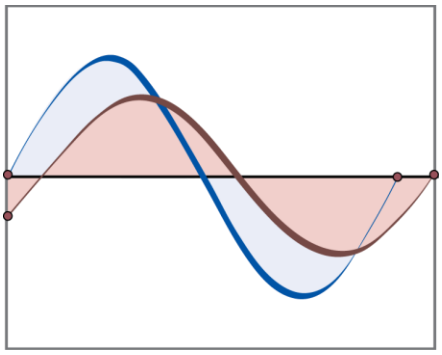
CENTRAL BANK OF TRINIDAD & TOBAGO

Working Papers

WP03/2019 August 2019



The Impact of Innovation, Competition, Risk and Regulation on Banks' Bottom Line: A Study of the Trinidad and Tobago Banking Sector

Tanisha Mitchell
Research Department

This paper investigates the domestic banking sector to evaluate and measure the impact regulation, competition, innovation and risk-taking behaviour have on the profitability of the commercial banking sector in Trinidad and Tobago. The paper utilises a structural equation modelling framework developed on commercial bank quarterly data spanning 1995-2017 to appraise the causal relationships. The analysis concludes that competition both directly and indirectly adversely impacts profitability. While innovation improves the banks' ability to earn profits the risk associated weighs down these earnings. Increased regulation is estimated to mitigate risk thereby having a positive net impact on bank's ability to earn profits.

JEL classification: G21

Keywords: Banking sector, profitability, structural equation modelling

The Impact of Innovation, Competition, Risk and Regulation on Banks' Bottom Line: A Study of the Trinidad and Tobago Banking Sector

Tanisha Mitchell

1.0 Introduction

The banking sector has been described as the "lifeline" of an economy (Bagehot (1873), Schumpeter (1912), King and Levine (1993)). The crucial role that is executed by the sector constitutes the dissemination of funds to investors from savers. This intermediation process is the catalyst for economic expansion since investment is the driver of growth in economies with sound financial systems (Alfaro et al (2006)). The impetus of growth generation lies squarely on the shoulders of the user of funds, but the banking sector plays a critical role in this process.

While the generation of economic activity might be the bigger picture banks seek the profit motive and set profit maximising interest rates (Stiglitz (1993)), an understanding of the factors that may influence that motive is of paramount significance. For instance, it is important to evaluate the impact that financial regulation may have on banks' bottom line and other financial sector characteristics that interplay with profitability. This gives a clearer picture of the drivers of bank decisions. The profitability of the banking sector in Trinidad and Tobago has always been an area of interest since banks make supernormal profits[1] in varying economic conditions. Regulators must ensure that policies implemented ensure the stability of the financial sector without stifling the ability of banks to adequately meet their objectives in the provision of services and overall profit motives. More importantly, the overall development of the financial sector is largely impacted by the commercial banking sector since they hold the lion's share of financial system assets. Stemming from financial system development comes the superior motive of overall economic development within which the commercial banking agents have a key role.

This discourse seeks to evaluate the different elements which may impact the profit making ability of commercial banks in Trinidad and Tobago using a structural equation model and poses the questions: How do financial innovation, competition, risk, regulation and profitability of commercial banks interact? What are the magnitudes of the causal relationships that exist? All with the aim of allowing regulators to fine tune policies that stabilise the banking sector without asphyxiating it. Following the introduction the paper proceeds onto a detailed literature review which covers the relationships amid the variables under investigation, section 3 explores the stylised facts surrounding the banking sector in Trinidad and Tobago; section 4 discusses the methodology and section 5 the data, while section 6 explores the results; the paper concludes in section 7.

2.0 Literature Review

The relationship between competition and innovation is analysed on a theoretical premise and also on the notion that innovation not only means developing new financial products but also tailoring existing products to suit new markets.

[1] Profits over and above the equilibrium or market return on capital.

One would anticipate a higher degree of financial innovation resulting in wider and deeper markets along with the generation of higher profitability in the banking sector. Financial innovation in Trinidad and Tobago, along with the rest of the Caribbean, tends to differ from that in more financially savvy economies like the US, UK and Eurozone etc. While the development of innovative products such as credit default swaps and the like were popular in more advanced countries, less financially advanced economies tend to lag behind in the development of new risky products but may find new ways of offering existing products. In the current climate in Trinidad and Tobago banks are exploring ways to embolden consumers to change their behaviour by pressing forward with online and mobile banking. Also, as domestic banks adopt various forms of financial technology (Fintech), financial innovation is likely to become more complex and impact the manner in which banks compete.

There exists a plethora of research into the relationship between competition and innovation. Schumpeter (1942) was one of the earliest theorists to conclude that monopolies tend to have increased investment in research and development. He explained that monopolies, in a bid to extend their reign and further deepen the barriers to entry invest heavily in research and development. Other schools of thought argue that increased competitiveness in a market perpetuates increased investment in research and development to separate the "movers and shakers" and more efficient firms from those who are late to the innovation game (Aghion et al (2005), Bos et al (2013), Schmutzler (2013), Aghion et al (2014)). While some authors explain that both types of market structures encourage innovation for different reasons, with the welfare optimum sometimes lower in competitive markets (Gilbert and Stiglitz (1979), Stiglitz (1981), Stiglitz (1984)).

A similar sentiment is echoed in Hart (1980) who assesses the relationship from a theoretical point of view and finds that markets which are highly competitive and produce similar products benefit from innovation when several firms opt to innovate. The gains to the group outweigh the gains of any individual firm which attempts to revolutionise their products. Cornaggia et al (2015) extend their study, relating bank competition to innovation and find that increased competition in the banking sector encourages non-financial firms to pursue innovative initiatives, since financing is easily available.

It would be remiss to ignore the problems in the US financial sector which were brought about by a drive for increased profitability through product and process innovation. Nonetheless this innovative push was only part of the problem as regulation and monitoring also lagged behind. Altunbas et al (2016) investigate the use of financial innovation, in this case securitisation, to alter banks' risky behaviour in a highly competitive market. Highly competitive markets in the banking sector can result in riskiness in the loan portfolio (Ahn and Breton (2014)) since banks will be more willing to give loans to risky investors due to a heightened competition in the market. As such innovation is thought to minimise this risk as banks find alternative ways to compete. On the other hand, the temporary reduction in bank risk as a result of securitisation resulted in banks willingness to take on other risks such as the implementation of weak lending practices (Mian and Sufi (2009)).

In evaluating the relationship between the level of competition in the banking sector and the level of risk taking behaviour it perpetuates, there is no clear consensus as contradictory evidence is presented in numerous studies. On one hand, research postulates that less competitive markets tend to behave riskier (Beck 2008), according to Boyd and De Nicolo (2005) this can be seen on the asset side of the bank's balance sheet. Lower competition in the banking sector leads banks to set higher interest rates on loans which can increase the risk of default by their customers. Conversely, some theorise that banks who earn monopoly profits have no desire to engage in risky behaviour since their profitability is guaranteed due to the structure of the market they operate in. Riordon (1993) and Repullo (2004)

explain that more competitive markets, in terms of the number of entrants and the ease of entry, tends to generate higher levels of risk taking behaviour. In particular the financial sector which is deemed to be highly competitive in the US saw financial agents taking larger and larger risks to generate profit in a saturated market.

The charter value hypothesis is said to provide a self-regulating element for banks'. It hypothesises that banks in concentrated markets will minimise risk in order to maintain their franchise value with the caveat that there must be regulatory intervention to ensure that banks continue to minimise risk (Hellman et al (2000)). On the other hand it has been countered that banks in concentrated markets seek higher risks in order to enhance their profitability. Concentrated markets suggest that banks have to find some unique way of differentiating themselves, whether it is via products offered or more attractive loan packages. In some instances this thrust to earn profits in a highly concentrated market may influence banks to take on higher levels of risk.

The impact of competition on bank profitability is evaluated on two frontiers. In the first instance the market Structure Conduct Performance Hypothesis (SCPH) is assessed followed by the Efficient Structure Hypothesis (ESH). The SCPH posits that the market structure in which a firm operates heavily influences its ability to make super normal/monopoly profits. The framework is built on the supposition that heavily concentrated markets grant firms the opportunity to operate in monopoly like form thereby earning super normal profits along with significant barriers to entry. In the case of the banking sector this likens itself to the ability to set low deposit rates and high loan rates, a phenomenon that awards banks the ability to have particularly high spreads even in a depressed economy.

The second hypothesis (ESH) (Demsetz (1973)) explains that firms in an industry can make high profits if they operate efficiently. Efficiency in this sense is related to the ability of a firm to significantly increase market share through efficiency via revenue increases from pricing adjustments or reduction of costs. The ability of the firm to maintain or expand its market share awards the firm the ability to lower the competition in the industry thus resulting in a relatively concentrated market and increased profitability. In Trinidad and Tobago the four largest banks control approximately 91 per cent of the banking system.

Literature on competition and stability in the banking sector suggests a unique relationship, where pre-liberalisation more concentrated markets were heavily regulated, but liberalisation increased competition which was followed by less stringent regulatory rules (Vives (2010), Carletti (2007)). This post-liberalisation relationship continued until the financial crash when the risky behaviour of banks contributed to instability in the financial sector. The relationship stems from the desire for banks to take higher risk to seek better returns in a highly competitive market. The antithetical relationship exists according to Vives (2010) where highly competitive banking sectors force banks to adopt more risky behaviours resulting in tighter regulation by the authorities to correct the failures created by banks.

Innovation positively impacts a bank's profitability (Sujud and Hashem (2017)) through the increase in service products such as internet banking, automatic teller machines, point of sale teller machines and electronic transfer of funds, these innovations in the Lebanese banking sector had a positive impact on the return on assets of the commercial banks. The causal relationship can move from innovation to profitability or vice versa. Highly profitable firms may find it beneficial to invest in research and development in an attempt to maintain or increase their market share and enhance their profit making ability.

Literature reviewing innovation and risk taking behaviour has been well developed over the years. Innovation has become necessary for firms to gain more or retain market share and is thought to be encouraged across all industries.

In many cases firm survival depends heavily on their innovative abilities. Some research draws a parallel between risk taking and innovation and suggests these concepts are interdependent since there exists some risk in the innovative process (March and Shapira (1987)). The goal in organisations is to minimise the risk associated with innovative developments. When risk management is at the helm of organisation's policies then innovation becomes even more beneficial (Norden et al (2014)).

In the financial sector, innovation can take the form of new products or new ways of doing business, for example internet finance in the case of China. These innovations have a U shaped impact on risk since they decrease management cost and reduce risk, but as the market becomes saturated with these innovations commercial banks have to seek new ways of marketing products which may require more risky ventures (Guao and Shen (2016)). Some other popular but unsuccessful financial innovations range from credit default swaps and subprime lending policies which were partially responsible for the financial crash of 2009, and put a negative spotlight on financial innovation. However, financial innovation must be accompanied by sound risk management in order to be fruitful.

"Financial innovations often respond to regulation by sidestepping regulatory restrictions that would otherwise limit activities in which people wish to engage" Calomoris (2009). While some argue that financial innovation provide ways and means for financial entities to circumvent regulations (Silber (1983)), other schools of thought argue that financial market players are first movers, and regulatory reform is usually reacting to these innovations. Regulation and financial innovation must work in cohesion, since financial innovation can spur financial crisis if regulation has not kept abreast (Kim et al (2013)). Kane (1981) explores the nexus between the regulator and those being regulated and postulates an interaction where both parties seek to optimise their private benefits based on the opposing party's actions. Kane views both innovation and regulation as reactionary, with regulation reacting to the financial climate and bank managers seeking to develop innovative methods to increase profitability, and retain or increase market share as an environmental reaction.

While some studies have found a positive relationship between risk in the financial sector and profitability (Hawley (1983), Witowschi et al (2016)), others like Berrios (2013), have found the converse. Moreover a study on bank holding companies during 2006-2009 by Tarraf and Majeske (2013) found that US bank holding companies with lower risk measured by their Z-Score had better profitability measures over the period. The capital asset pricing model (CAPM) also assesses the relationship between risk and return of a security. The main impetus behind the framework is that investors need to be compensated for additional risk. The risk measure known as beta compares the market asset returns to the market premium (the amount in excess of the risk free rate which is usually the government Treasury bill rate). Beta gives the overall risk of a security and the higher the risk the higher the expected return.

The discourse on risky bank behaviour and regulation will follow a similar path as the discussion on innovation and regulation. As previous studies have indicated, there tends to be some positive relationship between risk and profitability, and the risk appetite of an institution is highly dependent on the desire for risk by management. The agency problem is exacerbated where managers engage in risk taking activities that do not benefit the organisation as a whole or its stakeholders. In this instance self-regulation and risk management from an internal perspective is important. In a more systematic setting where risks taken by banks can adversely impact the wider financial sector the regulator has to take a prominent role in mitigating any risk that may arise from financial institutions under its purview.

If we take an intimate look at the regulatory spectrum, elements such as capital requirements will mitigate some levels of risk for banks (Fernandez and González (2005)). More stringent capital requirements give banks larger buffers to

guard against risk. Similarly, Barth et al (2004) found that non-performing loans declined significantly in countries which implemented strict supervisory measures. While overall strict regulatory measures should reduce risk Klomp and Haan (2010) found that high risk banks tend to be more affected by stricter regulatory and supervisory rules, versus their low risk counterparts. Likewise, some studies have found that increased regulation through higher capital requirements have led banks to engage in more risky behaviour (Shrieves and Dhal (1992), Rime (2001), Matejašák, Teplý, and Černohorský (2009)).

3.0 Stylised Facts: The Banking Sector in Trinidad and Tobago

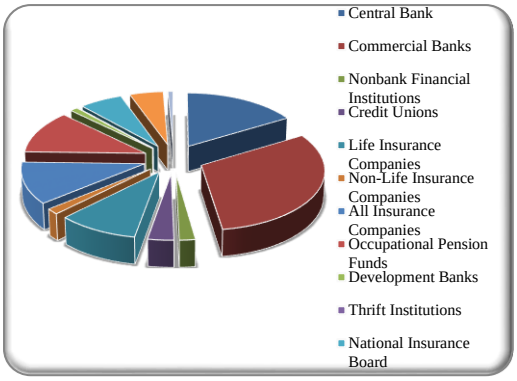
The commercial banking sector in Trinidad and Tobago has expanded and developed since the pre-liberalisation era. The sector moved from a rigid structure to one ushering in technological change to alter the way customers do business. The market is characterised as oligopolistic in nature (Forde (2007)) and remains highly concentrated with a few players (eight commercial banks). Of the eight banks four control approximately 91 per cent of the market share. Commercial banks in Trinidad and Tobago are profit maximisers and have prided themselves on their ability to make super normal profits in varying economic environments. This ability has led some detractors to accuse the players in the market of collusion and setting fees and charges that buffer their profitability. With regards to the size of financial system assets, the lion's share belongs to commercial banks followed by the Central Bank (Figure 1). This speaks to the importance of the commercial banks in the overall scheme as they continue to dominate the financial arena. Currently banks have a vast reach with approximately 123 branches throughout Trinidad and Tobago.

Since banks have largely homogeneous products they are charged with discovering alternative ways to compete. With this in mind the major players in the sector have undertaken innovative product offerings to retain their market share. Stemming from this the advent of internet banking grants banks the ability to reduce the costs of facilitating physical banking halls; shepherding in a new way of banking. In their annual report the Bankers' Association of Trinidad and Tobago (BATT) referenced the move into the digital age highlighting that "Over the years, banking in Trinidad and Tobago has evolved from passbooks to debit cards, from banking halls to Automatic Teller Machines, and from counter services to online transactions." BATT AGM report (2017).

Following the crisis in the 1980's commercial banks' non-performing loans (NPLs) remained relatively high but began to trend downward with some small fluctuations between 2002 to 2006 (Figure 2). The financial crisis brought about an increase in loan delinquencies which pushed the non-performing loan ratio higher. While these delinquencies were concentrated in a few banks that gave large loans to finance construction of luxury apartments, the financial health of the banking sector came under scrutiny. Non-performing loans trended upward from 2008 to 2011 and then reversed the trend, levelling off at around 3 per cent from 2015 to 2017. Despite the uptick in delinquencies, NPLs in Trinidad and Tobago remained relatively manageable when compared to other regions (Table 1).

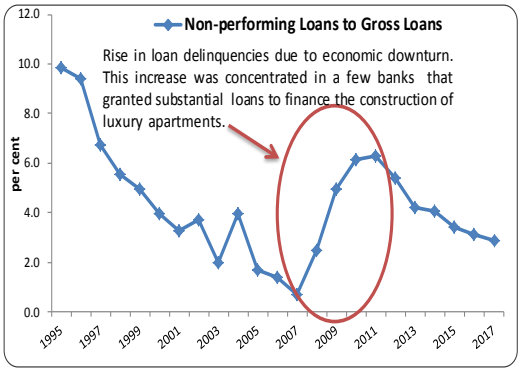
Commercial banks in Trinidad and Tobago have registered high profitability ratios with return on equity (ROE) in double digits since 2006. This phenomenon has resonated with consumers as banks continue to make super normal profits despite the economic conditions (Figure 3). This anomaly is not unique to Trinidad and Tobago since regional banking sectors also have high ROE ratios (Table 2).

Figure 1: Financial System Assets as at Sep 2017



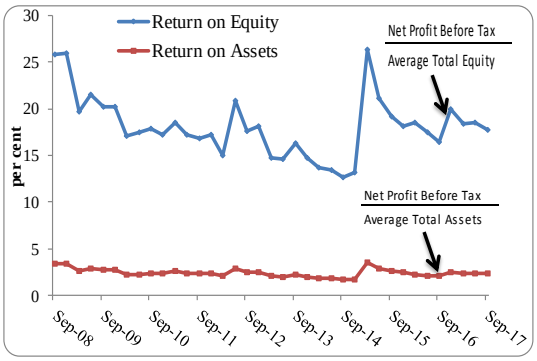
Source: Central Bank of Trinidad and Tobago

Figure 2: Commercial Banks' Non-performing Loan Ratio



Source: Central Bank of Trinidad and Tobago

Figure 3: Commercial Banks' Profitability



Source: Central Bank of Trinidad and Tobago

Table 1: Regional Non-performing Loan Ratios

Country	2008	2009	2010	2011	2012	2013	2014	2015	2016
Chile	1.0	2.9	2.7	2.3	2.2	2.1	2.1	1.9	1.8
Mexico	3.0	2.8	2.0	2.1	2.4	3.2	3.0	2.5	2.3
Brazil	3.1	4.2	3.1	3.5	3.4	2.9	2.9	3.3	3.9
Barbados	3.2	4.6	10.6	10.9	12.7	11.3	12.2	10.8	9.4
Dominican Republic	3.7	4.3	3.1	2.9	3.5	2.3	1.5	1.7	1.7
Trinidad and Tobago	2.4	4.9	6.1	6.2	5.3	4.2	4.1	3.4	3.1

Sources: World Development Indicators and Central Bank of Barbados FSR 2016

Table 2: Regional Banks Return on Equity

Country	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Chile	23.6	14.5	19.4	22.1	18.3	16.8	15.4	17.0	14.1	-
Mexico	24.1	14.8	15.2	16.8	15.5	17.5	19.3	15.9	15.4	16.5
Brazil	27.62	7.9	17.0	17.4	15.4	12.0	11.9	14.5	13.1	-
Barbados	24.35	23.4	17.0	12.1	6.0	7.3	7.9	8.8	4.8	-
Dominican Republic	21.6	22.6	19.7	22.4	18.7	20.9	19.4	19.4	19.2	-
Guyana	23.3	25.8	24.0	22.3	20.9	20.7	21.4	22.5	14.0	-
Trinidad and Tobago	27.7	25.9	20.2	17.2	17.2	18.1	14.7	13.2	18.2	19.9

Sources: Central Bank of Trinidad and Tobago and Federal Reserve Bank

4.0 Methodology

4.1 Structural Equation Model

Structural equation modelling (SEM) is a multivariate technique used to quantify causal relationships. The modelling techniques include but are not limited to path model analysis, measurement models and structural regression modelling, all used to hypothesise and measure the relationships between latent variables and observed constructs. For the purposes of this study, these three techniques are utilised.

Some general assumptions must be met before causal relationships can be measured among variables:

a) Temporal precedence must be satisfied whereby the variable estimated as a cause leads to the estimated variable identified as the effect.
b) There is a covariation between the cause and effect variables.
c) Independence of variables.
d) The distribution of the data must match that required for the statistical analysis; in this case the data distribution should be normal to satisfy the maximum likelihood estimation.
e) Causal directionality is correctly specified.

Werner and Engel (2009) explain that SEM models are equipped to handle more complex analysis in comparison to some rival models. They go on to surmise that SEM models improve validity since it allows the computation of an unobservable construct from observable variables; this is at the heart of confirmatory factor analysis. In the case of this research we can devise the latent construct of profitability by observing some variables that can be used to measure profitability such as return on assets, return on equity, net interest margin and the like. In multiple regression analysis the use of profitability in a model will require the inclusion of numerous variables the researcher believes could measure profitability, some maybe significant while others may not be significant in explaining the dependent variables. With SEM we can construct a profitability variable which was previously unobservable by mathematically computing the profitability variable through confirmatory factor analysis.

SEM allows complex relationships to be analysed simultaneously as they would be in reality. However, multiple regression models result in relationships with one dependent variable, if the problem has more than one dependent variable then a number of regression equations must be devised to assess these relationships and be analysed independently. Simultaneous analysis of the relationship among variables is sought since relationships do not occur in isolation but can all happen at the same time and also have feedback effects. While assessing the relationships individually can provide some information, the feedback effects from other variables may be overlooked, for example regulation may impact profit but also influence risk. It is important that the model employed considers the relationships in a simultaneous manner. SEM models have the benefit of evaluating all variables in the model synchronously as opposed to separately like multiple regression models. While SEM presents major empirical advantages in modelling and analysis of the interplay among numerous variables there are some potential challenges highlighted by Werner and Engel (2009). According to Werner and Engel these stem from model identification since parameters, coefficients and factor loadings are all estimated at the same time. Estimation problems can also occur due to non-convergence of the model.

In an attempt to identify the relationship among the variables the paper looks at a correlation matrix (Appendix A.1), it is important to note that correlation and causation are separate phenomenon and the former does not imply the latter. Nonetheless a correlation matrix is one rung in the ladder of identifying the relationships among the variables. While the main aim of the SEM is to identify and quantify causal relationships, other tests such as the granger causality test have been known to provide useful information on causation between variables. However, the granger causality test is better suited for pairs of variables, while SEM is more appropriate for a range of variables.

SEM commonly uses the maximum likelihood estimation (MLE) process to estimate the parameters of the model; however one important rule of MLE is the prerequisite of normally distributed data. In many cases time series data tend to have a non-normal distribution. Appendix A.2 gives the Shapiro-Wilk test for normality of the data collated. Since most of the data follows a non-normal distribution two data transformation processes were engaged; Box Cox transformation and the log transformation process (Appendix A.3). The data transformation process only succeeded in normalising a few of the distributions as such an asymptotic distribution free estimation process was applied to the standardised data to estimate the parameters in place of the MLE.

4.2 Measurement Models

While the path model attempts to identify hypothetical relationships among variables the measurement model involves quantifying these relationships allowing arithmetical analysis of relationships and the impacts of changes in one variable

on another. The relationship between latent variables and observed variables is identified. A latent variable is one which cannot be directly observed but is contingent on other constructs. In this study the latent variables are competition, regulation, innovation, profitability and risk taking, all of which are estimated via the observation of other constructs. The latent constructs listed are analysed via observed variables for instance we use the Herfindahl Hershman Index, Boone index and the four firm concentration ratio to measure the latent construct of competition since the concept is not directly observable. Observed variables which we use to construct our latent concepts must be valid and reliable.

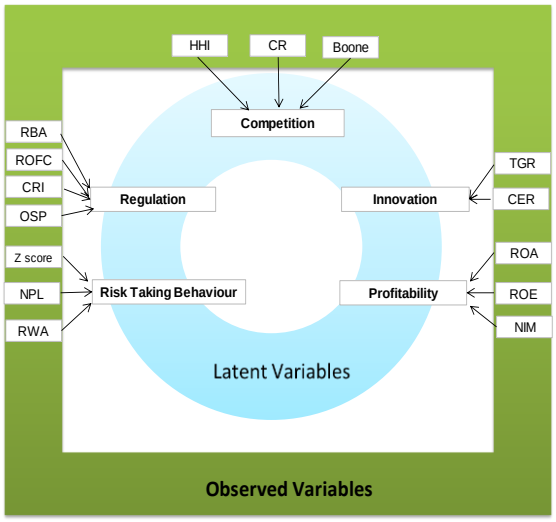
Figure 5 gives the latent variables and the observed variables used to measure the latent constructs. The latent construct innovation is observed through the efficiency ratio and technology gap ratio variables. We use return on assets, return on equity and net interest margin as observed variables to represent the latent construct profitability. Risk taking behaviour is observed through the Z-score, non-performing loan ratio and the risk weighted assets ratio. While regulation is analysed by variables constructed from a study of regulatory behaviour by Barth et al 2013. The variables extracted are; restrictions on bank activities, restrictions on overall financial conglomerates, capital regulatory index and official supervisory power.

The measurement model uses confirmatory factor analysis and gives the factor loadings of the observed variables on the latent variable. It allows testing of the hypothesis that a relationship between the observed variables and the latent constructs exists. In this sense the latent concept is devised based on the factor loadings and the observed variables. The measurement model is defined as follows:

$$\mathrm{Y} = \alpha_Y \ \lambda + u \qquad (eq.1)$$

$$\mathrm{X} = \alpha_X \ \beta + \varepsilon \qquad (eq.2)$$

Figure 5: Latent and Observed Variables



Equation 1 presents the exogenous variables whereas equation 2 gives the measurement model for the endogenous variables. The observed exogenous variables are represented by y in equation 1 and the observed endogenous

variables are given by x in equation 2. The matrix of factor loadings for the exogenous variables is represented by α in equation 1 and equation 2; this matrix relates the observable variables to the latent constructs (λ) and (β). With the measurement errors in equation 1 and 2 denoted by u and ε.

SEM studies and confirmatory factor analysis use classical measurement theory of reflective measurement where the latent construct causes the observed variables. Consider that commercial banks have existing business strategies that determine their profitability and here the concept of profitability is not directly observable but exists. We can observe that profitability through analysing ratios such as return on assets, return on equity and net interest margin along with many other ratios. In this sense the ratios do not determine profitability but simply allow us to observe it. This is known as reflective measurement.

Both competition and regulation are defined as exogenous variables in the model. Competition (λ_1) is measured by the HHI (y_1) and the four firm concentration ratio (y_2) along with the Boone index (y_3), regulation (λ_2) is measured by the regulator's restriction on bank activity (y_4), restriction on financial conglomerates (y_5), capital regulatory index (y_6) and overall supervisory power (y_7). The endogenous variables from equation 2 are as follows: innovation (β_1) measured by the cost efficiency ratio (x_1) and the technology gap ratio, risk (β_2) denoted by non-performing loans (x_2), risk weighted assets (x_3) and Z-score (x_4), and profitability (β_3); return on assets (x_5), return on equity (x_6) and net interest margin (x_7) resulting in the following equation:

$$\begin{pmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \\ y_6 \\ y_7 \end{pmatrix} = \begin{pmatrix} \alpha_{y1} & 0 \\ \alpha_{y2} & 0 \\ \alpha_{y3} & 0 \\ 0 & \alpha_{y4} \\ 0 & \alpha_{y5} \\ 0 & \alpha_{y6} \\ 0 & \alpha_{y7} \end{pmatrix} \begin{pmatrix} \lambda_1 \\ \lambda_2 \end{pmatrix} + \begin{pmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \\ u_5 \\ u_6 \\ u_7 \end{pmatrix} \quad (\text{eq. } 3)$$

$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \end{pmatrix} = \begin{pmatrix} \alpha_{x1} & 0 & 0 \\ 0 & \alpha_{x2} & 0 \\ 0 & \alpha_{x3} & 0 \\ 0 & \alpha_{x4} & 0 \\ 0 & 0 & \alpha_{x5} \\ 0 & 0 & \alpha_{x6} \\ 0 & 0 & \alpha_{x7} \end{pmatrix} \begin{pmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \\ \varepsilon_6 \\ \varepsilon_7 \end{pmatrix} \quad (\text{eq. } 4)$$

4.3 Structural Regression Models

While the measurement model quantifies the relationship between the latent variables and their measures, the structural model examines the relationship between the latent constructs. The impact of exogenous variables on endogenous variables and the relationship between endogenous variables are examined. In equation 5, ϕ is a matrix

of coefficients which give the affiliation among the endogenous variables and τ gives the impact of the exogenous variables on the endogenous system. With ή given as a vector of measurement errors.

$$\beta = \phi\beta + \tau\lambda + \acute{\eta} \quad (\text{eq. } 5)$$

5.0 Data

The model is developed on commercial bank system data collected from the Central Bank and other data repositories. The data spans 1995 to 2017 and is collated on a quarterly basis. The range of variables measured and their computations are discussed below.

5.1 Regulation

The regulation measure is developed on the work of Barth et al (2013); the authors in a study commissioned by the World Bank surveyed 180 countries of which Trinidad and Tobago was one. The intention was to identify some key strengths and weaknesses of the regulatory bodies in surveyed countries. The study entailed disseminating questions to the regulators based on allowable bank activities, supervisory power, information dissemination and disclosure, barriers to entry and exit, loan provisioning, capital buffers etc. One aim of the study is to place regulatory agents in categories based on their regulatory power. Appendix A.4 gives a sample of the survey conducted over a 12 year period, the first survey in 1999 respondents were asked to base responses on regulatory activities between 1995 to 1999, the survey in 2003 covered regulatory changes from 1999 to 2003 etc. In an attempt to model the impact regulation has on profitability the paper uses ratings from the categories (i) restrictions on banking activities, (ii) restrictions on overall financial conglomerates (iii) the capital regulatory index and (iv) overall supervisory power. Appendix tables A.4.1 to A.4.8 show the range of questions and Trinidad and Tobago's rating on the regulatory scale over the survey periods. Despite the survey ending in 2011 the regulatory strength in 2011 was replicated up to 2017.

5.2 Competition

As regards competition, the Trinidadian banking sector has been described as oligopolistic (Forde (2007)) this suggests that there are a few players in the market; significant barriers to entry and banks tend to make super normal profits. The interaction of competition and profitability has been well reviewed in the literature and the nature of the banking sector tends to suggest the ability of banks to maintain high profitability in light of limited financial innovation.

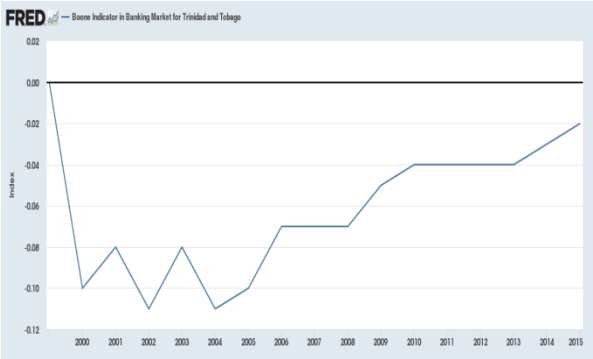
Studies which scrutinise competition and its impact on a range of elements tend to commonly use the Herfindhal Hershman Index (HHI) to measure market structure. The HHI measures the market share of firms in relation to industry size. It is a common measure used to ascertain the concentration in an industry. The ratio is measured by computing the sum of squares of a participants market share, in this case we look at banks' share of deposits. According to the US Department of Justice an HHI ratio between 1,500 and 2,500 implies some level of concentration in the market. An HHI in excess of 2,500 is indicative of significant market concentration.

The four firm concentration ratio is also utilised in the research as an indicator of competition in the banking sector. The four firm concentration ratio assesses the market share of the four largest players in the industry expressed as a percentage. The ratio ranges from 0 per cent to 100 per cent with the 0-50 per cent range indicating perfect competition

and over 50 per cent representative of medium to high concentration, symbolic of oligopolistic markets. Monopoly competition suggests the concentration ratio of 1 firm is 100 per cent.

Another indicator of competition in the market is the Boone indicator. It accounts for competition in an industry based on profit efficiency in the banking sector. It looks at the responsiveness of profits in the banking sector to marginal costs. Higher values for the index indicate a weakening of the manner in which financial firms compete since their profits are unresponsive to changes in cost.

Figure 6: The Boone Indicator for Trinidad and Tobago



Source: World Bank

5.3 Risk taking behaviour

Risk taking behaviour of a bank can be observed through their non-performing loan (NPLs) portfolio, which represents unscheduled suspended loan payments at least 90 days in arrears. High NPLs suggest that banks are engaged in risky behaviour since they are extending credit to entities which are unable to repay. Banks are in the business of taking deposits and extending loans, while the deposits represent a liability to the bank loans are an asset which they try to expand within reason. Risky bank behaviour via the extension of precarious lending practices can adversely affect the profitability of a bank. The risk weighted asset ratio can also be used to assess banks' risk taking behaviour through an assessment of risk weighted assets to total assets.

Similar to Hu and Xie (2016) the Zscore is also used as a measure of risk taking behaviour by the commercial banking sector with higher values being associated with lower levels of risk. The score is computed as the bank's return on assets (ROA) plus its capital adequacy ratio (CAR) divided by the standard deviation of the ROA.

$$\text{Zscore} = \frac{\text{ROA} + \text{CAR}}{\sigma(\text{ROA})}$$

5.4 Innovation

Financial innovation, as measured by (1) new products to market (product innovation) (2) new processes that improve product delivery or cut costs (process innovation) (3) marketing innovation and (4) organisational innovation can improve the bank's profitability by minimising costs or increasing revenue, or both. Financial innovation in Trinidad and Tobago has not kept pace with international standards as regards new products like credit default swaps etc., banks locally offer a more narrow range of products in comparison to international players but adequately tailor these products to suit its market. There has been limited growth in investment type products yet still banks appear to maintain their profitability. Despite the literature suggesting that the depth of financial innovation is needed to spur profitability Trinidad and Tobago appears to be a quite unique case. Banks locally have sought to cut costs in many ways particularly by embracing technological change.

The goal of innovation is either reducing cost or increasing revenue, as such the cost efficiency ratio is used to measure innovation since the ratio measures the bank's ability to turn a resource into revenue. The efficiency ratio is measured by Non-Interest Expense/ Revenue, the lower the ratio the more efficient the bank is at turning its resources into revenue. In Trinidad and Tobago some banks have sought cost cutting measures by reducing the size of their banking halls. In attempting to move customers from physical locations to more online business local banks have been able to cut costs. One bank has committed to "going digital" and another introducing card less cash. Banks have also found new ways to enhance existing products such as 100 per cent financing on mortgages and car loans.

5.5 Profitability

In the model profitability is a latent variable which we observe by assessing three ratios: return on assets (ROA) which measure the income a bank earns based on its existing resources, return on equity (ROE) which measures the profits generated from each dollar invested by shareholders, and net interest margin (NIM) which measures the difference between interest generated and interest paid out.

6.0 Results

The results from the SEM are analysed in this section. We can examine the direct, indirect and net impacts on profitability from Figure 7 and evaluate the size of the impact these variables have on profitability.

Table 3: Variable Statistics

Variable	Mean	Std. Dev.	Min	Max
Cost efficiency ratio **(cer)**	47.3	10.2	33.2	72.2
Technology gap ratio **(tgr)**	52.7	10.2	27.8	66.8
Return on equity **(roe)**	20.1	3.9	12.0	30.8
Return on assets **(roa)**	2.5	0.6	1.5	3.8
Net interest margin **(nim)**	890.8	310.8	275.3	1828.2
Herfindahl Hershman index **(hhi)**	2274.8	168.4	1955.9	2566.5
Four firm concentration ratio **(ffcr)**	91.5	2.7	86.5	95.9
Boone index **(bi)**	0.0	0.0	-0.1	0.0
Non-performing loans to gross loans **(nplsgl)**	4.4	2.3	0.7	10.3
Z-score **(zscore)**	14.6	3.4	8.0	23.4
Risk weighted assets to total assets **(rwata)**	54.5	4.8	47.0	63.0
Restrictions on banking activities **(rba)**	7.3	1.1	6.0	9.0
Overall financial conglomerates restrictiveness **(ofcr)**	6.3	1.5	4.0	8.0
Capital regulatory index **(cri)**	5.4	2.5	3.0	9.0
Official supervisory power **(osp)**	9.3	2.7	5.0	12.0

6.1 Competition and Profitability

Competition in the banking sector has a direct impact on bank profitability, and the results are in line with the SCPH hypothesis which posits that firms in highly concentrated markets have the ability to make super normal profits due to significant barriers to entry and possible collusion. The relationship as observed from Figure 7 is inverse and suggests that higher levels of competition in the banking sector will "eat away" at bank profitability. Specifically a one per cent increase in the level of competition in the banking sector will reduce bank profitability by 0.33 per cent.

Banks in Trinidad and Tobago are profitable, and the introduction of more banks will widen the range from which consumers have to choose and can serve as an opportunity for consumers to "shop" for improved offers and services. On this note a positive relationship was observed between competition and innovation. Higher levels of bank competition will ensure that banks have to find innovative ways to offer their products. The model suggests that a 1 per cent increase in competition will increase bank innovation by 0.40 per cent. On the other hand opening the financial sector to more players can have a stability impact particularly where new entrants are not closely managed or monitored. Moreover, the new entrants must be able to adequately compete with the four leading institutions.

Competition also has an indirect impact on profitability through innovation and risk. To compute this indirect effect we find the product of the impact competition has on innovation and the impact innovation has on risk then risk and profitability: *-0.15 = 0.40*0.54*-0.71*. A second indirect path exists from competition to innovation and innovation to profitability: *0.02= 0.40*0.06*

The net effect is the sum of the direct impact and the indirect impact of competition on profitability. The impact is *-0.46 (-0.33 + -0.15 + 0.02)* supporting the conclusion that increased competition leads to an overall decline in profitability. Evaluation of the indirect impact suggests a higher level of competition in the banking sector, given that the new entrants can compete with the four main players and carve into their market share, will result in a 0.13 per cent *(-0.15 + 0.02)* decline in bank profitability.

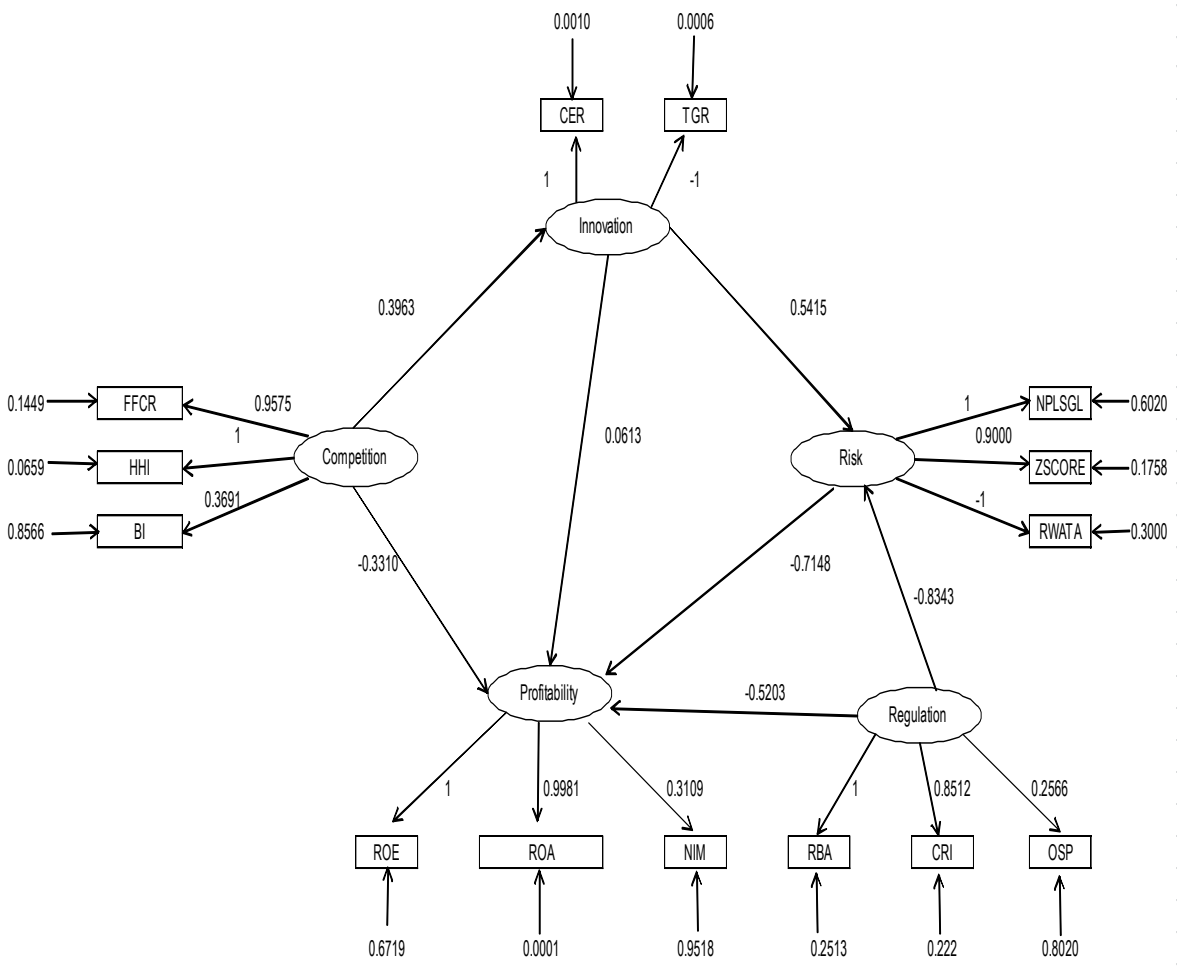
6.2 Innovation and Profitability

The variable innovation as measured by the cost efficiency ratio and technology gap ratio also has a direct impact on profitability, whereby an improvement in innovation, in this case an increase in the cost efficiency ratio and a reduction of the technology gap, will increase profitability by approximately 0.06 per cent. Increasing the cost efficiency ratio can come about through increasing revenue by offering new and improved products or by reducing costs. In Trinidad and Tobago banks have reduced the cost efficiency ratio by embracing technology through enhanced use of online banking, ATMs, fast deposit schemes. The ability to offer existing products in new ways or to new markets can also be seen as innovation, one example is loan sales where banks offer 100 per cent financing on mortgages. One bank has also led the way in pioneering card-less cash at their ATM machines. Other banks are in the process of developing digital cheque deposit schemes.

Banks have sought to encourage consumers to embrace the technological push with one bank attempting to go digital and minimise the number of banking halls in operations. Innovation also has an indirect impact on profitability through risk: *-0.38 = 0.54*-0.71*.

The net effect of innovation on profitability is negative due to the significant negative impact risk has on profitability. Innate in the innovation process is increased risk (March and Shapira (1987)); however the noteworthy impact risk has on profitability serves only to mitigate the positive impact of innovation. The latter resulted in the adverse impact of risk on profitability outweighing the positive impact of innovation on profitability resulting in a negative net effect of *-0.32 = 0.06 + (0.54*-0.71)*. One example of this is the offer of 100 per cent financing by some commercial banks in their loan sales to capture increased market share. While this may be a new way of offering an existing service the bank has increases its risk as the possibility of default on a loan which is fully financed by the bank leaves only the asset as collateral. These types of assets (homes, vehicles) are difficult to liquidate easily and the bank will now have a higher non-performing portfolio. As a result of their innovative measures the risk to the entity is increased. While banks do have strict lending criteria associated with these types of loans the possibility of higher risk still arises. As Norden et al (2014) postulated the main aim for firms, in this case commercial banks, are risk mitigation strategies that can minimise the adverse impact risk can have on bank profitability.

Figure 7
Path Model Coefficients



The above illustrates a network diagram from the SEM model in STATA. The ovals are the unobserved latent variables; innovation, risk, regulation, profitability and competition. The arrows from the latent variables to the observed variables show the causal effect of the latent variable on the observed variable, therefore the causal relationship between ROE and profitability is strong since the confirmatory factor analysis gives a factor loading of 1, and ROA also shows a strong causal relationship while NIM is weaker. The numbers on the outside of the observed variables e.g. 0.679 for ROE, 0.0001 ROA and 0.9518 NIM give the measurement errors of the variables. The arrows from one latent variable say competition to innovation gives their correlation; in this case an increase in commercial bank competition will increase innovation in the sector since more banks have to compete for the same resources. This is a direct relationship there are also indirect relationships which can be analysed for example the impact competition has on profitability which goes from competition to its impact on innovation and from innovation to risk and from risk to profitability. One benefit of SEM is its ability to assess relationships simultaneously.

6.3 Risk and Profitability

Risk also has a direct impact on profitability. The inability of banks to collect on monies advanced is a significant risk faced and is measured through their non-performing loan portfolio. Increasing risk means banks lose out on interest income which directly impacts their profit and will lower their Zscore. Additionally, commercial banks provision for losses represents an opportunity cost to the bank since these funds could be used for investment purposes and to generate additional revenue. Increased risk means banks have to boost provisioning in the future which can impact their bottom line. Similar to the findings of Tarraf and Majeske (2013) we note the inverse relationship between risk and profitability, the results suggest a 1 per cent increase in risk lowers profitability by 0.71 per cent.

6.4 Regulation, Profitability and Risk

Regulation can directly impact bank profits as measured by the return on equity indicator. In determining the capital adequacy ratios of a bank the regulator has the power to impact the profitability of a bank since higher equity holdings with an unchanged net profit will render the return on equity ratio lower. One caveat in Trinidad and Tobago is that commercial banks are already heavily capitalised with many holding capital in excess of the current 8 per cent requirement.

The model suggests more stringent regulatory rules, possibly in relation to the capital regulatory index measure, would adversely impact bank's profitability. From a theoretic point of view holding higher capital comes at a cost to banks since this dormant money can be used in the further generation of revenue through loans or investments etc. While the Central Bank is currently in the process of moving banks to a higher capital adequacy ratio of 10 per cent, a few banks will not be significantly affected since they are already over capitalised. The banks that are at the current 8 per cent may encounter some challenges with the higher ratio of 10 per cent. Should the Central Bank seek to increase the capital adequacy ratio beyond this 10 per cent (ceteris paribus) banks will almost certainly see some change in their profitability.

Moreover increased regulation in terms of restriction on banking activities seems to directly adversely impact bank profitability by 0.52 per cent as suggested by the SEM. While regulation ensures financial stability and manages bank's systemic risk, excessively stringent regulation can hamper the bank's ability to traverse the financial landscape by limiting its ability to innovate. In the SEM an increase in regulation via increased restrictions on bank activity, an increase in the regulatory capital requirements suggests a decline in risk. It is important to note that the net effect on profitability is positive since $0.59 = -0.83 * -0.71$. And as such the model suggests increased regulatory measures will indirectly positively impact profitability through risk mitigation.

The net impact of regulation on profitability is $0.07 = -0.52 + 0.59$. The positive impact through risk mitigation of profitability is more than the negative impact tightening regulation will have on profitability. As such the overall impact is an increase of 0.07 per cent in profitability despite tighter regulatory measures (specifically relating to those measured, restrictions on bank activities and tightening capital regulatory requirements).

The regulator is interested in ensuring stability in the financial arena and mitigating any severe adverse impacts commercial bank decisions may have on the overall financial system. One benefit in the Trinidadian economy is that at least half of the commercial banking sector starts from a position of high profitability and are well capitalised. The

latter minimises the impact of stronger regulatory measures; nonetheless additional regulation will impact the bottom line of banks unless they can utilise the innovation route to further expand their profit margins.

6.5 Goodness of fit tests

Hox and Bechger (2011) lament that "Statistical tests for model fit have the problem that their power varies with sample size". With very large samples as explained by the authors the goodness of fit tests tend to "behave better" versus sample sizes with smaller data sets. SEM also requires large data sets, approximately 200 data points. One shortcoming of this research is the limited data set since quarterly data from 1995-2017 only allows 92 data points, thereby affecting the goodness of fit tests for the model. In this section we analyse the goodness of fit tests the model performed well on and where the model fell short.

Table 4: Goodness of Fit Tests

Fit statistic	Value
Population error	
Root mean square error (RMSE)	0.260
90% CI, lower bound	0.236
Upper bound	0.285
Baseline comparison	
Comparative fit index (CFI)	0.859
Tucker-Lewis index (TLI)	0.853
Size of residuals	
Standardised root mean squared residuals (SRMR)	0.241
Coefficient of determination (CD)	0.961

The first goodness of fit test statistics is the group of population error tests. The root mean square error (RMSE) tests the fit between the estimated model and the true model. The lower the RMSE the better is said to be the model fit. Researchers usually accept an upper bound above 0.10 and a lower bound below 0.05. While the upper bound for the model is above 0.10 the lower bound is well above 0.05. The RMSE statistic of 0.26 indicates that the estimated model does deviate from the true model in regard to model fit. However one important note here is the data limitation since increasing the data west will improve the RMSE. Under baseline comparison the Tucker-Lewis Index (TLI) also known as the non-normed fit index measure and adjust for the complexity of the model. If the model fits perfectly the TLI will be equal to 1. A TLI that is 0.80 and above gives a good model fit.

7. 0 Conclusion

This paper investigates the country's commercial banking sector to understand some elements which may interplay with profitability. Commercial banks have generally been able to make profits despite periods of economic overhang. The paper uses a structural equation model (SEM) to ascertain the causal impacts on this profitability stance. Some interesting conclusions are drawn from the SEM which can have implications for the regulators of the sector.

Firstly, the paper concludes that competition adversely impacts profitability. This premise augurs well with findings in the literature which explain that concentrated markets tend to make high profits and there exists the possibility that new entrants into the market will "eat away" at these profits. In light of this it must be noted that the Trinidad and Tobago case is one where four banks control the market and therefore any new entrant must be able to attract a significant amount of the market away from the major players in order to impact bank profitability. On the other hand, increased competition may lead to further development of the commercial banking sector and may give consumers an increased choice. As a result it is not practical to say that the banking sector should not increase competition due to the adverse impact on profitability, particularly where the end goal is further development of the sector. The main caveat is the inclusion of additional banks should not adversely impact the financial stability of the financial sector.

Secondly, increased innovation has a negative net impact on profitability. While innovation increases profitability in a direct way, the indirect impact (through risk) is so significant that it results in an overall fall in profitability. Of note here is the importance of risk mitigation in any innovative venture. While innovation is important in the banking sector, it should not be sought after without close consideration for the risks involved. Further work can look at devising some risk threshold for domestic financial institutions; this threshold will give the point beyond which implementing the intended innovation or change becomes too risky for the financial institution. The importance in this measure will be internal risk analysis and external analysis by the regulatory bodies.

In the third instance the paper suggests that higher levels of risk directly reduce profitability. This may occur through banks having to set aside higher provisions for taking on increased risk in their portfolios. The final assertion suggests that more stringent regulation will improve bank profitability. This relationship occurred through the mitigation of risk that more stringent regulation brings. By lowering risk, stronger regulation inadvertently buffers bank profitability. The converse may ring true in this instance, where regulators can over regulate institutions and run the risk of stifling the financial sector. There must be harmonisation of regulation with the goals the financial sector set out to achieve.

Bibliography

Aghion, P., Bloom, N., Blundell, R., Griffith, R., and Howitt, P. (2005). Competition and Innovation: An inverted U relationship. *The Quarterly Journal of Economics*, 120 (2), 701-728.

Aghion, P., Bechtol, S., Cassar, L., and Herz, H. (2014). The causal effects of competition on innovation: Experimental evidence. *National Bureau of Economic Research Working Paper*, no. 19987.

Ahn, J. H. and Breton, R. (2014). Securitisation, competition and monitoring. *Journal of Banking and Finance,* 40 (C), 195-210.

Alfaro, L., Chanda, A., Ozcan, S. K., Sayek, S. (2006). How does foreign direct investment promote economic growth? Exploring the effects of financial markets on linkages. Retrieved from http://www.hbs.edu/faculty/Publication%20Files/07-013.pdf

Altunbas, Y., Marques-Ibanez D., and Van Leuvensteijn, M. (2016). Competition and bank risk: The effect of securitization and bank capital. *ECB Working Paper 1678 and International Monetary Fund Working Paper Series*, Forthcoming.

Barth, J.R., Caprio Jr., G., Levine, R. (2013). Bank regulation and supervision in 180 countries from 1999 to 2011. *National Bureau of Economic Research*. Retrieved from http://www.nber.org/papers/w18733.pdf.

Barth, J.R., Caprio Jr., G., Levine, R. (2004). Bank regulation and supervision: what works best? *Journal of Financial Intermediation*, 13, 205-248.

Beck, T. (2008). Bank competition and financial stability: friends or foes? *World Bank Policy Research Working Paper* 4656, The World Bank, Development Research Group, Washington D.C.

Bos, J., Kolari, J., Van Lomoen, R. (2013). Competition and innovation: Evidence from Financial Services. *Journal of Banking and Finance*, 37 (5), 1590-1601.

Boyd, J.H., and De Nicoló G. (2005). The theory of bank risk-taking and competition revisited. *Journal of Finance,* 60 (3), 1329-1343.

Calomiris, C. (2009). Financial innovation, regulation, and reform. *The Cato Journal*, 29, 65-91.

Carletti, E. (2007) Competition and regulation in banking. Retrieved from http://apps.eui.eu/Personal/Carletti/carletti-handbook_Thakor_Boot.pdf

Chava, S., Oettl, A., Subramanian, A., Subramanian, K. (2013). Banking deregulation and innovation. *Journal of Financial Economics*, 109 (3), 759-774.

Cornaggia, J., Mao, Y., Tian, X., Wolfe, B. (2015). Does banking competition affect innovation? *Journal of Financial Economics*, 115 (1), 189-209.

Demsetz, H. (1973). Industry, structure, market rivalry, and public policy. *Journal of Law Economics*, 16 (1), 1-9.

Fernández, A., and F. González. (2005). How accounting and auditing systems can counteract risk-shifting of safety-nets in banking: Some international evidence. *Journal of Financial Stability*, 4 (1), 466–500.

Forde, P. (2008). The evolution of the financial sector in Trinidad and Tobago (1996-2007). Retrieved from https://slidex.tips/download/the-evolution-of-the-financial-sector-in-trinidad-and-tobago-penelope-forde-edit.

Gilbert, R. J. (2006). Competition and Innovation. *Journal of Industrial Organisation Education*, 1(1), Article 8.DOI: 10.2202/1935-5041.1007.

Guo, P. and Shen, Y. (2016). The impact of internet finance on commercial banks' risk taking: evidence from China. *China Finance and Economic Review*, 4 (16), 2-19.

Hart, O. D. (1980). Perfect competition and optimal product differentiation. *Journal of Economic Theory*, 22, 279–312.

Hawley, F. (1983). The risk theory of profit. *The Quarterly Journal of Economic*, 7, 459-479.

Hellman, T.F., Murdock, K.C. and Stiglitz, J.E. (2000). Liberalisation, moral hazard in banking, and prudential regulation: are capital requirements enough? *American Economic Review*, 90, 147-165.

Hu, T. and Chi, X. (2016). Competition, innovation, risk-taking, and profitability in the Chinese banking sector: An empirical analysis based on structural equation modelling. *Discrete Dynamics in Nature and Society*, 2016, 1-10. doi:10.1155/2016/3695379.

Hussein, T. and Majeske, K. (2013). Impact of risk taking on bank financial performance during 2008 financial crisis. *Journal of Finance and Accountancy*, 13, 1-18.

Kane, E. (1981). Impact of regulation on economic behavior: Accelerating inflation, technological innovation, and the decreasing effectiveness of banking regulation. *The Journal of Finance*, 36 (2), 355-367.

Kim,T.,Bonwoo K., Minsoo P. (2013). Role of financial regulation and innovation in the financial crisis. *Journal of Financial Stability*, 9, 662-672.

King, R., and Levine, R. (1993). Finance, entrepreneurship and growth: Theory and evidence. *Journal of Monetary Economics*, 32 (3), 513-542.

Klomp, J., and J. de Haan. 2012. Banking risk and regulation: Does one size fit all? *Journal of Banking and Finance*, 36 (12), 3197–3212.

March J. and Shapira Z., (1987). Managerial perspectives on risk and risk taking. *Management Science*, 33 (11), 1404-1418.

Matejašák, M., Teplý, P., Černohorský J. (2009). The impact of regulation of banks in the US and the EU-15 countries. *E+M Ekonomie a Management*, 12 (3), 58–68.

Mian, A. and Sufi, A. (2009). The consequences of mortgage credit expansion: Evidence from the U.S. mortgage default crisis. *Quarterly Journal of Economics*, 124, 1449-1496.

Norden, L., Buston, C. and Wagner, W. (2014). Financial innovation and bank behavior: evidence from credit markets. *Emerging Markets Review*, 234 (2), 508-517.

Riordan, M. H. (1993). Competition and bank performance: a theoretical perspective in C. Mayer and X. Vives (eds), Capital Markets and Financial Intermediation, Cambridge, Cambridge University Press.

Rime, B. (2001). Capital requirements and bank behaviour: empirical evidence for Switzerland. *Journal of Banking and Finance*, 25 (4), 789–805. DOI: 10.1016/s0378-4266(00)00105-9.

Repullo, R. (2004). Capital requirement, market power, and risk taking in banking. *Journal of Financial Intermediation*, 13 (2), 156-182.

Schmutzler, A. 2013. "Competition and Investment — A Unified Approach". *International Journal of Industrial Organisation*, 31 (5), 477-487.

Schumpeter, J. A. (1942). Capitalism, Socialism, and Democracy. New York: Harper and Brothers. (Harper Colophon edition, 1976.)

Schumpeter, J. A. (1912). The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle. Transaction Publishers, 1934.

Silber, W. (1983). The process of financial innovation. *The American Economic Review*, 73 (2), 89-95.

Shrieves, R. E., Dahl, D. (1992). The relationship between risk and capital in commercial banks. *Journal of Banking and Finance*, 16 (2), 439–457. DOI: 10.1016/0378-4266(92)90024-t.

Stiglitz, J. (1993). The Role of the State in Financial Markets. *The World Bank Economic Review*, 7 (1), 19–52.

Stiglitz, J. (1984). Theory of competition, incentives and risk. Retrieved from https://www.princeton.edu/~erp/ERParchives/archivepdfs/M311.pdf

Stiglitz, J. (1981).The allocation role of the stock market: Pareto optimality and Competition. *Journal of Finance*, 36 (2), 235-251.

Sujud, H. and Hashem, B. (2017). Effect of bank innovations on profitability and return on assets (ROA) of commercial banks in Lebanon. *International Journal of Economics and Finance*, 9 (4), 35-50.

Tarraf, H. and Majeske, K. (2013). Impact of risk-taking on bank financial performance during 2008 financial crisis. *Journal of Finance and Accountancy*, 13, 1-18.

Vives, X. (2010). Competition and stability in banking. CESifo Working Paper Series 3050.

Werner, C. and Engel, k. (2009). Structural equation modeling: Advantages, challenges, and problems. Retrievedhttp://kharazmistatistics.ir/Uploads/Public/MY%20article/Structural%20Equation%20Modeling.pdf

Witowschi, I. and Luca, F. (2016). Bank capital, risk and performance in European banking: A case study of seven banking sectors. *Prague Economic Papers*, 205 (2), 127-142.

Technical Appendix

Path Models

The path model gives a hypothetical cause and effect analysis, one that is expected a priori (Figure A1). Path models extract relationships between variables based on existing hypotheses extracted from the literature or existing knowledge of interactions among variables. In this instance regulation is an exogenous variable determined by the monetary authorities and has an impact on innovation and the risk appetite of commercial banks. Competition in the sector is said to impact innovation since an oligopolistic market has to create innovative products in order to remain competitive. Both regulation and competition directly impact profitability along with innovation and risk taking.

Despite the hypothetical path model displaying regulation as an exogenous variable one can consider whether regulation tends to be reactionary. In the case of many international regulators policies tend to react to developments (both positive and negative) in the financial sector. Bankers are motivated to seek innovative ways to enhance the profitability of the institution as opposed to regulators, whose aim is financial stability. If this notion holds then regulation is just as reactionary as the other variables highlighted.

In the path model both regulation and competition are treated as exogenous variables which tend to be causal variables while the endogenous variables can be both cause and effect. In estimating the impact of the causal variables we look at the arrowed path and the coefficient associated with the impact (similar to regression analysis) for example, regulation has a direct impact on profitability since the regulators can influence capital ratios and provisioning which will ultimately affect the profitability a bank records. The direct path from regulation to profitability will be measured by the size and sign of the coefficient. On the other hand regulation also indirectly impacts profitability working through innovation and risk in this case the indirect impact will be measured by multiplying the direct effects of regulation on innovation, innovation on risk, and risk on profitability. The net effect is captured by the summation of all direct and indirect effects.

Figure A1: Path Model

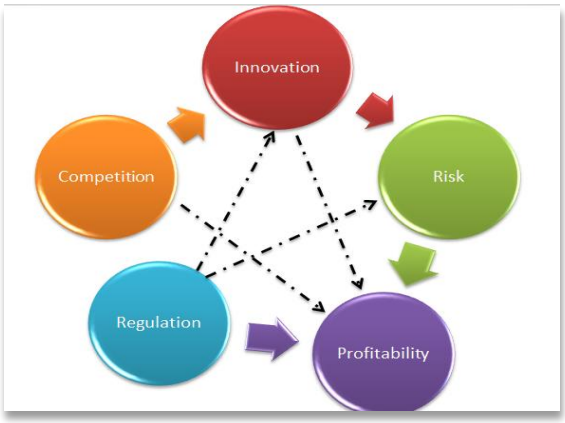


Table A1: Correlation matrix of observed variables

Variables	cer	roe	roa	nim	hhi	ffcr	bi	nplsgl	zscore	rwata	rba	ofc	cri	osp	tgr
Cost efficiency ratio (cer)	1														
Return on equity (roe)	-0.627	1													
Return on assets (roa)	-0.294	0.573	1												
Net interest margin (nim)	0.363	-0.245	0.204	1											
Herfindhal Hershman index (hhi)	-0.375	0.214	-0.327	-0.331	1										
Four firm concentration ratio (ffcr)	-0.336	0.153	-0.390	-0.358	0.894	1									
Boone Index (bi)	0.136	-0.155	-0.699	-0.209	0.306	0.420	1								
Non-performing loans to gross loans (nplsgl)	0.070	-0.168	-0.757	-0.353	0.250	0.317	0.671	1							
zscore	0.743	-0.781	-0.651	0.190	-0.346	-0.242	0.370	0.348	1						
Risk weighted assets to total assets (rwata)	-0.581	0.482	0.680	-0.051	0.116	-0.036	-0.641	-0.642	-0.754	1					
Restrictions on banking activities (rba)	-0.654	0.319	0.513	-0.131	-0.041	-0.066	-0.511	-0.387	-0.642	0.701	1				
Restrictions on overall financial conglomerates (ofc)	0.648	-0.409	0.276	0.525	-0.748	-0.617	-0.252	-0.437	0.454	-0.212	-0.249	1			
Capital regulatory Index (cri)	0.773	-0.424	-0.226	0.345	-0.511	-0.346	0.314	0.064	0.737	-0.662	-0.731	0.756	1		
Official supervisory power (osp)	0.616	-0.315	0.370	0.526	-0.711	-0.634	-0.500	-0.522	0.361	-0.078	-0.208	0.920	0.633	1	
Technology Gap Ratio (tgr)	-1.000	0.627	0.294	-0.363	0.375	0.336	-0.136	-0.070	-0.743	0.581	0.654	-0.648	-0.773	-0.616	1

Table A2: Shapiro -Wilk normality test

Hypothesis:

H0: Data is normally distributed

H1: Data is NOT normally distributed

Variable	Observations	W	V	z	Prob>z	Normality
Cost efficiency ratio (cer)	92	0.904	7.411	4.423	0	Non- normal
Technology gap ratio	92	0.903	7.411	4.423	0	Non-normal
Return on equity (roe)	92	0.974	2.008	1.539	0.062	Near-normal
Return on assets (roa)	92	0.960	3.081	2.485	0.006	Non-normal
Net interest margin (nim)	91	0.970	2.269	1.808	0.035	Near-normal
Herfindhal Hershman index (hhi)	92	0.949	3.918	3.016	0.001	Non- normal
Four firm concentration ratio (ffcr)	92	0.960	3.076	2.481	0.007	Non- normal
Boone index (bi)	92	0.987	1.005	0.010	0.496	Normal
Non-performing loans to gross loans (nplsgl)	92	0.953	3.619	2.840	0.002	Non-normal
zscore	92	0.951	3.755	2.922	0.002	Non-normal
Risk weighted assets to total assets (rwata)	92	0.931	5.300	3.683	0	Non-normal
Restrictions on banking activities (rba)	92	0.991	0.686	-0.832	0.797	Normal
Restrictions on overall financial conglomerates (rofc)	92	0.981	1.474	0.857	0.196	Normal
Capital regulation index (cri)	92	0.902	7.515	4.454	0	Non-normal
Official Supervisory Power (osp)	92	0.902	6.143	4.009	0	Non-normal

Table A3: Data transformation

Shapiro Wilk on Box Cox transformed variables

Variable	Obs	W	V	z	Prob>z	
bcroe	92	0.984	1.204	0.411	0.341	Normal
bcer	92	0.947	4.060	3.094	0.001	Non-Normal
bctgr	92	0.933	5.102	3.599	0	Non-normal
bcroa	92	0.968	2.447	1.976	0.024	Near-Normal
bcnim	91	0.979	1.637	1.087	0.138	Normal
bchhi	92	0.950	3.817	2.958	0.002	Non-Normal
bcffcr	92	0.961	3.027	2.446	0.007	Non-Normal
bcnplsgl	92	0.984	1.202	0.406	0.342	Normal
bczscore	92	0.984	1.245	0.484	0.314	Normal
bcrwata	92	0.935	5.031	3.568	0	Non-Normal
bccri	92	0.999	0.069	-5.896	1.000	Normal
bcosp	92	0.999	0.081	-5.557	1.000	Normal

Log transformation of non-normal variables

Variable	Obs	W	V	z	Prob>z	Normality
lncer	92	0.957	3.290	2.629	0.004	Non-Normal
lntgr	92	0.957	3.290	2.630	0.004	Non-normal
lnhhi	92	0.951	3.745	2.916	0.002	Non-Normal
lnffcr	92	0.956	3.371	2.684	0.004	Non-Normal
lnrwata	92	0.935	4.982	3.546	0.000	Non-Normal

Table A4: Sample questions from World Bank supervisory measures

Restriction on Overall Bank Activity

Table A.4.1 Bank Activity Regulation- Security Activities

Survey Year	Description	Range	Quantification	Trinidad and Tobago Score
1999	The extent to which banks may engage in underwriting, brokering and dealing in securities, and all aspects of the mutual fund industry.	1-4	(Higher value, more restrictive) Unrestricted = 1 = full range of activities can be conducted directly in the bank; Permitted = 2 = full range of activities can be conducted, but some or all must be conducted in subsidiaries; Restricted = 3 = less than full range of activities can be conducted in the bank or subsidiaries; and Prohibited = 4 = the activity cannot be conducted in either the bank or subsidiaries.	3
2003	What is the level of regulatory restrictiveness for bank participation in securities activities (the ability of banks to engage in the business of securities underwriting, brokering, dealing, and all aspects of the mutual fund industry): Unrestricted - A full range of activities in the given category can be conducted directly in the bank? Permitted - A full range of activities can be conducted, but all or some must be conducted in subsidiaries?	1-4	(Higher value, more restrictive) Unrestricted = 1 = full range of activities can be conducted directly in the bank; Permitted = 2 = full range of activities can be conducted, but some or all must be conducted in subsidiaries; Restricted = 3 = less than full range of activities can be conducted in the bank or subsidiaries; and Prohibited = 4 = the activity cannot be conducted in either the bank or subsidiaries.	2
2007	What are the conditions under which banks can engage in securities activities?	1-4	(Higher value, more restrictive) Unrestricted = 1 = full range of activities can be conducted directly in the bank; Permitted = 2 = full range of activities can be conducted, but some or all must be conducted in subsidiaries; Restricted = 3 = less than full range of activities can be conducted in the bank or subsidiaries; and Prohibited = 4 = the activity cannot be conducted in either the bank or subsidiaries.	1

2011	What are the conditions under which banks can engage in securities activities?
	a. A full range of these activities can be conducted directly in banks,
	b. A full range of these activities are offered but all or some of these activities must be conducted in subsidiaries, or in another part of a common holding company or parent,
	c. Less than the full range of activities can be conducted in banks, or subsidiaries, or in another part of a common holding company or parent,
	d. None of these activities can be done in either banks or subsidiaries, or in another part of a common holding company or parent.
		(Higher values indicate more restrictive .)
		a = 1;
		b = 2;
		c = 3; and
		d = 4.
				1

Restriction on Overall Bank Activity

Table A.4.2 Bank Activity Regulation- Insurance Activities

Survey Year	Description	Range	Quantification	Trinidad and Tobago Score
1999	The extent to which banks may engage in insurance underwriting and selling.	1-4	(Higher value, more restrictive) Unrestricted = 1 = full range of activities can be conducted directly in the bank; Permitted = 2 = full range of activities can be conducted, but some or all must be conducted in subsidiaries; Restricted = 3 = less than full range of activities can be conducted in the bank or subsidiaries; and Prohibited = 4 = the activity cannot be conducted in either the bank or subsidiaries.	2
2003	What is the level of regulatory restrictiveness for bank participation in insurance activities (the ability of banks to engage in insurance underwriting and selling): Unrestricted - A full range of activities in the given category can be conducted directly in the bank? Permitted - A full range of activities can be conducted, but all or some must be conducted in subsidiaries? Restricted - Less than a full range of activities can be conducted in the bank or subsidiaries? Prohibited - The activity cannot be conducted in either the bank or subsidiaries?	1-4	(Higher value, more restrictive) Unrestricted = 1 = full range of activities can be conducted directly in the bank; Permitted = 2 = full range of activities can be conducted, but some or all must be conducted in subsidiaries; Restricted = 3 = less than full range of activities can be conducted in the bank or subsidiaries; and Prohibited = 4 = the activity cannot be conducted in either the bank or subsidiaries.	4
2007	What are the conditions under which banks can engage in insurance activities?	1-4	(Higher value, more restrictive) Unrestricted = 1 = full range of activities can be conducted directly in the bank; Permitted = 2 = full range of activities can be conducted, but some or all must be conducted in subsidiaries; Restricted = 3 = less than full range of activities can be conducted in the bank or subsidiaries; and Prohibited = 4 = the activity cannot be conducted in either the bank or subsidiaries.	4

Survey Year	Description	Range	Quantification	Trinidad and Tobago Score

2011	What are the conditions under which banks can engage in insurance activities?
	a. A full range of these activities can be conducted directly in banks,
	b. A full range of these activities are offered but all or some of these activities must be conducted in subsidiaries, or in another part of a common holding company or parent
	c. Less than the full range of activities can be conducted in banks, or subsidiaries, or in another part of a common holding company or parent,
	d. None of these activities can be done in either banks or subsidiaries, or in another part of a common holding company or parent
		(Higher values indicate more restrictive.)
		a = 1;
		b = 2;
		c = 3; and
		d = 4.
				2

Restriction on Overall Bank Activity

Table A.4.3 Bank Activity Regulation- Real Estate Activities

Survey Year	Description	Range	Quantification	Trinidad and Tobago Score
1999	The extent to which banks may engage in real estate investment, development and management.	1-4	(Higher value, more restrictive) Unrestricted = 1 = full range of activities can be conducted directly in the bank; Permitted = 2 = full range of activities can be conducted, but some or all must be conducted in subsidiaries; Restricted = 3 = less than full range of activities can be conducted in the bank or subsidiaries; and Prohibited = 4 = the activity cannot be conducted in either the bank or subsidiaries.	2
2003	What is the level of regulatory restrictiveness for bank participation in real estate activities (the ability of banks to engage in real estate investment, development, and management): Unrestricted - A full range of activities in the given category can be conducted directly in the bank? Permitted - A full range of activities can be conducted, but all or some must be conducted in subsidiaries?	1-4	(Higher value, more restrictive) Unrestricted = 1 = full range of activities can be conducted directly in the bank; Permitted = 2 = full range of activities can be conducted, but some or all must be conducted in subsidiaries; Restricted = 3 = less than full range of activities can be conducted in the bank or subsidiaries; and Prohibited = 4 = the activity cannot be conducted in either the bank or subsidiaries.	2
2007	What are the conditions under which banks can engage in real estate activities?	1-4	(Higher value, more restrictive) Unrestricted = 1 = full range of activities can be conducted directly in the bank; Permitted = 2 = full range of activities can be conducted, but some or all must be conducted in subsidiaries; Restricted = 3 = less than full range of activities can be conducted in the bank or subsidiaries; and Prohibited = 4 = the activity cannot be conducted in either the bank or subsidiaries.	4

2011	What are the conditions under which banks can engage in real estate activities?
	a. A full range of these activities can be conducted directly in banks,
	b. A full range of these activities are offered but all or some of these activities must be conducted in subsidiaries, or in another part of a common holding company or parent
	c. Less than the full range of activities can be conducted in banks, or subsidiaries, or in another part of a common holding company or parent
	d. None of these activities can be done in either banks or subsidiaries, or in another part of a common holding company or parent
		(Higher values indicate more restrictive.)
		a = 1;
		b = 2;
		c = 3; and
		d = 4.
				3

Restriction on Overall Financial Conglomerates

Table A.4.4 Banks Owning Non-Financial Firms

Survey Year	Description	Range	Quantification	Trinidad and Tobago Score
1999	Regulatory restrictiveness of bank ownership of nonfinancial firms	1-4	(Higher value, more restrictive.) Unrestricted = 1 = a bank may own 100 percent of the equity in any nonfinancial firm; Permitted = 2 = a bank may own 100 percent of the equity of a nonfinancial firm, but ownership is limited based on a bank's equity capital; Restricted = 3 = a bank can only acquire less than 100 percent of the equity in a nonfinancial firm; and Prohibited = 4 = a bank may not acquire any equity investment in a nonfinancial firm whatsoever.	2
2003	What is the level of regulatory restrictiveness for bank ownership of nonfinancial firms: Unrestricted - A bank may own 100 percent of the equity in any nonfinancial firm? Permitted - A bank may own 100 percent of the equity in a nonfinancial firm, but ownership is limited based on a bank's equity capital? Restricted - A bank can only acquire less than 100 percent of the equity in a nonfinancial firm? Prohibited - A bank may not acquire any equity investment in a nonfinancial firm?	1-4	(Higher value, more restrictive.) Unrestricted = 1 = a bank may own 100 percent of the equity in any nonfinancial firm; Permitted = 2 = a bank may own 100 percent of the equity of a nonfinancial firm, but ownership is limited based on a bank's equity capital; Restricted = 3 = a bank can only acquire less than 100 percent of the equity in a nonfinancial firm; and Prohibited = 4 = a bank may not acquire any equity investment in a nonfinancial firm whatsoever.	2
2007	Can banks own voting shares in nonfinancial firms?	1-4	Higher value, more restrictive.) Unrestricted = 1 = a bank may own 100 percent of the equity in any nonfinancial firm; Permitted = 2 = a bank may own 100 percent of the equity of a nonfinancial firm, but ownership is limited based on a bank's equity capital; Restricted = 3 = a bank can only acquire less than 100 percent of the equity in a nonfinancial firm; and Prohibited = 4 = a bank may not acquire any equity investment in a nonfinancial firm whatsoever.	3

2011	What are the conditions under which banks can engage in nonfinancial businesses except those businesses that are auxiliary to banking business (e.g. IT company, debt collection company etc.) ?
	a. Nonfinancial activities can be conducted directly in banks,
	b. Nonfinancial activities must be conducted in subsidiaries, or in another part of a common holding company or parent
	c. Nonfinancial activities may be conducted in subsidiaries, or in another part of a common holding company or parent, but subject to regulatory limit or approval,
	d. None of these activities can be done in either banks or subsidiaries, or in another part of a common holding company or parent
		(Higher values indicate more restrictive.)
		a = 1;
		b = 2;
		c = 3; and
		d = 4.
				4

Restriction on Overall Financial Conglomerates

Table A.4.5 Non-Financial Firms Owning Banks

Survey Year	Description	Range	Quantification	Trinidad and Tobago Score
1999	Regulatory restrictiveness of ownership by nonfinancial firms of banks	1-4	(Higher value, more restrictive) Unrestricted = 1 = a nonfinancial firm may own 100 percent of the equity in a bank; Permitted = 2 = unrestricted with prior authorization or approval; Restricted = 3 = limits are placed on ownership, such as a maximum percentage of a bank's capital or shares; and Prohibited = 4 = no equity investment in a bank.	1
2003	What is the level of regulatory restrictiveness for nonfinancial firms ownership of bank: Unrestricted - A nonfinancial firm may own 100 percent of the equity in a bank? Permitted - Unrestricted with prior authorization or approval? Restricted - Limits are placed on ownership, such as a maximum percentage of a bank's capital or shares? Prohibited - No equity investment in a -bank?	1-4	(Higher value, more restrictive.) Unrestricted = 1 = a nonfinancial firm may own 100 percent of the equity in a bank; Permitted = 2 = unrestricted with prior authorization or approval; Restricted = 3 = limits are placed on ownership, such as a maximum percentage of a bank's capital or shares; and Prohibited = 4 = no equity investment in a bank.	2
2007	If any voting shares can be owned by nonfinancial firms, what are the limits?	1-4	(Higher value, more restrictive.) Unrestricted = 1 = a nonfinancial firm may own 100 percent of the equity in a commercial bank; Permitted = 2 = unrestricted with prior authorization or approval; Restricted = 3 = limits are placed on ownership, such as a maximum percentage of a bank's capital or shares; and Prohibited = 4 = no equity investment in a bank.	2

2011	Can nonfinancial firms own voting shares in commercial banks? Please see options provided and select option that best characterises your banking sector
	a. Nonfinancial firm may own 100% of the equity in a commercial bank.
	b. Nonfinancial firm may own 100% of the equity in a commercial bank, but prior authorization or approval is required.
	c. Limits are placed on ownership of banks by nonfinancial firms, such as maximum percentage of a commercial bank's capital or shares.
	d. Nonfinancial firms cannot own any equity investment in a commercial bank
		(Higher values indicate more restrictive.)
		a = 1;
		b = 2;
		c = 3; and
		d = 4.
				2

Restriction on Overall Financial Conglomerates

Table A.4.6 Non-Bank Financial Firms Owning Banks

Survey Year	Description	Range	Quantification	Trinidad and Tobago Score
1999	Can non-bank financial firms own shares in banks? What are the limits?	1-4	(Higher value, more restrictive) Unrestricted = 1 = a non-bank financial firm may own 100 percent of the equity in a bank; Permitted = 2 = unrestricted with prior authorization or approval; Restricted = 3 = limits are placed on ownership, such as a maximum percentage of a bank's capital or shares; and Prohibited = 4 = no equity investment in a bank.	1
2003	What is the level of regulatory restrictiveness for non-bank financial firms (e.g., insurance companies, finance companies, etc.) ownership of commercial banks: Unrestricted - A non-bank financial firm may own 100 percent of the equity in a bank? Permitted - Unrestricted with prior authorization or approval? Restricted - Limits are placed on ownership, such as a maximum percentage of a bank's capital or shares? Prohibited - No equity investment in a bank?	1-4	(Higher value, more restrictive.) Unrestricted = 1 = a non-bank financial firm may own 100 percent of the equity in a bank; Permitted = 2 = unrestricted with prior authorization or approval; Restricted = 3 = limits are placed on ownership, such as a maximum percentage of a bank's capital or shares; and Prohibited = 4 = no equity investment in a bank.	2
2007	Can nonbank financial firms (e.g., insurance companies, finance companies, etc.) own any voting shares in commercial banks?	1-4	(Higher value, more restrictive.) (Higher value, more restrictive.) Unrestricted = 1 = a non-bank financial firm may own 100 percent of the equity in a bank; Permitted = 2 = unrestricted with prior authorization or approval; Restricted = 3 = limits are placed on ownership, such as a maximum percentage of a bank's capital or shares; and Prohibited = 4 = no equity investment in a bank.	2

2011	Can nonbank financial firms (e.g. insurance companies, finance companies, etc.) own voting shares in commercial banks? Please see options provided and select option that best characterises your banking sector
	a. Nonbank financial firm may own 100% of the equity in a commercial bank.
	b. Nonbank financial firm may own 100% of the equity in a commercial bank, but prior authorization or approval is required.
	c. Limits are placed on ownership of banks by nonbank financial firms, such as maximum percentage of a commercial bank's capital or shares.
	d. Nonbank financial firms cannot own any equity investment in a commercial bank
		(Higher values indicate more restrictive.)
		a = 1;
		b = 2;
		c = 3; and
		d = 4.
				2

Capital Regulatory Index

Table A.4.7 Overall Capital Stringency

Survey Year	Description	Range	Quantification	Trinidad and Tobago Score
1999	Is it risk-weighted in line with Basle guidelines? Does the ratio vary with a bank's credit risk? Does the ratio vary with market risk? Before minimum capital adequacy is determined, which items are deducted from capital: • Market value of loan losses • Unrealised securities losses • Unrealised foreign exchange losses What fraction of revaluation gains is allowed as part of capital?		(Higher values indicate greater stringency.) Yes = 1; No = 0.	4
2003	Is this ratio risk weighted in line with the Basle guidelines? Does the minimum ratio vary as a function of an individual bank's credit risk? Does the minimum ratio vary as a function of market risk? Before minimum capital adequacy is determined, which of the following are deducted from the book value of capital: • Market value of loan losses not realised in accounting books? • Unrealised losses in securities portfolios? • Unrealised foreign exchange losses? What fraction of revaluation gains is allowed as part of capital?		(Higher values indicate greater stringency.) Yes = 1; No = 0.	3
2007	Is this ratio risk weighted in line with the 1988 Basle guidelines? Does the minimum ratio vary as a function of an individual bank's credit risk? Does the minimum ratio vary as a function of market risk? Before minimum capital adequacy is determined, which of the following are deducted from the book value of capital? • Market value of loan losses not realised in accounting books? • Unrealised losses in securities portfolios? • Unrealised foreign exchange losses? What fraction of revaluation gains is allowed as part of capital?			3
2011	Which regulatory capital adequacy regimes did you use as of end of 2010 and for which banks does each regime apply to (if using more than one regime)? Mark the appropriate response below and specify for which types of banks each regime applies a. Basel I b. Basel II c. Leverage ratio d. Other (please explain) Which risks are covered by the current regulatory minimum capital requirements in your jurisdiction? Please specify all applicable risks. a. Credit risk c. Operational risk d. Other risks (please explain) Are the following items deducted from regulatory capital? Enter Yes or No for each option. If the response is no, please explain their treatment.	.	(Higher values indicate greater stringency.) Yes = 1; No = 0.	7

	d.Unrealised losses in fair valued exposures Please explain a. Goodwill Please explain b. Deferred tax assets Please explain c. Intangibles Please explain e. Investment in the capital of certain banking, financial and insurance entities which are outside the scope of consolidation Please explain What fraction of revaluation gains is allowed as part of capital?			

Capital Regulatory Index

Table A.4.8 Initial Capital Stringency

Survey Year	Description	Range	Quantification	Trinidad and Tobago Score
1999	Are the sources of funds to be used as capital verified by authorities? Can assets other than cash/govt. securities be used to increase capital? Can borrowed funds be used?		(Higher values indicate greater stringency.) For question 1.5: Yes = 1; No = 0; For questions 1.6 and 1.7: Yes = 0; No = 1. 1.5+1.6+1.7	0
2003	Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities? Can the initial disbursement or subsequent injections of capital be done with assets other than cash or government securities? Can initial disbursement of capital be done with borrowed funds?		(Higher values indicate greater stringency.) For question 1.5: Yes = 1; No = 0; For questions 1.6 and 1.7: Yes = 0; No = 1. 1.5+1.6+1.7	0
2007	Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities? Can the initial disbursement or subsequent injections of capital be done with assets other than cash or government securities? Can initial disbursement of capital be done with borrowed funds?		(Higher values indicate greater stringency.) For question 1.5: Yes = 1; No = 0; For questions 1.6 and 1.7: Yes = 0; No = 1. 1.5+1.6+1.7	2

2011	Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities? Can the initial disbursement or subsequent injections of capital be done with assets other than cash or government securities? Can the initial disbursement or subsequent injections of capital be done with assets other than cash or government securities?	.	(Higher values indicate greater stringency.) For question 1.4.2: Yes = 1; No = 0; For questions 1.4.3 and 1.5: Yes = 0; No = 1. 1.4.2+1.4.3+1.5	2