Working Paper

An Investigation of the Determinants of Banks' Net Interest Margins in Jamaica

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Abstract

The aim of this study is to determine the firm- specific and macroeconomic determinants of net interest margins (NIM) in Jamaica. A generalized method of moments (GMM) technique was applied to a panel of 11 Jamaican financial institutions using quarterly data over the period 2002:1 to 2014:4. The results show that foreign bank participation and operating costs were the most significant reasons for the relatively high NIMs in Jamaica. Liquidity, credit and funding risks and the change in the size of the financial institutions were inversely related with the NIM. In regards to macroeconomic variables, NIM displayed a negative relationship with the exchange rate volatility. Overall, these results indicate that structural changes to improve the operational efficiency as well competition need to occur to reduce the NIM over the long- run in Jamaica.

JEL Classification numbers: E43;E44; G21; C23
Keywords: Banks' interest margins; Financial institutions; Panel data estimation.

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1.0 Introduction

The efficiency of the financial sector has always been topical given the perception that an inefficient financial sector is inimical to the economic growth prospects of a country. So the question debated in recent years particularly for Jamaica is 'why are interest rate margins so high?' In that regard, there are several theoretical and empirical studies published on the determinants of banks' net interest margin (NIM). Many of these studies have shown that banks' efficiency are not only influenced by firm-specific factors but also by macroeconomic factors.

Typically, interest margins are studied using the difference of the average banks' lending rate and the average banks' deposit rate. However, this paper approaches the question from the NIM, which is defined as the difference between a bank's interest income and expenses as a percentage of interest earning assets. Understanding the reasons for the level of NIM is an important policy, as it indicates how efficiently financial institutions perform their intermediation role of savings utilization and allocation. The inefficiencies in intermediation may emerge from structural problems: high operating costs, scale diseconomies due to small market size, lack of adequate competition.

The purpose of this study is to provide an econometric account of some of the main determinants of the NIM in Jamaica. The paper uses stacked quarterly data of financial institutions operating in Jamaica over the period of 2002 to 2014. To accomplish this objective, a modified version of the cost function model by (Klein, 1971) and (Monti, 1972) is estimated, adjusting for missing data and shocks within the economy. This empirical analysis is the first step towards a serious and informed policy discussion on feasible options to lower margins. Previous work done focused on high operational costs as the most relevant factor in determining NIM. Additionally, (Claeys & Vander Vennet, 2008) argue that developing countries have greater NIMs due to low efficiency and low degree of market competition.

The results of the study show that NIMs in Jamaica are relatively high to other developing countries such as Honduras and that the main determinants of the NIMs are operating costs, foreign- owned as well the debt re-profiling program, JDX. Given these results, the monetary authority should focus on ways to reduce high operating costs, monitoring foreign bank participation as they were found to have the most influence on the NIM as well as increase market competition within the financial sector.

The remainder of the paper is divided into 4 sections. In section 2, the paper will look at the relevant literature. Section 3 describes the method, variables and the data used. Section 4 examines the empirical results, diagnostic tests, the model specification as well as the analysis of the regressors. Finally, section 5 has the main conclusions and policy recommendations.

2. Literature Review

Starting with the seminal paper by (Ho & Saunders, 1981), it was found that positive interest margins will always exist due to transaction uncertainty faced by a bank using the dealership model. They highlighted that the four main factors contributing to the margins were: (i) the degree of managerial risk, (ii) the average size of transactions undertaken by the bank, (iii) bank- market structure and (iv) the adjustment cost of interest rates. This study paved the way for further studies as it relates to both theoretical and empirical models by providing useful financial management tools for banks to combat increased uncertainties over the future course of interest rates.

Subsequently, the theoretical model by (Ho & Saunders, 1981) has been expanded by other authors such as (Demirguc-Kunt & Huizinga, 1999); (Moore & Craigwell, 2002); (Brock & Franken, Bank interest margins meet interest rate spreads: how good is balance sheet data for analyzing the cost the cost of financial intermediation?, 2002); (Maudos & Solis, 2009); among others. (Demirguc-Kunt & Huizinga, 1999), suggests that bank interest spreads can be interpreted as an indicator of the efficiency of the banking system. Although the NIM signals efficiency or inefficiency, the results suggest that it is not always certain that a reduction in NIMs imply improved bank

efficiency. For instance, a reduction in NIM can reflect a reduction in bank taxation or a higher loan default rate. While the first case depicts an improved financial market function, the second case says the opposite. They also noted that variations in the accounting NIM may reflect differences in the interest expenditure (the numerator) and the average earning assets (the denominator). The paper showed that differences in interest margins as well as bank profitability were reflected by a variety of determinants: bank characteristics, macroeconomic conditions, bank taxation, deposit insurance guidelines, financial structure as well as legal and institutional indicators. The regression analysis suggests that a larger bank asset to GDP ratio and a lower market concentration ratio lead to lower margins as well as profits. This coincides with (Moore & Craigwell, 2002) who suggest that these bank-specific factors are significant to the banks' NIM. However, (Brock & Franken, 2002) noted that interest rate spreads are highly dependent on industry level as well as macroeconomic factors therefore bank- specific factors would be more relevant to other variables such as bank profitability. They also cautioned against using NIM as a proxy for interest rate spread as misinterpretation of the interest rate spreads are likely.

(Chirwa & Mlachica, 2004) tested the claims of typically high spreads in developing countries, highlighting that high spreads (as proxied by NIMs) will persist if the financial sector does not alter the structure in which banks operate. Evidence from this paper suggests that the interest rate spread may rise as a result of poorly-developed banking sectors as well as inefficiencies of the legal system and high corruption.

(Maudos & Solis, 2009) analysed the determinants of net interest income in Mexico for the period 1993-2005 simultaneously including operating costs, diversification and specialization as the determinants of the margins. Two methodologies were applied: a dynamic system GMM model and a panel data fixed effects static model. The results suggested that average operating costs and the Lerner Index, which measures the market power and also accounts for the market competition in the banking industry are positively linked to high interest income in Mexico. In addition, they recommended that policy- oriented measures should be directed at increasing banking competition, promoting efficiency in the industry and supporting stable economic conditions.

(Horvath, 2009) analysed the determinants of interest rate margins in Czech Republic for the period 2000-2006. He followed the dealership model first employed by (Ho & Saunders, 1981) using market structure, interest rate volatility, implicit payment, opportunity cost of reserves and capital requirements as the determinants. His main findings showed that bank market structure, interest rate volatility and bank capitalization are important determinants of banks' NIM.

In recent years, the ownership structure of banks has also been explored in relation to interest rate margins. (Hamadi & Awdeh, 2012) highlighted that the interest rate margins are different between domestic and foreign banks. For domestic banks, the bank size, liquidity efficiency, capitalization, credit risk, concentration as well as economic growth affected the interest margins negatively. On the other hand, macroeconomic conditions, industry factors, the central bank discount rate as well as the interbank rate have a much weaker impact on foreign bank interest margins. (Demirguc-Kunt & Huizinga, 1999) also implies that foreign-owned banks play a vital role in developing countries as they outperform domestic banks. Foreign ownership in developing countries was associated with higher NIMs and bank profitability.

The paper by (Nassar, Martinez, & Pineda, 2014), analysed the determinants of banks' NIM in Honduras during 1998- 2013. During this period the banks displayed rising NIM, there was foreign bank participation as well as consolidation. The competition among banks led to higher concentration and positively affected foreign banks' NIM. In addition to the bank specific determinant, inflation was an important determinant of high interest rate margins. Therefore, they conclude that further structural reforms and consolidation may reduce banks' NIMs. The current research on Jamaica's deposit taking sector will adopt a similar approach to the (Nassar, Martinez, & Pineda, 2014) paper however the methodology will employ the generalized method of moments (GMM) dynamic panel data estimation following previous studies (Maudos & Solis, 2009); (Moulton, 2011); (Liebeg & Schwaiger, 2006); among others). These studies included variables which were influencing the NIM. This paper adds to literature employing firm- specific and

macroeconomic variables as well as examines the impact of foreign- owned banks on the efficiency of the banking sector in Jamaica.

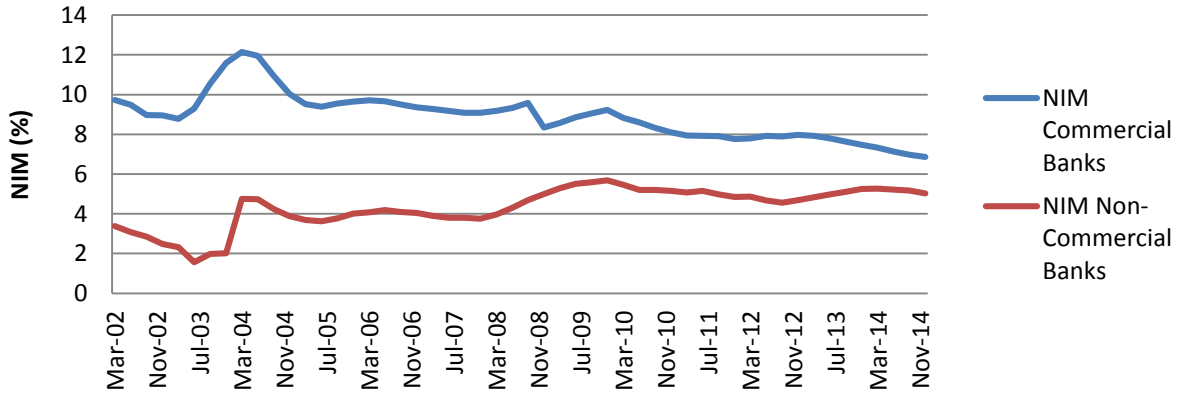
3. Data and Methodology

3.1 Data

The paper uses quarterly banking system data for the period March 2002 to December 2014. It employs an unbalanced panel since some institutions have exited the market or merged during the sample period. Data from 11 institutions utilized in the study which covers in the commercial banks, building societies' sectors and other institutions licensed under the Financial Institution Act (FIAs). The data is sourced from institutions' report to the Bank of Jamaica (BOJ).

This paper utilizes NIM as the measure of banks' efficiency. This represented the dependent variable in the study and is computed as the difference between a bank's interest income and expenses as a percentage of average interest earning assets. A system analysis showed that the average NIM for the sample totalled 7.83 per cent per quarter (*see* Table 2 in the Appendix). In addition, Commercial banks recorded higher NIMs than Non-Commercial banks as depicted in the figure below.

Figure 1. Jamaica: Commercial and Non-Commercial Net Interest Margins



The independent variables employed in the study are intended to cover the firm-specific as well as the macroeconomic determinants of banks' efficiency. The firm- specific determinants of banks' efficiency incorporated in this paper are operating costs, liquidity risks, credit risks, funding risks as well as the size of the bank.

Operating costs (OC) reflect the operating costs of the institutions as a share of its total earning assets and is expected to have a positive effect on the bank's NIM. (Nassar, Martinez, & Pineda, 2014) concluded that operating costs is the most important determinant of the banks' NIM in Honduras. Additionally, (Brock & Suarez, 2000) highlighted in their paper that larger costs can be interpreted as a higher spread.

Liquidity risk (LR) is defined as the losses that may arise from banks' inability to match deposits with loans, owing to maturity mismatch between their assets and liabilities. This is calculated as the ratio of liquid assets to total assets. The expected impact is positive/negative as the literature gives both a negative as well as a positive relationship with NIM.[1]

Credit risk (CR) was calculated as the ratio of the loan-loss provisions to total loans. It can be negatively correlated with NIM which implies banks with high credit risks tend to offer higher interest rates, to encourage depositors to bank with them. On the contrary, in line with the literature, credit risk was positively correlated with NIM which suggests that structural reform should aim at improving risk assessment as well as lower non-performing loans and higher loan loss provisions.

Funding risk (FR) is risk associated with the impact of higher funding costs or lack of availability of funds on a project's cash flow. This paper uses the credit-to deposit ratio as a measure of FR. According to (Nassar, Martinez, & Pineda, 2014) a decline in the credit-to deposit ratio puts

[1] (Hamadi & Awdeh, 2012) concluded that Liquidity has an inverse relationship with NIM as domestic banks may increase the interest rates on deposits therefore boosting liquidity which in turn lowers the Interest Margins. Conversely, (Nassar, Martinez, & Pineda, 2014) concluded that high liquidity ratio was translated into high NIM.

pressure on banks' business model which in turn leads to higher interest margins. This highlights the negative relationship expected with NIM.

The size (SIZE) of a financial institution is included in the analysis and is obtained by calculating the market share of each institution. In addition, the Herfindahl-Hirschman Index (HHI) is included in an effort to capture market concentration and also competition for the financial system.[2] It is obtained by the squaring and summing of market share of each institution. There is conflict in the literature on the expected impact. (Fungacova & Poghosyan, 2011) posit that due to increased economies of scale, banks providing more credit should benefit from their size and have lower margins. However, (Liebeg & Schwaiger, 2006) argued that the larger the size of the operations, the larger the concentration risk which implies higher NIMs.

Nominal GDP (NGDP) is expected to have a negative effect on the NIM. This view is supported by (Bernanke & Gertler, 1987) who suggested that potential borrowers with low wealth relative to the size of their investment (projects) will lead to higher agency costs and thus poor performance in the investment sector and in the economy as a whole.

A positive relationship between CPI inflation (INFL) and NIM has been observed in previous studies (Gelos, 2009); (Demirguc-Kunt & Huizinga, 1999).

The impact of the variability in interest rates was proxied by the 180-day Treasury bill rate (TBILL). The T-bill rate is generally used as an indicator of the interest policy being pursued by the government as well as a benchmark for rate charge by financial institutions. Therefore, it is

[2] The most widely used method of calculating market concentration is the Herfindahl Hirschman Index (HHI). Markets can be classified into three groups: (i) A value of below 0.1 indicates an unconcentrated index, (ii) 0.1 – 0.18 indicates a moderate concentration, and (iii) above 0.18 indicates high concentration (U. S. Department of Justice and Federal Trade Commission. Horizontal Merger Guidelines. 2010).

anticipated that a low- interest rate environment will in turn shrink the NIM. The exchange rate volatility (EXRVOL) was also calculated by the rolling three- quarter standard deviation for the exchange rate proxied by the weighted average selling rate (WASR). This variable is an indicator of macroeconomic instability and should be positively correlated with NIM.

A dummy variable representing Commercial banks (CB) is used to analyse the differences in the NIM of commercial banks versus non-commercial banks. This analysis is aimed at concluding whether commercial banks have higher NIM than non-commercial banks.

A dummy variable to represent foreign- owned banks (FOREIGN) is used for this study, since in the literature, (Demirguc-Kunt & Huizinga, 1999), it was concluded that foreign banks have greater NIMS in developing countries. It must be noted however that (Ho & Saunders, 1981) have argued that bank ownership was irrelevant in determining NIMs. They argue that banks would apply similar strategies when competing in the same market.

The paper includes a Jamaica Debt Exchange (JDX) dummy variable as (Bailey-Tapper, 2010) argued that the GOJ's debt re-profiling programme strongly affected the business model of Jamaican banks. More specifically, banks' investment and net earnings performance were significantly affected by this impact.[3]

[3] The JDX was launched on 14 January 2010 and involved investors voluntarily participating by surrendering old bonds and choosing new bonds according to specified rules. The financial settlement date was 24 February 2010 and on this date, new bonds were issued and accrued interest paid.

Similarly, a National Debt Exchange (NDX) dummy variable is included. (Robinson, 2002) notes that "the level of government borrowing and its influence on money and credit markets imposes constraints on the flexibility on interest rates." Therefore, an impact is expected on the NIM.[4]

The predictions can be summarized as follows: (i) higher operating costs, higher NIM; (ii) market concentration increases yield higher NIMs; (iii) liquidity and credit risks may be either positive or negative while (iv) funding risks, inflation, interest rates and exchange rates are positively related to NIM. On the other hand, Real GDP is expected to have a negative impact on NIMs. The dummies added should also be significant.

3.1.1 Stylized Facts

The table below depicts the comparison of the variables to some other countries. The NIM in Jamaica is relatively high in comparison to the United States (developed country) while it falls in the same region as Honduras (developing countries). Jamaican banks have relatively high liquidity risk in comparison to Barbados and the United States. The operating costs of banks in Jamaica and Honduras are relatively higher than the operating costs faced by banks in the United States. The Banking sector in Jamaica and Honduras are said to be highly concentrated while the banking sector in the United States is described as moderately concentrated (*see* Table 1).

[4] On February 12, 2013 the Government of Jamaica announced the launch of the National Debt Exchange Offer (NDX), which is an exchange of debt instruments between the government and creditors on the local market. The expected announcement of results and settlement was February 22, 2013.

Table 1. Variable Description for Jamaica, Barbados, Trinidad & Tobago and US (2007)

Variables	Specification	Notation	Jamaica	Honduras	US
Dependent Variable:					
Net Interest Margin	Net interest income/earning assets	NIM	7.14	7.11	3.35
Explanatory Variables:					
Operating Cost	Operating cost/earning assets	OC	5.60	5.25	2.87
Liquidity risk	Liquid assets/ total assets	LR	26.44	17.96	22.64
Herfindahl-Hirshman index	Sum square of market share	HHI	0.20	0.18	0.16
Inflation	Inflation rate	INFL	9.29	6.94	2.85

3.2 Methodology

The framework employed to evaluate the determinants of NIM is based on the empirical estimation model done by (Nassar, Martinez, & Pineda, 2014) which uses the cost function model developed by (Klein, 1971) and (Monti, 1972). This model highlighted that there is a cost function when operating a bank and this is dependent on the aggregate value of the assets being managed by the bank as well as other factors of production, that is *Costs = C(A; K,L)*. With the assumption that bank maximizes profits, the income accounting identity is therefore identified as:

$$Profits = r_A - r_D - C(A; K, L) - Provisions - Noninterest\ Expenses \quad (1)$$

For competitive bank profit maximization leads to the following first order condition (where *dD= dA* on the margin):

$$r_A - r_D = \frac{\partial C(A;K,L)}{\partial A} \quad (2)$$

The first order conditions state that a competitive bank will set the marginal cost of managing assets equal to the spread. All the other components of the identity will drop out because they involve infra-marginal profits.[5] If instead of competitive banking system in which banks take interest rates as exogenous, the baking system is assumed to be monopolistic, then profit maximization leads to the following condition:

$$r_A - r_D = D\frac{\partial r_A}{\partial D} - A\frac{\partial r_A}{\partial A} + \frac{\partial C(A;K,L)}{\partial A} = \frac{1}{\eta_D} + \frac{1}{\eta_A} + \frac{\partial C(A;K,L)}{\partial A} \quad (3)$$

where η_A and η_D are semi-elasticities of demand deposit and asset supply ($\eta_A = -\frac{1}{A}\frac{dA}{dr_A}$) and ($\eta_D = -\frac{1}{D}\frac{dD}{dr_D}$) respectively. In the banking system characterized as oligopolistic, the spread will be a function of the number of banks in the system. Under the assumption of a common linear cost function and Cournot behaviour, the spread can be expressed as:

$$r_A - r_D = \frac{\partial C(A;K,L)}{\partial A} + \frac{1}{N}\left(\frac{1}{\eta_A} + \frac{1}{\eta_D}\right) \quad (4)$$

where N is the number of banks. Equation (4) suggests that changes in the concentration of a banking system will affect the spread by altering the size of the oligopoly profits. It also

[5]Infra-marginal describes inside of, as opposed to at the margin. Example: for a firm that is producing 100 units, marginal cost is the cost of the 101st unit, while infra-marginal **cost** refers, usually only qualitatively and without a precise definition, to the cost of units 1-100.

emphasizes that increases in the spread are apt to be associated with a decline in the number of banks and with an increase in marginal costs of processing deposits and assets. A commonly used empirical proxy for concentration in banking is the Herfindahl Hirschman Index calculated in terms of total assets. Using HHI equation (4) can be rewritten as:

$$r_A - r_D \approx OC + HHI \tag{5}$$

where OC = $\frac{\partial C(A;K,L)}{\partial A}$ is operating costs.

3.2.1 Incorporating Risks

The basic results of equations (4) and (5) rely on a production function approach that could be applied to any industry. However, what is special about banks is that they bear financial risk as an integral part of being financial intermediaries. There are three fundamental risks considered in this paper: liquidity risk, credit risk and funding risk. Incorporated into equation (5), the liquidity risk, credit risk and funding risk motivate a linear regression framework as follows:

$$r_A - r_D = OC + LR + CR + FR + HHI \tag{6}$$

3.2.2 Other Considerations

There is no agreed upon model for analysing the consequences of macroeconomic shocks for interest rate spreads, nevertheless the empirical literature has identified a number of macroeconomic variables deemed to be significant sources of variation in the interest rate spreads. Thus, nominal GDP, inflation, exchange rate volatility and Treasury bill interest rate were added to the model. Also included in the model were the dummies, JDX, NDX, commercial banks and foreign- owned banks. Therefore, the equation that combines firm-specific, macroeconomic and dummy determinants of interest margins was specified as:

$$r_A - r_D = OC + LR + CR + FR + SIZE + HHI + NGDP + INFL + EXRVOL + TBILL + JDX + NDX + COMB + FOREIGN \quad (7)$$

The empirical estimation is written to take the form:

$$NIM_{it} = \beta_0 + \beta_1 OC_{it} + \beta_2 LR_{it} + \beta_3 CR_{it} + \beta_4 FR_{it} + \beta_5 \Delta SIZE_{it} + \beta_6 HHI + \beta_7 \Delta NGDP_{it} + \beta_8 INFL_{it} + \beta_9 EXRVOL_{it} + \beta_{10} \Delta TBILL_{it} + \beta_{11} JDX + \beta_{12} NDX + \beta_{13} COMB + \beta_{14} FOREIGN + \varepsilon_{it} \quad (8)$$

where subscripts *i* and *t* stand for banking sector (Commercial, Building society or FIAs) and year respectively. NIM_{it} is the NIM for the specific banking sector *i* in period *t*; and ε_{it} is the error term.

This paper applies the GMM dynamic panel data technique to estimate this model. This method is useful in providing unbiased and efficient estimates. The GMM methodology was first proposed by (Arellano & Bover, 1995). It combines a set of equations in levels and differences and uses its lagged levels and lagged first differences as instruments. This estimation technique was chosen explicitly to account for several characteristics of the panel data such as: (i) possible endogeneity of the firm- specific explanatory variables; (ii) the presence of fixed effects correlated with the explanatory variables; (iii) the presence of the lagged dependent variable may increase autocorrelation; and (iv) the possibility of heteroskedasticity. Therefore, the equation banks' NIM to the set of explanatory variables is:

$$NIM_{it} = \beta_0 + \beta_1 OC_{it} + \beta_2 LR_{it} + \beta_3 CR_{it} + \beta_4 FR_{it} + \beta_5 \Delta SIZE_{it} + \beta_6 HHI + \beta_7 \Delta NGDP_{it} + \beta_8 INFL_{it} + \beta_9 EXRVOL_{it} + \beta_{10} \Delta TBILL_{it} + \beta_{11} JDX + \beta_{12} NDX + \beta_{13} COMB + \beta_{14} FOREIGN + \varepsilon_{it} \quad (9)$$

Before the model was estimated, stationarity tests of the panel were carried out using the Levin, Lin & Chu and Fisher- Augmented Dickey Fuller (ADF) tests for stationarity. The results are shown in Table 5 of the Appendix. Both tests were revealed that the panel was stationary except for size which was integrated of order one and had to be first differenced. Additionally, the macroeconomic variables were also tested using ADF (*see* Table 6) and results indicated that all variables were stationary with exception of the 180–day Treasury Bill interest rate and the nominal GDP. Both variables had to be first differenced.

4. Empirical Results

Equation 8 is first estimated with random effects after which a post- regression test, the Hausman test is used to determine the appropriateness of the fixed versus the random effect specification. The Hausman test indicates a failure to reject the null hypothesis of no misspecification of the model (*see* Table 7). Additionally, a comparison of the coefficients of the models estimated by fixed and random effects reveals a failure to reject the null hypothesis of no difference between operating cost, liquidity risks, credit risk, funding risk, the change in size as well as foreign- owned banks and commercial banks estimated by the random and fixed effects method at the 5 per cent level.

Given the possible existence of serial correlation in the model, the GMM estimator is used to derive robust estimates of a dynamic panel model. The model was estimated using various firm-specific and macroeconomic factors as instrumental variables (*see* Table 9). The results of the most robust model are shown and includes all macroeconomic and firm- specific variables are inconsistent with the (Nassar, Martinez, & Pineda, 2014) paper, however appears consistent with other papers such as (Hamadi & Awdeh, 2012); (Liebeg & Schwaiger, 2006); (Demirguc-Kunt & Huizinga, 1999) and (Bailey-Tapper, 2010). The quality of the results obtained from the final model was subject to several robustness checks for dynamic panel model; specifically the results

of the Sargan test showed no evidence of over- identifying restrictions and instruments used in the model are valid.[6]

The empirical estimates show that there is a positive and significant relationship between the operating cost and NIMs. The coefficient of 2.43 implies that over the study period, the operating cost has risen by 2.43 per cent. This coincides with (Nassar, Martinez, & Pineda, 2014); (Brock & Suarez, 2000) that highlighted high operating costs is translated into higher NIMs. Operating costs reflect the activities in which financial institutions specialize. Therefore financial institutions operating with high costs due to diseconomies of scale must operate with high NIMs to cover those costs. High operating costs reflect less efficient management, however financial institutions can increase their operational efficiency and realize cost saving through technological change. Banks could move towards electronic banking systems, high-speed check imaging systems; these allow banks to reduce costs by substituting human capital for labour.

The negative and significant coefficient of 0.15 on the liquidity risk variable suggests that as liquidity risks expand the NIM will decrease by 0.15 per cent. (Hamadi & Awdeh, 2012) highlighted this negative effect stems from financial institutions tend to have excess liquidity, the exposure to liquidity risks is low which contributes to lower margins. In addition, the loan-loss provisions to total loans (the measure of credit risk) displays an inversely relationship with the NIM. The negative and highly significant coefficient of 0.53 suggests that as the credit risks increases the NIM will decline by 0.53 per cent. This suggests that as the loan-loss provisions increases, the interest income decreases which in turn decreases the NIMs.

In line with the literature of the empirical model, the estimated coefficient of the funding risk is negative and significant. Therefore with an increase in the loan-to-deposit ratio in the financial

[6] The Sargan statistic is distributed as a $\chi(p-k)$, where k is the number of estimated coefficients and p is the instrument rank.

sector it will in turn reduce the NIM. The results suggest that as the funding risk increases the NIM will be reduced by 0.02 per cent.

The coefficient associated with the change in size of the financial institutions suggests that as the change decreases the NIM will decrease by 0.45 per cent. This follows the paper by (Fungacova & Poghosyan, 2011) that argued due to increased economies of scale, banks that provide more credit should benefit from their size and have lower margins. On the other hand, the market concentration proxied by HHI displayed a positive relationship with the NIM with the coefficient suggesting that as the HHI increases the NIM will also see an increase by 0.002 per cent. This can be explained as the market concentration increases; competition decreases (oligopolistic market structure) and in turn increases the NIM (Hamadi & Awdeh, 2012).

Turning to the macroeconomic variables, the results are mixed. Similar to (Nassar, Martinez, & Pineda, 2014) the change in Nominal GDP growth has no statistically significant impact on the NIM. Additionally, inflation as well as the variability in the 180- day Treasury bill rate were statistically insignificant in determining the NIM in Jamaica. The negative coefficient on exchange rate is significant even though this result was not expected. (Randall, 1998) highlighted in her study that there is a negative relationship between the economic activity and bank spreads. It is interpreted that an increase in the exchange rate volatility will subsequently lead to a decline in the NIM by 0.002 per cent.

In examining the effect of dummy variables employed in the model, NDX proved to be insignificant in determining the NIM. However, JDX displayed a positive and highly significant relationship with the NIM, which implies that the three quarters (March-September) in 2010 subsequently showed an increase in the NIM of 1.75 per cent. In addition, Foreign –owned banks are positively and significantly correlated with NIM. In fact, the estimated coefficient is the largest among all the explanatory variables, therefore it is most important determinant of NIM. It implies that foreign- banks have higher NIMs in Jamaica and this coincides with (Demirguc-Kunt &

Huizinga, 1999) paper that highlighted that within developing countries, foreign- owned banks have higher margins. Contrary to the actual data, commercial banks display a negative and significant relationship with NIM. This implies that commercial banks have lower NIMs in Jamaica. This could be explained by the financial institution, MFG being an outlier, had NIMs twice the size of any commercial bank.

5. Conclusions and Policy Implications

The main purpose of the study was to investigate the firm – specific and macroeconomic determinants of the net interest margin in Jamaica for the period 2002:1 to 2014:4. The determinants were classified as firm –specific variables which include operating costs, liquidity risk, credit risk, funding risks, size, market concentration and macroeconomic variables: nominal GDP, inflation, exchange rate volatility, Treasury bill rate. JDX, NDX, commercial banks and foreign-owned banks were also added to the model to address shocks experienced by financial institutions as well as ownership of the financial institution. This was accomplished through the estimation of a dynamic unbalanced panel framework, using the (Arellano & Bover, 1995) GMM technique.

The paper revealed that NIM in Jamaica is mainly dependent on the ownership of the bank. Foreign- owned banks have operated with persistently higher margins than that of domestic banks. The analysis also supports evidence that the observed financial institutions' margins were positively and significantly impacted by operating costs, market concentration proxied by HHI and the implementation of the JDX program. On the other hand, the results displayed that the NIM was negatively and significantly affected by the liquidity risks, credit risks, funding risks, size of the financial institution, exchange rate volatility as well as being a commercial bank.

Several policy implications emanate from this paper. Firstly, financial institutions must continue to deal with the issues of high levels of operating costs and the diseconomies of scale in their operations. Enhancing operational efficiencies to exploit scale and scope economies must become

urgent priority of financial institutions. Secondly, with respect to competition, a more competitive environment would help to mitigate some of the monopoly rents extracted by financial institutions. Policies that link access to liquidity from the Bank that is inversely related to bank size and deposit could aid in reducing market concentration and increase competition. Overall, reduction in the NIM supports long-term economic growth for Jamaica.

This study can be extended looking at the role of foreign bank entry and the effects it has on the operation of the domestic banks. It would be interesting determining whether the main determinant for this study is overall welfare improving for Jamaica in the long-run.

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Appendices

Table 2: ***Descriptive Statistics of Variables***

	NIM	OC	LR	CR	FR	SIZE	HHI	NGDP	INFL	TBILL	EXR-VOL
Mean	7.81	2.88	16.7	2.30	64.2	9.51	2120.0	2.62	3.19	13.09	150.59
Maximum	24.33	8.72	73.4	38.2	237	35.08	2510.2	8.58	10.00	33.47	807.17
Minimum	1.08	0.00	0.00	0.00	6.96	0.152	1959.7	-2.06	-1.77	6.22	8.33
Std. Dev.	4.78	1.70	14.2	2.99	33.4	10.55	120.53	3.05	2.26	5.96	159.60
Observations	516	516	547	546	547	547	572	572	561	572	572

Table 3: ***Specification and Expected Sign of Variables***

Variables	Specification	Notation	Expected Signs
Dependent Variable:			
Net Interest Margin	Net interest income/earning assets	NIM	
Explanatory Variables:			
Operating Cost	Operating cost/earning assets	OC	+
Liquidity risk	Liquid assets/ total assets	LR	-/+
Credit risk	Loan-loss provisions/total loans	CR	-/+
Funding risk	Total loans/total deposit	FR	-
Size	Market share	SIZE	-/ +
Herfindahl-Hirshman index	Sum square of market share	HHI	-/+
Nominal GDP	Nominal GDP quarterly	NGDP	-
Inflation	Quarterly inflation rate	INFL	+
Exchange Rate Volatility	Rolling three-quarter standard deviation of the WASR	EXRVOL	+
Interest Rate	The 180-day Treasury bill rate	TBILL	+

Table 5: ***Results of Stationarity Tests for the Firm-Specific Variables***

Variables	Levin, Lin & Chu		Fisher - ADF		Order of Integration
	t-stat	p-value	χ^2	p- value	
NIM	-2.4227	0.0077	64.3410	0.0000	I(0)
OC	-5.0652	0.0000	72.5160	0.0000	I(0)
LR	-6.2561	0.0000	93.4423	0.0000	I(0)
CR	-18.8475	0.0000	122.269	0.0000	I(0)
FR	-3.3475	0.0004	41.8724	0.0065	I(0)
SIZE	-1.5521	0.0603	22.9801	0.4029	I(1)
HHI	-7.5266	0.0000	83.2546	0.0000	I(0)

Table 6: ***Results of Stationarity Tests for the Macroeconomic Variables***

Variables	Augmented- Dickey-Fuller (ADF) Test		Order of Integration
	t-stat	p-value	
NGDP	-1.6274	0.4604	I(1)
INFL	-6.4104	0.0000	I(0)
EXRVOL	-3.0525	0.0370	I(0)
TBILL	-1.8471	0.3541	I(1)

Table 7: ***Correlated Random Effects- Hausman Test with NIM***

Correlated Random Effects - Hausman Test
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	8.102375	7	0.3237

Table 8: ***Comparison of random and fixed effects specification***

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
OC	2.045015	2.043520	0.000351	0.9364
LR	-0.132500	-0.128776	0.000017	0.3721
CR	-0.396749	-0.371530	0.000555	0.2844
FR	-0.022248	-0.020191	0.000004	0.3216
DSIZE	-0.408579	-0.419440	0.000119	0.3189
FOREIGN	5.693246	5.594732	0.007364	0.2510
COMB	-1.727532	-1.712419	0.002906	0.7792

Table 9: ***Determinants of Net Interest Margin***

Explanatory Variables	**GMM System**
OC	2.4316***
	(0.0913)
LR	-0.1499***
	(0.0168)
CR	-0.5347***
	(0.0781)
FR	-0.0163**
	(0.0060)
ΔSIZE	-0.4580**
	(0.1963)
HHI	0.0018***
	(0.0003)
ΔNGDP	-0.0048
	(0.0368)
INFL	-0.0443
	(0.0565)
EXRVOL	-0.0024**
	(0.0010)
ΔTBILL	-0.0012
	(0.0597)
JDX	1.7491***
	(0.4872)
NDX	0.4242
	(0.6220)
COMB	-1.5728***
	(0.3620)
FOREIGN	5.8281***
	(0.3985)
Observations	454
Adjusted R^2	0.7618
Sargan Test#(p-value)	0.2229

Note: White's Cross-Section Standard errors are in parentheses.

Levels of Significance are indicated by asterisks: 1% (***), 5% (**), 10% (*).

#- The test for over-identifying restrictions in GMM dynamic model estimation.

Δ- Indicates a variable that has been first- differenced to attain stationarity.