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Competitive Conditions in the Jamaican Banking Market 1998-2009

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Abstract

This paper presents an empirical assessment of the degree of competition within the Jamaican banking sector during the period 1998 to 2009. We employ a dynamic version of the Panzar - Rosse Model to estimate market power among the sample of banks that constitute over 90 percent of the banking market. Using the conventional statistical tests, we are unable to reject monopoly/perfect collusion for the merchant banking sector in Jamaica but find competitive conditions in the commercial banking sector. This contrasts with earlier findings using alternative estimators that find monopolistic competition in the market as a whole.

Keywords: Competition, banking, Rosse-Panzar H statistic, dynamic panel estimation, Jamaica

JEL Codes: G21, G28

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1. Introduction

The level of competition in the banking sector of any economy has a major impact on consumer welfare and economic growth. Changes in the competitive structure of the banking industry may occur in response to local or global stimuli such as financial liberalisation, deregulation, technological advancements, crises, internationalisation or harmonisation. The liberalisation of the Jamaican economy in the early 1990s, the experience of financial crises in the mid- to late-1990s, the enhancement of information technologies and the imminent establishment of the CARICOM Single Market and Economy (CSME) carry cogent implications for bank competition.

The purpose of this paper is to undertake an empirical assessment of the competitive conditions within the Jamaican banking sector between 1998 and 2009. Among the most widely used methods to assess the degree of competition in banking is the model popularised by Rosse and Panzar (1977) and Panzar and Rosse (1987) (P-R model). The P-R model assesses the intensity of competition on the basis of a reduced form equation that explains revenue in terms of factor input prices and other explanatory variables. However, this model has been challenged by a new strand on two main grounds. The first basis of the challenge is that it is misspecified. Bikker *et al.* (2006) argue that the revenue equation is misspecified since it is effectively reduced to a 'price equation if the logarithm of income relative to assets is taken as the dependent variable' as is the case in much of the extant literature. They note that the misspecification has important far-reaching implications for the interpretation of the *H*- statistic. Bikker *et al.* (2006) further argue that similar misspecification occurs with the use of scaled covariates (such as the natural logarithm of total assets) and that the use of scaling variables renders the equation 'indistinguishable from a price equation.'

The second point of challenge is that the Panzar and Rosse model is static and presumes market equilibrium or instantaneous adjustment to equilibrium at each point in time when the data are observed. Goddard and Wilson (2009) note that this presumption is not in

line with reality as adjustment towards equilibrium is often not instantaneous and markets are therefore not necessarily in continuous equilibrium. Accordingly, they recommend a dynamic estimation model.

The objectives of this paper are three-fold. First, it affords testing for equilibrium within the Jamaican banking sector over the period 1998-2009. Second, it affords robust estimation of the degree of competitiveness among Jamaican banks. Third, it differentiates between the levels of competitiveness in the commercial banking sector and the merchant banking sector. The data set consists of an unbalanced panel of eleven banks: five merchant banks and six commercial banks. The findings are indicative of disequilibrium but high levels of competition in the commercial banking sector, alongside equilibrium but low levels of competition in the merchant bank sector.

The next section outlines the background to Jamaica's banking sector. Section 3 reviews the literature and the methodology on bank competitiveness. Section 4 discusses the model strategy and data. Section 5 presents the results and Section 6 some concluding remarks.

2. The Jamaican Banking Sector 1998 to 2009

Jamaica's network of banks is fairly well-developed and diversified consisting of the Bank of Jamaica (BoJ – the Central Bank), commercial banks, merchant banks, non-banking financial firms and development banks. In Jamaica's liberalised financial environment, banks operate within a relatively small market and therefore expect tough competition. Despite an expansion in the number of merchant banks in the early 1990s, the 'traditional' commercial banks dominate both in terms of their geographical presence through branches across the island and also by share of total banking assets.

Jamaica experienced crisis in the financial sector in the mid-1990s that resulted in a transformation of the sector, significantly reducing the number and types of banks with

resulting changes in ownership. The structural changes that took place within Jamaica's banking sector over the period 1998 to 2009 included a number of mergers and consolidations in 1999, acquisitions by foreign stakeholders in 2001, transfer of assets and liabilities to other entities and licences surrendered in 2002 and 2003, further mergers in 2004, more licences surrendered in 2007 and the conversion of a merchant bank to a commercial bank in 2008. At the end of 2009, six of the remaining ten operating banks had majority foreign ownership. The relative number of mergers, consolidations and acquisitions that occurred during the 1990s and in the new century suggests a high level of concentration. The conventional measure of market concentration, the Herfindahl-Hirschman Index (HHI) and 3-bank concentration ratio (CR3) supports this notion as evidenced by Table 1 below.

Table 1: Share of Total Banking Assets by Category of Banks

Year	Commercial Banks	Merchant Banks	Local Banks	Foreign Banks	HHI	CR3
1998	96	4	54	46	3206	86
1999	98	2	58	42	2925	89
2000	98	2	56	44	2872	87
2001	95	5	54	46	2752	83
2002	85	15	16	84	2301	75
2003	92	8	11	89	2600	80
2004	88	12	16	84	2367	75
2005	89	11	15	85	2399	76
2006	91	9	14	86	2413	76
2007	92	8	13	87	2485	77
2008	94	6	06	94	2819	83
2009	95	5	05	95	2854	83

Source: Bank of Jamaica and authors' calculations

Concentration measured by the 3-bank concentration ratio and HHI remained high throughout this period, reaching a low point in 2002 and rising consistently through to 2009. According to the current screening guidelines in the USA, the banking industry is regarded to be competitive market if the HHI is less than 1000, somewhat concentrated market if the HHI lies between 1000 and 1800, and very concentrated market if HHI is more than 1800¹. By this standard, the Jamaican banking industry has been very concentrated. However, concentration alone is an insufficient indicator of anti-competitiveness if the market is considered

¹ See Rhoades (1993).

contestable in the sense of Baumol (1982). In the following sections we explore the competitive conditions Jamaican banking market.

3. Measuring market power in Banks

Earlier studies on bank competition may be classified into one of the two schools of the structural and the non-structural approaches. Many early studies on market power within banking took the form of structure-conduct-performance (SCP) analysis or the efficient-structure hypothesis (ESH).² The Panzar-Rosse (P-R) model is from a new school – the New Empirical Industrial Organisation (NEIO) models – that was developed to address the shortcomings of the early approaches.³ NEIO models measure the impact of monopoly and oligopoly power by estimating the deviation between marginal cost and competitive pricing without explicitly using the market structure indicator. The Rosse-Panzar reduced-form revenue model and the Bresnahan-Lau⁴ mark-up model are two important methods in this strand of literature. Both approaches are derived from profit-maximizing equilibrium conditions. However, Shaffer (2004) notes that the Rosse-Panzar model is preferable as it is robust even in small empirical samples and works well with firm-specific data on revenues and factor prices without requiring information about equilibrium output prices and quantities for the industry.

The model by Rosse and Panzar (1977) and Panzar and Rosse (1982, 1987) as well as the extension to banking by Nathan and Neave (1989) and Perrakis (1991) assumes that firms can enter or leave rapidly any market without losing their capital, and that potential competitors possess the same cost functions as firms that already serve in the market. The test of the model is based on the properties of a reduced form log-linear revenue equation for a panel data set of banks of the following type:

² See, for example, Bikker (2004) for an overview of these approaches.

³ See, for example, Berger (1995), Berger *et al.* (1997) and Paul (1999) for discussion of the shortcomings.

⁴ Bresnahan (1982) (1997) and Lau (1982)

$$\ln R_{i,t} = \alpha_0 + \sum_{j=1}^J \alpha_j \ln w_{j,i,t} + \sum_{k=1}^K \beta_k \ln X_{k,i,t} + \sum_{n=1}^N \gamma_n \ln Z_{n,t} + \varepsilon_{i,t} \quad (1)$$

where R = the revenue of bank i at time t ,

w = the j^{th} input price for each bank,

X = K bank-specific variables that affect the banks' revenue and cost functions,

Z = N macroeconomic and market conditions variables that affect the banking market as a whole, and $\varepsilon_{it} = \mu_i + v_{it}$ is a stochastic term where μ_i denotes the unobservable bank-specific effect and v_{it} denotes a random term which is assumed to be IID.

The stylized bank-specific variables which have been used by researchers in these equations are; a measure of the riskiness of the bank's overall portfolio, a proxy for size and the extent of diversification effect, and the ratio of the number of branches of each bank to the total number of branches of the whole banking system (viewed as a traditional way of maintaining market share by providing consumers with close-quarter access to financial services, and mitigating, to some extent, price competition).⁵

The H -statistic is calculated from the reduced form revenue equation and measures the sum of long-run elasticities of total revenue of the banks with respect to the banks' input prices. In the context of equation (1), $H = \sum_{j=1}^J \alpha_j$. Rosse and Panzar (1977) and Panzar and Rosse (1982, 1987) outline certain conditions from which inferences may be drawn about the structure of the market from the estimated value of the H statistic. A value of $H = 1$ is consistent with perfect competition and $0 < H < 1$ is consistent with monopolistic competition but $H \leq 0$ is consistent with monopoly or cartelisation.

However, the specification approach characteristic in the extant literature on banking competition involves the 'rescaling' of the dependent variable through division by total assets or its inclusion as a control variable. Bikker *et al.* (2006) suggest that this inadvertent

⁵ See, for example, Northcott (2004). Because branching has cost implications, there is a trade-off between maintaining market share and increasing cost of branch maintenance.

misspecification of the revenue equation as a price equation ‘leads to wrong inference about the market structure and the degree of competitiveness through a strong bias of H towards one’.

Much of the extant literature utilise the ‘misspecified’ equation (1) discussed above and infer an H -statistic with a bias towards one, suggesting a prevalence of monopolistic competitiveness.⁶ Unfortunately, there remains a paucity of research on critical banking issues for Jamaica. The single known study of competition among Jamaican banks by Duncan and Langrin (2004) utilises the misspecified model and static equilibrium to examine competition in the commercial banking market over the thirteen-year period 1989 to 2002 using quarterly panel data. Using the ratio of total interest revenue to total assets as the dependent variable, their results indicate declining competition in the banking market in the presence of monopolistic competition.

An important condition for the estimation of the H statistic is that the market should be in equilibrium. Competitive capital markets will equalise risk-adjusted returns such that in equilibrium rates of return should be uncorrelated with input prices. The equilibrium test involves replacing the dependent variable revenue in equation (1) with a profit equation of the form:

$$\ln \pi_{i,t} = \alpha'_0 + \sum_{j=1}^J \alpha'_j \ln w_{j,i,t} + \sum_{k=1}^K \beta'_k \ln X_{k,i,t} + \sum_{n=1}^N \gamma'_n \ln Z_{n,t} + u_{i,t} \quad (2)$$

which is identical to (1) except for π which represents return on assets. The model assumes a one-way error component as described by:

$$u_{i,t} = \eta_i + \nu_{i,t} \quad (3)$$

where η_i is the bank-specific (fixed) effect and ν_{it} is an IID random error. Here,

$E = \sum_{j=1}^J \alpha'_j = 0$ indicates long-run equilibrium and $E < 0$ indicates disequilibrium.

⁶ Bikker and Haaf (2002) find monopolistic competition the prevailing market structure in 100 of 101 countries. See also Al-Muharrami *et al.* (2006) for a summary of results from other studies.

However, the shocks to the Jamaican banking system during this period suggest that the market was not in continuous equilibrium and following Goddard and Wilson (2009) the equilibrium condition is best modelled as a dynamic process as described by equation (4).

$$\Delta \ln \pi_{i,t} = \sum_{j=1}^J \alpha_j'' \Delta \ln w_{j,i,t} + \sum_{k=1}^K \beta_k'' \Delta \ln X_{k,i,t} + \sum_{n=1}^N \gamma_n'' \Delta \ln Z_{n,t} + \lambda'' \Delta \ln \pi_{1,t-1} + v_{i,t}$$

(4)

The equilibrium condition that $E = \sum_{j=1}^J \alpha_j'' = 0$ remains the same as for (2).

4. Measuring bank competitiveness in Jamaica: data and model strategy

Due to the lack of detailed information on factor prices, much is imputed from accounting information for measuring levels of competition in banking. We utilise annual audited unconsolidated financial data and focus on Jamaican commercial and merchant banks only, between 1998 and 2009.⁷ Data were obtained from publicly available resources, including Bankscope, financial statements and Annual Reports, the website of the respective banks, the website of the Central Bank, and media reports.⁸ Notably, all the banks now use International Financial Reporting Standards (IFRS) to report financial information.⁹ Data was not consistently available for all banks; in a few instances a number of working assumptions had to be made to fill gaps in the data.¹⁰ In the final analysis we therefore used an unbalanced panel of 11 banks for which data are available or could be reasonably estimated for the entire sample period. In the case of mergers, the banks are treated as two separate entities until the point of merger; thereafter, only one bank is reported.¹¹

The sample used in this study is comprised of a small number of banks that constitute

⁷ Unconsolidated means data relating to the bank entity only, excluding other group companies.

⁸ Bankscope database, maintained by Bureau Van Dijk, provides financial and other data for over 29,000 banks worldwide.

⁹ IFRS were adopted in Jamaica for financial year-end reporting on or after July 2002. Some financial statements have therefore been reported using the local accounting standards (Local GAAP) previously in use for a part of the sample period. Daley (2004) and Daley (2002) discuss the likely impact of the change.

¹⁰ For example, some amounts were estimated based on prior year figures. These assumptions are not pervasive.

¹¹ There is an assumption that the merged banks assume similar strategy with respect to its competitive stance and business mix (see, for example, Kishan and Opiela (2000); Hempell (2002)).

the majority of the population and asset share of the sector over the ten-year period. In total the sample consists of 105 bank years. The sample period 1998 to 2009 spans a period of continuing structural change resulting from crisis in the Jamaican banking sector during the early to mid-1990s. While the macroeconomic environment has not been identified as a cause of failure during the Jamaican banking crisis, it was acknowledged that a weak macroeconomic environment could render marginal banks infeasible (see, for example, Daley, 2007). For this reason, the final equations (1) and (2) include a time series variable, in the form of the logarithm of real GDP ($\ln\text{RGDP}$) and the growth of real GDP.¹²

We focus at the outset on identifying any departure from the critical P - R assumption of long-run equilibrium in the banking market. We distinguish between the commercial and merchant banking sector in our analysis by allowing for differential responses of profit to factor prices.

Using the empirical test for equilibrium described in (2) above, we compute the dependent variable as $\ln(1 + ROA)$ shown in equation (3), since our sample includes small negative values.¹³ The dynamic adjustment model proposed by Goddard and Wilson (2009) is set out below.

$$\begin{aligned} \Delta \ln(1 + ROA)_{i,t} &= \lambda' \Delta \ln(1 + ROA)_{i,t-1} + \alpha'_1 \Delta \ln PL_{i,t} + \alpha'_2 \Delta \ln PK_{i,t} + \alpha'_3 \Delta \ln PF_{i,t} \\ &+ \delta'_1 \Delta \ln PL_{i,t} * MB + \delta'_2 \Delta \ln PK_{i,t} * MB + \delta'_3 \Delta \ln PF_{i,t} * MB \\ &+ \sum_{k=1}^K \beta'_k \Delta \ln X_{k,i,t} + \sum_{n=1}^N \gamma'_n \Delta \ln Z_{n,t} + \Delta u_{i,t} \end{aligned} \quad (5)$$

where i denotes banks $i=1, \dots, I$; and t denotes time $t=1, \dots, T$. The variables are defined as follows:

ROA = return on assets measured by profits after tax divided by total assets

PL = personnel expenses to number of employees (unit price of labour)

PK = capital expenses to fixed assets (unit price of capital)

PF = ratio of interest expenses to total customer deposits (unit price of funds)

¹² Coccoresse (2004) recognises the role of macroeconomic indicators in assessing bank competition in Italy.

¹³ See also Claessens and Laeven (2004) for use of the log of the adjusted ROA as a dependent variable.

MB = zero-one dummy variable identifying merchant banks as $MB=1$

X = bank specific variables and included $KASS$ (ratio of capital to assets, measuring funding risk (leverage)), $DLNS$ (ratio of deposits to loans, measuring business risk), $NLASS$ (ratio of net loans to assets, measuring portfolio risk), BR (ratio of bank branches to total bank branches per year).

Z = macroeconomic variables included $RGDP$ (real GDP) and $GROWTH$ (growth of real GDP) and a market structure variable such as the HHI or three-bank concentration ratio ($CR3$).

The first-differencing operation eliminates the unknown bank specific effects. The banking market is deemed to be in equilibrium for the commercial banking sector if

$$E_{cm} = \sum_{j=1}^3 \alpha'_j = 0 \text{ and for the merchant bank sector if } E_{mb} = \sum_{j=1}^3 \alpha'_j + \sum_{j=1}^3 \delta'_j = 0.$$

5. Empirical results and analysis

Equation (5) is tested on the data from our unbalanced panel using the Arellano-Bond GMM estimator. However, as a preliminary we investigate the variability of the E-statistic by estimating equation (2) using a rolling-regression. The impact of the price of factors for the merchant banks is distinguished by including an interaction term between the $\{0,1\}$ dummy variable identifying the merchant banks and the factor prices. The results of this exercise are shown in table 3. For parsimony, the final model was determined by strict variable deletion on statistical grounds and tested for fixed effects against pooled estimation on a conventional Chow test indicating rejection of the pooled specification in all cases.

Table 2: Dependent variable $\ln(1 + ROA_{1,t})$; Fixed effects model. Testing for market equilibrium

Sample period	H0: $E_{mb} = 0$		H0: $E_{cb} = 0$	
	Statistic	Decision	Statistic	Decision
1998-2003	F(1,34)=0.41	Not reject	F(1,34)=1.48	Not reject
1999-2004	F(1,33)=0.73	Not reject	F(1,33)=5.63**	Reject
2000-2005	F(1,31)=0.12	Not reject	F(1,31)=5.47**	Reject
2001-2006	F(1,31)=0.03	Not reject	F(1,31)=1.99	Not reject
2002-2007	F(1,30)=0.42	Not reject	F(1,30)=4.67**	Reject
2003-2008	F(1,29)=0.05	Not reject	F(1,29)=2.85	Not reject
2004-2009	F(1,28)=0.08	Not reject	F(1,28)=0.22	Not reject

Notes: ** Significant at 5%

Table 2 shows that the sum of the input price elasticities of the factors prices, for each estimation period, for both the merchant and commercial banking sectors on a rolling basis. It can be seen that while the merchant banking sector may have been in equilibrium throughout the period, there were periods when the commercial banking sector was not in market equilibrium.

As a check for dynamic equilibrium, following Goddard and Wilson (2009), we estimate equation (5) shown in Table 3, using the generalized method of moments (GMM) dynamic panel estimator as proposed by Arellano and Bond (1991).

Table 3: Dynamic profit model, Arellano-Bond GMM Dynamic Panel Estimation. Dependant variable $\Delta \ln(1 + ROA)_{i,t}$, No of obs 84

Variable	Parameter 'p' value in parenthesis
$\Delta \ln(1 + ROA)_{i,t-1}$	0.3094 (.000) ^{***}
$\Delta \ln PL_{i,t}$	0.0234 (.017) ^{**}
$\Delta \ln PF_{i,t}$	0.0018 (.711)
$\Delta \ln PK_{i,t}$	-.0022 (.704)
$MB \times \Delta \ln PL_{i,t}$	-.0229 (.118)
$MB \times \Delta \ln PF_{i,t}$	-.0008 (.894)
$MB \times \Delta \ln PK_{i,t}$	0.0007 (.919)
$\Delta \ln BR_{i,t}$	-.0184 (.000) ^{***}
$\Delta \ln NLASS_{i,t}$	-.0011 (.695)
$\Delta \ln KASS_{i,t}$	.0259 (.000) ^{***}
$\Delta \ln RGDP_t$	-.1364 (.063) [*]
$\Delta GROWTH_t$	0.0034 (.004) ^{***}
$CR_{3,t}$	0.0006 (.089) [*]
<i>intercept</i>	0.5819 (.104)
Equilibrium Test	$E_{mb} = -.0015$; $H_0: E_{mb}=0$; $\chi^2(1) = .05$
	$E_{cb} = 0.0229$; $H_0: E_{cb}=0$; $\chi^2(1) = 2.93^*$
Wald $\chi^2(13)$	207.55 ^{***}

The main finding of the dynamic specification is that long-run equilibrium could not be rejected at the conventional level of significance (5%) for both merchant banks and commercial banks, which suggests that the autoregressive structure is adequate in picking-up the adjustment to long-run equilibrium. However, it is noteworthy that the non-rejection of long-run equilibrium for the commercial banks is on the margin of statistical significance.

Having established short-run disequilibrium with dynamic adjustment to long-run equilibrium, we model the full dynamic revenue model¹⁴ using the GMM dynamic panel estimator for bank total income (*TOTINC*) and interest income (*INTINC*). We utilize the model of Panzar and Rosse with adjustments recommended by Bikker *et al.* (2006) and Goddard and Wilson (2009).

$$\begin{aligned}
 \Delta \ln R_{it} = & \beta_0 + \beta_1 \Delta \ln PL_{it} + \beta_2 \Delta \ln PK_{it} + \beta_3 \Delta \ln PF_{it} + \beta_4 \Delta \ln PL_{it} * MB + \\
 & \beta_5 \Delta \ln PK_{it} * MB + \beta_6 * \Delta \ln PF * MB + \beta_7 \Delta \ln KASS_{it} + \beta_8 \Delta \ln NLASS_{it} + \\
 & \beta_9 \Delta \ln Br_{it} + \beta_6 \Delta CR_{3t} + \gamma_1 \Delta GROWTH_t + \gamma_2 \Delta \ln RGDP_{it} + \lambda \Delta \ln R_{it-1} + \Delta \epsilon_{it}
 \end{aligned} \tag{6}$$

¹⁴ The re-specified equation addresses the mis-specifications noted by Bikker *et al.* (2006) and concurred by Goddard and Wilson (2009). These are mis-specifications regarding the 'scaling' of the dependent variable (dividing by total assets) or the inclusion of a 'scaled' covariate, *lnSIZE*, that lead to flawed conclusions in the interpretation of the *H*-statistic.

where R = total bank revenue, measured by total income ($TOTINC$) or interest income ($INTINC$), all other variables are as defined above. The long-run (dynamic) H -statistic is given by $H = (\beta_1 + \beta_2 + \beta_3)/(1 - \lambda)$.

Table 4 summarises the results. To assess the degree of competition in the Jamaican banking sector, we estimate the long-run value of the Rosse-Panzar H -statistic and apply the usual statistical criteria. We report the estimated values of H for each of the two specifications.

Table 4: Dynamic P-R Model, Arellano-Bond GMM Dynamic Panel Estimation; No obs=84

Variable	$\Delta \ln TOTINC_{i,t}$	$\Delta \ln INTINC_{i,t}$
Lagged Dependent Variable	.3984 (.000) ^{***}	.6118 (.000) ^{***}
$\Delta \ln PL_{i,t}$	.1403 (.509)	.6075 (.019) ^{**}
$\Delta \ln PF_{i,t}$	.2585 (.018) ^{**}	.0159 (.822)
$\Delta \ln PK_{i,t}$	.4683 (.001) ^{***}	.1581 (.149)
$MB \times \Delta \ln PL_{i,t}$	-.6328 (.046) ^{**}	-.6728 (.046) ^{**}
$MB \times \Delta \ln PF_{i,t}$	.2935 (.042) ^{**}	.2387 (.016) ^{**}
$MB \times \Delta \ln PK_{i,t}$	-.6301 (.000) ^{***}	-.3311 (.027) ^{**}
$\Delta \ln BR_{i,t}$	.2911 (.009) ^{***}	.3648 (.056) [*]
$\Delta \ln LNASS_{i,t}$	-.1904 (.004) ^{***}	-.1014 (.178)
$\Delta \ln KASS_{i,t}$	.0749 (.423)	.0279 (.853)
$\Delta \ln RGDP_t$	3.253 (.085) [*]	1.293 (.510)
$\Delta GROWTH_t$	-.0213 (.437)	-.0108 (.720)
$CR_{3,t}$	-.0199 (.017) ^{**}	-.0033 (.827)
Intercept	-7.23 (.399)	-2.031 (.827)
Tests for Competitiveness	$H_{mb} = -.1022$ $H_0: H_{mb}=0, \chi^2(1) = 0.41$ $H_0: H_{mb}=1, \chi^2(1) = 17.8^{***}$ $H_{cb} = .8671$ $H_0: H_{cb}=0, \chi^2(1) = 8.54^{***}$ $H_0: H_{cb}=1, \chi^2(1) = 0.68$	$H_{mb} = .0163$ $H_0: H_{mb}=0, \chi^2(1) = 0.20$ $H_0: H_{mb}=1, \chi^2(1) = 21.3^{***}$ $H_{cb} = .7815$ $H_0: H_{cb}=0, \chi^2(1) = 6.2^{**}$ $H_0: H_{cb}=1, \chi^2(1) = 2.00$
Wald Chi-square	$\chi^2(13) = 321.9^{***}$	$\chi^2(13) = 206.2^{***}$

The results for $TOTINC$ are better defined than the results for $INTINC$, however the results using the two different dependent variables produce similar estimates of the H statistic for the commercial banks and merchant banks. The H statistic for the merchant banks is not

significantly different from zero and significantly different from unity but in the case of the commercial banks it is significantly different from zero but not significantly different from unity. We firmly reject $H=1$ or the perfectly competitive banking market for Jamaica for the merchant banks over the sample period, however, $H=0$ cannot be rejected indicating collusive behaviour. In contrast, we can firmly reject collusive behaviour in the case of the commercial banks and cannot reject the competitive case.

In this paper, we concur with the views of Bikker and Haaf (2002) and interpret H as a continuous measure of the level of competition with higher values indicating stronger competition than lower values. Therefore, based on the GMM estimator, the Rosse-Panzar H -statistic suggests that in contrast to the findings of Duncan and Langrin (2004), the Jamaican banking market was largely characterised by competitive behaviour between 1998 and 2009. Collusive behaviour is confined to the merchant bank sector and the evidence of Table 2 suggests that this sector has been in equilibrium throughout the whole of the sample period.

In general, our broad conclusion is inconsistent with the findings of Duncan and Langrin (2004) who reported the Jamaican banking market as reflecting monopolistic competition over the period 1989 to 2002. They note that ‘... there was a steady decline in competition throughout the specified sample period’ which is consistent with measures of the Herfindahl-Hirschman Index provided in their study and Table 1. However, allowing for dynamic equilibrium our findings do not support monopolistic competition conclusion. While we may try to attribute the different inferences from the H -statistic to the variation of sample periods (both in terms of the frequency of the data and the actual years covered) and sample size, a more pointed explanation remains. The separation of the response of the factor prices of the merchant banks and commercial banks to income shows starkly contrasting competitive behaviour. The non-separation of the merchant banks from the commercial banks

produces results that are consistent with overall collusive behaviour¹⁵. We suggest that the Duncan and Langrin (2004) findings are polluted by the aggregation of the two banking sectors. Furthermore, the P-R model estimated by Duncan and Langrin (2004) is the ‘mis-specified’ equation discussed earlier. The equation estimated is in fact a price equation as noted by Bikker *et al.* (2006) and therefore $0 < H < 1$ should be interpreted as monopoly or conjectural variations short-run oligopoly instead of monopolistic competition.

6. Concluding remarks

In this paper we have examined the structure of the Jamaican bank sector and sought to draw inferences about market power. Rolling estimates of the Panzar-Rosse *E*-statistics of a static model suggests that the Jamaican banking market was characterised by disequilibrium in the commercial banking market but equilibrium in the merchant banking market over the period 1998 to 2009. In other words, there was some correlation between rates of return on banking assets and the prices of factor inputs for the commercial banking sector. This finding necessitated the use of a dynamic estimator to be applied to a dynamic revenue equation for market power inferences. We have followed the innovative work of Goddard and Wilson (2009), and applied the Arellano and Bond (1991) dynamic GMM estimator to the Panzar-Rosse model.

The period 1998 to 2009 spans the end of a period of crisis within Jamaica’s banking sector to the post-crisis phase and embraces various structural, reporting and legislative changes. Our results suggest that over this period, Jamaica’s banking market may have been characterized by cartelisation in certain areas of the banking market. With the current trends and challenges in global markets, it is apposite that current policy decisions focus on levels of competition within Jamaica’s banking sector. The literature would benefit from any future work with a longer period of data.

¹⁵ Removing the separation between the two types of banks for the response of factor prices produces collusive behaviour using *TOTINC* as the revenue variable and an indeterminate result in the case of *INTINC* as the revenue variable.

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