaining ones are nine-variable profile equations. The fourth specification is derived from the third one by a simple reduction of the set of explanatory variables to those proved statistically significant. Since any variable may appear significant when subsamples are tested, despite being rejected when testing the total sample, we use the third specification for further analysis.

The chosen proxy for loan default risk is statistically significant, but, contrary to what theory suggests, it indicates an inverse relation between default risk and the NIM. However, this finding does not come as a complete surprise. Some studies (Brock & Rojas Suarez, 2000) also confirmed that a similar default risk proxy is negatively associated with bank interest spread in developing countries, challenging the adequacy of loan loss provisions. We can offer another explanation. As is known from theory (Fisher, 1933), changes in banks' exposure to default risk coincide with credit cycles.

Recessions will increase the default rate of businesses and households. However, their effects on bank interest rates and NIM are less clear. At least for existing loan customers, if possible, banks will re-price existing loans as they become due or when they are renegotiated. This will generate a positive relation between default risk and the NIM, *ceteris paribus*. In turbulent times, however, a credit crunch is also a plausible scenario. Loan rates may even be lower because of credit rationing, which prevents any further increase in the loan rate. Those effects on the NIM come from the revenue side. To get a complete picture, it is necessary to jointly address developments that come both from the revenue and the expenditure side. Worsening credit conditions are expected to go hand in hand with a rise in the cost of bank funds. However, contemporary credit crunches have to date met with almost immediate responses of monetary authorities, which decreased the cost of funds (EURIBOR, LIBOR). These developments have had a modest net impact on regional banking groups that operate in Serbia, since the drops in major international market rates coincided with credit outflow, which ultimately increased the average cost of funds. Moreover, most banks have been isolated from foreign credit markets and rely exclusively on more expensive local (deposit) sources. Even among foreign-owned banks, credit support from abroad is concentrated in the few leading ones. Therefore, the increase in the average cost of finance has driven the NIM down, generating the negative effect of default risk exposure to the NIM.

The baseline results suggest that banks with an above-average equity-to-asset ratio tend to report higher NIMs. ‘Risk aversion’ is a plausible explanation. Nevertheless, there is another obvious explanation for this regularity. Equity, as an alternative source to debt, differs in that it requires no interest expenses, which makes the margin of better-capitalised banks wider than the margin of their less capitalised competitors. However, this mode of saving on interest expenses should be mirrored by the lower return on equity.

The liquidity risk proxy turned out to be inconclusive. A plausible explanation for the finding is the fact that the regulator imposes the ratio. Banks must hold liquidity reserves equal to the threshold set by the regulator, so that the ratio tends to be more or less the same across all banks, unless some of them persistently hold excess liquidity reserves, which is not systemically the case.

Contrary to the previous indicator, the first proxy tested for management quality appears significant in all specifications. The ratio is actually an inverse means of expressing a balance-sheet identity similar to the one we investigated using the liquidity risk ratio. Except for newly established banks (which have a high share of investments in fixed assets), liquid assets and earning assets are by far the most important asset components, and offset each other. This ratio may statistically rule out the significance of the previous one. As for the estimated prefix, it turned out that the fewer funds are employed in earning assets, the higher the NIM. Fixed assets may also play a role, since they are the third important component of the asset structure, apart from liquid and earning assets. If a bank holds proportionally greater investments in fixed (non-earning) assets, it might tend to structure its earning assets more aggressively to offset for income ‘lost’ in fixed assets. It may also indicate that the quality of earning assets plays a greater role than their volume, and serves as a warning of the role of the liability structure and cost of capital in determining the NIM.

The most significant of all industry-specific and macroeconomic explanatory variables is the proxy for concentration (competition). It is statistically significant in almost all alternative specifications, and carries the predicted prefix. The industry concentration ratio (HHI) becomes greater as the distribution of market share becomes less equal, or

as industry becomes more concentrated (with the maximum set at 1). Therefore, the positive prefix of the regression coefficient indicates that an industry that is more concentrated demands a higher NIM. The result holds true even if banking assets or average bank size increase with time, so that improved scale efficiency might induce the opposite effect. These elements are related to each other, since various sources of cost inefficiency limit the role competition can play in passing the benefits on to bank customers, in the same manner as competition itself forces banks to improve efficiency. Nevertheless, we could take it as a strong case in favour of the structure-conduct-performance (SCP) hypothesis.

The explanatory power of the other three industry-specific and macroeconomic variables is rather weak, as suggested by inadequate *t*-statistics, *p*-values, and standard errors (the last two not enclosed). In all regressions but one (the second one), the test rejected the significance of the variables.

6. Effects on inter-bank differences

In order to gain an insight into regularities that explain the variability of the NIM across individual banks, we disaggregated data from the original sample into subsamples according to two additional criteria: type of ownership and size. The approach employed is alternative to one that ‘dummies out’ these categorical variables and uses them in baseline regressions. This approach is in some ways superior, as it permits us to introduce more than two classes of the same categorical variable. This section presents a test of the third baseline econometric specification (Table 3) on banks re-sampled first according to the type of ownership, and then according to asset size (Table 4). Those two attributes of the banking industry’s structure are closely interconnected. In the last decade, it was the entry of foreign capital that predominantly restructured the ownership structure of the Serbian banking industry. Foreign competitors most often penetrated the local market by acquiring either domestic privately or publicly owned banks. The same force is responsible for changing both the ownership structure of the banking industry and its level of consolidation. A sequence of takeovers gradually led to an increase in the concentration of the banking industry and the predominance of foreign ownership. In terms of the origin of foreign banking capital, the Serbian banking industry is largely in line with more generally observed regularities (Van Horen, 2007). All foreign banks came from neighbouring developed countries, while economic integration and geographical proximity played a significant role.

6.1 Effects of bank ownership

Studying the effects of bank ownership on the efficiency of banks that operate in an industry that has undergone privatisation and is faced with a constantly reshaping institutional environment is a challenging but nonetheless important task. Many banks that operate in Serbia have changed their form of ownership with time (see Table A2), which brings into focus an attempt to explore the potential importance of types of ownership for explaining bank performance.

The effect of bank ownership on various measures of bank efficiency has of late become an extensively studied issue. In a paper that is now classic, Bonin, Hasan, and Wachtel (2005b) confirmed that foreign greenfield banks were the most efficient of all bank types in six transition countries explored. These are followed by banks sold to strategic foreign owners after being initially restructured. The study reported that

Table 3. Estimation results by bank ownership.

Variable	Foreign	Domestic private	Domestic public
Intercept	-0.101 (-0.891)	-0.016 (-0.133)	-0.174 (-0.817)
Default risk	-0.099 (-1.688)*	-0.135 (-3.177)***	-0.065 (-2.675)**
Capitalisation	0.207 (7.029)***	0.195 (7.081)***	0.208 (3.888)***
Liquidity	0.008 (0.552)	0.039 (2.487)**	-0.022 (-1.011)
Management quality 1	-0.050 (-1.538)	-0.118 (-3.241)***	-0.240 (-4.661)***
Interest rate risk 2	0.004 (1.239)	-0.008 (-1.233)	-0.010 (-1.058)
Concentration	0.024 (1.705)*	0.017 (1.022)	0.072 (2.209)**
Bank intermediation	1.925 (0.462)	3.020 (1.092)	-2.751 (-0.569)
Inflation	0.006 (0.050)	0.087 (0.719)	-0.233 (-0.993)
Growth	1.197 (1.183)	0.062 (0.328)	0.543 (1.736)*
R^2	0.519	0.753	0.752
Adjusted R^2	0.453	0.689	0.678
F	7.817	11.847	10.142
N	75	45	40

Figures in parenthesis are t -statistics.

*Significant at 10% level.

**Significant at 5% level.

***Significant at 1% level.

Source: Authors calculation.

state-owned banks are the least efficient (concerning both cost and profit efficiency). Those foreign banks that entered local markets through takeovers of controlling shares after privatisation operated more efficiently than foreign banks with dispersed ownership did. They also tend to be more prudent and reluctant to lend in a weak environment (Clarke, Cull, & Shirley, 2005, Yilmaz & Koyuncu, 2010). Some other studies came to similar conclusions. Banks controlled by local industrial groups are often more exposed to credit and interest rate risk (Boubakri, Cosset, Fischer, & Guedhami, 2005), but they have the local advantage of access to fee generating business (Bonin, Hasan, & Wachtel, 2005a). Nevertheless, the effect of foreign ownership on bank efficiency is not always assessed as positive. In a recent study (Lensink, Meesters, & Naaborg, 2008) that covers a broad range of countries, foreign banks are found inferior in comparison to domestic banks, with inferiority in the relative level of efficiency weakening along with the disappearance of the gap between institutional development of the home and host countries. Furthermore, studies on ownership effects on efficiency of banks operating in a developed environment (in the German market) contrast the results obtained for developing and transition countries. Altunbas, Evans, and Molyneux (2001) found public banks superior to their privately-owned counterparts, with all appearing to benefit from economies of scale. Their superior efficiency holds true even when controlled for size differences, and is explained by the lower cost of finance.

Table 4. Estimation results by bank size.

	Large	Medium size	Small
Intercept	0.144 (1.338)	-0.056 (-0.327)	-0.087 (-0.717)
Default risk	-0.052 (-2.454)**	0.006 (0.112)	-0.076 (-3.928)***
Capitalisation	0.171 (7.885)***	0.126 (2.245)**	0.251 (7.726)***
Liquidity	-0.015 (-0.986)	0.024 (1.036)	0.001 (0.036)
Management quality 1	-0.132 (-3.435)***	-0.116 (-2.426)**	-0.160 (-5.091)***
Interest rate risk 2	-0.003 (-1.065)	0.021 (2.802)***	-0.012 (-2.246)**
Concentration	0.004 (0.306)	0.024 (0.982)	0.036 (2.007)*
Bank intermediation	-3.700 (-1.152)	0.040 (0.008)	2.208 (0.665)
Inflation	0.058 (0.549)	0.059 (0.321)	0.033 (0.229)
Growth	0.040 (0.268)	0.105 (0.405)	0.288 (1.399)
R^2	0.631	0.358	0.792
Adjusted R^2	0.557	0.226	0.746
F	8.541	2.723	17.301
N	55	54	51

Figure in parenthesis are *t*-statistics.

*Significant at 10% level.

**Significant at 5% level.

***Significant at 1% level.

Source: Authors calculation.

Privatisation alone transforms the efficiency of a banking system in transition, but it strongly depends on whether the state will privatise better-performing banks first and hold its stake in loss-making ones, or vice versa (Bonin, Hasan, & Wachtel, 2005a). Empirical findings suggest little optimism about the impact of privatisation on divested banks (Megginson, 2005). Moreover, privatisation is expected to have positive effects on bank performance, but these results will not even be close to those seen in non-financial industries. This implies that the relative efficiency of banks with different forms of ownership will be country-specific, since the model of bank privatisation and the sequence of steps will depend on national privatisation policy.

The ability of the form of ownership to explain the variability of the NIM across banks has been studied extensively. Košak and Čok (2008) found that NIM was the best discriminator (amongst the performance measures tested) between foreign-owned and domestic banks in six South-Eastern European countries, but evidence of which form of ownership performed better was rather mixed. Paghosyan (2010) found that foreign bank participation had no relevant influence on the NIM in Central and Eastern European countries. The impact remained insignificant even when proxies for foreign bank market share and dummy variables for different type of foreign entry (greenfield and acquired foreign banks) were included. The findings may be explained by the fact that the other variables tested already account for the main influences of foreign ownership on the NIM. Chen and Liao (2011) followed a similar approach. They simply added the

form of ownership (dummy) to the many other explanatory variables for different measures of bank profitability (among others the NIM). They found that foreign bank profitability crucially depends on differences between home and host country conditions (competitiveness, supervision, etc.). Differences in financial conditions among the various forms of ownership can reflect different customer bases, procedures, and tax regimes (Claessens, Demirgüç-Kunt, & Huizinga, 2001). The only facts that favour domestic banks are their local knowledge and existing customary base.

The ownership transformation of Serbian banks is a process that has now been underway for some time. The above review indicates that inter-bank variations in NIM may be related to differences in ownership. The first step in examining them is to disaggregate the total sample into subsamples of foreign ownership, domestic private ownership and domestic public ownership. Banks are divided into classes according to the origin of their equity. If no type of owner controls over 50% of a bank's equity, that bank will be classified according to the origin of its major owner. Therefore, although the Republic of Serbia rarely owns more than 50% of the equity of any one bank, it is recorded as the major owner in several instances. The data-set comprises bank-year observations: as the banking industry has seen rapid transformation over the last decade in terms of ownership, the ownership structure at the end of the time span differs substantially from that at its beginning. In classifying banks into different groups according to ownership, we examined the actual year when each bank changed its form of ownership. Data on the year in which a bank moved into another class are provided in the Appendix (Table A2). The years under a previous form of ownership were separated from the years of new ownership according to the following rule: the first year of new ownership is taken to be the first year after the year that the ownership transformation actually took place.

6.2 *Bank-size effects on the net interest margin*

The consolidation of financial service providers has recently become a global phenomenon. In a theoretically oriented paper, Milbourn, Boot, and Thakor (1999) point out some reasons why expanding the size of a bank may be seen as beneficial to shareholders. The authors suggest that increasing size (and scope) may be the right strategic decision in an environment with sufficient profitability in current operations and substantial uncertainty about the future core competences of a bank, but it may also be a result of managers seeking to enhance their reputation. Nevertheless, theory tells us little about the links between size and pricing policy, as well as NIM. The market microstructure theory implies that, if the market (both deposit and credit) is competitive, banks that are less aggressive in terms of their quoted interest rate spreads are expected to have the lowest market share in both the deposit and the credit market. Bearing in mind that overheads are largely fixed, the less aggressive pricing policy will draw such banks out of the market, which will ultimately cause a high cost-to-income ratio, restrict return on assets, or even make financial results negative. Therefore, the second attribute of a bank that is taken to be important for explaining the variability of the NIM is bank size. If the size of a bank is important for pricing policy and the degree of efficiency, it should be apparent in variations of the NIM.

Total assets are the most widely accepted measure of bank size. The classification of banks according to differences in size appears to be less straightforward than according to the previous attribute. Some researchers (e.g. Angbazo, 1997) start out with clear-cut classes of banks that are used officially for reporting purposes and analytics.

Unfortunately, the national regulatory body does not recognise either this or any other similar system of grouping banks. We were therefore free to arbitrarily choose the boundaries for assigning a bank to one of the various size groups.

Again, size rankings happened to change frequently during the time span observed, so that taking the final or the starting rank of each bank to judge its relative size was not a reliable method. As in the preceding cases, we initially started with the actual ranking of each bank in each year. The classification was simplified by disaggregating the total sample into three subsamples, each containing a similar number of banks. Thus, the classes are as follows: large, medium-sized and small, representing respectively the upper, middle and lower third of the total number of banks that made up the sample for each reporting year. This type of classification proved to have the smallest number of transitions among classes during the entire period. Neither class consists of more than 15% of observations that do not belong to the assigned class consistently through time. There were 10% of 'transitions' between classes in total during the entire period. This form of classification produced the following boundaries: all banks that reported total assets in excess of 80 billion Serbian dinars in 2009 were placed into the large-size group; banks holding total assets between 40 and 80 billion were assigned to the medium-size group; while banks with total assets below 40 billion made up the smaller-size group. Although there is some connection between size and type of ownership, this is not so clear-cut. The majority of foreign-owned banks belong to the top tier, but they appear in the next subsample only slightly more rarely. Therefore, the unclear nature of the size-ownership relationship justifies a separate analysis of the impact of size and ownership impact on NIM. If size does have any effect on NIM, it may indicate differences in pricing policy and the structure of assets and liabilities. Leading foreign-owned banks raise finance by borrowing directly from other group members abroad at a cost that regularly stays below the price of domestic sources. Those difference in liability structure may be responsible for the narrower NIM and generate both size and ownership effects.

Disaggregation of the total sample resulted in some changes in the significance of the explanatory variables. Default risk is more important for domestic private banks than for the foreign ones, which confirms the assumption that foreign banks apply more conservative lending practices. The management quality proxy (earning assets to total assets) appears significant, and remains so when banks are sorted by either ownership or size. The inverse relation between the share of earning assets and the NIM may indicate that the quality of earning assets plays a greater role than their volume, and warns us of the role of liability structure and cost of capital in determining the NIM. For large banks, the interest rate risk proxy remains outside the relevant explanatory variables, as opposed to the other two groups, probably because the largest banks are better able to hedge against it.

The importance of industry concentration deserves special scrutiny. In the study mentioned above, Claessens, Demirgüç-Kunt, and Huizinga (2001) found that the number of entrants matters more than their market share. The same is true of the Serbian banking industry. Since 2006, when an increasing number of foreign banks began operating, the NIM started to decrease. The trend was broken only in the turbulent year of 2008, when a twin crisis hit the local banking market. This finding underlines the very nature of the competitive structure of banking markets. If product lines are very much the same across all banks, or if we have a conditionally homogeneous product, new entrants can act as a serious treat to their rivals already present in the market. It becomes easy for late entrants to catch up with the early ones if there is no hidden

reason for a customer to stay with a bank that charges more for the same service. Although we emphasised that the transition between size groups in time was rare, changes in ranking inside size groups were nonetheless apparent.

However, the mobility of bank customers is limited since banks regularly charge their customers special fees if they attempt to switch to another bank (e.g. costly pre-payment options), and thus effectively segment the market. This explains why less efficient competitors were able to keep their presence in the market, and even to increase their assets. This effect is coupled with the well-known interdependence of price and quality (Stiglitz & Weiss, 1981). Different banks, quoting different prices, will serve different ranges of customers. Top-quality customers make up the client base of the most efficient banks while others are forced to seek elsewhere, so that cutthroat competition is not something one sees in banking markets.

7. Conclusion

Baseline regression results show that various risk-related determinants (e.g. default risk proxy, leverage) are alone able to explain a significant portion of NIM variability. We take it as proof that pricing policy largely takes into account risk exposure. The reported statistical insignificance of different interest rate proxies may indicate that average banks are well insulated against interest rate risk. Risk exposure captures prospective losses or effective costs. There are also different types of operational costs that have to be covered by NIM. The statistical insignificance of the cost-to-income ratio rejects the assumption that banks burdened with overheads can escape the adverse impact on profitability simply by passing these costs on to their customers. The competition is plausibly the force that limits the ultimate effects of such efforts. The cost-to-income ratio may prove to have greater explanatory power in a multi-country study, since banks often enjoy some level of protection from outside competitors as long as they remain inside national boundaries. If each country differs in terms of the level of bank competition, different amounts of costs will be able to be passed on to end-users.

We should exercise some caution when using this analysis to gain insight into bank pricing policies. The overall potential of NIM variability to explain cross-bank differences in pricing policy is not as strong. Although the spread between the loan rate and the deposit rate is captured in the NIM, it tells us nothing of whether the spread is equally centred. The same spread might be reached by setting both rates at levels below those set by competitors, above them, or uniformly for all banks. Market microstructure literature tells us that an intermediary does not have to be equally aggressive in pursuing its interests on both sides of the banking market, i.e. when raising or employing finance. We have already noted that foreign banks that borrow substantially from their parent groups – and that are at the same time industry leaders – are not ruthless in competing with domestic-owned banks for domestic sources. Nevertheless, cheap foreign funds make it possible for them to set loan rates competitively, capture market share, and attract top-quality borrowers. This may explain why the NIM of medium-sized banks is less responsive to their default risk exposure. Less efficient competitors may have to ‘follow the leader’ in quoting their rates. This makes individual risk exposure less important in a price setting, and challenges its relevance as a NIM determinant. However, a great deal of issues remain unsolved, and this justifies further research using a different approach appropriate for a separate analysis of credit and deposit market mechanics.

Acknowledgements

The authors acknowledge the comments of two anonymous referees and the financial support from the Republic of Serbia Ministry of Education and Science (Research Project: OI 179015).

References

- Albertazzi, U., & Gambacorta, L. (2010). Bank profitability and taxation. *Journal of Banking and Finance*, 34, 2801–2810.
- Altunbas, Y., Evans, L., & Molyneux, P. (2001). Bank ownership and efficiency. *Journal of Money, Credit and Banking*, 33, 926–954.
- Angbazo, L. (1997). Commercial bank net interest margins, default risk, interest-rate risk, and off-balance sheet banking. *Journal of Banking and Finance*, 21, 55–87.
- Bonin, John P., Hasan, I., & Wachtel, P. (2005a). Bank performance, efficiency and ownership in transition countries. *Journal of Banking and Finance*, 29, 31–53.
- Bonin, John P., Hasan, I., & Wachtel, P. (2005b). Privatization matters: Bank efficiency in transition countries. *Journal of Banking and Finance*, 29, 2155–2178.
- Boubakri, N., Cosset, J., Fischer, K., & Guedhami, O. (2005). Privatization and bank performance in developing countries. *Journal of Banking and Finance*, 29, 2015–2041.
- Brock, Philip L., & Rojas Suarez, L. (2000). Understanding the behavior of bank spreads in Latin America. *Journal of Development Economics*, 63, 113–134.
- Carbó, V. S., & Rodríguez Fernández, F. (2007). The determinants of bank margins in European banking. *Journal of Banking and Finance*, 31, 2043–2063.
- Chen, S., & Liao, C. (2011). Are foreign banks more profitable than domestic banks? Home- and host-country effects of banking market structure, governance, and supervision. *Journal of Banking and Finance*, 35, 819–839.
- Claessens, S., Demirgüç-Kunt, A., & Huizinga, H. (2001). How does foreign entry affect domestic banking markets? *Journal of Banking and Finance*, 25, 891–911.
- Claeys, S., & Vennet, R. V. (2008). Determinants of bank interest margins in Central and Eastern Europe: A comparison with the West. *Economic Systems*, 32, 197–216.
- Clarke, George R.G., Cull, R., & Shirley, M. (2005). Bank privatization in developing countries: A summary of lessons and findings. *Journal of Banking and Finance*, 29, 1905–1930.
- Demirgüç-Kunt, A., Laeven, L., & Levine, R. (2003). The impact of bank regulations, concentrations, and institutions on bank margins. *Policy research working paper*, 3030 Washington, DC: World Bank.
- Drakos, K. (2003). Assessing the success of reform in transition banking 10 years later: An interest margins analysis. *Journal of Policy Modeling*, 25, 309–317.
- Fisher, I. (1933). The debt-deflation theory of great depressions. *Econometrica*, 1, 337–357.
- Fungáčová, Z., & Poghosyan, T. (2011). Determinants of bank interest margins in Russia: Does bank ownership matter? *Economic Systems*, doi:10.1016/j.ecosys.2010.10.007
- Gambacorta, L. (2008). How do banks set interest rates? *European Economic Review*, 52, 792–819.
- Gambacorta, L., & Albertazzi, U. (2009). Bank profitability and the business cycle. *Journal of Financial Stability*, 5, 393–409.
- Ho, T., & Saunders, A. (1981). The determinants of bank interest margins: Theory and empirical evidence. *Journal of Financial and Quantitative Analysis*, 16, 581–600.
- Ho, T., & Stoll, H. R. (1981). Optimal dealer pricing under transactions and return uncertainty. *Journal of Financial Economics*, 9, 47–73.
- Kasman, A., Tunc, G., Vardar, G., & Okan, B. (2010). Consolidation and commercial bank net interest margins: Evidence from the old and new European Union members and candidate countries. *Economic Modelling*, 27, 648–655.
- Košak, M., & Čok, M. (2008). Ownership structure and profitability of the banking sector: The evidence from the SEE region. *Zbornik radova Ekonomskog fakulteta Rijeka*, 26, 93–122.
- Lensink, R., Meesters, A., & Naaborg, I. (2008). Bank efficiency and foreign ownership: Do good institutions matter? *Journal of Banking and Finance*, 32, 834–844.
- Lepetit, L., Nys, E., & Tarazi, A. (2008). The expansion of services in European banking: Implications for loan pricing and interest margins. *Journal of Banking and Finance*, 32, 2325–2335.

- López-Espinosa, G., Moreno, A., & Pérez de Gracia, F. (2011). Banks' net interest margin in the 2000s: A Macro-Accounting international perspective. *Journal of International Money and Finance*, 30, 1214–1233.
- Maudos, J., & Fernández de Guevara, J. (2004). Factors explaining the interest margin in the banking sectors of the European Union. *Journal of Banking and Finance*, 28, 2259–2281.
- Maudos, J., & Solís, L. (2009). The determinants of net interest income in the Mexican banking system: An integrated model. *Journal of Banking and Finance*, 33, 1920–1931.
- Megginson, William L. (2005). The economics of bank privatization. *Journal of Banking and Finance*, 29, 1931–1980.
- Milbourn, T. T., Boot, A. W. A., & Thakor, A. V. (1999). Megamergers and expanded scope: Theories of bank size and activity diversity. *Journal of Banking and Finance*, 23, 195–214.
- Naceur, S. B., & Omran, M. (2011). The effects of bank regulations, competition, and financial reforms on banks' performance. *Emerging Markets Review*, 12, 1–20.
- O'Hara, M. (2004). *Market microstructure theory*. Cambridge: Blackwell Publishers.
- Poghosyan, T. (2010). Re-examining the impact of foreign bank participation on interest margins in emerging markets. *Emerging Markets Review*, 11, 390–403.
- Rogers, K., & Sinkey, J. F., Jr. (1999). An analysis of nontraditional activities at U.S. commercial banks. *Review of Financial Economics*, 8, 25–39.
- Saunders, A., & Schumacher, L. (2000). The determinants of bank interest rate margins: An international study. *Journal of International Money and Finance*, 19, 813–832.
- Sinkey, F. J., Jr. (2002). *Commercial bank financial management* (6th ed.). (p. 119). Prentice Hall: Upper Saddle River.
- Stiglitz, J., & Weiss, A. (1981). Credit rationing in markets with imperfect information. *American Economic Review*, 71, 393–410.
- Van Horen, N. (2007). Foreign banking in developing countries; origin matters. *Emerging Markets Review*, 8, 81–105.
- Wong, K. P. (1997). On the determinants of bank interest margin under credit and interest rate risks. *Journal of Banking and Finance*, 21, 251–271.
- Yilmaz, R., & Koyuncu, C. (2010). Foreign bank participation and banking crises in transition economies. *Economic Research*, 23, 15–29.

Appendix

Table A1. Variable definition and sources.

Variable	Definition	Data source
NIM	Interest income minus interest expenses divided by average earning assets	BankScope
Default risk	Ratio of loan loss reserves to gross loans	BankScope
Capitalization	Ratio of book equity to total assets	BankScope
Liquidity	Ratio of liquid assets to sum of deposits and short-term funding	BankScope
Management quality 1	Ratio of earning assets to total assets	BankScope
Management quality 2	Cost to income ratio	BankScope
Interest rate risk 1	Difference between short term assets and short term funding divided by equity	BankScope
Interest rate risk 2	Earning assets minus sum of deposits and short-term funding, divided by equity	BankScope
Concentration	Herfindhal-Hirschman index of concentration (assets)	National bank of Serbia
Inflation	Annual consumer price index	Statistical Bureau
Bank intermediation	Ratio of bank assets to gross domestic product	National bank of Serbia and Statistical Bureau
Growth	Real GDP rate of change	Statistical Bureau

Source: Authors calculation.

Table A2. List of banks entering the sample and ownership status.

Bank name	Initial status		Change of status	
	In the form	Covered from	Into	Starting at
BancaIntesa	DPR	2002	FO	2006
Komericijalna banka	DPU	2008	–	–
Raiffeisen bank	FO	2002	–	–
EFG bank	FO	2005	–	–
Hypo Alpe Adria	FO	2003	–	–
AIK banka	DPR	2002	–	–
Societe Generale bank	FO	2003	–	–
Unicredit	FO	2004	–	–
Vojvodanska banka	DPU	2003	FO	2007
Alpha banka	FO	2008	–	–
Procredit	FO	2002	–	–
Volksbanka	FO	2005	–	–
Erste banka	DPU	2002	FO	2006
OTP	FO	2006	–	–
Pireaus banka	DPR	2002	FO	2006
NLB banka	DPR	2004	FO	2008
Agrobanka	DPR	2003	–	–
Credi Agricole	DPR	2005	FO	2006
Univerzal banka	DPR	2005	–	–
Razvojna banka Vojvodine	DPU	2003	–	–
Poštanska štedionica banka	DPU	2004	–	–
Marfin banka	DPR	2004	FO	2007
Čačanska banka	DPU	2003	DPR	2006
KBC banka	DPR	2005	FO	2008
Findomestic	DPR	2004	–	–
Srpska banka	DPU	2002	–	–
Opportunity banka	FO	2006	–	–
Privredna banka Beograd	DPU	2004	–	–
Jubmes	DPU	2002	–	–

Legend: FO – foreign owned; DPR – domestic privately owned; DPU – domestic publicly owned.

Note: Banks are listed according to their size at the end of 2009.

Source: Authors calculation.