The Impact of Macroeconomic Uncertainty on Commercial Bank Lending Behavior in Barbados

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Draft

Abstract

This paper investigates the relationship between macroeconomic uncertainty and the allocation of commercial bank lending in Barbados. Using an empirical framework that describes the relationship between macroeconomic uncertainty and commercial bank portfolio holdings, it was found that there is a statistically significant negative relationship between macroeconomic uncertainty and the cross-sectional dispersion of the loan-to-assets ratios of commercial banks.

1. Introduction

The banking system can be described as the most important source of finance for businesses and individuals in Barbados[1]. At the end of 2009, the consolidated asset base of commercial banks accounted for approximately 80.6% of the assets of depository corporations, while the loans portfolio was 74.5% of the total loans made in the financial system. Furthermore, with commercial banks assets being 1.4 times the size of the national GDP of Barbados, it is of interest to examine how commercial banks have transformed their operations over time. For the purposes of this paper, the analysis will be limited to how banks have adjusted their assets portfolios. Specifically, how banks' holdings of loans have responded to macroeconomic uncertainty.

Banks, which are an integral component of any well-functioning financial system, perform an intermediary role in the economy, linking potential borrowers to lenders, a role that is important to the development of firms and businesses and so their influence is vital to real economic growth. Additionally, commercial banks are important to the transmission of monetary policy in an economy. These relationships are dependent on the focus displayed by banks in the management of their portfolios, and in turn will influence how asset portfolios are managed. Some factors which have been found to influence the evolution of banks' portfolios over time include such institutional factors as the ownership structure of banks, differences in bank size, and the impact of capital requirements; as well as systematic factors inclusive of changes in government activity, household activity and the general macroeconomic environment that exists in a country. It has been found that while large banks may have a comparative advantage in lending to large companies, that small banks may have a comparative advantage in lending to small customers (Haas et al. 2010). It was also found that macroeconomic uncertainty has an impact on the portfolio holdings of commercial banks (Baum et al. 2009).

This paper performs an assessment of the response of commercial bank's loan holdings to macroeconomic uncertainty in Barbados. To achieve this goal a measure of the cross-

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[1] This point was made by Craigwell et al. (2005)

sectional dispersion of the ratio of total loans to total assets is regressed on a measure of macroeconomic uncertainty, with the cross-sectional variation of the loans-to-assets ratio measured over time being representative of the level of cross-sectional dispersion. This paper adopts the model introduced by Baum et al. (2009), who presented a testable framework within which macroeconomic uncertainty is expected to impact upon commercial bank lending behaviour. The empirical framework established by Baum et al. has been tested for the United States, the United Kingdom and Canada, and one of the aims of this paper is to examine if the relationship described in those previous studies will hold in the case of Barbados. The model is estimated by generalised method of moments (GMM). The findings of this paper show that there appears to be a negative relationship between macroeconomic uncertainty and the dispersion of commercial banks' loans-to-asset ratios. That is, evidence suggests that in times of increased macroeconomic uncertainty, commercial banks display a measure of what Quagliariello (2009), in an earlier study, referred to as herding behaviour in banks' portfolio decision making.

The rest of this paper is structured as follows. In section 2, the model used by Baum et al. is presented. A brief literature review is presented in section 3. Section 4 describes the econometric methodology and results of the empirical investigation, and section 5 concludes the paper.

2. Macroeconomic Uncertainty and Bank Lending

Understanding how commercial banks respond to the business cycle is important in that it allows decisions makers to adapt policy aimed at building the resilience of the financial system, of which banks are an integral component. A framework which describes how banks manage their asset portfolios in response to macroeconomic uncertainty has been developed by Baum (2009). Baum et al. (2009) argued that macroeconomic uncertainty should have an impact on the lending strategies of commercial banks, by affecting the ability of bank managers to predict returns from lending opportunities. Baum et al. (2009) claimed that in times of high macroeconomic uncertainty, banks are likely to act more

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homogeneous in their portfolio decisions while in periods of low macroeconomic uncertainty, the lending behaviour of banks may be more heterogeneous.

Baum et al. (2009) proposed that in times of economic tranquility, more information is available to banks on which they can make base their decisions on, and it is expected that the loan-to-asset ratios of banks should be more diversified. On the other hand, as macroeconomic uncertainty increases, bank managers behave more homogeneous in their loan-to-asset ratios. A testable model of how macroeconomic uncertainty impacts on banks' portfolio decisions has been developed by Baum et al. (2009), and is presented in the following paragraphs.

In the model, it is assumed that banks maximize profit by allocating total assets to either loans or securities. Securities are assumed to provide a risk free rate of return ($r_{f,t}$) while the return on loans is determined by a time-varying risk premium which can be represented as $r_{i,t} = r_{f,t} + premium_{i,t}$. The expected risk premium is $E(premium_{i,t}) = p$ and its variance is $Var(premium_{i,t}) = \sigma^2_{\varepsilon,t}$. The return on risky loans is:

$$r_{i,t} = r_{f,t} + p + \varepsilon_{i,t}, \text{ where } \varepsilon_{i,t} \sim N(0, \sigma^2_{\varepsilon,t})$$

It is assumed that bank managers cannot observe the risk premium. They however do observe a noisy signal of the risk premium which can be represented as $S_{i,t} = \varepsilon_{i,t} + v_t$, where v_t denotes the noise and is normally distributed as $v_t \sim N(0, \sigma^2_{v,t})$ and is independent of $\varepsilon_{i,t}$. It is further assumed that although each bank manager observes a different signal, that the noise component of the observed signal is identified in all cases, which proxies for the degree of macroeconomic uncertainty. The inclusion of v_t as a proxy for macroeconomic uncertainty is due to a lack of information sharing amoung banks. The risk exposure of banks is subject to the ability of banks to assess all information available. However because banks do not share their private information the noise component v_t exists.

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Baum et al suggested that " in times of greater turmoil in the economy, a higher variance of v will render bank managers' estimates of the time returns on risky loans less accurate and vice versa."

The optimal forecast of the return from risky loans is

$$E_t\,(\varepsilon_{i,t}\,|\,S_{i,t}) = \lambda_t S_{i,t}$$

where

$$\lambda_t = \frac{\sigma^2_{\varepsilon,t}}{\sigma^2_{\varepsilon,t} + \sigma^2_{v,t}}\,.$$

Therefore total conditional expected returns takes the form

$$E(\,\overline{Y}_{i,t}\,|\,S_{i,t}) = x_{i,t}(r_{f,t} + p + \lambda_t S_{i,t}) + (1 - x_{i,t})r_{f,t}$$

where $\overline{Y}$ denotes total returns. The conditional variance of returns will be

$$Var(\,\overline{Y}_{i,t}\,|\,S_{i,t}) = \lambda_{i,t}\sigma^2_{i,t}\,x^2_{i,t}$$

Assuming that risk averse banks have the following utility function:

$$E(\,\overline{U}_{i,t}\,|\,S_{i,t}) = E(\,\overline{Y}_{i,t}\,|\,S_{i,t}) - \alpha/2\;Var(\,\overline{Y}_{i,t}\,|\,S_{i,t})$$

which is increasing in expected returns and decreasing in the variance of returns conditional on the signal $S_{i,t}$, and α is the coefficient of risk aversion. The ith bank's loan-to-asset ratio is represented as:

$$x_{i,t} = \frac{p + \lambda_t S_{i,t}}{\alpha \lambda_t \sigma^2_{v,t}}$$

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The cross-sectional dispersion of the loan-to-asset ratio is

$$\text{Var}(x_{i,t}) = \frac{\sigma_{\varepsilon,t}^2}{\alpha^2 \sigma_{v,t}^4}$$

A testable relationship is derived by taking the first derivative of $x_{i,t}$:

$$\frac{\partial Var(x_{i,t})}{\partial \sigma_{v,t}^2} = \frac{2\sigma_{\varepsilon,t}^2}{\alpha^2 \sigma_{v,t}^6} < 0$$

which says that as macroeconomic uncertainty increases, then the cross-sectional variance of the loan-to-asset ratio decreases. The relationship between uncertainty and the loan-to-asset ratio is the relationship that will be tested in the rest of the paper.

3. Literature Review

Haas et al. (2010) examined how bank characteristics and the institutional environment influence the composition of banks' loan portfolios. The variables that they suggest will have the most significant impact on the composition of bank's loan portfolios were bank ownership, bank size and the legal environment that is faced by the banks in a country. Haas et al. found that small banks lend more to small and medium sized enterprises compared to large banks, which had an advantage in lending large clients. The authors also found that foreign banks dominated in terms of lending to foreign firms.

Leahy and Whited (1995) examined the effect of uncertainty on firm investment for the United States. The authors used a panel of firms and found that an increase in uncertainty decreases investment.

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Rossi et al. (2009) made an assumption that bank managers are not risk neutral. The authors noted that managers who display characteristics of risk aversion may at times be more selective in terms of their portfolio holdings. In their study, Rossi et al. (2009) found that diversification reduces the realized risk faced by bank.

Baum et al. (2009) empirically investigated whether there was a relationship between macroeconomic uncertainty and the cross dispersion of commercial bank loans for the United States commercial banking sector. Their priori assumption was that the cross-sectional dispersion of the loan-to-asset ratios of commercial banks should narrow as economic uncertainty increases, and that a decline in uncertainty will lead to a widening of the cross dispersion of banks' loan-to-asset ratios. Using quarterly data for the period 1979 – 2003, the measure of cross-sectional dispersion used was the cross-sectional standard deviation of the loan-to-asset ratios of US commercial banks. Baum et al. estimated two general specifications of their model, where they used two different measures of macroeconomic uncertainty obtained by estimating the conditional volatility in GARCH models of inflation and industrial production growth. The results from the econometric analysis confirmed that as macroeconomic uncertainty increases, the cross dispersion of the loan-to-asset ratios decreases.

Quagliariello (2009) conducted a study on the impact of uncertainty on banks' lending decisions for Italy. Similar to Baum (2009), the author also investigated the role of macroeconomic uncertainty in banks' lending decisions. The author used a similar model to Baum et al. (2009), albeit with a few innovations. The measure of dispersion used was the cross-sectional coefficient of variation rather than the cross-sectional standard deviation used by Baum et al. (2009). Quagliariello also included a variable to measure idiosyncratic uncertainty, which allowed him to examine the impact of idiosyncratic risk on banks' lending decisions. The results of the analysis confirmed a negative relationship between the macroeconomic uncertainty and the dispersion of commercial banks loan-to-assets ratio, while also showing evidence of a positive relationship between idiosyncratic uncertainty and the cross-sectional dispersion of banks loans-to-assets ratios.

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4. Data, Methodology and Results

The principle variable of interest in this paper is the cross-sectional dispersion of banks' loans-to-total assets ratios, where dispersion is measured by the cross-sectional standard deviation of the loans-to total assets ratios of all commercial banks in Barbados taken at a point in time. Using this method, a quarterly series of dispersion is obtained for the period 1996 Q1 to 2009 Q4. It must be noted here that a population size of just six banks is far from an ideal number to obtain a measurement of cross-dispersion. The obvious reason is the susceptibility of the measurement of cross variability to the presence of any outlier that may occur in the data. This issue of small size is a valid concern; nevertheless, it has been observed that though the data for the banking system in Barbados does vary significantly, there is a general absence of any shocks of note to any one particular bank, which would have exacerbated the problem of small size. The cross-sectional dispersion variable is plotted in figure 1. Of note, is the period during the middle 2000s where there was a sharp downturn in the measure of dispersion amoung commercial banks. Other than that the transition in the plotted series seems to have occurred at a gradual rate over the sample period.

Figure 1.
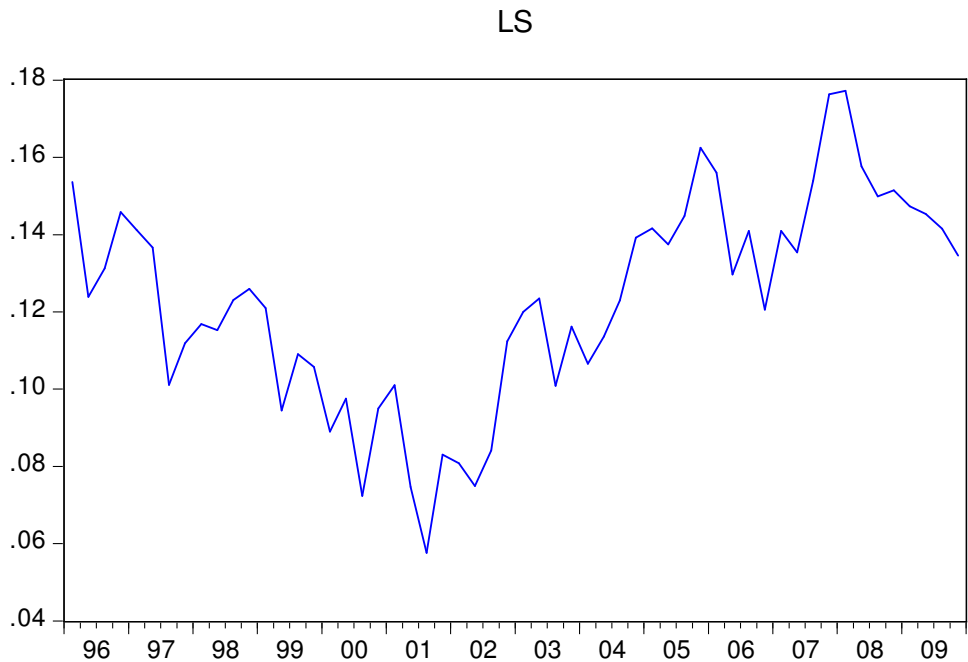
Macroeconomic Uncertainty

A GARCH measure of volatility would have been the preferred option to measure macroeconomic uncertainty, however, GARCH effects were not found in the estimation of a mean equation of several macroeconomic variables. Therefore, the measure of uncertainty used in this paper can be considered to be more of a naïve proxy of macroeconomic volatility and is derived from the residuals of an autoregressive model of seasonally adjusted quarterly tourist arrivals. It is assumed that any uncertainty that may be present in tourist arrivals will be an adequate representation of macroeconomic uncertainty in Barbados. The forecasting model of tourist arrivals is:

$$TR_t = a + b*TR_{t-1} + \mu_t \qquad\qquad (1)$$

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Overlapping standard deviations of five year periods are calculated of the residuals of equation 1[2]. The resulting data series is the measure of macroeconomic uncertainty used in the main empirical model of this paper.

The Empirical Model

The empirical model can be represented as follows:

$$LS_t = a + b*UN_t + c*\Delta TR_t + \upsilon_t \qquad (2)$$

where LS_t is the cross-sectional dispersion of the loan-to-assets ratios of Barbados' commercial banks at time t; measured as the cross-sectional variance of banks' loan-to-asset ratios. UN_t is the proxy of macroeconomic uncertainty obtained from equation 1, and υ_t is an error term with zero mean and constant variance. Additionally, the growth of tourist arrivals, ΔTR_t, is included as a control variable.

It is expected that the sign of the coefficient of the uncertainty term should be negative, reflecting an inverse relationship between macroeconomic uncertainty and the loan-to-asset ratios of commercial banks. The equation, (1), was estimated by a GMM estimator to account for non-linearity in the data. The uncertainty variable was instrumented by a it's one period lag value. The direction of the response to tourism growth is ambiguous.

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[2] A similar uncertainty measure was used by Ghosal and Loungani (2000)

Table 1. Results for estimation of the loans-to-assets ratio

Regressors	Coefficient	Std. Error
UN_t	-0.714	0.133***
ΔTR_t	0.004	0.002
Constant	3.713	1.113***
R^2	0.699	
J-statistic	0.000	

*** denotes significance at the 1% level.

The results of the empirical investigation are summarised in table 1. It is revealed that there is a statistically significant negative relationship at the five percent level between the proxy for macroeconomic uncertainty and the cross dispersion of commercial bank loan holdings. It can therefore be surmised that commercial banks in Barbados do exhibit some level of homogeneity in their holdings of loans as macroeconomic uncertainty increases. This finding is in line with that observed by Quagliariello (2009) and Baum et al. (2009) and suggests that commercial banks in Barbados do exhibit some level of homogeneity in their decision making in regards to their holdings of loans as macroeconomic uncertainty increases. However, a significant relationship was not found for tourist arrivals growth.

5. Conclusion

This paper examines the relationship between macroeconomic uncertainty and the dispersion of commercial banks' loans-to-assets ratios in Barbados. The relationship was modeled by a generalised method of moments (GMM) estimator for the period 1996 Q1 to 2009 Q4, where it was found that as macroeconomic uncertainty increases, the dispersion in the level of total loans as a proportion of total assets within the banking system diminishes. This result was similar to that found in previous applications of the empirical model to the United States and Italy and suggests that the assertion made by

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Baum et al. (2009) that commercial banks display herding behavior as the level of uncertainty increases, may be relevant to Barbados.

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