“What influences net interest rate margins? Developed versus developing countries”

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What influences net interest rate margins? Developed versus developing countries

Abstract

This paper attempts to identify the main determinants of net interest rate margins for a group of developed and developing countries. The methodology follows a two-step GMM dynamic panel data regression and also applies the Lerner index in order to account for competition considerations. The results are divided into three: a) the entire sample; b) the group of developed countries; and c) the group of developing countries. The main results suggest that the main determinants of net interest rate margins in developed countries include: operating costs, capital adequacy, interest rate risk, the size of banks, the inflation rate, economic growth and the level of tax. Whereas the main determinants of the net interest rate margin in developing countries include: capital adequacy, credit risk, implicit interest payments, cost of holding reserves, the efficiency level and the level of taxes. Overall, operating expenses is the most important variable responsible for increased net interest rate margins for the entire sample. The findings also establish no relationships between the Lerner index and net interest rate margins.

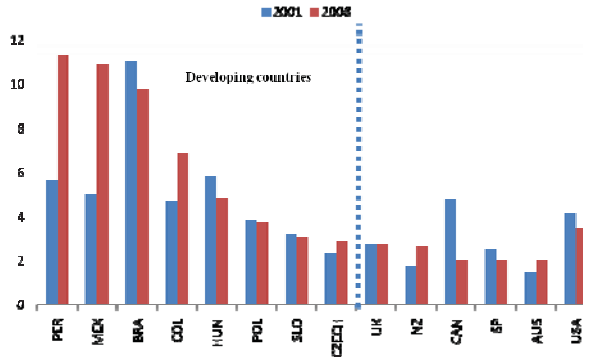
Keywords: banking, net interest rate margins, Lerner index, generalized method of moments.
JEL Classification: G21, L10.

Introduction

One of the main functions of a financial intermediary is to transfer funds from depositors to borrowers, therefore, allocating these funds efficiently, where they are most needed. However, this process of intermediation may not be fully efficient due to factors that may be distorting the net interest rate margin (*NIM*), e.g., by paying lower fees to depositors and/or charging higher fees to borrowers. Thus, the analysis of the determinants of net interest rate margin becomes relevant. Recent studies have suggested that the net interest rate margin is higher in developing countries than their developed counterparts. It has become of recent interest to understand what the main factors which influence these margins are and how they vary in different countries.

Ho and Saunders (1981) in their seminal paper argue that there are four main factors which affect the "pure spread": the degree of risk aversion, the market structure, the average size of bank transactions, and the variance of interest rates on loans and deposits. Furthermore, many other authors have contributed by expanding the original model by Ho and Saunders (1981) adding more factors as possible determinants of interest rate margins (Angbazo, 1997; Maudos and Fernandez de Guevara, 2004; Carbo Valverde and Rodriguez Fernandez, 2007; Saunders and Schu-macher, 2000; Brock and Rojas-Suarez, 2000; Martinez and Mody, 2004; Gelos, 2009, among others). This paper attempts to identify the main determinants of the net interest rate margin for a group of developing and developed countries following previous studies.

A comparison of the *NIM* for two periods in time (2001 and 2008) is presented in Figure 1, for a sample, of developed and developing countries. It can be clearly observed that developing countries experience higher *NIM* values than developed countries. Claeys and Vander Vennet (2008) argue that developing countries have greater *NIMs* due to low efficiency and a low degree of market competition. On the other hand, many of these countries, particularly Latin American countries, have increased their *NIMs* through time. Many questions come to mind, when you try to understand why there are differences in *NIMs* between developed and developing countries. It is important to notice that the *NIM* values in Eastern European countries have been converging to their Western European counterparts, thus, their values are not as high compared to Latin American *NIM* values[1].



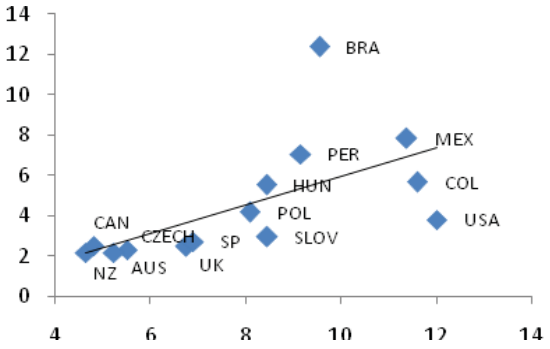
Source: Bankscope.
Note: The net interest rate margin is defined as the difference between interest rate income and interest rate expense in terms of total earning assets.

Fig. 1. Net interest rate margin

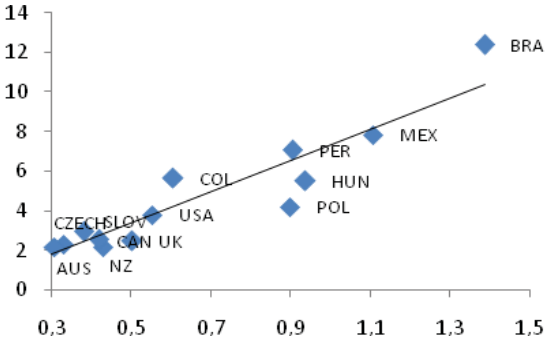
[1] Claeys and Vander Vennet (2008) study the determinants of net interest margins in Eastern European countries (including accession countries) and find that their *NIM* values have converged considerably to Western European *NIM* values, mainly through increased efficiency and capital adequacy.

As explained by Ho and Saunders (1981), there are four main factors that affect the pure spread of the *NIMs*. The relationship between these factors and *NIMs* for a group of countries: Peru, Mexico, Brazil, Colombia, Hungary, Poland, Slovakia, Czech Republic, UK, New Zealand, Canada, Spain, Australia and USA is shown in Figure 2. It can be observed from Figure 2 that there is a positive trend between credit risk, market risk, and capital adequacy with the net interest rate margin. As such, any increases in risk are normally passed to consumers via costlier financial intermediation (higher *NIMs*). However, the same result cannot be observed from the concentration level. As shown in Figure 2, there is a negative trend between the degree of concentration and the net interest rate margin.

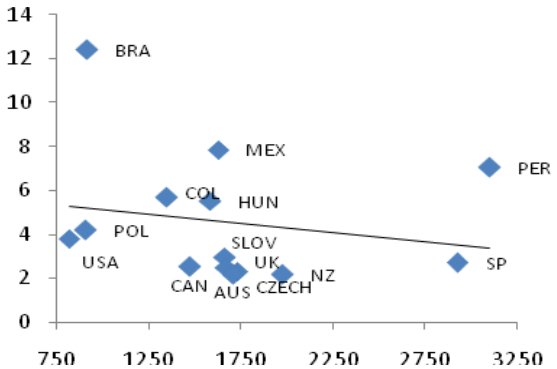
Capital adequacy vs. *NIM*



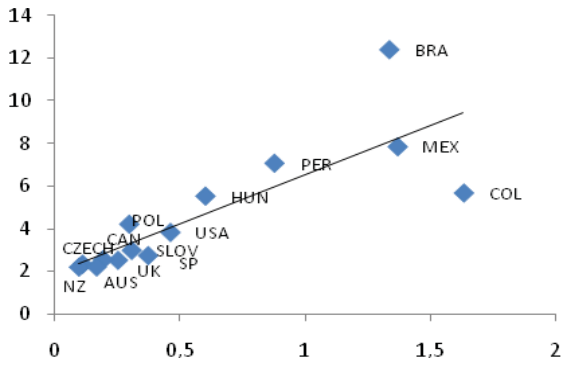
Market risk vs. *NIM*



Concentration vs. *NIM*



Credit risk vs. *NIM*



Source: Bankscope and IFS.
Note: *NIM* is defined as the difference between interest income and interest expenses divided by total earning assets; capital adequacy is defined as equity over total assets, market risk is defined as the annual standard deviation of the monthly money market rate; concentration is the Herfindahl-Hirschmann Index in terms of assets; credit risk are the loan loss provisions in terms of total assets

Fig. 2. Average of all commercial banks: 2001-2008

This paper is divided into four Sections. Section 1 presents the recent literature review of the determinants of the net interest rate margin. Section 2 describes the data and methodology used in this paper. Section 3 presents the results of the study and the final Section concludes.

1. Literature review

The seminal paper by Ho and Saunders (1981) was the first study which analyzed the determinants of net interest rate margins, studying the US banking sector. In their paper they apply a two step procedure which accounts, firstly, for the determinants of the "pure spread" such as structural variables and macroeconomic factors and, secondly, bank-based variables which capture their relationship with the net interest rate margin. Since then, many studies have tried to analyze the determinants of interest rate margins as cross-country studies, for developed countries and more recently for developing countries. The findings have been diverse, particularly depending on the degree of development of the country (i.e. developed versus developing countries).

There are several recent studies trying to establish the determinants of net interest rate margins. Kasman et al. (2010) examine the effects of financial reforms on the determinants of commercial bank net interest margins of new EU member states and candidate member states for two periods in time: for 1995-2000 and for 2001-2006. They apply a GLS panel data in order to find the determinants of interest rate margins in two periods of time for a group of 29 countries. The results argue that operating costs are by far the most important factor explaining rising interest rate margins in new EU member

states and candidate member states. Finally, they find that credit risk and implicit interest payments are positively related to interest rate margins while size and the degree of efficiency are negative and significant in relation to interest rate margins. However, they find contrasting results with regards to the level of competition (Lerner index), being positive in new EU member states and candidate states, but negative for old EU member states. Gelos (2009) analyzes the determinants of interest rate margins for a group of 85 countries, including 14 Latin American countries, for the period of 1999-2002. The main motivation of this study is the fact that Latin American's interest rate spreads are high by international standards. He applies a cross-country panel data methodology and focuses on the decomposition of the difference between Latin American's interest spreads and the average among the remaining countries in the study. His findings suggest that the main determinants of Latin American's interest rate spreads are determined by high overhead costs, high interest rates, low economic growth, high reserve requirements and a less supportive legal environment. They argue towards pursuing greater banking competition alongside enhancing the efficiency levels in the banking sector. Horvath (2009) analyzes the determinants of interest rate margins in the Czech Republic for the period of 2000-2006. He follows the dealership model by Ho and Saunders (1981) and, firstly, analyzes the determinants of the pure spread (e.g., market structure and interest rate volatility); and, secondly, controls for the effects on the net interest margin (e.g., implicit interest payment, opportunity cost of reserves and capital requirements). His main findings suggest that bank market structure, interest rate volatility and bank capitalization are important determinants of bank spreads. Maudos and Solis (2009) study the determinants of net interest income in Mexico for the period of 1993-2005. They apply two different methodologies: a dynamic system GMM model and a panel data fixed effects static model. Their conclusions suggest that average operating costs and the Lerner index are positively related to high interest income in Mexico. They conclude that policy oriented measures should be aimed at increasing banking competition, promoting efficiency in the industry and favoring stable economic conditions.

Hawtrey and Liang (2008) study the determinants of bank interest margins for a group of OECD countries for the period of 1987-2001. They apply a panel data methodology and find that bank margins are mainly influenced by market power, operational costs, risk aversion, interest rate volatility, credit risk, the volume of loans, implicit interest payments and the quality of management. Liebeg and Schwaiger (2006) study the determinants of interest rate margins in Austria for the period of 1996-2005. They apply the Ho and Saunders (1981) dealership model and find that the main factors reducing net interest margins in Austria are decreasing operating costs, the importance in foreign currency lending, rising shares of non-interest revenue and increased banking competition. Maudos and Fernandez de Guevara (2004) study the main factors, explaining the interest rate margins in the banking sectors of Germany, France, the UK, Italy and Spain for the period of 1993-2000. They apply a panel data methodology for the whole sample and also for each country individually. The first conclusion is that the pure spread is dependent on competitive conditions, interest rate risk, credit risk, average operating expenses and risk aversion of banks. On the other hand, they suggest that the recent downfall of the net interest margin may be attributable to increased competition in the banking sector, a reduction of average operating costs in the industry and an improvement on the overall efficiency levels. They suggest that favorable economic conditions as well as the convergence of the euro zone may have induced this behavior.

2. Data and methodology

2.1. Data. The data used in this study was obtained from the Bankscope database maintained by Fitch and from the IFS (International Financial Statistics) from the IMF. The sample consists of 3,020 unbalanced bank observations for the period of 2001-2008. The countries in study include: Australia, Brazil, Canada, Colombia, Slovakia, Spain, Hungary, Mexico, New Zealand, Peru, Poland, Czech Republic, the UK, and the USA. The countries selected represent developed (6) and developing countries (8), and were considered due to data availability. The Table 1 presents the description of the variables.

Table 1. Description of variables

Variable	Description
Lerner index (*LERNER)*	Lerner index of market power
Operating costs (*OOETA)*	Other operating expenses/total assets
Capital adequacy (*EQTA)*	Equity/total assets
Interest rate risk (*INTVOL)*	Interest rate volatility (money market rate)
Credit risk *(LLPTA)*	Loan loss provisions/total assets
Risk covariance *(COVAR)*	Interaction: credit risk × interest rate risk
Size *(SIZE)*	Logarithm of assets
Implicit interest payments (*IIP)*	(Non-interest expenses – other operating income)/total assets
Opportunity cost of holding reserves (*OCR)*	Liquid reserves/total assets
Efficiency *(EFF)*	Cost to income ratio
Inflation rate *(INFL)*	Year end consumer price index
GDP growth *(GDP)*	Year end real GDP growth
Tax *(TAX)*	Tax/total assets
Foreign ownership *(FOREIGN)*	Dummy variable on foreign ownership

Table 2 presents the descriptive statistics of the variables used. Since the mix of countries includes developed and developing countries, the descriptive statistics show quite contrasting parameters, in particular, the interest rate volatility ratio varies from 0.03 to 4.14, the inflation level varies from 0.1 to 14.72, and GDP growth varies from -1.5 to 10.42.

Table 2. Descriptive statistics

Variable	Mean	Standard deviation	Minimum	Maximum
LERNER	.147	.105	-.511	.477
OOETA	2.967	4.797	-.59	95.4
EQTA	13.065	12.203	.1	100
INTVOL	.758	.741	.03	4.14
LLPTA	.847	2.11	-13.906	32.392
COVAR	.808	2.677	-23.049	46.389
SIZE	6.468	.982	3.13	9.48
IIP	5.399	29.553	-37.18	1,168.37
OCR	3.372	8.449	-.93	204.77
EFF	63.447	46.592	-663.13	748.22
INFL	4.288	2.575	.1	14.72
GDP	3.075	1.86	-1.5	10.42
TAX	.512	1.161	-28.338	21.695
FOREIGN	.308	.462	0	1

Note: Where *LERNER* is a measure of competition, *OOETA* are the operating expenses, *EQTA* is a measure of capital adequacy, *INTVOL* is a measure of interest rate risk, *LLPTA* is a measure of credit risk, *COVAR* is the interaction between credit risk and interest rate risk, *SIZE* is the logarithm of assets, *IIP* are the implicit interest rate payments, *OCR* is a measure of opportunity cost of reserves, *EFF* is the managerial efficiency, *INFL* is the inflation rate, *GDP* is the *GDP* real annual growth, *TAX* is a measure of tax and *FOREIGN* is a dummy variable for foreign banks.

2.2. Methodology. This paper applies the generalised method of moments (GMM) dynamic panel data following previous studies (e.g., Maudos and Solis, 2009; Carbo Valverde and Rodriguez Fernandez, 2007; Liebeg and Schwaiger, 2006; among others). These studies consider a series of variables which may affect both the "pure spread" and also other variables which incorporate other various factors which could be influencing the net interest rate margin.

The GMM methodology was first proposed by Arellano and Bover (1995) and Blundell and Bond (1998) as a system of equations in both differences and levels, hence, the name system GMM. The system GMM suitably combines a set of equations in levels and differences and uses its lagged levels and lagged first differences as instruments. Moreover, the system GMM allows classifying the variables of the model as endogenous or exogenous adding to the explanatory power of the model[1]. This paper applies the two-step system GMM following the Windmeijer (2005) finite-sample correction[2]. In order to determine the consistency and validity of the GMM model estimators, the Hansen j-test and the first and second order autocorrelation tests are observed to determine the correct specification of the variables in the model[3].

The econometric model is specified as follows:

$$NIM_{it} = \alpha_i + \lambda NIM_{it-1} + \sum_{j=1}^{J} \beta_j SP_{it}^j + \\ + \sum_{k=1}^{K} \phi_K X^K{}_{it} + \sum_{m=1}^{M} \mu_m Y_i^M + \varepsilon_{it}, \quad (1)$$

where $\varepsilon_{it} = \eta_i + \nu_{it}, \eta_i$ is an unobserved time-invariant effect and ν_{it} is a disturbance term;

where $t = 1,...,T$ is the time period and $i = 1,...,I$ is the bank observations.

The variable NIM_{it} is the net interest rate margin, NIM_{it-1} is the lagged dependent variable, SP_{it} refers to the determinants of the pure spread, X_{it} refers to bank-specific variables, and Y_t refers to the macroeconomic variables.

The following variables are considered as determinants of the pure spread.

2.2.1. Lerner index of market power (LERNER). The Lerner index of market power is used to account for market competition within the banking industry, its values range from 0 (perfect competition) to 1 (monopoly). It is calculated as the difference between the price and the total marginal cost as a proportion of the price. The price is the total revenue calculated as the sum of personnel expenses, interest rate expenses and other operating expenses, whereas the marginal costs are a translog function with one output (total assets) and three inputs (labour, physical capital and lendable funds):

$$lnTC = \alpha_0 + \alpha_j \sum_{j=1}^{3} w_{it}^j + \frac{1}{2} \sum_{j=1}^{3} \sum_{k=1}^{3} \alpha_{jk} \ln w_{it}^j w_{it}^k + \\ + \beta_1 lnY_{it} + \frac{1}{2} \beta_2 (lnY_{it})^2 + \sum_{j=1}^{3} \beta_3 lnY_{it} \ln w_{it}^j + \quad (2) \\ + \varphi_{1t} T + \frac{1}{2} \varphi_{2t} T^2 + \sum_{j=1}^{3} \varphi_{3t} T \ln w_{it}^j + \varphi_{4t} T lnY_{it} + \mu_i + \mu_t,$$

[1] Maudos and Solis (2009) consider that the Lerner index is an example of a variable which cannot be classified as strictly exogenous, since it may be endogenous when the degree of market power or the value of non-interest income depend in bank margins.

[2] The asymptotic standard errors of the efficient two-step system GMM may produce downward biasedness in small samples, however, Windmeijer (2005) suggests correcting any heteroskedasticity problems by applying robust standard errors.

[3] In order to test the validity of the instruments used, the Hansen over-identifying test is applied, the test must be accepted. In addition, the Hansen difference test is applied to test the moment conditions used in levels in the equation, the test must also be accepted. Finally, a test of serial correlation of the error in levels must be performed; there must be evidence of first-order serial correlation but no significant second-order serial correlation (Arellano and Bond, 1991).

where TC are the total costs, w is the price of the three inputs (personnel expenses/total assets, interest rate expenses/total deposits and other operating expenses/fixed assets), Y is total assets, T is a time trend which captures the effect of technical progress and μ captures the individual fixed effects (Maudos and Solis, 2009).

According to Maudos and Solis (2009), a positive relationship between the Lerner index and net interest margins is expected since banks with greater market power should exercise their market position to widen their interest rate margins (above competitive price levels). However, Gelos (2009) argues that it is difficult to find a strong correlation between the interest rate spread and a measure of competition.

2.2.2. Other operating expenses (OOETA). Brock and Rojas-Suarez (2000) argue that in a stable industry structure, any increment in operating costs should be transferred as higher interest spreads rather than reduced dividends. Maudos and Fernandez de Guevara (2004) argue that even in the absence of market power or any sorts of risks banks must cover their operational costs charging higher margins. Studies, which have found a positive relationship between operating costs and *NIMs*, include Gelos (2006), Demirguc-Kunt and Huizinga (1999), Saunders and Schumacher, 2000; Affanasief et al. (2002) among others.

2.2.3. Credit risk (LLPTA). Credit risk is proxied as loan loss provisions over total assets. Brock and Rojas-Suarez (2000) explain that an increase in this ratio may affect interest margins in a two-fold manner: firstly, it may increase the spread in order to cover expected losses, but secondly, if the bank is weak it may decrease the spread in order to obtain funds to cover for these expected losses. Many studies have found a positive relationship between credit risk and *NIMs* (e.g., Anbgazo, 1997; Maudos and Fernandez de Guevara, 2004; Carbo Valverde and Rodriguez Fernandez, 2007).

2.2.4. Market risk (INTVOL). This variable is proxied by the annual standard deviation of the monthly money market interest rate. Ho and Saunders (1981) find that interest margins rise with increases in the variance of interest rates, reflecting the degree of intermediation risk. Liebeg and Schwaiger (2006) suggest that higher interest rate risk will increase credit default and, therefore, the interaction is important to consider. Brock and Rojas-Suarez (2000) find mixed results depending on the country of study. However, the majority of the countries studied observe a positive relationship with *NIMs*.

2.2.5. Capital adequacy ratio (EQTA). This is a proxy of bank solvency; it represents a premium on bank margins (Carbo Valverde and Rodriguez Fernandez, 2007). A positive relationship with NIM is expected as net interest rate margins should increase the capital base as the exposure to risk increases (Ho and Saunders, 1981; Berger, 1995). However, high capital adequacy may reflect greater banking stability and contribute to lower interest rate margins (Horvath, 2009; Hawtrey and Liang, 2008).

2.2.6. Interaction between credit risk and market risk (COVAR). The interaction is measured as *LLPTA * INTVOL*. Liebeg and Schwaiger (2006) argue that higher interest rate risks will increase the likelihood of default. On the other hand, Brock and Rojas-Suarez (2000) suggest that an inverse relationship with NIMs may be found because of inadequate provisions for loan losses.

2.2.7. Size (SIZE). The size of the bank is proxied by the logarithm of assets of each bank. Some authors suggest a positive relationship between the size of a bank and *NIMs*, however, the literature presents contrasting results. Fungacova and Poghosyan (2009) argue that due to increased economies to scale, banks that provide more credit should benefit from their size and have lower margins. However, the larger the average size of the operations, the larger the risks concentrated in single customers and the higher the *NIMs* (Liebeg and Schwaiger, 2006; Maudos and Fernandez de Guevara, 2004).

The following bank-specific variables are considered as determinants of the net interest rate margin following previous studies.

2.2.8. Implicit interest payment (IIP). This variable is measured by the difference between non-interest expenses and other operating income in terms of total assets. Maudos and Solis (2009) explain that an implicit interest payment represents extra payments to depositors transferring service charges or other types of transfers. This additional costs to banks will be offset by higher margins, thus, we expect a positive relationship (Ho and Saunders, 1981; Angbazo, 1997; Saunders and Schumacher, 2000; Maudos and Fernandez de Guevara, 2004).

2.2.9. Quality of management (EFF). This variable is proxied by the cost to income ratio. According to Maudos and Solis (2009), a negative relationship is expected since high levels of inefficiency may imply that banks select less profitable assets and high cost liabilities (increasing the interest rate margins). Altunbas et al. (2001) suggest that higher operating costs results in increased operating inefficiency, thus, inefficiency should be positively related to bank margins.

2.2.10. Opportunity cost of reserves (OCR). The opportunity cost of reserves is proxied by the level of cash in a bank in terms of its total assets. According to Maudos and Solis (2009), this measure represents an opportunity cost to the banks of not maintaining high-yielding assets, transferring this cost to consumers as high levels of *NIM* (Ho and Saunders, 1981; Angbazo, 1997; Saunders and Schumacher, 2000; Maudos and Fernandez de Guevara, 2004).

2.2.11. Tax rate (TAX). The tax rate is the yearly tax expense of each bank in terms of assets. According to Honohan (2003), effective taxation usually rises along with inflation and short-term interest rates, and at higher inflation levels taxation should influence *NIMs* positively.

Finally the set of macroeconomic variables used as determinants of the net interest margin are described as follows.

2.2.12. Inflation rate (CPI). The inflation rate is the yearly rate of change of the consumer price index for each country. A positive relationship between inflation and *NIM* has been observed in previous studies (e.g., Honohan, 2003; Gelos, 2009), since bank spreads may be correlated with the inflation level (Gelos, 2009).

2.2.13. GDP growth rate (GDP). The yearly GDP real growth rate. Bernanke and Gertler (1990) suggest that an increase in economic activity increases the net worth of borrowers, thus, reducing the interest rate spreads. Gelos (2009) finds a negative relationship between greater economic growth and lower interest rate margins.

2.2.14. Foreign ownership dummy (FOREIGN). The foreign ownership dummy variable is 1, when the bank is foreign owned and 0 otherwise. Ho and Saunders (1981) argued that bank ownership structure was irrelevant irrespective of *NIMs* since banks apply similar strategies, when competing in the same market. There are other studies which have added to importance of including this variable. In particular, Micco et al. (2007) show that bank ownership has a strong influence on bank performance, and, thus, on its *NIMs* in developing countries. Demirguc-Kunt and Huizinga (1999) also find that foreign banks have greater *NIMs* in developing countries than domestic banks. Martinez Peria and Mody (2004) show in their study that foreign banks in Latin America exhibit lower interest rates than domestic banks; they argue that this is through improved banking efficiency. Contrastingly, Dabla-Norris and Floerkmeier (2007) find no relationship between foreign banks and *NIMs*.

3. Results

The methodology employed is a two-step system GMM following previous studies (Liebeg and Schwaiger, 2006; Maudos and Solis, 2009). The results are divided into three: a) the results for entire sample of countries; b) the results for the group of developed countries; and c) the results for the group of developing countries. Table 3 presents the results for the entire sample.

Table 3. *NIM* determinants for the entire sample

	Model 1	Model 2	Model 3
Lagged NIM	.17*	.193	.21*
LERNER	-.006	.015	.026
OOE	.66***	.977***	.722**
EQTA	.075*	.076	.038
INTVOL	-.516	-.1	-.392*
LLPTA	-.101	-.027	.282
COVAR	.548*	.259	.222
SIZE	.714	-.21	-.134
IIP	.385**	.263*	.313**
OCR	.038	.083	.051
EFF	-.034***	-.051***	-.036***
CPI		-.104	-.023
GDP		-.324*	-.316*
TAX			.444
FOREIGN			.249
CONS	-2.863	4.595	3.234
AR(1) p-value	3.24 (0.001)	-2.48 (0.013)	-3.04 (0.002)
AR(2) p-value	-0.80 (0.423)	-0.07 (0.943)	-0.23 (0.821)
Hansen j-test p-value	135.09 (0.253)	98.87 (0.201)	95.15 (0.283)
Sargan test p-value	37.31 (0.547)	56.94 (0.203)	41.83 (0.349)
F-test p-value	54.88 (0.000)	85.99 (0.00)	78.44 (0.00)
Observations	2198	2198	2172
Country dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes

Notes: *, **, *** represents significance at 10%, 5% and 1% confidence intervals. The macroeconomic variables, time and country dummies are considered strictly exogenous whereas, the bank specific variables are considered endogenous variables. Up to three lags of the endogenous variables are used as instruments, where *lagged NIM* is the lagged dependent variable, *LERNER* is a measure of competition, *OOE* is a measure of operating expenses, *EQTA* is a measure of capital adequacy, *INTVOL* is a measure for interest rate risk, *LLPTA* is a measure for credit risk, *COVAR* is the interaction between interest rate risk and credit risk, *SIZE* is the logarithm of assets, *IIP* are the implicit interest payments, *OCR* are the opportunity cost of reserves, *EFF* is the degree of efficiency, *CPI* is the inflation rate, *GDP* is a measure for economic growth, *TAX* are the total taxes in terms of assets, and *FOREIGN* is a dummy variable representing foreign ownership. The entire sample consists of Peru, Mexico, Brazil, Colombia, Hungary, Poland, Slovakia, Czech Republic, the UK, New Zealand, Canada, Spain, Australia and the USA.

The main results for the entire sample show that the *LERNER* variable is not significant in any case, disregarding the market structural implications on *NIMs*. On the other hand, *OOE* is positive and significant in relationship with *NIM* as expected from the literature. Increased operating costs are normally transferred to consumers via higher intermediation. Moreover, there is evidence of a positive relationship between *EQTA* and greater margins. Ho and Saunders (1981) argue that a higher capital base is a consequence of greater margins as risk exposure increases. According to Claeys and Vander Vennet (2009), when banks hold excess capital (above the minimum requirements), they can use this capital to perform riskier and more profitable activities which would increase the interest rate margins. Moreover, high regulatory or determined capital ratios tend to erode bank profitability; banks, therefore, lower the cost of holding capital by increasing *NIMs* (Saunders and Schumacher, 2000). On the other hand, there is evidence of a negative relationship between *INTVOL* and *NIM*, thus, interest rate risk is related to lower margins. However, the interaction variable *COVAR* shows a positive relationship with *NIMs*, thus, interest rate risk may be increasing the likelihood of greater default (credit risk), which is pushing *NIMs* upward. The *IIP* is consistently positive and significant with *NIMs*, thus, the implicit interest rate payment is being transferred to consumers as greater *NIMs*. Saunders and Schumacher (2000) find that *IIP* is the most important variable in determining interest rate margins. They argue that an increase in this variable is offset by increasing the loan rates and/or decreasing the deposit rates. The *EFF* variable, on the other hand, is negative and significant to *NIMs* as expected since more inefficient banks tend to have greater costs, which increase the *NIM*. Finally, the macroeconomic variables are not significant except for *GDP* growth, which is inversely related to *NIMs*. Claeys and Vander Vennet (2009) find a negative relationship between *GDP* growth and interest rate margins; they suggest that greater economic growth contributes to greater lending and lower credit default. On the other hand, the insignificant result obtained from the *FOREIGN* variable support the Ho and Saunders (1981) hypothesis which states that banks compete with similar strategies in common markets regardless of their ownership structure. Table 4 presents the *NIM* determinants in developed countries.

Table 4. *NIM* determinants in developed countries

	Model 4	Model 5	Model 6
Lagged NIM	.074	.084	.11
LERNER	.001	-.001	-.006
OOE	.158**	.175	-.113
EQTA	-.008	-.038	-.041*
INTVOL	-.495*	-.363	-.681
LLPTA	1.209***	1.336***	1.499***
COVAR	-.556**	-.534*	-.534**
SIZE	-.161**	-.195*	-.105
IIP	.012	.013	-.002
OCR	.002	-.009	.006
EFF	-.003	-.003	-.0003
CPI		.216**	.198
GDP		-.366*	-.17
TAX			.578*
FOREIGN			-.078
CONS	4.191***	3.9***	3.533***
AR(1) p-value	-3.93 (0.000)	-3.71 (0.000)	-3.37 (0.00)
AR(2) p-value	1.41 (0.158)	1.11 (0.267)	1.20 (0.231)
Hansen j-test p-value	177.82 (0.614)	89.71 (0.429)	92.08 (0.307)
Sargan test p-value	33.82 (0.952)	46.01 (0.595)	40.15 (0.332)
F-test p-value	35.73 (0.00)	27.98 (0.00)	23.01 (0.00)
Observations	1,144	1,144	1,135
Country dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes

Notes: *, **, *** represents significance at 10%, 5% and 1% confidence intervals. The macroeconomic variables, time and country dummies are considered strictly exogenous, whereas the bank specific variables are considered endogenous variables. Up to three lags of the endogenous variables are used as instruments, where *lagged NIM* is the lagged dependent variable, *LERNER* is a measure of competition, *OOE* is a measure of operating expenses, *EQTA* is a measure of capital adequacy, *INTVOL* is a measure for interest rate risk, *LLPTA* is a measure for credit risk, *COVAR* is the interaction between interest rate risk and credit risk, *SIZE* is the logarithm of assets, *IIP* are the implicit interest payments, *OCR* is the opportunity cost of reserves, *EFF* is the degree of efficiency, *CPI* is the inflation rate, *GDP* is a measure for economic growth, *TAX* are the total taxes in terms of assets, and *FOREIGN* is a dummy variable representing foreign ownership. The sample of developed countries consists of the UK, New Zealand, Canada, Spain, Australia and the USA.

The *LERNER* variable is not significant in any case for the case of developed countries. Similarly, Claeys and Vander Vennet (2009) find no significance for greater market share and margins for a group of Western European countries. The *OOE* variable is positive and significant in Model 4, which is consistent with the results observed for the entire sample. Other studies have found a positive relationship between operating costs and interest rate margins in developed countries: Fernandez de Guevara (2004) for Spanish banks and Maudos and Fernandez de Guevara (2004) for European banks. The variable of capital adequacy is negative and significant in Model 6, suggesting that a greater capital base induces lower margins.

Although, this result contradicts the Ho and Saunders (1981) dealership model, less capitalized banks have the motivation to accept more risk (which is associated with higher margins) in order to obtain greater profits (Brock and Franken, 2003). At the same time, *INTVOL* presents an inverse relationship with net interest margins. *LLPTA* is positive and significant in all cases, suggesting that an increase in this ratio is compensated by pushing *NIM* upwards. *LLPTA* is by far the most important variable determining higher *NIMs* in developed countries. The interaction variable *COVAR* is consistently negative and significant, as well as the *SIZE* variable with respect to *NIM*. This result may imply that banks may grow aggressively due to low margins (Zhou and Wong, 2008). The *IIP* is not significant in any case. Similarly, Liebeg and Schwaiger (2006) find no significance with *IIP* and *NIMs* in Austria. From the macroeconomic variables, *CPI* is positive and significant in Model 5, so increases in the inflation rate affect the *NIMs* in a positive way. Boyd et al. (2001) indicate that price stability contributes to better financial intermediation. The *GDP* variable is negative and significant, suggesting that economic growth generates lower margins in the banking sector. Finally, the level of *TAX* is positive and significant, implying that increases in taxes are transferred to consumers via greater margins. Table 5 presents the results of the *NIM* determinants in developing countries.

Table 5. *NIM* determinants in developing countries

	Model 7	Model 8	Model 9
Lagged NIM	.178*	.247**	.177
LERNER	.016	.011	.017
OOE	-.045	.435	.718
EQTA	.016	.039	.075*
INTVOL	-.919**	-.448	-.343
LLPTA	-.945**	-.783*	-.329
COVAR	.82**	.436**	.326
SIZE	-.09	1.139	.846
IIP	1.012***	.796***	.588
OCR	.117*	.089	.163
EFF	-.039**	-.04**	-.04**
CPI		.059	-.044
GDP		-.033	-.147
TAX			1.073*
FOREIGN			.83
CONS	2.332	-6.909	-5.26
AR(1) p-value	-2.64 (0.008)	-2.36 (0.018)	-2.42 (0.016)
AR(2) p-value	-0.80 (0.421)	-0.25 (0.803)	0.67 (0.503)
Hansen j-test p-value	137.69 (0.206)	182.17 (0.524)	95.36 (0.230)
Sargan test p-value	38.30 (0.502)	32.83 (0.963)	40.82 (0.306)
F-test p-value	61.79 (0.00)	86.00 (0.00)	74.46 (0.00)
Observations	1054	1054	1002
Country dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes

Notes: *, **, *** represents significance at 10%, 5% and 1% confidence intervals. The macroeconomic variables, time and country dummies are considered strictly exogenous, whereas the bank specific variables are considered endogenous variables. Up to three lags of the endogenous variables are used as instruments, where *lagged NIM* is the lagged dependent variable, *LERNER* is a measure of competition, *OOE* is a measure of operating expenses, *EQTA* is a measure of capital adequacy, *INTVOL* is a measure for interest rate risk, *LLPTA* is a measure for credit risk, *COVAR* is the interaction between interest rate risk and credit risk, *SIZE* is the logarithm of assets, *IIP* are the implicit interest payments, *OCR* is the opportunity cost of reserves, *EFF* is the degree of efficiency, *CPI* is the inflation rate, *GDP* is a measure for economic growth, *TAX* are the total taxes in terms of assets, and *FOREIGN* is a dummy variable representing foreign ownership. The sample of developing countries consists of Peru, Mexico, Brazil, Colombia, Hungary, Poland, Slovakia and Czech Republic.

LERNER is not significant in any case for developing countries. Similarly, Horvath (2009) finds that market power variables are not significant in determining the net interest margins in the Czech Republic. The variable *OOE* is positive and significant, consistent with other studies on developing countries (Brock and Rojas-Suarez, 2000; Martinez Peria and Mody, 2004; and Gelos, 2006 for Latin American banks; and Maudos and Solis, 2009 for Mexican banks). The variable *LLPTA* is negative and significant in Model 7, but not significant in any other case. This result has also been observed in the literature when analyzing developing countries (Brock and Rojas-Suarez, 2000 for Latin American banks). Brock and Rojas-Suarez (2000) find that greater credit risk increases interest rate spreads in industrialized countries but have the opposite effect on weak banking systems. Moreover, the interaction variable *COVAR* is also negative and significant. Brock and Rojas-Suarez (2000) argue that this result may be the consequence of a bad provision for loan losses in developing countries. The results also show evidence of a positive relationship between *OCR* and *NIM* for developing countries. Zhou and Wong (2008) find that *OCR* is influential in establishing higher *NIM* values. The *EFF* is consistently negative and significant in all models, similarly to other findings in the literature for developing countries (Clayes and Vander Vennet (2009) for Eastern European countries; Gelos (2009) for Latin American countries). *GDP* growth is not significant in any case; this result can be explained by the high levels of volatility in developing countries, in which periods of economic growth are interrupted by sudden economic crises (Claeys and Vander Vennet, 2009).

Table 6. Determinants of the net interest rate margin (comparison of results)

	All	Developed countries	Developing countries
LERNER			
OOE	+	+	
EQTA	+	-	+
LLPTA		+	-
INTVOL	-	-	-
COVAR	+	-	+
SIZE		-	
IIP	+		+
OCR			+
EFF	-		-
CPI		+	
GDP	-	-	
TAX		+	+
FOREIGN			

In Table 6, the relationship of all the variables can be observed when analyzing the entire sample, developed countries and developing countries. In the entire sample, it is noticeable that the main factors increasing the interest rate margins are the operating expenses, capital adequacy, the interaction between interest rate risk and credit risk and the implicit interest payments. On the other hand, interest rate risk, managerial efficiency and *GDP* growth seem to be inversely related to net interest margins.

In developed countries there is evidence of a positive relationship between operating expenses, credit risk, the inflation rate and the level of tax as determinants of greater net interest margins. On the other hand, capital adequacy, interest rate risk, the interaction variable between interest rate risk and credit risk, the size of banks and *GDP* growth are inversely related to net interest rate margins.

Finally, the factors which affect the net interest rate margin in developing countries positively are capital adequacy, the interaction variable, implicit interest payments, opportunity cost of reserves, and the level of tax. Meanwhile, credit risk, interest rate volatility and the level of efficiency are negatively related to the net interest margin.

Conclusion

This paper attempts to identify the main determinants of the net interest rate margin for a group of developed and developing countries. Normally, the literature has found that there are vast differences in the level of the interest rate margins in developed versus developing countries, observing higher values in developing countries. These higher values are normally associated with higher inefficiencies. However, it is important to find which variables are determining these higher values.

The main findings of this paper argue that the main determinants of higher interest rate margins in developing countries are mainly capital adequacy, the interaction between credit and interest rate risk, the implicit interest payment, the opportunity cost of holding reserves and the level of tax. Contrastingly, the variables of credit risk and interest rate volatility present an inverse relationship with net interest rate margins. It seems that implicit interest payments alongside the level of tax are the most important variables determining higher interest rate margins in developing countries.

On the other hand, the main variables increasing interest rate margins in developed countries are operating expenses, credit risk, the inflation rate and the level of tax. The variables of interest rate risk, capital adequacy, the size of banks and *GDP* growth decrease the net interest rate margins. The most important variables affecting greater margins in developed countries are credit default and the level of tax.

Overall, analyzing the entire sample, operating costs, capital adequacy, implicit interest payment, and the interaction between interest rate risk and credit risk are responsible for increases in margins. *GDP* growth and managerial efficiency seem to be the main determinants of lower margins; surprisingly, interest rate risk is responsible for lower margins. However, since the interaction between interest rate risk and credit risk is positive with regards to net interest rate margins, increases in interest rates may be increasing the likelihood of default and, therefore, interest rate volatility is having an indirect positive impact on net interest rate margins. Finally, the Lerner index of competition is not significant in any case, thus, the degree of competition does not influence interest rate margins.

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