Heterogeneity in the Influence of Monetary Policy: An Empirical Analysis Focused on the Philippines

by Laura B. Fermo

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Correspondence: Laura B. Fermo, Bangko Sentral ng Pilipinas (BSP), Room 513, 5-Storey Building, BSP Complex, Mabini corner P. Ocampo Sts., Malate, Manila, Philippines 1004. Email: lfermo@bsp.gov.ph

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The author also wishes to thank her family, who has been her greatest inspiration.

DECLARATION

Except where otherwise indicated, this thesis is my own work.

Laura B. Fermo

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OVERVIEW OF THE DISSERTATION

Monetary policymakers are concerned with how much influence they can exert over market interest rates. Looking at how far and when relevant market interest rates are deviating from policy rates provide us with a perspective of how the degree of influence of the central bank's main policy rate over market rates change over time and, if there are periods of divergence found, an understanding of what factors are causing this divergence. It is generally well accepted that the degree of influence of central banks on market interest rates is a reflection of central bank choice between several monetary policy objectives: monetary independence, exchange rate stability, and financial openness—the degree of attainment of which vary significantly across different policy frameworks, between different stages of development, and over time. In addition to this, more recent literature have come to realize that how much the central bank policy rate can influence market interest rates could as well be driven by financial market characteristics. Hence, given that different factors affect the degree of influence of monetary policy in the economy, then it is reasonable to expect that there will be heterogeneity in the response to this influence: heterogeneity across different economies because of differences in monetary policy objectives and financial market characteristics, and heterogeneity in the response of different banks in terms of growth in bank lending and bank lending rates being the main sector by which monetary policy interest rates affects the rest of the real economy, especially in consideration of the new financial environment brought on by the recent global financial crisis.

In the first chapter, we take a closer look at the policy rate divergence of the ASEAN-4 economies: the Philippines, Indonesia, Malaysia and Thailand. In this chapter, we utilize a Markov-type regime-switching regression (MS Regress) with time-varying transition probabilities empirical technique. Our empirical findings confirm that the policy rate divergence in the ASEAN-4 economies is indeed regime-switching, and the switching is best depicted to occur within a two-regime specification. In addition, because the indicators we have tested in the estimation significantly drive the transitional probabilities, we establish further that this regime-switching is time-varying as well. The MS Regress model allowed us to conduct a deeper investigation, by testing empirically what are significant determinants of the switching probabilities from one regime to the other, and in the end enabled us to identify and characterize the drivers of the transition probabilities themselves. We were hence able to test and with a robust specification and methodology, how attractiveness and sensitivity factors figure into the transitional probabilities of the regime-switching rate gap. We then proceed with a more in-depth analysis of these determinants, as well as the associated monetary policy, macroeconomic, and external developments in the context of the Trilemma principle which have occurred across the ASEAN-4 during both the low rate gap periods and high rate gap periods that could explain both the similarities (within each subgrouping) as well as the heterogeneity in the timing and magnitude of the rate gap across the four economies.

In the second chapter of this study, we again estimate empirically the policy rate divergence in the Philippines and the three other members of the ASEAN-4: Indonesia, Malaysia and Thailand in order to corroborate our results in Chapter 1 of the study. We established that even in consideration of the volatility in the rate gaps and utilizing MS GARCH with conditional variance technique as an alternative methodology, we still find that there is, in fact, regime-switching in the policy rate gaps of these economies. We discover as well, that even with their similarities, empirical results indicate that the region is not a homogenous set in terms of the timing and magnitude of the policy rate divergence. Via events analysis, we also identified graphically the variables that appear to drive or trigger the transition probabilities of the regime switches. In particular, in this chapter we were able to identify the switches which are associated with significant Trilemma index changes. We were not able to figure this variable into the study in Chapter 1 as it is an annual measure which then can only be assessed in terms of its association with the timing of the regime switches via a simple events analysis.

In the third and final chapter, we examine the influence of monetary policy in the Philippines at the micro level, and evaluate it in terms of the response of bank lending growth and bank lending rates on the Reverse Repurchase (or RRP) Rate, the main policy instrument of the BSP. We use data at the individual bank level in order to establish heterogeneity in banks' response to monetary policy and the business cycle. Using Panel Data Estimation, we estimated regression coefficients for monetary policy rate changes, changes in macroeconomic indicators (real GDP

growth and inflation), bank characteristics including indicators for size, liquidity and capitalization as explanatory variables, as well as the interaction variables between the monetary policy variable and these macroeconomic indicators and the five bank characteristics we have chosen to study. More importantly, we also include in this empirical exercise a dummy variable denoting bank affiliation or holding status as an interactive variable with the monetary policy indicator and the macroeconomic policy variables. We conduct this estimation technique for all 20 banks in the sample, as well as for 10 domestic banks and then 10 foreign banks in the subsample.

CHAPTER 1

Policy Rate Divergence in the ASEAN-4: An Empirical Analysis Using Markov-Switching with Time-Varying Transition Probabilities[1]

1. Introduction

In this study, we would like to: 1. establish that the gap between the policy rate and the short-term market interest rate in the case of the Philippines, Indonesia, Malaysia, and Thailand follow a Markov-type regime-switching process and, 2. test further whether the transition probabilities of the regime-switching in the rate gap for these economies are time-varying, by identifying what variables, either common to emerging markets such as measures of global risk appetite and US monetary policy, or idiosyncratic factors relating to the financial market characteristics of each economy, are driving the transition probabilities. We will use a Markov-Switching (MS) Regression model with time-varying transition probabilities (TVTP) based on Filardo (1994, 1998). Establishing what factors are driving the switches in the rate gap can help policymakers understand why there are periods of divergence, and at the same time identify those indicators which would then be important to follow closely and possibly be used as early warning system or leading indicators to help anticipate periods of weaker influence versus periods of stronger monetary policy influence, or as part of an interest rate forecasting model. Our objective in this paper is to characterize the data on the rate gap, rather than explicitly model its behavior. The paper goes as follows: Section 2 summarizes the literature in this area of study. Section 3 discusses the characteristics of financial markets in the ASEAN-4, the data used, and the empirical methodology. Section 4 presents and analyses the empirical results. In Section 5 we conclude and submit areas for future study.

2. Review of Related Literature

In theory, money market rates and Treasury bill yields are expected to be at a premium over overnight monetary policy rates reflecting term, liquidity, and credit or counterparty risk factors. This relationship reflects the interest rate channel which remains as the key transmission channel of monetary policy in emerging markets (EMs) (Mohanty and Turner, 2008). For the purposes of this paper, the degree of influence or the effectiveness of monetary policy is represented conceptually by the gap computed as the policy interest rate less the benchmark interest rate identified for four ASEAN-4 economies (ASEAN-4), Indonesia, Malaysia, the Philippines and Thailand, and we term this gap as the rate gap. The closer or higher the benchmark interest rate is compared to the policy rate, the more effective monetary policy is in influencing market interest rates. Policymakers are not concerned about periods of close to zero or negative rate gaps because they are expected given term and the other risk factors we enumerated above.

[1] Published as Fermo, L. B. (2016). Policy Rate Divergence in the ASEAN-4: Impact of Global Risk Perception and Financial Market Characteristics. Theoretical and Practical Research in Economic Fields (TPREF), Volume VII, Summer, 1(13): 30-52. DOI:10.14505/tpref.v7.1 (13).03. Available from: http://www.asers.eu/journals/tpref/curent-issue.

More importantly, low or negative rate gaps represent periods when the degree of influence of the central bank policy rate is the strongest. However, it is during those periods when market interest rates fall below the policy rate—the high rate gap periods—when policymakers are most worried. Given that the relevant market interest rate acts as a benchmark for lending rates in the transmission process, a positive and high rate gap means that the impact of policy rates on lending rates are believed to be blunted. This is a concern for central banks because when market interest rates are below the policy rates, the general expectation is that they could translate to lending rates which are lower than the levels which are consistent with the central bank's forecasts, its intended policy stance as well as its targets for policy objectives.

There is a girth of literature where the time series properties of short-term market interest rates are estimated. However, only a few studies such as Panigirtzoglou, et. al. (2000) and Affandi and Peiris (2012) have studied empirically the behavior of the divergence of market interest rates from the policy rates used by central banks. Panigirtzoglou et. al. (2000) looked at the volatility and persistence of the divergences between short-term market interest rates and policy rates using Brenner et.al.'s (1996) class of models that combine a model of the levels and a volatility GARCH model of market interest rates for Germany, Italy and the United Kingdom. More recently, Affandi and Peiris (2012), assessed whether the gap between the central bank policy rate and Treasury bill rates (but computed as Treasury bill rates less the policy rate) has blunted the effectiveness of the interest channel of monetary policy for the Philippines. They, too, utilized a single-regime GARCH model where the conditional variance process accommodated both volatility clustering and dependence on the level of interest rate as in Panigirtzoglou et. al. (2000) and Brenner et. al. (1996). Affandi and Peiris (2012) also estimated the persistence and volatility of the deviation of market rates from policy rates, the determinants of the divergence of market rates from policy rates, and the interest rate transmission mechanism and its relation to prevailing lending conditions in the Philippines. Based on their findings, liquidity, portfolio flows, fiscal factors and the supply of government securities appeared to be driving the rate gap for the Philippines, but proposed that global factors such as monetary policy in advanced economies and global liquidity may also be driving the divergence.

In contrast to these two studies which utilized single-regime GARCH models, we relax the assumption of a single regime in this study, in favor of a Markov-type regime-switching regression model for the rate gap. Regime-switching models in general allow us to model data generated by shifting or changing economic mechanisms within a single unified model, and are therefore more complex, flexible structures. To account for the possibility that the economic relationships that generate the gap between the policy rate and the market interest rate undergo a finite number of changes over the sample period, the coefficients in this model are different in each regime. Although the regimes are unobserved, the coefficients can be estimated, and probabilistic statements can be made about the relative likelihood of the occurrence of the regimes, conditional on a given information set (Gray 1996).

The Markov-switching mechanism was first considered by Goldfeld and Quandt (1973). Hamilton (1988, 1989) introduced the fixed transition probability (FTP) Markov-switching model and applied it for use in dynamic macroeconomic analysis. As an extension of the FTP Markov-switching model to incorporate time-varying transition probabilities, Filardo (1994) developed a first-order Markov process with state-dependent transition probabilities governing the switching between regimes. In this time-varying transition probability (TVTP) Markov-switching model, transition probabilities are allowed to vary with variables such as the strength of the economy, deviations of fundamentals from actual values, and other leading indicators of change (Filardo, 1998). His work on the Markov-type regime-switching TVTP model was first applied to business cycle analysis for the US. As of this writing, there is yet no published study in the literature delving on the implication of changing global risk appetite and financial market idiosyncrasies on the divergence between the policy rate and the benchmark interest rate. The application of Markov-switching regression as an empirical technique for data on the rate gap and its relationship with global factors and financial market characteristics are also relatively new and more so for emerging Southeast Asia as a group.

In identifying potential variables that could account for the switching in the rate gap, the literature points out that while central bank objectives affect the level and direction of the policy rate, financial market characteristics affect the ***sensitivity*** of asset market yields to international investment flows. On the other hand, global factors such as the

perception of risk on EMs that is prevailing in global markets, US monetary policy and global liquidity affect the ***attractiveness*** of these asset markets to foreign investors. Because these two classes of factors affect either the supply, the demand or the price of the relevant asset, both affect movements in benchmark yield rates and hence, the rate gap. Cerutti et.al. (2015) found in their study that financial market characteristics, such as liquidity in the recipient country and composition of the foreign investor base, rather than macroeconomic fundamentals, most robustly explain some emerging countries' sensitivity to global factors affecting capital flows. The taper-tantrum in May-June 2013 illustrated that not all EMs are equally exposed to the same changes in global conditions. Meanwhile, Ahmed, et. al (2015), Forbes and Warnock (2012) and Ghosh et. al. (2014) have documented the importance of global factors such as advanced economy interest rates and global risk appetite in affecting capital flows to small open economies. Cerutti et. al. (2015) noted as well that various episodes of large, on and off waves of non-resident capital flowing to and from EMs over the past decade has re-emphasized the importance of common factors in driving global capital flows. Milesi-Ferretti and Tille (2011) and Rey (2015) are in consensus on the significant impact of US monetary policy, the supply of global liquidity, and global risk perception in helping explain the flow of foreign capital into asset markets of EMs. What is central in all the literature we have discussed above is that various global factors including measures of risk perception, as well as the idiosyncratic characteristics of the relevant asset markets, are the relevant variables in understanding the movements in the rate gap of the ASEAN-4 because they are the main drivers of non-resident capital flows that affect both the policy rate and the benchmark interest rate and hence, the rate gap.

It is interesting to note further, that the monetary policy objectives of the central bank could also have an effect not only on the policy rate per se, but also on either the sensitivity of relevant asset markets or the attractiveness of these asset markets to international flows, or both. This is because the central bank's decision among three objectives: monetary independence, exchange rate stability, and financial openness has some bearing on not only the policy rate itself, but also on the wedge between the policy rate and the market interest rate. In understanding the behavior of the rate gap and the factors that are driving its recurring cycle of convergence and then divergence, it is therefore helpful to look at it within the context of the Impossible Trinity principle. For one, an important factor to consider in understanding the movements in the rate gap in emerging economies is that what is "chosen" by the domestic financial market as the benchmark rate with which to price loans—the direct channel by which policy interest rates are transmitted into lending rates and ultimately into prices and output in EMs—are the yields for assets which are attractive to both resident investors as well as non-resident ones. As long as this asset market is liquid enough and volumes are adequate, it becomes the natural "benchmark" interest rate. For the same reason, this benchmark asset market is potentially highly responsive to non-resident investment flows.

The theory of the Impossible Trinity or the Trilemma in fact usually requires an extremely high degree of substitutability between domestic and foreign assets, but this perfect substitutability is rarely seen in the real world. What we do see, however, is that the yields of assets which are invested upon by both residents and non-residents alike is the most responsive to both monetary policy and global factors so that often, asset markets with this characteristic is where we can observe the Trilemma story coming into play. We can say descriptively that the constraints of the Impossible Trinity become binding during periods of positive and high rate gaps in the relevant asset markets, whereas the Impossible Trinity constraints become loosened during those periods of close to zero or negative rate gaps or when the benchmark rate is close to or higher than the policy rate. Periods of high global risk premia in emerging economies act as a "natural wall" against disruptive capital flows, so that in this environment, impossible trinity constraints have been loosened because the third side of the Trilemma triangle—perfect capital mobility—appear to be irrelevant because high risk premia acts as some form of a natural barrier against volatile or yield-seeking foreign capital. Meanwhile, during periods of low global risk premia when this natural wall disappears, the reverse is true.

The literature on global financial market analysis also noted that an important repercussion of both the Asian financial crisis (AFC) and the global financial crisis (GFC) relevant to our study at hand is that the financial system of emerging Asian economies became entrenched in an environment where some kind of a risk-on, risk-off (RoRo) cycle in short-term foreign investment flows prevails. Grenville (2011) recognized this as well, describing how global investors have been taking advantage of the opportunities from interest rate differentials in emerging countries in their favor, in waves of confidence with retreats or sudden stops when confidence evaporates and the rational investor exits,

analogous to a bank run. He adds that these sudden changes in assessment are explicable in terms of global investors' imperfect knowledge, so that shifts in assessment can be triggered by the arrival of news, or by other investors' actions. In the end, these leave emerging countries as the reluctant hosts to non-resident short-term capital flows, which cause volatility not only to exchange rates, but to asset prices as well. Indeed, global investors appear to be caught in a binary view of the world and as a result, their appetite for risk rises and falls over time.

Risk-on, risk-off behavior is particularly true for portfolio funds, where periods of perceived low financial risk encourage investors to take risk, therefore creating a risk-on situation, and periods of perceived high financial risk cause investors to take less risk, creating a risk-off situation.[2] RoRo could cause investors to behave in a herd-like manner and is more likely to occur in times of economic uncertainty.[3] Hence, the switching between high and low appetite for emerging market bonds and securities began to happen more frequently and in greater intensity in the fallout to the GFC, and the subsequent adoption of unconventional monetary policy by the US Federal Reserve, the European Central Bank, and the Bank of Japan and, more recently, with the uncertainty about the timing of exits from such policies. The 2008 GFC, for example, is generally viewed as a risk-off year, when global investors reduced risk by selling existing risky positions and moving money to either cash positions or low to no-risk positions, such as U.S. Treasury bonds. Meanwhile, during 2009-2010, global funds were invested in higher-risk instruments in search of better yields, and when EMs showed a higher degree of resilience and registered better economic and inflation performance than the advanced economies, global funds were transferred into emerging financial markets as a result—a risk-on period.

We can then then relate these three themes together: the regime switching in the rate gap, the risk on, risk off or RoRo cycle in global investor appetite, and the Trilemma story. The regime-switching in the rate gap is potentially driven by changing global risk perception which, in turn, is driven by the risk-on, risk off behavior of short-term foreign capital. There is some kind of "natural wall" provided by high global risk perception during risk-OFF episodes, which discourages the influx of these disruptive, short-term foreign capital flows especially those of the carry trade variety into relevant EM financial markets. Meanwhile, during episodes when global risk premia are low—the risk-ON episodes—this natural wall is gone and the Trinity constraints become binding, but only in the asset markets that are accessible and attractive to speculative, short-term non-resident flows, such as portfolio capital. In this sense, we can find unique regimes in EMs when the Impossible Trinity story is prevailing not in the entire financial system, but only in those bond markets which are both ***attractive*** and ***sensitive*** to non-resident portfolio flows.[4] Policy-overwhelming international capital flows and its implications to monetary policy are central to the Impossible Trinity[5] story.

Aizenman and Ito (2014) and Ito and Kawai (2014) both shared how for small, open emerging economies, the Trilemma policy constraints are binding such that given the varying degrees of free capital mobility in these countries, they are wrought with the challenges of disruptive capital flows to monetary policy. Based on a case study by Hsing (2012), there is a Trilemma situation in the Philippines, Malaysia, and Singapore, but he did not find evidence for a similar situation in Indonesia and Thailand. Hsing (2012) noted further that different macroeconomic policy combinations prevailed in these three economies over time, rendering the ability to switch to different policy combinations in order to deal with major economic events, such as a crisis.

[2]Geordie Clarke, Financial Times, http://lexicon.ft.com/Term?term=risk-on,-risk-off.
[3]Aimee Steen, Financial Times, *Ibid*.
[4] Foreign direct investment and other long-term flows have an indirect impact on benchmark interest rates, and an entirely different impact on policy rates. As these types of capital flows are also driven by a separate set of global indicators, the dynamics and effects of these type of flows are outside of the purview of this study, and we reserve its study for future research.
[5] The purest or "strict" view of the policy constraints under the impossible trinity is that countries that have barriers to capital mobility and a floating exchange rate can achieve a substantial degree of monetary policy independence, while countries with a fixed exchange rate but an open capital account would attain a lower level of monetary policy independence (Obstfeld et al. 2005). A more nuanced view, however, is that the impossible trinity represents trade-offs, with an economy gaining greater monetary independence as it either allows more exchange rate flexibility or as it prohibits some types of international capital flows permanently or restricts them during certain periods or episodes (Rummel, 2014).

3. Description of the Data and Empirical Framework Used

a. The Data

In this study, we use the available monthly data from January 2000 to May 2015 for each of the four member countries of the ASEAN-4—the Philippines, Indonesia, Malaysia, and Thailand. In measuring the rate gap that we will be using in the estimation, we have identified the appropriate short-term benchmark interest rates for the four economies being reviewed based on stylized facts in the literature as well as through central bank consultations describing the asset markets which are most liquid and attractive to both resident and nonresident investors. Meanwhile, the main policy rates were obtained from each of the ASEAN-4 central banks. As discussed in the previous section, the rate gap represents the degree by which the monetary authority maintains its influence or control over the market interest rates prevailing in each of the four economies: the lower the rate gap, the higher the degree of influence of monetary policy over short-term market interest rates and vice versa. All interest rate data series were taken mainly from the CEIC database augmented by respective central bank data, as needed. Financial market data were either in monthly or quarterly frequency obtained largely from the AsianBondsOnline database of the ADB, augmented by central bank data, where applicable. Data available, however, were not uniform in frequency and in terms of the number of observations, and can vary depending on each specific data and for each country. Appendix Table 1 shows in detail further information on data definitions and specific sources and series names used in the empirical estimation, as well as the expected signs for each variable in the empirical exercise.

The Interest Rate Gap

Policy interest rates are expected to anchor money market rates, whereas Treasury bill (Tbill) yields act as benchmarks for deposit and loan rates. As noted earlier, money market rates and Tbill yields should be higher than overnight policy rates in theory, reflecting term, liquidity and credit risk factors. In the ASEAN-4, however, there were specific periods when benchmark interest rates have become significantly lower than the policy rate. Figure 1 displays the movements of the policy rate, the benchmark interest rate and a risk premium measure in each of the four countries between January 2000 and May 2015. We can see from Figure 1 how the divergence between the main policy rate and the short-term benchmark interest rate in the ASEAN-4 have evolved over time. The gap between the dotted line and the solid line in the figure is the rate gap, while the bars are the levels of sovereign risk premium in basis points. What we can surmise from interest rate gap data is that the magnitude of the divergence and convergence between the policy rate and the benchmark interest rate and the timing of the regime-switching in the rate gap appear to vary over time for the four economies, so that the dynamics behind rate gap movements could be different for each economy. This variation and the potentially different impact of global factors and idiosyncratic financial market characteristics on the rate gap would have been lost under panel data estimation. This holds support to our use of a Markov-switching, time-varying transition probability model in order to understand the dynamics and drivers of the regime-switching rate gap for each individual country in the ASEAN-4.

For the Philippines, for example, what is observable from Figure 1 is that there are two distinct alternating cycles of larger and then smaller or zero to negative gap between the policy rate and the short-term benchmark interest rate, associated with increasing country risk premiums versus periods of declining country risk premiums, respectively. This trend is also shared by Indonesia where recently, money market rates have fallen well below the policy rate. In Malaysia, Sharifuddin and Ling (2014) pointed out that due to the surge in portfolio flows in 2007, and then again in 2010 and 2011, the entire yield curve fell below the overnight policy rate. In Thailand, the decline in spread of country sovereign bond prices to risk free bond prices (CDS spreads) in 2005, and the lower Emerging Bond Market Index+ (EMBI+) spreads for Thailand in 2007 and then again in 2009 to 2011 was associated with one-month Tbill rates falling below the policy rate.

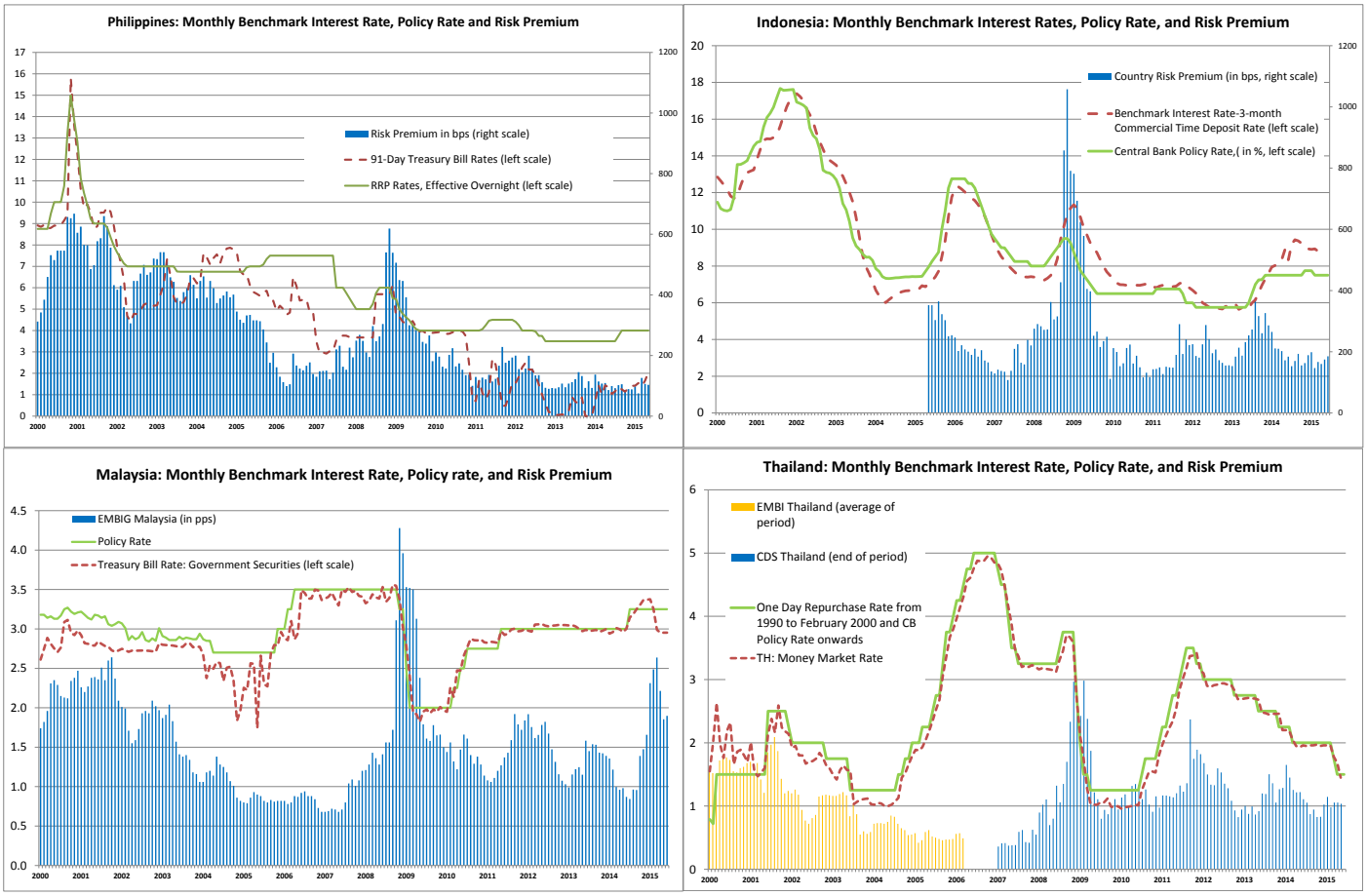


Figure 1: The Rate Gap vs. Country Risk Premium in the ASEAN-4

Financial Market Characteristics

Data on financial market characteristics, primarily the investor profile of local currency bonds as well as foreign currency bonds which we have hypothesized in the previous section as potential variables affecting the **sensitivity** of the rate gap, are available either a monthly or quarterly frequency. The majority of the data available begins in January 2000 and ends in March 2015 and were obtained primarily from the Asian Development Bank's (ADB) Asian Bonds Online database with url www.asianbondsonline.adb.org, as well as the central banks and finance ministries in the case of countries whose data are not available in this website.

Data for the Philippines' foreign holdings of local currency-denominated (LCY) bonds from the Department of Finance is available from 2005 to 1Q 2015, and non-residents' vs. residents' holdings of foreign currency denominated (FCY) bonds is available from the Bangko Sentral ng Pilipinas (BSP) from 2006 to 2015 Q1. The frequency of the available data is quarterly for the more recent period and annual for earlier years. Meanwhile, data for Indonesia, Malaysia and Thailand on the foreign holdings of LCY bonds are reported in AsianBondsOnline.com as a quarterly series. As such, we used the ECOTRIM© program to interpolate all three sets of data into a monthly frequency, using univariate methods. We recognize here there are potential drawbacks of such an interpolation method.

Based on data for the size and domestic financing profile of asset markets in each of the four economies, we see that the Philippine asset market is the thinnest in terms of the volume of domestic financing composed of domestic credit, bonds, or equity among the ASEAN-4, followed by Indonesia. This is especially so for the bond market, as the Philippine bond market amounts to only US$D21.0 billion in 2000 and US$104 billion in 2014, which is about 28% and 21% of total domestic financing, respectively, compared to Indonesia's US$52.8 billion in 2000 and US$123 billion in 2014 (or about 32.0% and 12.3% of the total), Malaysia's US$68.7 billion in 2000 and US$316 billion in 2014 (or about 22.0% and 25% of the total) and Thailand's US$31.0 billion in 2000 and US$281.3 billion in 2014 (or 18.0% and 27% of the total). This observation will be especially relevant in the analysis of empirical results later on.

Meanwhile, in terms of the investor profile of LCY bonds, banks accounted for the biggest share in the total holdings of LCY bonds historically for the Philippines, Indonesia, Malaysia and Thailand. More recently, however, bank holdings have been on a declining trend, accompanied by a trend increase in foreign holdings of government securities. Graphical inspection would in fact show us some sort of an inverse relationship between foreign holdings and commercial bank holdings—while foreign holdings were on the rise, commercial bank holdings of government securities (GS) were on a declining trend in all four economies. Nevertheless, in the case of both the Philippines and Indonesia, commercial banks still account for the biggest share of LCY bond ownership as of 2014 and early 2015.

In terms of the investor profile of foreign-issued and foreign currency-denominated government securities or FCY bonds, we find that historically, the Philippines had the biggest level of FCY debt in US$ value among the ASEAN-4. Indonesia, however, has recently surpassed it with the steepest climb in the levels by the first quarter of 2015. FCY bonds issued by the government as a share to total issuance is also the largest in the Philippines at about 80 percent historically, followed by Indonesia at about 50 percent. In Malaysia, the government's share of FCY bond issuance has shrunk to about 5.0 percent of the total by Q1 2015, whereas banks and financial institutions' share climbed to about 55.0 percent for the same period. Corporates account for the biggest share of FCY bond issuance in Thailand, peaking at about 65.0 percent in 2009, and falling to around 40.0 percent in Q1 2015. The share of the corporate sector in FCY, is also high in Malaysia, following Thailand, at about close to 40.0 percent on the average.

Global Factors

In Section 2, we proposed that global factors are expected to influence the **attractiveness** of the benchmark bond markets to global investors for the ASEAN-4. The global indicators we have used were taken mainly from Bloomberg, the International Monetary Fund (IMF) online database, the CEIC Economic database, the Emerging Portfolio Fund Research, Inc. (EPFR) Web interface, as well as the Institute of International Finance (IIF) online database, using data series available from 2000 to Q1 or March 2015.

We computed and/or obtained several indicators for changes in global risk perception associated with the emerging market assets under review. One is the differential between the interest rate on 10-year dollar-denominated sovereign debt of each country and the interest rate on US 10-year Treasury Notes, which has become a benchmark for most emerging countries in tracking global markets' view of country risk vis-à-vis safe haven assets, such as US Treasuries. Another more commonly used indicator of global risk perception in financial market analysis, and among the most readily available, consist of market information extracted from JP Morgan's Emerging Market Bond Index (EMBI) spreads as well as the spreads of country sovereign bond prices to risk-free bond prices (CDS), both available from Bloomberg. Changes in the market-implied default probabilities extracted from EMBI+ Global Index and the EMBI Index per country, as well as the 5-year CDS premia on sovereign debt are often used in the literature and by market participants as an indirect measure of the market's perception of sovereign risk. We also tested for the significance of HSBC's Risk On – Risk Off (RORO) index in the analysis. This index takes the rolling correlations between the daily returns of the 34 assets they monitor around the world and combines them into a single index. HSBC constructed the index by using principal component analysis to decompose the 34 asset return time series into 34 principal components, which are mutually uncorrelated variables that explain the observed asset returns.

What we finally used in the empirical estimation as the main country-specific risk premium data, which also captures the RoRo, or risk-on, risk-off episodes of global investments in the empirical analysis for each of the ASEAN-4, is the 10-year dollar-denominated sovereign bond rate minus 10-year US Treasury Note for the Philippines and Indonesia, and the EMBI Index spreads for Malaysia. For Thailand, we have combined the CDS data which is available from January 2000 to February 2006 only, with the EMBI Thailand data, which is available from January 2007 to March 2015, in order to have a longer, more useful data series to be used as the risk premium indicator specific to Thailand. The EMBI+ Global spreads as well as HSBC's RORO Index (HSBC Global Research, 2012), meanwhile, serve as global indicators of risk perception that is common to all four emerging economies.

Apart from the individual countries' and global risk premium data, the other global factors we tested as possible regressors of the regime-switching in the rate gap as well as determinants of the transition probabilities consist of global indicators that represent US monetary policy, measures of global liquidity or bond flows going into each emerging market, as well as global volatility indices relevant to emerging markets. These include the US real Federal Reserve Fund rates, the US 10-year Treasury as well as US secondary market yields, EPFR's Bond Flows data going into the Philippines, Indonesia, Malaysia and Thailand and the Chicago Board Options Exchange (CBOE)'s Volatility Index[6] or VIX data.

Further information on the sources, any transformation on the data used, as well as the expected signs for the variables used as regressor of the rate gap or as determinants of the transition probabilities in the study are summarized and presented in Appendix Table 1.

b. Empirical Framework: The Markov Regime-Switching Regression Model

Following Hamilton (1988) and Filardo (1994, 1998), we illustrate the Markov regime-switching regression process by assuming that the random variable of interest, $\boldsymbol{g}_t$, follows a process that depends on the value of an unobserved discrete state variable S_t. We assume there are 2 possible regimes, and the process is said to be in state or regime m in period t when $S_t = m$, for m = 1,2. The switching model then assumes that there is a different regression model associated with each regime. We assume an autoregressive process of the following form:

$$(1) \qquad \boldsymbol{g}_t - \boldsymbol{\mu}_t(m) = \boldsymbol{\varphi}_m (\boldsymbol{g}_t - \boldsymbol{\mu}_t(m)) + \boldsymbol{\varepsilon}_t \quad m = 1,2$$

Where $\boldsymbol{\mu}_t(m)$ is given by:

$$(2) \qquad \boldsymbol{\mu}_t(m) = \boldsymbol{\beta}_m, \text{ for } m = 1,2$$

and $\boldsymbol{\varepsilon}_t$ is an identically, independently (i. i. d.) and normally distributed random variable. From (13), if $\boldsymbol{\varphi_1 = \varphi_2}$ the coefficient of the AR(1) process will be regime independent. If $\boldsymbol{\varphi_1 = \varphi_2} = 0$, there will just be regime-dependent constants in the regression model. It is assumed further that the probability of being in a regime depends on the previous state, that is, it is governed by a first-order Markov process[7] so that

$$(3) \qquad P(\boldsymbol{S}_t = j \mid \boldsymbol{S}_{t-1} = i) = \boldsymbol{P_{ij}}(t) \quad \text{for } i = 1,2;\ j = 1,2.$$

The Basic Model assumes that these probabilities are time invariant, so that $P_{ij}(t) = P_{ij}$ for all t. Clearly, the transition probabilities must satisfy $P_{i1} + P_{i2} = 1$. The transition matrix governs the random behavior of the state variable, and is given by

[6] VIX is a trademarked ticker symbol for the CBOE Volatility Index, a popular measure of the implied volatility of S&P 500 index options calculated by the Chicago Board Options Exchange (CBOE). Often referred to as the fear index or the fear gauge, the VIX represents one measure of the market's expectation of stock market volatility over the next 30-day period.

[7] See also Filardo (1998) and Kim and Nelson (1999) for a more thorough analysis of the model and its estimation.

(4) $$P = \begin{pmatrix} P(S_t = 1 \mid S_{t-1} = 1) & P(S_t = 2 \mid S_{t-1} = 1) \\ P(S_t = 1 \mid S_{t-1} = 2 & P(S_t = 2 \mid S_{t-1} = 2 \end{pmatrix} = \begin{pmatrix} \mathbf{P}_{11} & 1 - \mathbf{P}_{11} \\ 1 - \mathbf{P}_{22} & \mathbf{P}_{22} \end{pmatrix}$$

Our Basic MS-Regress Model refers to the combination of (2) and (4). We are also considering time-varying transition probabilities (or TVTP) model where the transition probabilities may postulated as being functions of some of the exogenous or predetermined variables, so that the transition probabilities may vary with time. In this case, instead of (4), the stochastic process on S_t can be summarized by the transition matrix:

(5) $$P(S_t = s_t \mid S_{t-1} = s_{t-1}, z_t)$$

$$= \begin{pmatrix} \mathbf{P}_{11}(z_t) & 1 - \mathbf{P}_{11}(z_t) \\ 1 - \mathbf{P}_{22}(z_t) & \mathbf{P}_{22}(z_t) \end{pmatrix}$$

where the history of the economic indicators variables is $z_t = \{z_t, z_{t-1}, \ldots.\}$. $\mathbf{P}_{11}(z_t)$ and $\mathbf{P}_{22}(z_t)$ are given by:

(6) $$\mathbf{P}_{11}(z_t) = \frac{exp(z_t \alpha_1)}{1 + exp(z_t \alpha_1)}$$

(7) $$\mathbf{P}_{22}(z_t) = \frac{1}{1 + exp(z_t \alpha_2)}$$

Where α_1 and α_2 are the vectors of coefficients to be estimated. When $\alpha_1 = \alpha_2 = 0$, the model reverts to being a model with time invariant transition probabilities.

It should also be noted that given (6) and (7):

(8) $$\frac{\partial \mathbf{P}_{11}(z_t \alpha_1)}{\partial z_t} = \alpha_1 \mathbf{P}_{11}(z_t \alpha_1)(1 - \mathbf{P}_{11}(z_t \alpha_1))$$

(9) $$\frac{\partial \mathbf{P}_{22}(z_t \alpha_2)}{\partial z_t} = -\alpha_2 \mathbf{P}_{22}(z_t \alpha_2)(1 - \mathbf{P}_{22}(z_t \alpha_2))$$

So that provided all the transition probabilities are nonzero, $0 < \mathbf{P}_{11}(z_t \alpha_1) < 1$ and $0 < \mathbf{P}_{22}(z_t \alpha_2) < 0$, then the sign of α_1 and $\frac{\partial \mathbf{P}_{11}(z_t \alpha_1)}{\partial z_t}$ are the same, while the sign of α_2 and $\frac{\partial \mathbf{P}_{22}(z_t \alpha_2)}{\partial z_t}$ are the opposite of one another. Of course,

$$\frac{\partial \mathbf{P}_{12}(z_t \alpha_1)}{\partial z_t} = - \frac{\partial \mathbf{P}_{11}(z_t \alpha_1)}{\partial z_t}, \text{ and } \frac{\partial \mathbf{P}_{21}(z_t \alpha_2)}{\partial z_t} = - \frac{\partial \mathbf{P}_{22}(z_t \alpha_2)}{\partial z_t}.$$

In addition, the regression component of (1) can be extended to

(10) $$\mu_t(m) = \beta_m + X_t'\gamma_m + W_t'\delta, \qquad \text{for } m = 1,2.$$

Where γ_m and δ are vectors of coefficients to be estimated, and X_t and W_t are vectors of explanatory variables. As can be seen from (8), the coefficients on X_t (W_t) are regime dependent (independent). Our Markov-Switching TVTP model refers to the combination of (5), (6), (7) and (8).

Equations (10) and (5) show how information can enter the model in two ways, one directly through the regression component and another indirectly through the transition probabilities, respectively. We hypothesize that indicators of global risk perception and other global factors as well as on financial market characteristics per country could affect both the transition probabilities and the regression component.

It is natural to want to test the null hypothesis that there are 1 regime against the alternative of 2 regimes, that is, to test whether there are any changes in the regime at all. However, the likelihood test of this hypothesis fail to satisfy the usual regularity conditions, because under the null hypothesis, some of the parameters of the model are unidentified. The best alternative is to use and compare the Akaike Information Criterion (AIC) for the MS Regressions for the models assuming 1 and 2, and this is what we have done in this study. The models with 2 regimes presented in section 4 dominated the similar model with only 1 regime in each of the four countries.

4. Presentation and Analysis of Results

All models are estimated using EViews 8. We begin the analysis with a discussion of our Basic MS Regress results, by looking at the coefficients and indicators of model performance of the basic Markov-switching models per country presented in Table 1 below. We denote this model as "Basic" because in this regression, we first look at the basic parameters without considering possible determinants for the transitional probabilities. The results are arranged so that the first regime represents the high rate gap regime, when the divergence between the policy rate and the benchmark interest rate is large. Conversely, regime 2, is the regime when the rate gap diminishes, or when the divergence between the policy rate and the benchmark interest rate is small or even negative. We see this in the estimates of the intercepts β_1 and β_2 which, in our basic specification, are estimates of the average rate gap for regimes 1 and 2, respectively. Under this model specification, the Philippines recorded the highest average rate gap during regime 1, or the high rate gap regime, at 2.60 percent over the 2000-2015 period. Indonesia recorded the second highest average rate gap at 0.69 percent, followed by Malaysia and then Thailand.

During regime 2, or the low rate gap regime, the Philippines still had the highest positive average rate gap at 0.21 percent, but the rankings for the other countries changed. The Philippines' average rate gap is now followed by Malaysia at 0.02 percent. Indonesia and Thailand both recorded a negative average rate gap under regime 2. This means that for both Indonesia and Thailand, not only does the level of the benchmark interest rate approach or converge towards the level of the policy rate in regime 2, the low rate gap regime, but the market rates in fact surpasses the policy rates, thus resulting in the negative average rate gap levels. Among the four economies during the period in review, therefore, the Philippine policy rate appears to have the comparatively weakest influence over market interest rates, as it recorded the highest average rate gap for both regime 1 and regime 2, and always surpassing the second in rank and the rest of the ASEAN-4 countries by a significant amount. The average rate gap in Malaysia and Indonesia, are both relatively low, which is an indication that based on our definition of the rate gap, the central bank policy rate appears to have a relatively stronger influence or control over the benchmark interest rate in Malaysia and Thailand, compared to that in the Philippines and Indonesia.

Table 1. Results from the Basic MS Regression Model of Conditional Mean

	Variables	Philippines	Indonesia	Malaysia	Thailand
Number of Observations		**185**	**185**	**185**	**185**
Coefficients in Regression					
Constant Term, Regime 1	β_1	2.60	0.69	0.33	0.12
z-statistic		28.26***	10.45***	15.98***	9.63***
Constant Term, Regime 2	β_2	0.21	-0.99	0.02	-0.57
z-statistic		2.12**	-13.90***	1.88*	-12.53***
Parameters in Transition Probabilities					
Constant Term, Staying Probability in Regime 1	a_1	3.25	3.30	3.02	5.36
z-statistic		6.07***	6.12***	4.62***	4.94***
Constant Term, Switching Probability from Regime 2 to 1	a_2	-3.16	-3.45	-3.53	-4.01
z-statistic		-5.82***	-5.55***	-6.57***	-2.28**
Transition Probabilities					
Probability of staying in Regime 1	P11	0.96	0.96	0.95	1.00
Probability of switching to Regime 2, when already in Regime 1	P12	0.04	0.04	0.05	0.00
Probability of switching to Regime 1, when already in Regime 2	P21	0.04	0.03	0.03	0.02
Probability of staying in Regime 2	P22	0.96	0.97	0.97	0.98
Expected Durations, in number of months					
Regime 1		26.90	28.11	21.55	214.47
Regime 2		24.59	32.57	35.27	56.33

Source: Author's estimates.

If we examine the probabilities that the rate gap will stay in regime 1 when it is already in regime 1, $P_{11,}$ it is the highest for Thailand at 0.995 or almost 1.0 when rounded off. This is influenced by the outcome of the estimated smoothed regime probabilities, where Thailand recorded only one switch in 2001 from the low rate gap regime to the high rate gap regime, and no other switch was estimated by the model. It also follows that the expected duration of regime 1 is highest for Thailand's rate gap, at 214.5 months, whereas the expected duration for regime 2 is still the highest for Thailand compared to the other three countries, estimated at 56 months. The expected duration for regime 1 in Indonesia is at 28 months, followed by the Philippines at 27 months and Malaysia at 21.6 months. Meanwhile, Indonesia has the second highest P_{11}, at 0.964, followed closely by the Philippines at 0.963 and then Malaysia at 0.953.

The estimated transition probabilities for all four economies to stay in regime 2 when it is already in regime 2, P_{22}, are all high as well—all in the 0.96 to 0.98 level. The estimated switching probabilities, meanwhile, show that Malaysia has the highest probability of shifting to regime 2 when it is in regime 1, at 0.046 followed by the Philippines at 0.037, and then Indonesia at 0.036. Thailand has the lowest P_{12} result. When we look at the estimated probability of switching to regime 1 when it is already in regime 2, we see that the highest probability is for the Philippine rate gap, which could be interpreted to mean that this country tends to stay in the high rate gap regime, regime 1, or move towards the high rate gap regime, when it is already in regime 2. In terms of estimated expected duration, regime 1 or the high rate gap regime tends to last the longest in Indonesia at 28 months, while it tends to last for 26 months in the Philippines. Meanwhile, regime 2 or the low rate gap regime is expected to last the longest in Malaysia and Indonesia, at 35.3 and 32.6 months for both economies, respectively.

We proceed to look into the timing of the regime switches in the rate gap of the ASEAN-4 economies by presenting estimates of the smoothed regime probabilities from our basic MS-Regress Model in Figure 3. It can be observed that the four economies experienced regime switches at different times over the period of our study. Whereas this model specification detected seven (7) Markov-type regime switches in the Philippines, it detected six (6) Markov switches each in Indonesia and Malaysia, but only one (1) regime switch in 2001 detected in Thailand. The high rate gap periods—those months when the transition probability for Regime 1, the high rate gap regime, is close to, or is at exactly 1.0, and the low rate gap periods—those months when the transition probability for Regime 2, the low rate gap regime, is close to or is at exactly 1.0, for each ASEAN-4 economy are depicted in Table 2.

As a supplementary step in the empirical analysis, we also compare the timing of the regime switches by superimposing two of the most important variables—significant Trilemma changes and the changes in global risk perception—to see how they match graphically. One may recall that in the literature review, we proposed a connection between the Trilemma story, the RoRo periods of global risk appetite, and the high rate gap vs. low rate gap regimes. We have decided to include this graphical analysis of dummy indicators against the regime switches as a way to verify this connection because the Trilemma indexes are estimated in annual terms, so that the annual frequency does not allow us to test it directly as a determinant of the transition probabilities within the MS Regress methodology itself. The most updated and readily available indicator of significant movements along the Impossible Trinity triangle, reflecting changes in at least one, two or all of the three main objectives of a central bank, is based on the estimated Trilemma indexes from Aizenman et. al. (2013) available via url http://web.pdx.edu/~ito/trilemma_indexes.htm for the data series covering 2000 to 2014. For our purposes, we constructed a dummy variable that has the value of one (1) for periods when there were any changes greater than or equal to 20 basis points in absolute value terms in the level of one, two or all of the three indexes comprising the main index: the Exchange Rate Stability Index, the Monetary Independence Index, and the Financial Openness Index, and zero (0) otherwise.

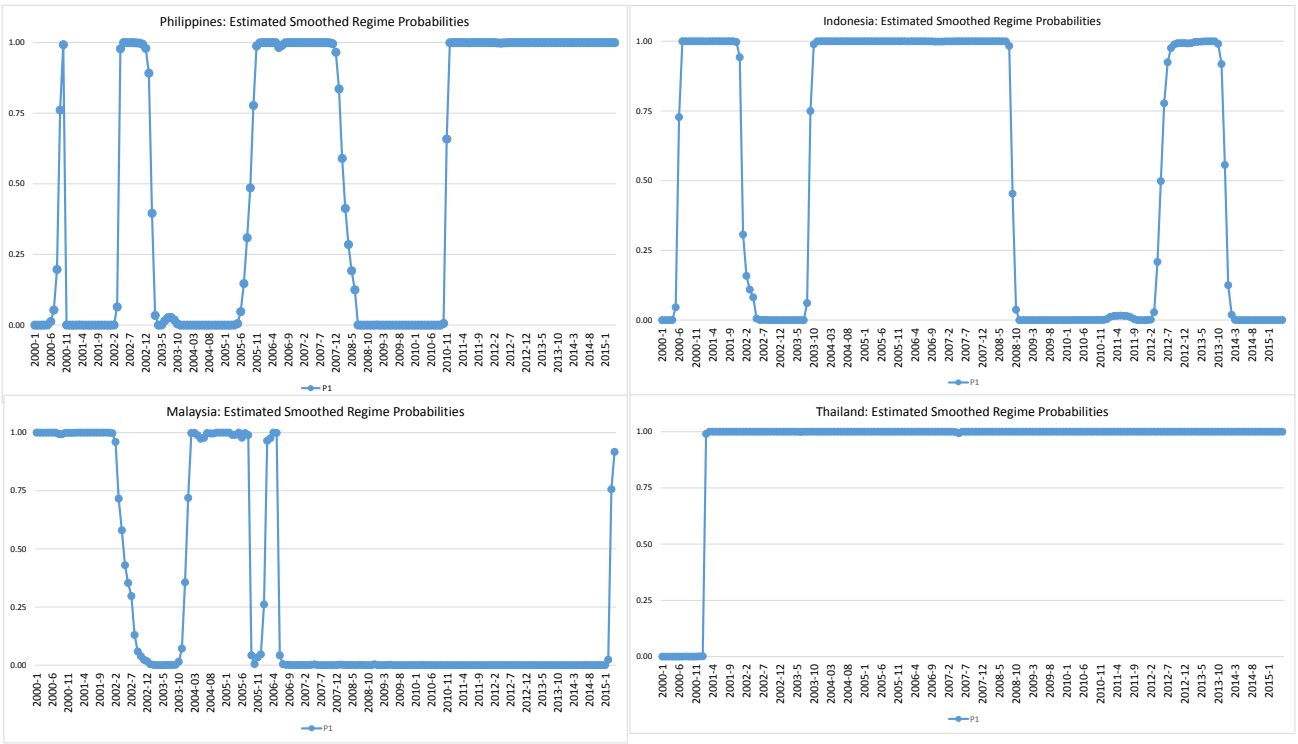


Figure 3. Estimated Smoothed Regime Probabilities from the Basic MS-Regress Model

Table 2. HIGH RATE GAP AND LOW RATE GAP PERIODS			
Philippines	Indonesia	Malaysia	Thailand
Regime 1: High Rate Gap periods			
Oct 2000	Aug 2000 to Jan 2002	Jan 2000 to Mar 2002	Apr 2001 to May 2015
Jun 2002 to Jan 2003	Dec 2003 to Aug 2008	Mar 2004 to Aug 2005	
Nov 2005 to Apr 2008	Aug 2012 to Dec 2013	Mar to May 2006	
Jan 2011 to May 2015		May 2015	
Regime 2: Low Rate Gap periods			
Jan to Jul 2000	Jan to May 2000	Jul 2002 to Nov 2003	Jan 2000 to Jan 2001
Nov 2000 to Feb 2002	May 2002 to Aug 2003	Nov to Dec 2005	
May 2003 to Jul 2005	Dec 2008 to Apr 2012	Aug 2006 to Feb 2015	
Aug 2008 to Oct 2010	Apr 2014 to May 2015		
Source: Author's estimates			

Another dummy variable we have chosen to include in our graphical analysis is that which marks the periods when the risk premium measure per country have recorded peaks and troughs, which acts as our indicator of risk-on and risk-off behavior in global risk perception. We have constructed this dummy variable to have the value of one (1) for the month marking a peak or a trough in the County Risk Premium data (10-Year sovereign yield rate minus 10-Year US Treasury yield rate for the Philippines and Indonesia, and the EMBI Index spreads for Malaysia, and the combination of EMBI Index spreads and CDS spreads for Thailand), and zero (0) otherwise. As with the case of the Trilemma index dummy variable, plotting these indicators as dummy variables alongside the regime probabilities by country allows us to conduct a preliminary assessment whether the timing of the regime switches we obtained from the Markov model are detected by, or associated with, the changes in the Trilemma indexes and the risk-on, risk-off events indicated by each variable.

From Table 3 and Figure 4, it can be seen that both the risk premium dummy variable and the Trilemma index dummy variable are associated with at least two regime switches per country, especially so for the Philippines, Indonesia and Malaysia. The risk premium peak and trough dummy indicators are most associated with the regime switches, as it coincides with five out of the seven switches for the Philippines, and with three of the regime switches for both Indonesia and Malaysia, but none for Thailand. Trilemma indexes, nonetheless, are annual indexes, so that by design there would expectedly be fewer matches or association with the rate gap regime switches, the estimation of which involved monthly data. Nevertheless, we see at least two matches between the regime-switches and the significant changes in the Trilemma Indexes for the first three countries.

Across the four ASEAN-4 economies, the timing of the regime switches as well as of the high rate gap regimes versus the low rate gap periods does differ, but there are also some common switches among them. This finding is a reflection of the fact that global factors common to these emerging Asian economies, such as changes in global risk perception on EMs in general, could affect the rate gap of all four countries at the same time, so that there would be periods when the timing of the regime switching could be identical. At the same time, however, the magnitude and timing of the impact of global indicators can differ across the four countries being reviewed and can vary over time. This indicates that there must then be other idiosyncratic factors which are driving as well whether a Markov-type regime switching will occur in one country or not for that period.

Table 3. TIMING OF THE REGIME SWITCHES AND ASSOCIATED CHANGES IN GLOBAL RISK PERCEPTION AND MONETARY OR OTHER POLICIES				
Regime Switches per Country	Associated Monetary and Other Policy Changes or Global Shocks[a]	Comparison with Dummy Variables on Risk Premium Peaks and Troughs and Trilemma Changes		
Philippines		Risk Premium Peaks dummy	Risk Premium Troughs dummy	Trilemma Changes dummy
Aug to Sep 2000	In early 2000, the BSP decided to shift to inflation targeting.			
Nov 2000	In late 2000, the BSP was confronted with the challenges of dealing with severe market turbulence in the events leading up to the removal of then President Joseph Estrada, including a massive loss of confidence and pressure on the Philippine peso.	Sep 2001		
March to May 2002	The BSP finally implemented the inflation targeting framework by January 2002. In Sep 2002, the rediscount window had been liberalized to allow a generalized and uniform access to the facility by all sectors of the economy at market rates, reorienting it to be used for money supply management (complementing open market operations) instead of selective credit allocation.		May 2002	2002
Feb to Apr 2003	The current account shifted to a surplus beginning in 2004, and has remained in surplus to this time.		Aug and Nov 2003	2004
Aug to Oct 2005	The EVAT Law was enacted in May 2005--a signal to global investors of sustained fiscal reforms; the current account shifting from historically negative balance into a surplus beginning in 2004 largely from sustained OF remittances, the emerging BPOs**, and a growing international reserve base .	May 2005	Apr 2005	2005
May to Jul 2008	2008-2009 Global Financial Crisis (GFC) with EMBI Philippines Spreads reaching a peak in December 2008.	Dec 2008		
Nov to Dec 2010	Philippine GDP Growth has begun to accelerate after the GFC, and at a rate even higher than its neighbors. Given constraints on issuance on its own securities, and its limited holdings of government securities for use as collateral in its reverse repurchase transactions, the BSP nearly exhausted its holdings and relied increasingly on other instruments such as nontradeable Special Deposit Accounts--the levels for which peaked during 2010-2011. On 28 October 2010, the BSP further amended the FX regulatory framework to keep FX transactions attuned to current economic conditions.		Dec 2010	2010
Indonesia				
Jun to Jul 2000	In 1999, a new central banking law enacted establishing the independence of Bank Indonesia (BI), setting of the inflation target, and the shift from base money targeting to interest rate targeting; Big Bang fiscal decentralization formally implemented in 2001.			
Feb to Apr 2002	July 2005: the reference rate changed to the overnight cash rate; implementatio of the BI rate through open market operations.	Jul 2005		
Sep to Nov 2003	Bank Indonesia and the national government established an Inflation Management Team in 2004 to implement an integrated policy roadmap.			
Sep to Nov 2008	2008-2009 GFC with EMBI Indonesia Spreads reaching a peak in November 2008.	Nov 2008	Apr 2007	2007 and 2008
May to Jul 2012	Beginning mid-2010, Indonesia added macroprudential measures to manage capital flows and safeguard financial system stability within its monetary policy framework.		Oct 2010	2010 and 2011
Jan to Mar 2014	When the taper tantrum hit in mid-2013, BI rapidly unwound the term deposit facilities with banks, particularly in the June-July 2013 period. Bank Indonesia also raised the secondary reserve requirement (RR) in September 2013 (fulfilled by banks' holding of treasury and BI securities) from 2.5 percent to 4.0 percent, to be phased in by December 2013.	Aug 2013	Jul 2014	2013
Malaysia				
Apr to Jun 2002		Oct 2002	Apr 2002	
Dec 2003 to Feb 2004	Malaysia undertook successive stages of foreign exchange liberalization measures beginning in 2004. The New Interest Rate Framework was also implemented in 2004.[b]	May 2004		2004
Sep to Oct 2005	July 2005: BNM moved to a managed float; Easing of restictions on capital flows; liberalization of restrictions on international transactions, leading to the accumulation of foreign assets by private entities as well as reserves. During the GFC in 2008-2009, the reduction in capital inflows in large part offset by repatriation of domestic capital abroad. Large sales by foreign investors were absorbed with minimal impact on domestic yields.			
Jan to Feb 2006	As a key enhancement to the breadth of the		December 2006	2006
Jun to Jul 2006	BNM's monetary policy instruments is the		January 2007	
Mar to Apr 2015	With the 2014 budget approved in October 2013, Malaysian authorities have continued to impose a series of targeted, gradual, and escalating Macroprudential Policies (MAPs), which have been mainly directed at speculative purchases of homes and unsecured credit.	Mar 2015	July 2014	2013
Thailand				
Feb to Mar 2001	Coming from a managed float under the IMF Program, the BOT announced the adoption of its inflaton targeting framework in 2001, implementing monetary policy by influencing short-term money market rates via the policy rate.*	Aug 2001		2000

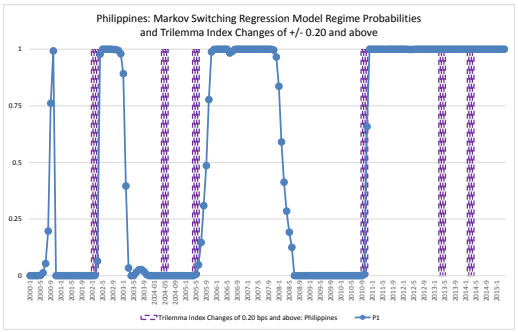
[a] The table includes only a general listing of the most prominent or major policy changes or shocks; The author does not claim it to be a comprehensive listing.

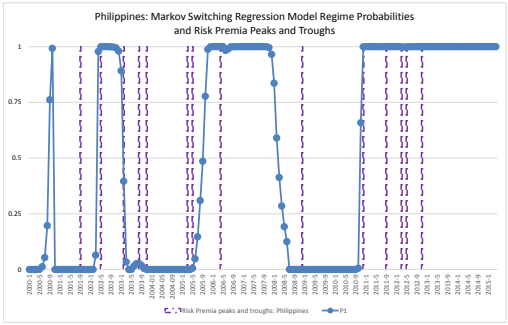
[b] Please see Sharifuddin et. al. (2014), Appendix 3, for a complete listing of the foreign exchange liberalization measures implemented by BNM in 2004.

* From May 2000 to January 2007, the policy rate was the 14-day repurchase rate. Effective January 2007, the policy rate has been the 1-day repurchase rate.

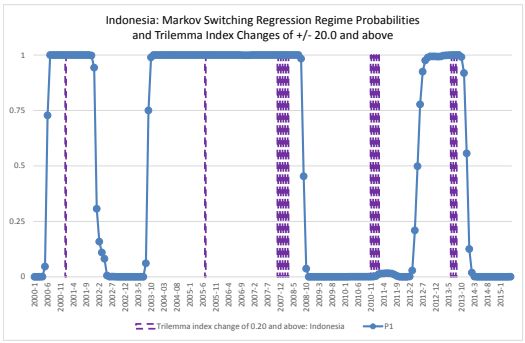
Sources: Regime switches are based on Author's estimates; Policy changes and shocks are based on materials from Central Bank websites such as the BNM's Annual Reports, IMF Article IV Reports and Selected Issues Papers 2010-2015, Asian Development Bank and the AsianBondsOnline.com, and the Bank for International Settlements.

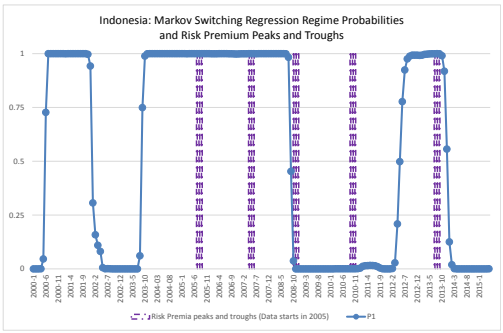
Philippines



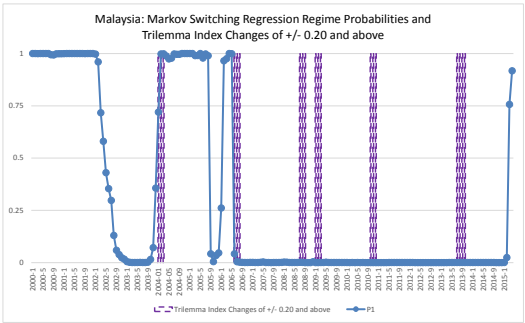


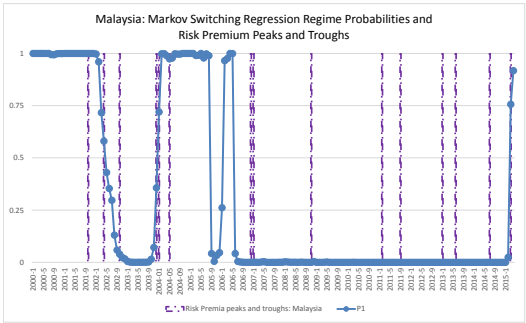
Indonesia



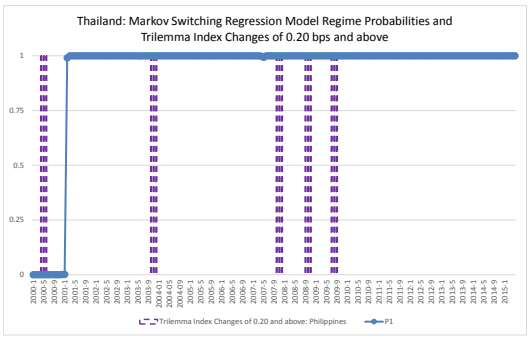


Malaysia





Thailand



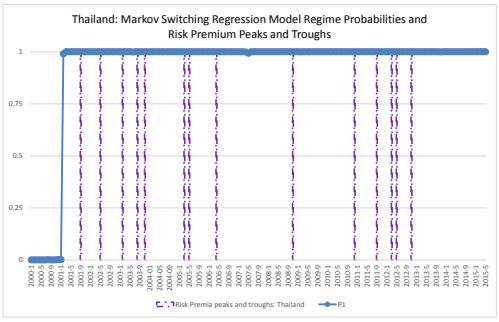


Figure 4. Estimated Regime 1 Probabilities from the Basic Model and Comparison with Dummy Indicators

One of the most interesting regime switch is the one detected in 2008, common to both the Philippines and Indonesia. This outcome is not surprising as the impacts of the global financial crisis (GFC) were of such scale, magnitude and coverage that it wrought havoc in emerging Asian countries' financial markets. The GFC affected the monetary and financial policies and interest rate-setting in central banks as well as the prices of, and returns to, assets which are accessible to foreign funds—generally leading to a narrowing of the rate gap and expectedly triggering a switch from the high rate gap to a low rate gap regime. During 2008, in fact, all four economies recorded a peak in their respective risk premium indicators based on Figure 2, as the global perception of risk on emerging economies rose at that time–a risk-OFF episode. As we had proposed, high risk premia acts as a "natural wall" that effectively shielded off the flow of speculative capital, and this is achieved even without any change in capital controls or any movement in the Trilemma index particularly in terms of policies relating to financial market openness or capital mobility.

Other common switches which were detected by the estimated smoothed regime probabilities were in 2000 and 2003 for the Philippines and Indonesia, 2002 for the Philippines, Indonesia and Malaysia and in 2005 for the Philippines and Malaysia. On these occasions, the risk premium dummy variable series we had utilized marked either a peak or a trough in risk premia levels for these periods, except for Indonesia in 2000 and Malaysia in 2005. Interestingly, the year 2000 for Indonesia, and the year 2005 for Malaysia marked important milestones in the monetary policy framework of these economies, so that the regime switching may have been driven by these policy changes even without significant movements in the country risk premia (see Table 3). Additionally, both 2002 and 2005 are also associated with positive changes in the monetary and other financial policies in the Philippines, Indonesia and Malaysia which could have either directly affected the level of the rate gap—either via the policy rate or via the benchmark interest rate—or indirectly by reducing the level of global risk perception attached to these economies and opening up its domestic asset markets to foreign investment flows and hence driving down the returns—thus affecting the rate gap in two ways. We also see the MS Regress model detecting very recent switches in 2014-2015 for Malaysia and Thailand. Both switches coinciding with the risk premia peaks and troughs dummy indicator, as well as changes or movements in the Trilemma Indexes of these two economies for these periods.

Based on Table 3 and Figure 4, one result that deserves attention is that in contrast to the case for the Philippines and Indonesia, the MS-Regress model for both Malaysia and Thailand did not detect a switch in 2008, which we would expect to be the case as well for these two emerging economies. When we look at the regime probabilities for both Malaysia and Thailand in Figure 2, it appears as if either the level of the rate gap has effectively shielded itself from the effect of global factors, or that financial market characteristics were static or unchanged, remaining stable all throughout 2006 to 2014. During the GFC, the reduction in capital inflows in Malaysia was reported to have been largely offset by sales of foreign reserves and the repatriation of domestic capital invested abroad, given its well-developed and relatively large domestic capital market. Large sales of domestic bonds by foreign investors were absorbed with minimal impacts on domestic yields. The stabilizing role of reserves and private outflows, coupled with the greater flexibility of the exchange rate and strength of domestic financial institutions, could have allowed Malaysia to weather the global financial crisis, effectively establishing firmly its monetary policy independence during this time. This could well be the reason why no regime switching occurred in Malaysia during the GFC. In the case of Thailand, beginning in the first quarter of 2008, a new Bank of Thailand Act strengthened the transparency and accountability of Thailand's monetary policy process, and at the same time, the bond market of Thailand has expanded and deepened by this time. The Act established a clear and formal framework for monetary policy, where the Monetary Policy Committee was charged with legal responsibility in the realm of both the monetary policy target and exchange rate management policy (Grenville and Ito, 2010). This strategy appears to bode well for maintaining stability and monetary independence in the country all throughout the GFC in 2007-2008. These policy developments could well account for the reason why the rate gap did not experience a regime switch in 2008 for Thailand.

Table 4. Results from the Full MS Regression Model of Conditional Mean and TVTP					
	Variables	Philippines	Indonesia	Malaysia	Thailand
Number of Observations		**111**	**120**	**124**	**185**
Coefficients in Regression					
Common Regressors (time-invariant)					
JP Morgan's EMBI+ Global Index	δ	-0.21			
z-statistic		-2.06**			
Switching Regressors (time-varying)					
Constant Parameters, Regression					
Constant Term, Regime 1	β_1	3.41	1.08	0.43	0.18
z-statistic		7.19***	5.33***	10.52***	0.15
Constant Term, Regime 2	β_2	1.94	0.78	0.01	0.18
z-statistic		4.03***	2.27**	0.32	5.87***
Coefficient Parameters, Regression					
JP Morgan's EMBI+ Global Index, lagged one period, Regime 1	V11		-0.56		
z-statistic			-10.89***		
JP Morgan's EMBI+ Global Index, lagged one period, Regime 2	V12		-0.04		
z-statistic			-0.32		
Risk Premium = 10-Year Sovereign Rate minus 10-Year US Bond Yield Rate, Regime 1	V21				-0.35
z-statistic					-4.38***
Risk Premium = 10-Year Sovereign Rate minus 10-Year US Bond Yield Rate, Regime 2	V22				-0.05
z-statistic					-1.89*
Autoregressive component, lag 1 for Regime 1	ϕ_1	0.85		1.24	
z-statistic		10.04***		6.30***	
Autoregressive component, lag 1 for Regime 2	ϕ_2	0.89		0.43	
z-statistic		12.64***		5.28***	
Coefficients in Transition Probabilities					
Risk Premium = 10-Year Sovereign Rate minus 10-Year US Bond Yield Rate,	α11	-2.70	0.42		
z-statistic		-1.69*	0.98		
Risk Premium = 10-Year Sovereign Rate minus 10-Year US Bond Yield Rate	α21	-4.26	-1.19		
z-statistic		-2.15**	-2.39**		
Foreign Holdings of Local Government Assets as % of Total	α12	0.77	0.08		
z-statistic		2.31**	2.04**		
Foreign Holdings of Local Government Assets as % of Total	α22	0.61	0.03		
z-statistic		1.68*	0.60		
JP Morgan's EMBI+ Global Index, staying probability in Regime 1	α13				0.65
z-statistic					5.33***
JP Morgan's EMBI+ Global Index, switching probability from Regime 2 to 1	α23				-0.94
z-statistic					-9.13***
Foreign Holdings of Tbills	α14			12.84	
z-statistic				1.6*	
Foreign Holdings of Tbills	α24			14.66	
z-statistic				2.9**	
US 10-Year Bond Yield Rate	α15				0.24
z-statistic					1.67*
US 10-Year Bond Yield Rate	α25				-0.23
z-statistic					-9.44***
HSBC's RORO Index	α16			-11.98	
z-statistic				-1.59*	
HSBC's RORO Index	α26			-15.38	
z-statistic				-4.45***	

[b] For Thailand, including AR(1) it in the full model, whether as a common regressor or as switching regressor makes the parameters either NAs or insignificant.

For Indonesia, AR(1) was estimated in another model, separate from the basic because it made regime switching probabilities unclear when included.

We proceed to the discussion of the estimation outputs from the full MS Regress models with TVTP for the four economies, tabulated in Table 4. Under this full model specification, we consider AR(1) coefficients and time-varying transition probabilities as in Filardo (1994,1998), and test which of the global factor or financial market characteristics are significant in the models either as regressors of the switching rate gap or as determinants of the transition probabilities. For the full TVTP specification, the AR(1) coefficient enters the model significantly as a switching

regressor for Malaysia and the Philippines. This is indicative of the autoregressive component of the rate gap stemming from policy interest-rate smoothing by these central banks, or the stickiness in the market interest rates, or perhaps from both.

The EMBI+ Global Index emerged as a significant common regressor for the Philippines and a switching regressor for Indonesia. For the Philippines, the coefficient of EMBI+ Global is negative, which means that when the index increases, the rate gap falls regardless of what regime the economy is in. This is consistent with our expectation that higher risk perception acts as a "natural wall" discouraging the inflow of non-resident funds, allowing for the market interest rate to rise and converge towards the level of the policy rate, and the rate gap falls, and the converse is true as well. For Indonesia, the coefficient of EMBI+ Global is more negative during regime 1, the higher rate gap regime, which again lends support to our hypothesis that the higher the indicator of risk perception, the lower the rate gap. Additionally, the coefficient of EMBI+ Global is a lower negative number, but is nonetheless insignificant, under regime 2 for Indonesia.

The EMBI+ Global is also a significant driver of transition probabilities in Thailand. The coefficient sign of EMBI+ Global as a driver of its transition probabilities is negative, which is as expected for both P_{11} and P_{21}. The higher the risk premium, the lower the probability of staying in regime 1, the high rate gap regime, and the lower the probability of switching to regime 1 when it is already in regime 2. What we had expected based on our earlier discussions for all four emerging ASEAN-4 economies is that higher risk perception in emerging economies would mean that foreign investors would be on a risk-OFF mode, and would tend move funds away from emerging Asia, drive up domestic market interest rates, and therefore cause the rate gap to move into, or stay in, the low rate gap regime, regime 2.

The country risk premium indicator, is a statistically significant determinant of the transition probabilities P_{11} and P_{21} for the Philippines. This variable enters the model with a negative coefficient as expected, with an absolute value higher for P_{21} and lower for P_{11}. This would mean that the higher the risk premium, the lower the transition probability in both cases, but the magnitude of its impact is higher for the probability of switching to regime 1 when it is already in regime 2, than for staying in regime 1 when it is already in regime 1. For Indonesia, the risk premium indicator is a significant determinant for P_{21} as well. The coefficient of the risk premium indicator for the transition probability of switching from regime 2 to regime 1 has a negative sign, just as we expected. The coefficient of the same variable for P_{11}, however, is insignificant and positive, which would mean that for Indonesia, the probability of staying in regime 1 when it is already in regime 1 increases with higher risk premium levels.

The share of foreign ownership of local currency debt is also a significant determinant of the transition probabilities for the Philippines and Indonesia, with the expected signs in the coefficient values. It is significant and positive for both the switching (P_{21}) and staying (P_{11}) transition probabilities in the Philippines, and although it is also of the expected sign and significant as a driver for P_{11} in Indonesia, it is of the expected sign but insignificant for P_{21}. This outcome means that the higher the share of foreign ownership of local currency debt for the Philippines and Indonesia, the higher the probability of staying or switching into regime 1, the high rate gap regime. This is a result we are expecting based on the hypothesis we have set out in the beginning, that higher non-resident funds' buying into domestic bonds drives down the benchmark interest rate, widening the rate gap.

Foreign investments in Tbills is a significant determinant for Malaysia's rate gap, and the signs are as expected. The coefficient is in fact high at 12.84 for the staying probability, and at 14.66 for the switching probability, which means the higher the foreign ownership of Tbills in Malaysia, the higher the probability of the rate gap staying in regime 1, and the higher the switching probability to regime 1 when it is already in regime 2. Meanwhile, HSBC's Risk-On, Risk Off (RORO) Index entered as a significant driver of both the staying and switching probability to regime 1 in Malaysia, and with the expected negative sign. This could be interpreted to mean that the higher the RORO Index— an indicator that increases when the risk on behavior is prevailing among global investors and decreases otherwise—the lower the probability of staying in the high rate gap regime, and switching into a high rate gap regime when it is already in the low rate gap regime.

For Thailand, the US 10-Year Bond Yield rate is a significant determinant of its transition probabilities, but with coefficients at different signs. Its coefficient is negative, as expected, for the switching probability P_{21}, which means that the higher the US 10-year bond rate, the lower the probability of the rate gap moving into regime 1 or the high rate gap regime. However, it is positive for the staying probability, which is not what we expected. Nonetheless, Thailand's monetary policy and domestic financial markets appears to have a relatively stronger linkage with global financial markets and particularly with US monetary policy, possibly reflecting its managed float exchange rate regime as well as its highly developed and flexible bond markets. Within the ASEAN, it is perhaps acting in the same way as a financial hub over the period being investigated.

From these empirical results, we observe that the ASEAN-4 does not comprise a homogenous set. Looking more closely into the different results, there is what seems to be two subgroupings within the ASEAN-4 economies: the Philippines and Indonesia showing more frequent and more prominent switches and longer duration of staying in regime 1, the high rate gap regime on one end, and Malaysia and Thailand depicting less and a longer duration for staying in regime 2, the low rate gap regime. For the Philippines, the average rate gap is the highest under both regime 1 and regime 2, so that within the definition used in this paper, its policy rate has the weakest influence over market interest rates among the ASEAN-4. Regime-switching in the rate gap of the Philippines is also the most frequent and prominent in the region. This outcome could possibly be traced to factors beyond global attractiveness indicators and financial market sensitivity variables. As seen by Affandi and Peiris (2012), the limited amount of government securities held by the BSP for repo operations and the inability of the BSP by law to issue its own securities could be the structural factors that are keeping Philippine Tbill rates at even more depressed levels even when compared to Indonesia. A second plausible factor is the Philippine National Government's significant foreign borrowing abroad, resulting in numerous rejections in the issuance of domestic Tbills which is limiting the supply of this asset market even further. Given the already thin volumes of government securities available in the Philippine domestic financial markets, a more limited issuance means that when large non-resident funds access the market, interest rates are brought down even further. A deeper examination of these structural issues could be a potential topic for future research.

For factors common to the Philippines and Indonesia, we can point out two most plausible reasons that account for these economies' relatively more pronounced, more frequent recurrence of alternating divergence and then convergence in the rate gap, and a longer duration for the high rate gap regime. One, relates to the ***attractiveness*** of their domestic assets to foreign investors arising not only because of factors common to EMs, but from remarkable improvements in each of their macroeconomic performance, monetary policy credibility, stability in the external accounts and overall sovereign credit worthiness, compared to how it was performing relative to its ASEAN neighbors in the past. These factors have improved significantly for the two economies during the period in review, and perhaps even more so for the Philippines which achieved some sort of a paradigm shift towards low and stable inflation, consistent current account surpluses up to the present, a high level of foreign reserves, a stable currency, and remarkably improved fiscal discipline all resulting in non-resident capital flows flocking into safer Philippine government securities in search of yield.

A second issue emerging from our analysis is that the higher average rate gaps and the more frequent regime-switching in the rate gap could also a product of relatively thinner and underdeveloped financial markets in both the Philippines and Indonesia, making them more ***sensitive*** to foreign inflows. The supply of government securities is much more limited in these two countries, and to a larger extent is dominated by government compared to Malaysia and Thailand, so that surges and stops in foreign funds buying into these domestic assets affect benchmark interest rates in a much bigger way. Meanwhile, the financial markets of Malaysia and Thailand are deeper and more developed than in the Philippines and Indonesia. This adds to the stability in domestic interest rate movements so that foreign investors buying into domestic assets are not as disruptive to benchmark interest rate levels for the latter set of countries.

The BOT, in particular, carefully plans the types of bonds it issues to fill in the tenor gaps, i.e. by issuing only shorter-term bonds with tenors that do not replicate national government issues—a strong sign of coordination between the national government and the central bank. More recently, the issuance of BOT bonds in 2011 has contributed to

an even wider range of securities for Thailand, so that the domestic bond market has increasingly attracted investors of all types–both locals and non-residents alike. Monetary authorities of Thailand believe that the allocation of absorption instruments need to be designed such that it takes both the effectiveness of monetary policy transmission and financial market developments into account (Bank of Thailand, 2013). Meanwhile, the BNM and other regulatory agencies in Malaysia undertook large-scale efforts to develop a ringgit bond market resulting in its bond market emerging as one of the biggest and most advanced in the region (Sharifuddin and Ling, 2014). During the GFC, for example, the reduction in capital inflows to Malaysia were largely offset by sales of foreign reserves and the repatriation of domestic capital invested abroad. Large sales of domestic bonds by foreign investors were therefore absorbed with minimal impact on domestic yields.

5. Conclusion

We began this study with the hypothesis that the gap between the policy rate and the benchmark market interest rate follows a Markov-type regime-switching process for ASEAN economies: Indonesia, Malaysia, the Philippines, and Thailand. In addition, we espoused further that the transitional probabilities of the regime-switching in the rate gap for these economies are time-varying, and that the switching from one regime to the next is driven by either variables common to EMs (what we denoted as ***attractiveness*** factors), such as global risk perception and global liquidity, or other idiosyncratic factors relating to financial market characteristics of each economy (which we denoted as ***sensitivity*** factors).

From our empirical exercise, we established that the rate gap of the Philippines, Indonesia, and Malaysia could be depicted as a 2-regime, Markov-type regime-switching model of conditional mean and time-varying transition probabilities using the model specification from Filardo (1994,1998). The result for Thailand is not as robust, however, in that it is only showing one regime switch that occurred in 2001. Unlike in the other three economies, the rate gap of Thailand does not seem to strongly depict a Markov-type regime-switching process whereby there is a recurrence of divergence and convergence over the period being reviewed. Nonetheless, the AIC criterion and the MS Regress results confer that the rate gap of Thailand behaves as a Markov-type regime-switching process, and with two variables emerging as significant determinants of its time-varying transition probabilities.

We have also established in this study that indeed, there are country-specific ***sensitivity*** factors, as well as external or global ***attractiveness*** factors which influence the evolution and regime-switching in the degree of influence of monetary policy on market interest rates in the ASEAN-4. Among the indicators of financial market characteristics, it is foreign ownership of local currency debt securities—either as a share to total, or in terms of the levels—that emerged as drivers of the transition probabilities in the rate gap of the ASEAN-4 particularly so for the Philippines, Indonesia and Malaysia. Among the attractiveness factors, changes in global risk perception, such as the country risk premium variable and HSBC's RORO Index, have emerged either as a common regressor of the switching rate gap, or as a determinant of the transition probabilities for the ASEAN-4. For Thailand, US 10-year bond rates turned up as a significant driver of its regime-switching transition probabilities.

These determinants are variables that could be helpful if followed closely by monetary policymakers and perhaps be used as early warning system or leading indicators. They could signal the probability and the number of periods of either staying in or entering a high rate gap period or staying in or switching into a low rate gap period, and hence incorporating the changing relationships between the rate gap and global factors as well as financial market indicators within these two distinct regimes. If incorporated into a macroeconomic forecasting model, for example, the central bank could take into account and anticipate, based on expectations on the global risk premia and foreign ownership variables which were found to be significant drivers of the switching probabilities, those periods when the policy rate has an expectedly weaker influence over market interest rates versus when it has a stronger influence on market rates as additional information in the setting of the appropriate monetary policy stance. The high rate gap and low rate gap periods, and the variables identified for each country as determinants of the switches, could also be used

in an interest rate forecasting model which could, if so desired, establish the preferred gap between the policy rate and the relevant market rate over the policy horizon by the monetary authorities in the ASEAN-4.

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APPENDIX TABLE 1: Data Definitions and Expected Signs

		Expected Sign of the Variable as Regressor	Expected Sign of the Variable as Driver of P11 and P21 transition probabilities	**Philippines**	**Indonesia**	**Malaysia**	**Thailand**
				2000-2015 May	2000-2015 May	2000-2015 May	2000-2015 May
The Dependent Variable: Rate Gap = Benchmark Interest Rate - Main Policy Rate of CB							
Sources: central bank websites, CEIC, Bloomberg	Benchmark Interest Rate			91-Day Treasury-bill (Tbill) Rates	3-Month Commercial Time Deposit Rate	Treasury Bill Rate: Government Securities	Money Market Rate
	Series Name			TBIL91	STRATE	STRATE1	STRATE3
	Main Policy Rate			Reverse Repurchase (RRP) Rate of the Bangko Sentral ng Pilipinas (BSP)	Central Bank Policy Rate, end period	Intervention Rate (or the 3-month Interbank Rate) for 2000 to March 2004; Overnight Policy Rate from April 2004-2015 latest	Policy Rate, month end
	Series Name			CBPOLRT	CBPOLRT	CBPOLRT	CBPOLRT
	Interest Rate Gap			INTGAP1	INTGAP2	INTGAP1	INTGAP2
Independent Variables Tested and Used in the MS-Regress Model with Conditional Mean and TVTP							
Financial Market Characteristics							
Sources: AsianBondsOnline.com, Bangko Sentral ng Pilipinas, PHI Department of Finance	Foreign Holdings of LCY: as % of total holdings of LCY and in Levels	+	+	FORLCY	FORLCY, FORLCYLEV	FORLCY, FORLCYLEV	FORLCY, FORLCYLEV
NOTE: Data series from AsianBondsOnline for Indonesia, Malaysia and Thailand are quarterly, so that they were interpolated using ECOTRIM into monthly data using Univariate methods; For the Philippines, data from 2005 to 2013 are annual from the Department of Finance (DOF), and 2014 to latest are either quarterly or monthly. In cases when available data is quarterly or annual for the Philippines, they were interpolated into monthly series using ECOTRIM, Univariate methods.	Foreign Holdings of GS; Foreign Holdings of Tbills in Levels	+	+	FORGSLEV	FORGSLEV, FORTBILEV	FORGSLEV, FORTBILEV	FORGSLEV, FORTBILEV
	LCY owned by Banks as % of Total	-	-	LCYBANK	LCYBANK	LCYBANK	LCYBANK
	FCY total outstanding in levels (USD Billion)	+	+	FCYTOTLEV	FCYTOTLEV	FCYTOTLEV	FCYTOTLEV
	FCYRES in levels from DOF	-	-	Resident holdings of FCY			
	FCYNONR in levels from DOF	+	+	Non-Resident holdings of FCY			
Indicators of Global Factors	*Indicators of per Country Risk/Return Perception*						
Sources: Bloomberg and AsianBondsOnline.com	Country Risk Premium (10-Year Sovereign Rate - US 10-Year Treasury Note)			RISKPR1	RISKPR	RISKPR	RISKPR
	EMBI Global per country and EMBI+ for PHI	-	-	EMBIPHIP, EMBIFPHI	EMBIINO	EMBIMAL	Combined EMBITHA and CDSTHA
	CDS per country	-	-	CDSPHI	CDSINO	CDSMAL	
	HSBC Bond Return per country	+	+	HSBCRET	HSBCRET	HSBCRET	HSBCRET
	Other Global Indicators						
	Real US Fed Funds Rate: USRealRt	-	-	USREALRT	USREALRT	USREALRT	USREALRT
	10-Year US Bond Yield Rate	-	-	USTENNOTE	USTENNOTE	USTENNOTE	USTENNOTE
	10-Year US Secondary Market Rate	-	-	USTENSEC	USTENSEC	USTENSEC	USTENSEC
	US Inflation	-	-	USINFLRT	USINFLRT	USINFLRT	USINFLRT
	Chicago Board Options Exchange (CBOE) Volatility Index or VIX, end of period, or period average	-	-	VIXEOP/ VIXAVE	VIXEOP/ VIXAVE	VIXEOP/ VIXAVE	VIXEOP/ VIXAVE
	EMBI+ Global for Emerging Markets	-	-	EMBGLOB	EMBGLOB	EMBGLOB	EMBGLOB
	HSBC's RORO Index, which takes the rolling correlations between the daily returns of the 34 assets identified and combines them into a single index. HSBC constructs the index by using principal component analysis (PCA) to decompose the 34 asset return time series into 34 principal components (PCs), which are mutually uncorrelated variables that explain the observed asset returns.[a]	-	-	RORO	RORO	RORO	RORO
	Monthly Change in the Cross-border bond flows from the Global area and the Emerging Markets area, respectively, going into the Philippines, Indonesia, Malaysia, and Thailand taken from the Equity Bond Money Market Balanced Specialty Fund Flows (EPFR) Global online database	+	+	FLOBONGLOB FLOBONEM	FLOBONGLOB FLOBONEM	FLOBONGLOB FLOBONEM	FLOBONGLOB FLOBONEM
Dummy Variables used in the MS Regress Regime 1 Estimated Smoothed Probabilities charts per country	Changes in the Trilemma Indexes of greater than or equal to 20 basis points (bps) by Aizenman, Chinn and Ito (2013), 2000-2014						
	Risk premium peaks and troughs based onCountry Risk Premium data for the Philippines and Indonesia, EMBI Index spreads for Malaysia and Thailand and CDS spreads for Thailand, 2000 - 2015						

[a]HSBC Global Research. Currency Strategy from Currency Weekly, 17 April 2012.

CHAPTER 2

Policy Rate Divergence in the ASEAN-4: An Empirical Analysis Using Markov-Switching GARCH Model of Conditional Variance

1. Introduction

An empirical analysis of the volatility in the divergence between policy rates and benchmark interest rates could lend us invaluable insights on how movements in the divergence play out for an economy. This is true especially in the case of relatively small and open emerging market economies such as the members of the ASEAN-4, given common global factors as well as specific idiosyncratic factors, affecting and characterizing each country's financial markets. It will be misleading to discuss the rate gap between the policy rate and market interest rates without characterizing the idiosyncratic factors that govern the domestic financial system prevailing in the economy: the size and liquidity of the relevant benchmark money market and the investor profile of domestic assets, as well as the global factors that drive foreign risk-taking and search for yield—the monetary policy in advanced economies, measures of global liquidity, and global risk perception—as these drive the rate gap as well. The focus and main contribution of this study is that, especially for the Philippines, Indonesia, Malaysia and Thailand, both global factors and domestic financial market characteristics, as well as the interplay between these two, affect the degree of influence of policy rates over market interest rates than is usually pointed out in the literature.

In most of the existing studies which involved looking into the volatility of the gap between the policy rate and market interest rates (which we will term hitherto as the rate gap), the interest rate volatility is modelled either as a constant variance model (Levels models) or as a variance model (Generalized Autoregressive Conditional Heteroskedasticity or GARCH models), or a combination of both, as in Brenner (1996). According to Gray (1996), one potential source of misspecification of the existing models for market interest rates—the Levels model, the GARCH model, or a combination of both—is that the structural form of the conditional variances is relatively inflexible and is held fixed throughout the entire sample period. These models are single-regime models as they assume one prevailing structure for the conditional mean and variance of the market interest rate.

Rather than estimate within a single-regime framework as in the models in the literature described above, our estimation in this study will be utilizing a Markov-type regime-switching GARCH model for the variance of the gap between the policy rate and the relevant market interest rate. Regime-switching models are more complex, flexible structures that allow us to model data generated by shifting or changing economic mechanisms within a single unified model. The coefficients in this model are different in each regime to account for the possibility that the economic relationships that generate the gap between the policy rate and the market interest rate undergo a finite number of changes over the sample period. Although the regimes are unobserved, the coefficients can be estimated, and probabilistic statements can be made about the relative likelihood of the occurrence of the regimes, conditional on a given information set (Gray 1996).

Our hypothesis in this study is that the gap between the policy rate and the short-term market interest rate follow a Markov-switching GARCH volatility process in the case of the Philippines and three other ASEAN economies: Indonesia, Malaysia, and Thailand. In addition, we espouse further that the switching from one regime to the next is influenced by either variables common to emerging markets, such as global risk perception and global liquidity, or other idiosyncratic factors relating to important financial market characteristics of each economy. We identified and qualified these variables, and made an assessment on whether the variables representing these factors are driving the switches in the rate gap of the four emerging economies of interest via graphical and some form of events analysis.

The paper goes as follows: Section 2 summarizes the various existing research that are related to this study. Section 3 sets out a simple theoretical framework. Section 4 discusses the data set and stylized facts about the Philippines and the other three ASEAN economies that underpin the motivation for this area of research, and the empirical methodology used. Section 4 lays down the results and its interpretation. In Section 5 we conclude and submit policy implications.

2. Review of Related Literature

The short-term rate of interest, in particular, is fundamental to much of theoretical and empirical finance, so that the literature is rich with studies that try to model the dynamics of its volatility. Based on Brenner, *et al.* (1996), models which parametrize volatility only as a function of interest rate levels, what they termed as Levels Models, tend to over emphasize the sensitivity of volatility to levels and fail to model adequately the serial correlation in conditional variances. On the other hand, serial correlation-based models, such as Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models, fail to capture adequately the relationship between interest rate levels and volatility, and results tended towards an explosive conditional variance. Brenner *et al.* (1996) hence introduced and tested a new class of models for the dynamics of short-term volatility, which allows for the volatility to depend on both interest rate levels and information shocks.

As a result, Gray (1996) developed a generalized regime-switching model of the short-term interest rate. His model allowed the market interest rate to exhibit both mean reversion and heteroskedasticity and nested the GARCH and square root process specifications. Hence, the conditional variance process in his model accommodated both volatility clustering and the dependence on the level of interest rate, similar to Brenner, *et al.* (1996). A first-order Markov process with state-dependent transition probabilities governs the switching between regimes. This is also similar to the work on Markov-Switching time-varying transition probabilities (TVTP) of Filardo (1994, 1998) which he applied to business cycle analysis. Kuan, (2002) applied Gray's (1996) regime-switching framework to model the short-term market interest rate of Taiwan.

The recent literature looking at regime switching in monetary policy has typically analysed and interpreted changes in policymakers' behavior as regime-switching simple interest rate rules (Liu, et. al., 2009), policy reaction functions that incorporate regime-switching coefficients in the model as in Debortoli and Nunes (2011)[8], empirical investigation on time-varying transition probabilities in business cycle analysis as in Filardo (1994, 1998). Hamilton (2005), Juang and Rabiner (1986, 1991) and Rabiner (1989) described Markov-switching specifications that incorporate autoregressive elements, and they termed these as "hidden Markov models". But Markov-switching techniques were first introduced by Goldfeld and Quandt (1973).

As of this writing, there is yet no study in the literature looking into the influence of global risk perception and financial market characteristics on the divergence between the policy rate and the benchmark or short-term interest rate in the economy. The application of the Markov-type regime-switching GARCH model as the empirical technique for data on the rate gap for this purpose is also relatively new for the Philippines and the emerging Southeast Asia as a group. The existing literature on regime-switching as a methodology applied to Philippine data in particular is all but a handful. Bautista (2000) examined regime-switching in boom-bust cycles and crisis periods in the Philippines using a 3-state Markov-switching model. Gochoco-Bautista (2012) identified a 2-state Markov-Switching BSP reaction function, using monthly data and a 2-state regression model assuming regime switching in the intercept and slopes of the regressors, where one regime is the inflation targeting regime versus the regimes when the monetary authority may have been conducting exchange rate targeting. Magadia (2012) estimated risk measures for the Philippine Stock

[8] The paper analyzes policy regime switches explicitly modeling policymakers' behavior and objectives. They showed how current monetary policy is affected and should optimally respond to alternative regimes. They also show that changes in the parameters of simple rules do not necessarily correspond to changes in policymakers' preferences. In fact, capturing and interpreting regime changes in preferences through interest rate rules can lead to misleading results. Retrieved from Debortoli, D. and Nunes, R. (2011).

Exchange index using an m-state normal-hidden Markov (HMM) model, and found that the HMM performs fairly well in forecasting and concludes further that proper modelling involves using the right number of regimes that should be based on the data at hand rather than the researcher's own subjective perception. Lastly, Cruz and Mapa (2013) utilized Markov-switching techniques to identify high and low inflation regimes for their paper.

It was Panigirtzoglou, e*t al*. (2000) who first looked at the volatility and persistence of the divergences between short-term market interest rates and policy rates using Brenner's (1996) new class of a combination of Levels and GARCH model of market interest rates for Germany, Italy and the United Kingdom, recognizing how important it is for monetary policy makers to know how closely money market rates follow the policy rates they set. Their analysis aimed to offer insights on the effectiveness of various monetary operating system approaches that the central banks in these European economies have employed, considering that they have remarkably different systems of money market operations before the introduction of the euro.

More recently, Affandi and Peiris (2012) looked into the empirical interest rate transmission mechanism vis-a-vis domestic lending conditions, to assess whether the market interest rate structure has blunted the effectiveness of the interest channel of monetary policy for the Philippines. The authors also estimated the persistence and volatility of the deviation of market rates from policy rates, the determinants of the divergence of market rates from policy rates, and the interest rate transmission mechanism and its relation to prevailing lending conditions. They utilized a single-regime model where the conditional variance process accommodated both volatility clustering and dependence on the level of interest rate as in Panigirtzoglou *et al*., (2000) and Brenner (1996).

The Affandi and Peiris (2012) paper noted that structural factors and changing patterns of demand and supply conditions for treasury securities could explain the spread between T-bill rates and policy rates. Based on their findings, liquidity, portfolio flows, fiscal factors and the supply of government securities appeared to be driving the rate gap for the Philippines, but proposed that global factors such as monetary policy in advanced economies and global liquidity may also be driving the divergence. Meanwhile, Panigirtzoglou, *et al.* (2000) established that differences in historical factors as well as in the priorities and objectives across different central banks can also affect the way and degree by which central banks are able to influence relevant market interest rates. Another distinction they have identified in their paper is that the maturity of the interest rates that the monetary authority were keenest to influence was the main focus for policy such that yields in these reference markets were more stable compared to other maturities.

Partly in response to studies which observed that structural breaks in the variance could account for the high persistence in the estimated conditional variance, Hamilton and Susmel (1994) and Cai (1994) introduced Markov-switching parameters to autoregressive conditional heteroskedasticity (ARCH) models, and Dueker (1997) extended this approach to GARCH models. Most relevant to our study, however, is that Dueker (1997) introduced a more tractable method of filtering the data, and hence a more tractable log likelihood process. Dueker's filtering method is to keep one lag of the regime, where the terms can be handled the way they are in a simple ARCH. Dueker (1997), in fact, pointed out that GARCH processes subject to Markov-switching make estimation feasible via his method. In our empirical estimation, we therefore follow the model of Dueker (1997) where the volatility model specification assumes a student-t error distribution with $\boldsymbol{n}_t$ degrees of freedom in the dependent variable.

3. Theoretical Background

The Mundell-Fleming model is by all means a good starting point in analyzing the implications of capital flows on monetary policy where both the short-term market interest rate and the exchange rate are important in the central bank's policy framework and decision-making, which is true for the emerging ASEAN economies of interest in our study. However, this textbook model includes some strong assumptions which make it misleading to rely on if one was to understand the dynamics of the interest rate gap in the four emerging Asian countries being reviewed.

As envisaged under the Impossible Trinity story, we focus on monetary policy being reflected in the short term interest set by monetary authorities. Monetary policy then is a relatively short-term interest, that guides or helps shift the short end of the yield curve. Gray and Malone (2008), however, augmented the basic Mundell-Fleming model to incorporate several features that has become important in light of emerging market crises. Most fundamentally, they generalized the model to include a risk premium in the interest rate that domestic borrowers must pay to investors, and highlight several channels by which this risk premium affects the economy.

The theoretical mechanism visualized under the theory of the Impossible Trinity, however, represents only a partial representation, or an incomplete explanation of the actual dynamics affecting non-resident capital flows into emerging market economies, especially in Asia. Capital controls may well be a useful part of monetary policymakers' toolkit, but they are not needed only to counter the interest-rate arbitrage flows envisioned by the Trilemma principle. Rather, capital controls or other "gatekeeping" policies and other financial market idiosyncracies are mostly needed to counter fluctuations in investors' volatile sentiment which, in turn, are motivated by other global factors (Grenville, 2011).

As we had pointed out in the first chapter, central bank objectives affect the level and direction of the policy rate, whereas financial market characteristics affect the ***sensitivity*** of asset market yields to international investment flows. On the other hand, the perception of risk on emerging markets that is prevailing in global markets, US monetary policy and global liquidity affect the ***attractiveness*** of these asset markets to foreign investors. Because these class of factors affect either the supply, the demand or the price of the relevant asset, both therefore affect movements in benchmark yield rates, and hence, the rate gap. It is interesting to note further, that the monetary policy objectives of the central bank could also have an effect on either the sensitivity of relevant asset markets or the attractiveness of these asset markets to international flows, or both, so that the central bank's decision among three objectives: monetary independence, exchange rate stability, and financial openness has some bearing as well not only on the policy rate, but also on the wedge between the policy rate and the short-term market interest rate itself.

Financial market characteristics affect how **sensitive** asset market yields are to non-resident capital flows in emerging economies such as the ASEAN-4. The taper-tantrum in May-June 2013 illustrated that not all emerging markets (EMs) are equally exposed to the same changes in global conditions (Mishra, *et al.,* 2014, Ahmed, *et al*., 2014, and Ghosh, *et al*., 2014).[9] A number of studies in the literature identify local macroeconomic fundamentals as strong determinants of surges in inflows to EMs, and found that fundamental factors—stronger fiscal balance, higher level of reserves, deeper financial markets, external financing needs, capital account openness, and the exchange rate regime, for example—determine the final magnitude of surges. Nonetheless, Cerutti, *et al.* (2015) pointed out that the role of financial market factors in affecting foreign capital flows to EMs is still an open question. The authors found in their study that financial market characteristics, such as liquidity in the recipient country and composition of the foreign investor base, rather than macroeconomic fundamentals, most robustly explain some emerging countries' sensitivity to global push factors affecting capital flows.

But what we would like to point out here is that an even more important factor to consider in understanding the movements in the rate gap in emerging economies is that what is "chosen" by the domestic financial market as the benchmark rate with which to price loans—the direct channel by which policy interest rates are transmitted into lending rates and ultimately into prices and output in emerging economies—are in fact the yields for assets which are attractive to both resident investors as well as non-resident ones. As long as this asset market is liquid enough and volumes are adequate, it becomes the natural "benchmark" interest rate. For the same reason, this benchmark asset market is potentially highly responsive to non-resident foreign exchange flows.

The theory of the Impossible Trinity in fact implies a substantial degree of substitutability between domestic and foreign assets, but this perfect substitutability is rarely seen in the real world. What we do see, however, is that the yields of assets which are invested upon by both residents and non-residents alike is the most responsive to both monetary policy and global factors, so that often asset markets with this characteristic is where we can observe the

[9] As cited in Cerutti, *et al.* (2015).

Trilemma story coming into play. In other words, we can say descriptively that it is in these asset markets where the constraints of the Impossible Trinity become binding under certain circumstances or during certain periods. As described by Morgan (2013), the influx of carry trade inflows that are seeking yield in a global environment characterized by ultra-low long-term interest rates at zero bound drives upwards the bond prices of domestic assets that are accessible and attractive enough to foreign investors, causing market interest rates for these assets to fall precipitously and hence move away from the main policy interest rate. These conditions, therefore, must represent the need for a short run change in monetary policy—either through its interest rate policy (policies that would adjust the economy in terms of its degree of monetary independence, or conversely disassociate or detach the domestic financial markets from these carry trade inflows or via exchange rate management (allowing for some degree of exchange rate volatility or depreciation, or move towards partially unsterilized or fully unsterilized intervention) in order to contain the destructive effects of such flows on the economy (Obstfeld, Shambaugh, and Taylor, 2004).

Meanwhile, our idea that global factors affect how **attractive** emerging markets are to foreign investors has also been recognized in a recent IMF study. Many studies such as Ahmed and Zlate (2013), Forbes and Warnock (2010), Fratzscher, *et al.* (2013), and Ghosh *et al.* (2012) have documented the importance of global factors such as advanced economy interest rates and global risk appetite in affecting capital flows to small open economies.[10] Cerutti, *et al.* (2015) pointed out that various episodes of large, on and off waves of non-resident capital flowing to and from emerging markets over the past decade has re-emphasized the importance of common factors in driving global capital flows. Grenville (2014) also noted that global investors have been recognizing the opportunities from interest rate differentials in emerging countries in their favor [including a favourable movement in the exchange rate] in waves of confidence, with retreats ("sudden stops") when confidence evaporates and the rational investor exits, analogous to a bank run. He adds that these sudden changes in assessment are explicable in terms of global investors' imperfect knowledge, so that shifts in assessment can be triggered by the arrival of news, or by other investors' actions. This may also be as a result of what is termed as the "home bias" in foreign investors' view of risk, as described in Philips, Kinniry and Donaldson (2012). In the end, these leave emerging countries as the reluctant hosts to non-resident short-term capital flows which cause volatility not only to exchange rates, but to asset prices as well.

We bring to fore once more what we had discussed in the first chapter of this study, that an important repercussion of both the Asian financial crisis (AFC) and the global financial crisis (GFC) is that the financial system of emerging Asian economies became entrenched in an environment where some kind of a risk-on, risk-off (RoRo) cycle in short-term foreign investment flows prevails. Global investors appear to be caught in a binary view of the world: either it is a good year to invest in emerging countries, or it is a complete disaster and uncertainty is just too high in this region so that risk tolerance falls and non-resident funds go back to safe haven investments in more stable advanced economies. Financial Times describes that quite often, risk-on, risk-off behavior follows global markets and this is particularly true for portfolio funds, where periods of perceived low financial risk encourage investors to take risk, therefore creating a risk-on situation, and periods of perceived high financial risk cause investors to take less risk, creating a risk-off situation.[11] The switching between high risk and low risk investments began to happen more frequently and in greater volumes in the fallout to the GFC. RoRo can cause investors to behave in a herd-like manner depending on the risk environment and this investor behavior is more likely to occur in times of economic uncertainty.[12] Global investors' appetite for risk hence rises and falls over time, and there are instances when they are more likely to invest in higher-risk instruments than during other periods.[13] The 2008 financial crisis, for example, is generally viewed as a risk-off year, when global investors reduced risk by selling existing risky positions and moving money to either cash positions or low to no-risk positions, such as U.S. Treasury bonds. Meanwhile, during 2009-2010, global funds were invested in higher-risk instruments in search of better yields, and when emerging markets showed a higher degree of resilience and registered better economic and inflation performance than the advanced economies, global funds were transferred into emerging financial markets as a result—a risk-on period.

[10] As cited in Aizenman, Chinn, and Ito (2015).
[11] Geordie Clarke, Financial Times, http://lexicon.ft.com/Term?term=risk-on,-risk-off.
[12] Aimee Steen, Financial Times, *Ibid*.
[13] http://www.investopedia.com/terms/r/risk-on-risk-off.asp

But what were the factors unique to the period we have reviewed which resulted in a more prominent risk-on, risk-off cycle of investor perception, and thus more volatile capital flows and a widening in the rate gap of emerging ASEAN-4 countries? There are both supply and demand dynamics, or push and pull factors, driving market sentiment positively and leading to low risk premiums, and hence more non-resident inflows, into the emerging economies of Asia. A key push factor is that global financial market conditions have been characterized by very low interest rates, now remaining close to, or at the zero lower bound, in the case of the US and in other developed countries. This encouraged a search for yield—financed largely by carry trades—that compressed risk premiums in most emerging markets. Professor Ronald McKinnon called this the "malfunctioning dollar standard" which he describes as the phenomena where near-zero US short-term interest rates launch hot money flows into emerging markets (McKinnon 2014 and McKinnon and Liu, 2013). Historically, low US Treasury yields meant that emerging Asian central banks incur losses when domestic bond rates fall as a result of foreign exchange intervention—either as a result of selling domestic bonds (i.e., sovereign or central bank bills), as an indirect result of open market operations, or larger interest payments to fixed income or repurchase facilities that (are meant to) attract the additional liquidity in the system, driving the yields down on any of these sterilization tools (Rummel, 2014). This is parallel to what Filardo and Grenville (2012) denoted as the proliferation of lazy assets.[14]

What is central in all the literature we have discussed above is that the investor profile of the relevant asset markets as well as various global factors including measures of risk perception, are critical components in understanding the movements in the rate gap of the ASEAN-4 because they are the main drivers of non-resident capital flows that affect both the policy rate and the benchmark interest rate. Policy-overwhelming international capital flows and its implications to monetary policy are central to the Impossible Trinity[15] story. Aizenman and Ito (2013) and Ito and Kawai (2012) both shared how for small, open emerging economies the Trilemma policy constraints are binding such that given the varying degrees of capital mobility in these countries, they are wrought with the challenges of disruptive capital flows to monetary policy. Based on a case study by Hsing (2012), his empirical findings support the presence of a Trilemma situation in the Philippines, Malaysia, and Singapore, but did not find evidence for a similar situation in Indonesia and Thailand. They noted further that different macroeconomic policy combinations prevailed in Malaysia, Philippines and Singapore, rendering the ability to switch to different policy combinations over time in order to deal with major economic events, such as a crisis.[16]

Periods of high global risk premia in emerging economies can, in fact, act as what we term here a "natural wall" against disruptive capital flows, so that in this environment, impossible trinity constraints have been loosened because the third side of the Trilemma triangle—perfect capital mobility—is irrelevant. The natural wall provided for by high global risk perception during risk-off episodes, discourages the influx of disruptive, short-term foreign capital into emerging markets especially those of the carry trade variety. Meanwhile, during episodes when global risk premia are low—the risk-on episodes—the Trinity constraints become binding, but only in the asset markets that are accessible and attractive to speculative, short-term non-resident flows, such as portfolio flows. In this sense, we can find unique regimes in EMs when the Impossible Trinity story is not prevailing in the entire financial system, but only in those bond markets which are ***attractive*** and ***sensitive*** to non-resident portfolio flows. FDI and other long-term flows have an indirect impact on benchmark interest rates, and an entirely different impact on policy rates. As these types of capital flows are also driven by a separate set of global indicators, the dynamics and effects of these type of flows are outside of the purview of this study, and we reserve its study for future research.

4. Description of Data and Empirical Framework Used

[14] "...lazy assets—a collection of low-yielding assets on private sector bank balance sheets which during good times increases the incentive for banks to leverage up and seek increasingly risky loans or investments as a means to boost the average return on assets," as cited in Rummel, O. (2014).

[15] The purest or "strict" view of the policy constraints under the impossible trinity is that countries that have barriers to capital mobility and a floating exchange rate can achieve a substantial degree of monetary policy independence, while countries with a fixed exchange rate but an open capital account would attain a lower level of monetary policy independence (Obstfeld, et al. 2005)[15]. A more nuanced view, however, is that the impossible trinity represents trade-offs, with an economy gaining greater monetary independence as it either allows more exchange rate flexibility or as it prohibits some types of international capital flows permanently or restricts them during certain periods or episodes (BOE-CCBS, 2013).

[16] As cited in Ramanathan and Teng, (2013).

a. The Data

In this study, we are using the same dataset as what we have used in Chapter 1. We will utilize available monthly data from January 2000 to May 2015 for each of the four member countries of the ASEAN-4—the Philippines, Indonesia, Malaysia, and Thailand. In measuring the rate gap that we will be using in the estimation, we have identified the appropriate short-term benchmark interest rates for the four economies being reviewed based on stylized facts in the literature as well as through central bank consultations describing the asset markets which are most liquid and attractive to both resident and nonresident investors. Meanwhile, the main policy rates were obtained from each of the ASEAN-4 central banks. As discussed in the previous section, the rate gap represents the degree by which the monetary authority maintains its influence or control over the market interest rates prevailing in each of the four economies: the lower the rate gap, the higher the degree of influence of monetary policy over short-term market interest rates and vice versa. All interest rate data series were taken mainly from the CEIC database augmented by respective central bank data, as needed. Financial market data were either in monthly or quarterly frequency obtained largely from the AsianBondsOnline database of the ADB, augmented by central bank data, where applicable. Data available, however, were not uniform in frequency and in terms of the number of observations, and can vary depending on each specific data and for each country. Table shows in detail further information on data definitions and specific sources and series names used in the empirical estimation, as well as the expected signs for each variable in the empirical exercise.

The Interest Rate Gap

As the key motivation for this study, let us briefly look at how the divergence between the main policy rate and the short-term benchmark interest rate in the ASEAN-4 have evolved over time, and at the same time compare its path to the country risk premium measures (i.,e., country risk premium for all four countries computed as the 10-year dollar-denominated sovereign bond rate minus 10-year US Treasury Note, as well as the EMBI+ Global rate for Malaysia and Thailand and the CDS for Thailand) for each country which would capture the RoRo, or risk-on, risk-off episodes of global investments into the ASEAN-4. What is clear via graphical analysis using Figure 1, is that the magnitude of the alternating divergence and convergence in the policy rate and the benchmark interest rate, as well as the timing of the regime-switching in the rate gap, vary across the four economies, so that the dynamics behind rate gap movements are different for each economy—there is heterogeneity in the policy rate divergence—and that indeed, it is time-varying. The differential impact of idiosyncratic financial market characteristics in the rate gap would have been lost under panel data estimation, which is more common in the literature. This holds support to our use of a Markov-switching, time-varying transition probability model in order to understand the dynamics and drivers of the regime-switching rate gap for each individual country in the ASEAN-4.

Financial Market Characteristics

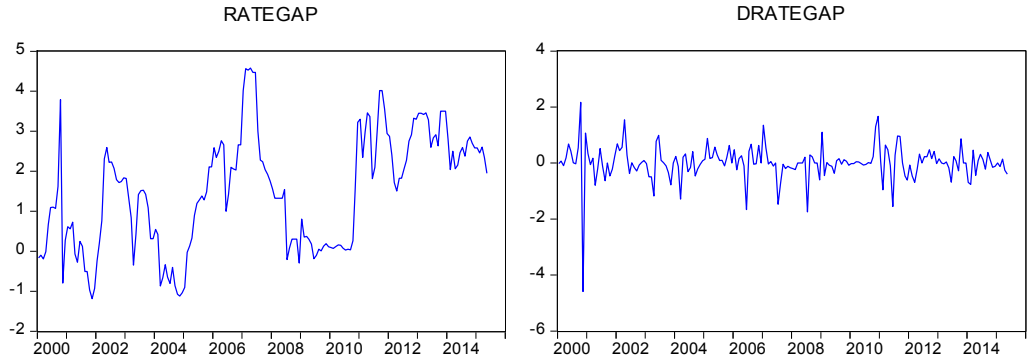
Financial market characteristics, primarily the investor profile of local currency bonds as well as foreign currency bonds which we have discussed in the previous section as potential variables affecting the **sensitivity** of the rate gap and/or either of its two components, are available monthly data from 2000 to 2014 taken primarily from AsianBondsOnline.com of the Asian Development Bank, as well as the central banks and finance ministries in the case of countries whose data are not available online.

Data for the Philippines' foreign holdings of LCY bonds from the Department of Finance from 2005 to 1Q2015, and non-residents' vs. residents' holdings of FCY bonds from the Bangko Sentral ng Pilipinas from 2006 to 1Q2015 are quarterly for the more recent period and annual for earlier years. Meanwhile, data for Indonesia, Malaysia and Thailand on the foreign holdings of LCY bonds, are reported in AsianBondsOnline.com as a quarterly series. As such, we have used the ECOTRIM© program to interpolate the data into a monthly frequency, using Univariate methods. We

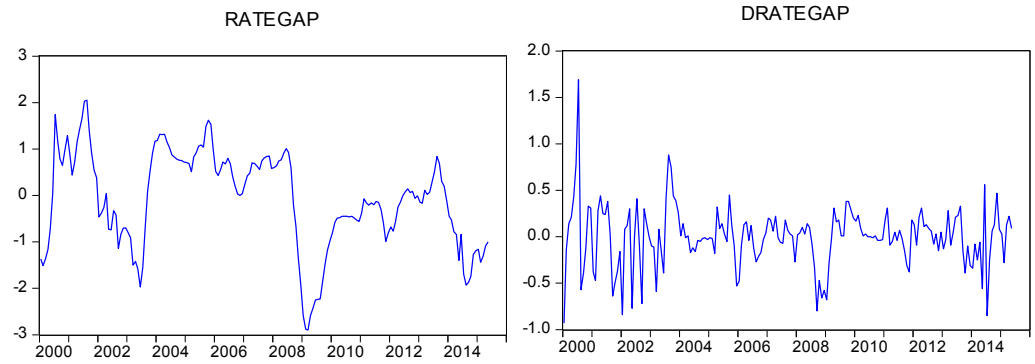
recognize here the drawbacks of such an interpolation method, and we would recommend re-estimation of results in the future if and when a longer, higher frequency historical series for this set of data becomes available.

Figure 1. Monthly Rate Gap and Rate Gap Change of the ASEAN-4, 2000-2015

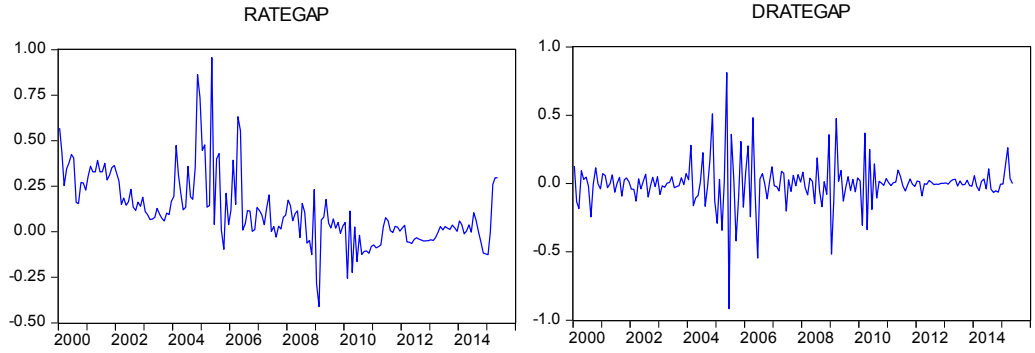
Philippines



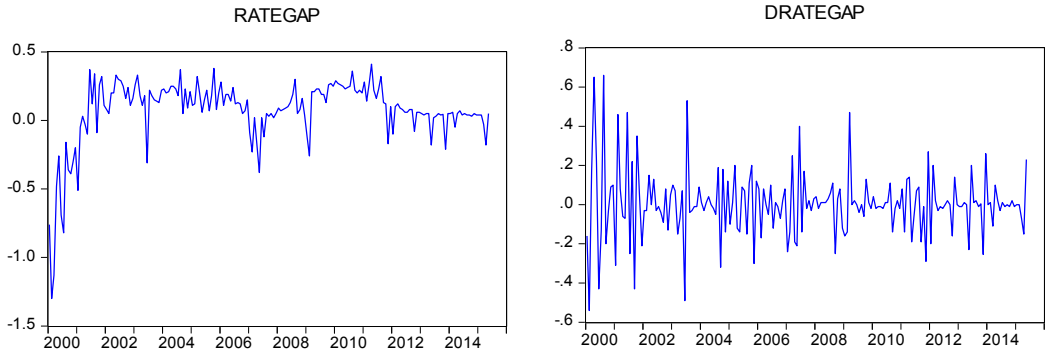
Indonesia



Malaysia



Thailand



Based on the data on the size and domestic financing profile of asset markets in each of the four economies, we see that the Philippine asset market is the thinnest among the ASEAN-4. This is especially so for the bond market, where the Philippine market amounts to only USD21.0 billion in 2000 and USD99.2 billion in 2012, or 28% and 21% of total domestic financing, respectively, compared to Thailand's USD31 billion in 2000 and USD281.3 billion in 2014, Indonesia's USD52.8 billion in 2000 and USD118 billion in 2014, and Malaysia's USD68.7 billion in 2000 and USD312 billion in 2014. This observation will be especially relevant in the empirical analysis later on.

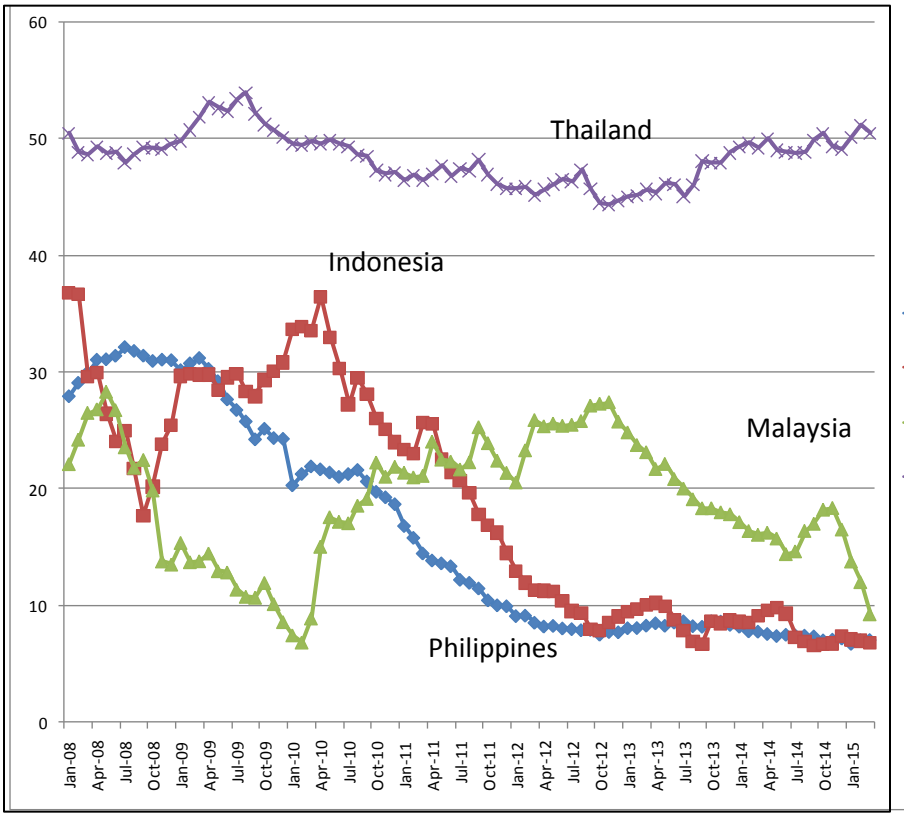
Government is the biggest issuer of LCY in the Philippines and Indonesia, currently accounting for about 80 percent for both. Treasury bills (Tbill) account for about 6% in Q1 2015 for the Philippines, compared to its close to 30 percent share in 2008. Central bank Tbill issuance in Malaysia was on a trend increase since after the Lehman crisis in 2009, but has since trended downwards beginning in October 2012. The share of bonds issued by the government is the higher in the Philippines and Indonesia, at about 90.0 percent in Q1 2015. The share of Thailand Government Tbill and Tbond issuance remained stable throughout the sample period, at about 50.0 percent historically, as well as for central bank Tbills steady at about 40.0 percent.

Table 1. ASEAN-4 LCY Bond Market, in USD Billions and % of Total, 2000-2015

ASEAN-4 LCY Bond Market							
	Bonds, in USD Billions, eop						
Year	2000	2007	2008	2012	2013	2014	2015
Philippines	21.0	58.0	56.7	99.1	99.0	104.0	101.0
Indonesia	52.8	85.7	70.0	111.3	108.0	123.0	127.0
Malaysia	68.7	164.5	166.1	326.9	312.0	316.0	261.0
Thailand	31.1	139.2	140.9	278.5	275.0	281.0	278.0
Source: www.asianbondsonline.adb.org							

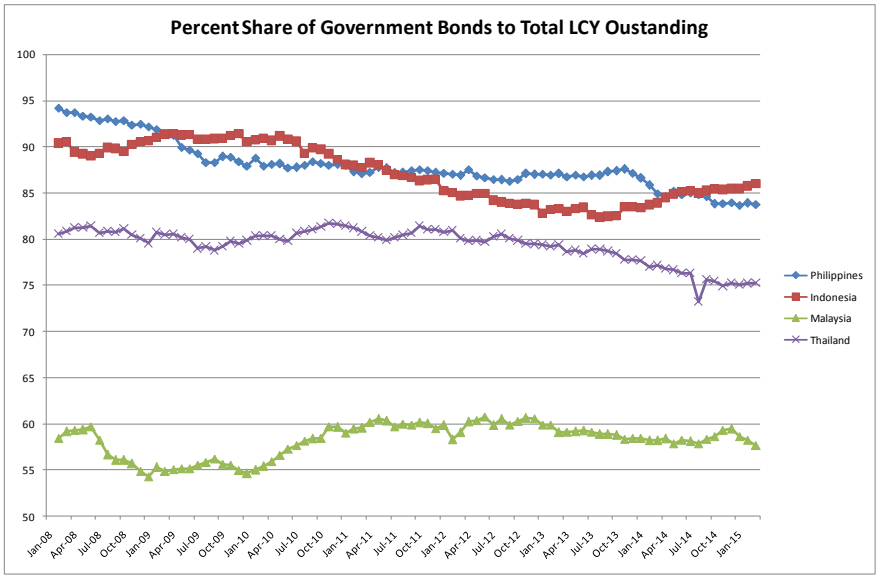
Figure 2A. LCY Government Bond Holdings in ASEAN-4, 2008-2015

% Share of Treasury Bills to Total Government LCY Issuance



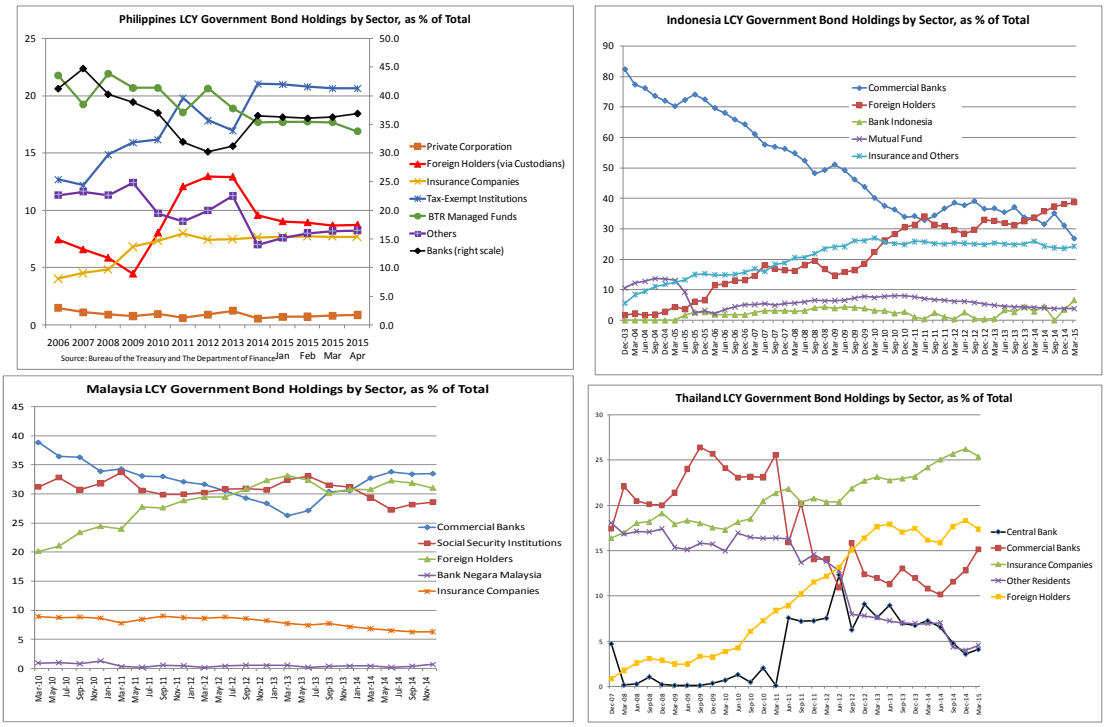
Source: AsianBondsOnline, www.adb.org.

Figure 2B. LCY Government Bond Holdings in ASEAN-4, 2008-2015



Source: AsianBondsOnline, www.adb.org.

Figure 3. LCY Bond Holdings by Sector in ASEAN-4



Source: AsianBondsOnline, www.adb.org.

Meanwhile, in terms of the investor profile of local currency bond holdings or LCY, banks accounted for the biggest share in total holdings of LCY for the Philippines, Indonesia, Malaysia and Thailand historically. More recently, however, bank holdings have been on a declining trend, accompanied by a trend increase in foreign holdings of government securities. Graphical inspection would in fact show us some sort of an inverse relationship between foreign holdings and commercial bank holdings—while foreign holdings were on the rise, commercial bank holdings of GS were on a declining trend. Nevertheless, in the case of both the Philippines and Indonesia, commercial banks still account for the biggest share of LCY ownership.

Figure 4A. FCY Bond Holdings in the ASEAN-4

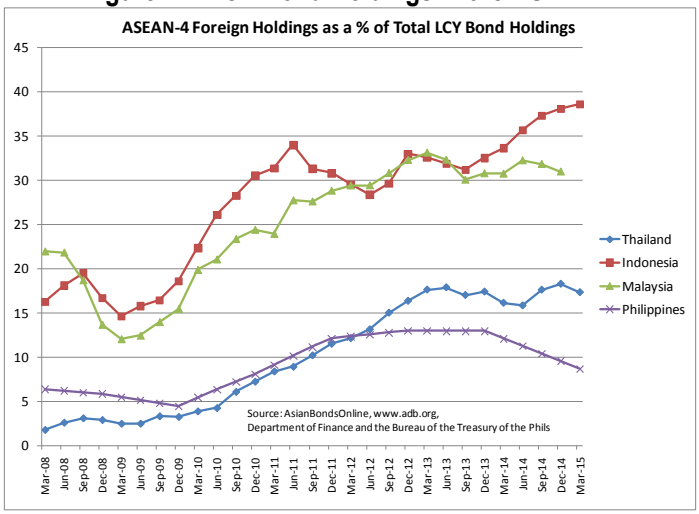
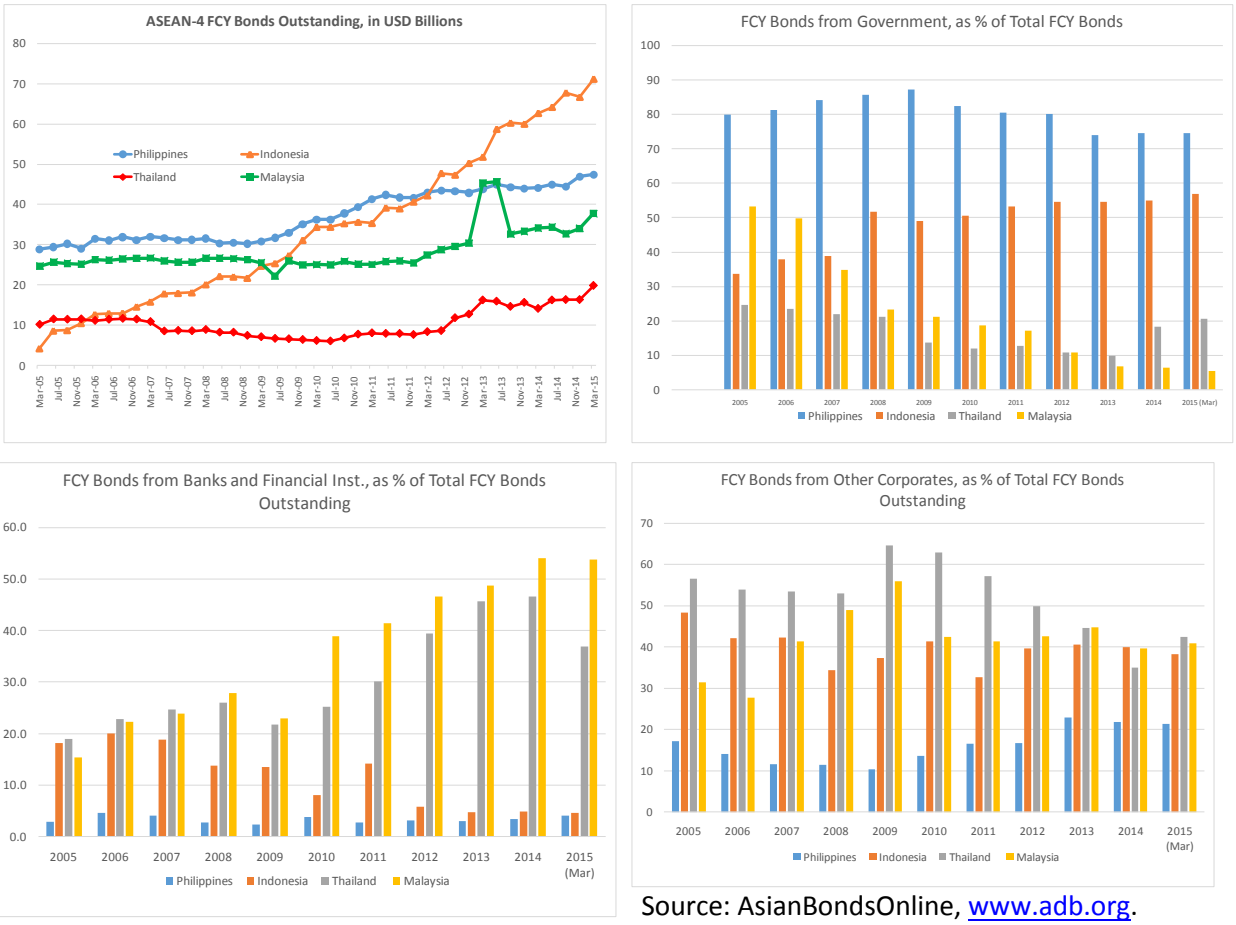


Figure 4B. FCY Bond Holdings in the ASEAN-4



Source: AsianBondsOnline, www.adb.org.

In terms of the investor profile of foreign-issued and or foreign currency-denominated government securities or FCY, we find that the Philippines has had the biggest level of FCY debt among the ASEAN-4 since 2005. Indonesia, however, has recently surpassed it with the steepest climb in the levels by the first quarter of 2015. FCY bonds issued by the government as a share to total issuance is the largest in the Philippines at about 80 percent historically, followed by Indonesia at about 50 percent. In Malaysia, the government's share to FCY issuance has shrunk to about 5.0 percent of the total by Q1 2015, whereas banks and financial institutions' share climbed to about 55.0 percent for the same period. Corporates account for the biggest share of FCY bond issuance in Thailand, peaking at about 65.0 percent in 2009, and falling to around 40.0 percent in Q1 2015. The share of the corporate sector in FCY, is also high in Malaysia, following Thailand, at about close to 40.0 percent on the average historically.

Global Factors

Global factors, what we had identified earlier as indicators of the **attractiveness** of the benchmark bond markets to global investors for the ASEAN-4, were mainly taken from Bloomberg as well as the Asian Development Bank, the IMF, the EPFR, as well as IIF online databases, where applicable, and using data series available from 2000 to Q1 2015. There are several indicators for the global risk premium associated with emerging market assets which are used in financial market analysis. The most commonly used, and readily available, indicators of global risk perception are market information extracted from the EMBI and the CDS, or from the spreads of country sovereign bond prices to risk-free bond prices. Changes in the market-implied default probabilities extracted from EMBI+ Global or the EMBI per country, as well as the 5-year CDS premia on sovereign debt are often used as an indirect measure

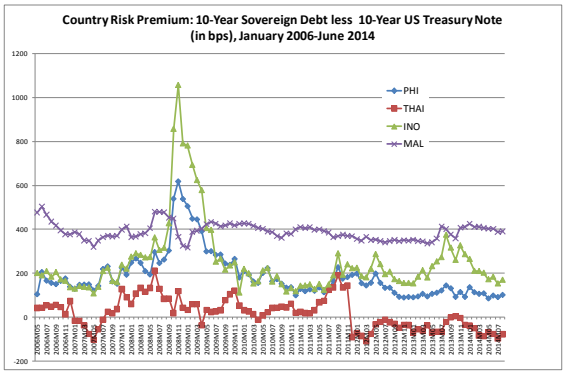
of the market's perception of sovereign risk (Das, Oliva, and Takihiro, 2012). Meanwhile, the differential or gap between 10-year dollar-denominated sovereign debt of each country and US 10-year Treasury Notes, has become a benchmark for most emerging countries in tracking global markets' view of country risk vis-à-vis safe haven assets, such as US Treasuries.

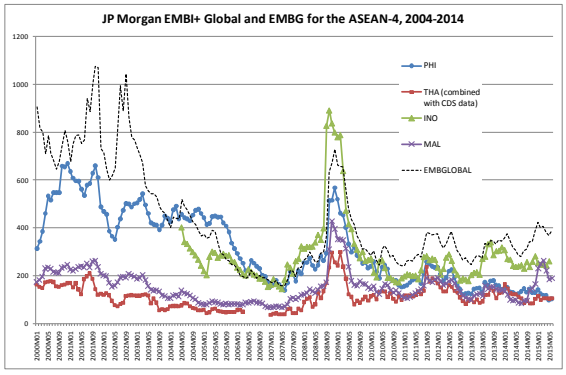
What we have used to test as determinants of the transitional probabilities in the rate gap are common emerging market risk indicators such as the US real rates, the US ten year treasury yields, VIX data as well as EMBI+ global, portfolio flow variables according to that going into debt and into equity, as well as individual countries' risk premium data. For Thailand, we have combined the CDS data which is available from January 2000 to February 2006 only, with the EMBIG data, which is available from January 2007 to the present, in order to have a longer, more useful data series as the risk premium indicator.

As in Kennedy and Palerm (2010), we follow the literature in assuming that EMBI+ spreads embody the probability of default, which can arise from combinations of market, liquidity and credit risk. Based on simulations using the authors' estimated model for EMBI+ spreads in the same study, it was found that world financial market risk conditions play the more important role in accounting for changes in EMBI+ spreads from 2002 to 2010. Nonetheless, while recognising the importance of world risk conditions, the rise in EMBI+ spreads from late 2007 to December 2008, at the time of the GFC, for a majority of the countries they studied show that global financial markets at this time were giving more weight to domestic developments. Kennedy, M. and Palerm A. (2010) submitted that in this context, it can be argued that global financial markets in the most recent episode of deteriorating risk conditions were generally more discriminating regarding emerging-market economies now than in the past.

As indicated in Figure 5 below, the risk premium indicators associated with sovereign assets of the ASEAN-4 were moving at more or less the same pace and on a declining trend, but with some upswings and downswings. The most prominent upswing and downswing was that during and after the GFC, respectively. The risk perception on Indonesia have been some 100 basis points higher than the other three economies of the ASEAN-4 as of May 2015, although Malaysia's EMBI Global spread experienced a sharp upswing beginning the mid-2014 and peaking in March 2015.

Figure 5. Country Risk Premium, EMBI+ and EMBI Global Spreads for the ASEAN-4





Source: BSP estimates of the Country Risk Premium; Bloomberg

b. Empirical Framework

Earlier in this chapter, we have established why it is reasonable to hypothesize that the rate gap in the ASEAN-4 countries may behave differently during different periods. Central banks in the four economies we are studying—the Philippines, Indonesia, Malaysia and Thailand—carefully monitor any one, two or all of these that form part of their main objectives: price stability, monetary aggregates, or the foreign exchange market, and monetary policy either responds or intervenes in these markets in the face of any major political or economic shock that pose a threat to the attainment of these objectives. The influence of monetary policy, as represented by the rate gap, may therefore change or vary over time depending on the kind of environment or regime prevailing during that period. Volatility clustering is also a well-documented feature of any financial rates of return that are captured in volatility models. Price changes that are large in magnitude tend to occur in collections or clusters rather than with equal spacing. These observations motivated us to apply the Markov-type regime-switching framework, because it allows us to test whether the regime-switching process is detected in the rate gap data of the ASEAN-4 economies, either with conditional variance using the models of Gray (1996) and Dueker (1997).

The Markov-switching GARCH model of conditional variance enable us to distinguish between the different rate gap regimes in the four economies under study, and therefore relate it to the Trilemma story, as well as examine the data process of each country rather than treat them in a cross-sectional framework of analysis where the nuances for each economy could be lost. We therefore replicate the Markov-switching GARCH framework with conditional variance based on Dueker (1997). To examine and provide evidence whether the risk-on, risk-off (RoRo) type of cycle in global risk perception—as indicated by various measures of global risk premium—and other global factors and financial market characteristics, affect the regime changes, we conducted a simple events analysis where we looked into various indicators of these two group of factors and compared the timing of major events and data changes via graphical inspection with the resulting regime probabilities which we obtained from the empirical exercise. This additional step will help establish which of the indicators are associated closely with the expected switches in the four economies as predicted by the movements in the risk premia and indicators of RoRo such as the Flight-to-Safety (FTS) Index and the HSBC RORO Index.

The Markov-Type Regime-Switching GARCH Model of Conditional Variance

We estimate the rate gap using a Markov-switching model with conditional variance, to see if Markov-switching is detected in the variances of the rate gap, following the work of Gray (1996) for market interest rates. However, we replicated here the log likelihood estimation method of Dueker (1997) from the paper replication programming codes of RATS Estima®. Dueker (1997)'s estimation has been recognized as a relatively more efficient and hence preferred estimation process for a Markov-switching GARCH model than that used by Gray in 1996. In addition, as in Panigirtzoglou and Proudman (2000), and Affandi and Peiris (IMF 2012), our dependent variable here is the degree of influence that central banks in the ASEAN-4 exercise over short-term market interest rates, or the rate gap. The rate gap is computed as the policy rate less the benchmark interest rate. This represents the divergence of the market interest rate (what we identified earlier as the benchmark interest rate in the market whose volumes and rates are attractive to both resident and non-resident investors) from the main policy rate (the interest rate on the main monetary instrument used by the central bank to provide marginal liquidity to the financial system).

Let g_t denote the rate gap. Based on the leading empirical model for short-term market interest rates, its specification is:

(1) $$g_t = \mu_t + \varepsilon_t$$

where $$\mu_t = \alpha_0 + \beta_0 g_{t-1}$$

and ε_t is typically modelled in many empirical studies as a simple GARCH (1,1) process:

(2) $$\varepsilon_t = \sqrt{h_t v_t} \text{ with}$$

$$h_t = c_0 + a_0 \varepsilon^2_{t-1} + b_0 h_{t-1} .$$

h_t is the conditional variance of ε_t given all the information in the past up to time t-1, and v_t are i.i.d. random variables with mean zero and variance 1. Later we will allow the error terms to be independent white noise with a possibly non-normal distribution, such as the standard t-distribution based on Dueker (1997). The conditional variance in this specification is a linear function of the square of the lagged error terms (ε_{t-1}) or the ARCH term (also referred to as information flows or the "news from the past"), and the lag of the past values of the conditional variance h_{t-1}, the GARCH term, to accommodate for volatility clustering, plus a constant c_0 which is the weighted long run average variance. However, this model does not allow for sensitivity to interest rate levels per se. Gray (1996) included a term adding a levels term $\beta_1 g_2 \gamma_{t-1}$ directly into the GARCH (1,1) model to allow for the volatility in the rate gap to depend on both the LEVELS effect, and the GARCH effect. Using this specification, Gray (1996)'s model also nests both the LEVELS only model (if $c_0 = a_0 = b_0 = 0$) and the GARCH only model (if $\beta_1 = 0$) as described in the literature review. We do not pursue this possibility here, however.

To allow for Markov-switching parameters in the GARCH model, (1) becomes

(3) $$g_t = \mu_{i,t} + \varepsilon_{i,t}$$

where $$\mu_{i,t} = \alpha_i + \beta_i g_{t-1} \quad \text{when } S_t = i$$

and,

$$\varepsilon_{i,t} = h_{i,t} v_{i,t} \text{ with}$$

(4) $$h_{i,t} = c_i + a_i \varepsilon^2_{t-1} + b_i h_{t-1}$$

The unobserved regime, S_t, takes two values (0 or 1) and each regime has a different degree of mean reversion to a different long run mean. The conditional variances in each regime also takes a very general form incorporating the GARCH effects. According to Gray (1996), in the most general version of the model, the functional form of the conditional mean incorporates mean reversion in one standard way. Within this framework, the conditional mean and variance could have an even more general paratmetrization. For example, the means could be autoregressive moving average ARMA (p,q) and the variances could be GARCH (p,q) just like in a univariate time series analysis.

Gray (1996), Cai (1994) and Hamilton and Susmel (1994) all pointed out, however, that regime-switching GARCH models are intractable to estimate due to the dependence of the conditional variance in the entire past history of the data in a GARCH specification. This means that the distribution at time t, conditional on the regime S_t and on available information, depends directly on S_t, and also indirectly on $\{S_{t-1}, S_{t-2}, \ldots..\}$ due to the path dependence inherent in regime-switching GARCH models. Gray (1996) illustrates that this is because the conditional variance at time t depends upon the conditional variance at time t-1, which depends upon the regime at time t-1, and so on.

The model is estimated using quasi-maximum likelihood estimation, with the log-likelihood function constructed following the RATS Paper Replication of Dueker (1997)'s Switching GARCH model. Given that the regime-switching GARCH specification involves the dependence of the lagged variance term upon the entire history of the regimes, the exact likelihood function is hence impossible to compute, particularly in large financial data sets. An exact

analysis of a Markov-switching GARCH model cannot be estimated, in fact, except in very small data sets. Instead, an approximation or filter is required to shorten the length of the dependence, by finding some form of summary of the history of the regimes in a determinate number of lags.

The two principal filtering methods that have been proposed is that of Gray (1996) and Dueker (1997). Gray (1996) collapses the regimes history immediately, so that there is just one lagged variance. Meawhile, Dueker (1997) collapses it after a one period lag, so each regime at t-1 has its own variance. Based on RATS[17], Dueker's method is simpler to use in practice and is in fact more general of the two. Gray's estimation filter requires quite a bit of extra calculation especially if the residual is also regime-dependent (if the mean equation switches) because the lagged variance calculation needs to take into account the differing means and the lagged squared residual terms also need to be collapsed. Because Dueker's filter keeps one lag of the regime, those terms can be handled the way they are in a simple ARCH. Operationally, Gray's model also tend to lead to a large portion of the data series being discarded or unused in the estimation. Dueker (1997) in fact pointed out that GARCH processes subject to Markov-switching make estimation feasible via his method. As it can be estimated more easily within a tractable log likelihood estimation process, we therefore follow the model of Dueker (1997) where the volatility model specification assumes a student-t error distribution with $\boldsymbol{n}_t$ degrees of freedom in the dependent variable to specify:

(5) $$\boldsymbol{g}_t = \boldsymbol{\mu}_t + \boldsymbol{\varepsilon}_t$$

where $\boldsymbol{\varepsilon}_t \sim$ student's t (mean = 0, $\boldsymbol{n}_t$, $\boldsymbol{h}_t$), $\boldsymbol{n}_t > 2$

The conditional mean, $\boldsymbol{\mu}_t$, is allowed to switch according to a Markov process governed by a state variable, S_t:

(6) $$\boldsymbol{\mu}_t = \boldsymbol{\mu}_t S_t + \boldsymbol{\mu}_h (1 - S_t), \qquad S_t \in \{0,1\}\ \forall_t$$

(7) $$\Pr(\boldsymbol{S}_t = 0 | \boldsymbol{S}_{t-1} = 0) = \boldsymbol{p}$$
$$\Pr(\boldsymbol{S}_t = 1 | \boldsymbol{S}_{t-1} = 1) = \boldsymbol{q}$$

So that the unconditional probability of $\boldsymbol{S}_t = 0$ is $(1 - \boldsymbol{q})/(2 - \boldsymbol{p} - \boldsymbol{q})$. The variance of $\boldsymbol{\varepsilon}_t$ is denoted as $\boldsymbol{\sigma}^2_t$ and is a function of $\boldsymbol{n}_t$ and $\boldsymbol{h}_t$. $\boldsymbol{h}_t$ is assumed to be a GARCH (1,1) process:

(8) $$\boldsymbol{h}_t(\boldsymbol{S}_t, \boldsymbol{S}_{t-1}, \ldots, \boldsymbol{S}_0) = \gamma(S_t) + \alpha(S_{t-1})\,\boldsymbol{\varepsilon}^2_{t-1} + \beta(S_{t-1})\boldsymbol{h}_{t-1}(S_{t-1}, S_{t-2}, \ldots, S_0)$$

The presence of lagged h on the right side of equation (7) above illustrates how the GARCH variable becomes a function of the entire history of the state variable. As in Kim (1994), Dueker addressed this problem by introducing a collapsing method to make the evaluation of the maximum likelihood function possible. $\boldsymbol{h}_t$ here is treated as a function of only S_t and S_{t-1}:

(9) $$\boldsymbol{h}_t^{(i,j)} = \boldsymbol{h}_t(S_t = \boldsymbol{i}, S_{t-1} = \boldsymbol{j})$$

This method of "summarizing" $\boldsymbol{h}_t^{(i,j)}$ into $\boldsymbol{h}_t$ now makes (7) a tractable GARCH formula:

(10) $$\boldsymbol{h}_t^{(i,j)} = \gamma(S_t = i) + \alpha(S_{t-1} = j)(\boldsymbol{\varepsilon}^i_{t-1})^2 + \beta(S_{t-1} = j)\,\boldsymbol{h}^{(j)}_{t-1}$$

The collapsing procedure integrates out the first lag of the state variable $\boldsymbol{S}_{t-1}$, from the GARCH function, $\mathbf{h}_t$, at the right point in the filtering process to prevent the conditional density from becoming a function of the growing number of past values of the state variable. The variance is also assumed to follow a GARCH process so that $\boldsymbol{\sigma}^2_t = \boldsymbol{h}_t$, and the only parameter in $\boldsymbol{h}_t$ subject to Markov-switching is the intercept γ. This type of switching is tantamount to allowing

[17] RATS Learning Examples, Chapter 13: Markov Switching ARCH and GARCH.

shifts in the unconditional variance because the unconditional variance of the ordinary constant parameter GARCH (1,1) process is γ / (1 – α – β). For this model, the GARCH variance hence takes the form:

(11) $$\boldsymbol{h}_t^{(i,j)} = \gamma (S_t = i) + \alpha(\boldsymbol{\varepsilon}^{(j)}_{t-1})^2 + \beta \boldsymbol{h}^{(j)}_{t-1}$$

with constant α and β with switching in the unconditional variance.

e. Presentation and Analysis of Results

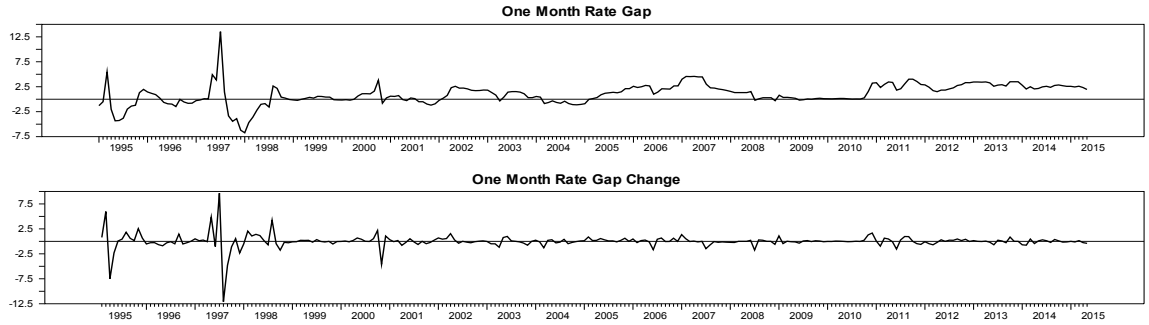
Chart 1A and 1B plot the monthly rate gap and the monthly rate gap change for the ASEAN-4, the former chart is for the entire period available which is 1995 to 2015, and the latter for the more recent data series from 2000 to 2015. Looking at both charts, there is no obvious upward and downward trend, i.e., the mean appears constant, and the change in the rate gap reverts at close to 0. However, the variability is not uniform, and shows chunks mixed with occasional spikes. It is noteable that for these four economies, the largest change and volatility in the rate gap was during the 1997-98 Asian crisis and, despite some rise in volatility in the periods leading up to the 2007-08 global financial and economic crisis, the chunkiness and spikes in the Asian crisis remain unprecedented.

1) Results of the simple AR(1)-GARCH(1,1) and Heteroskedasticity Tests

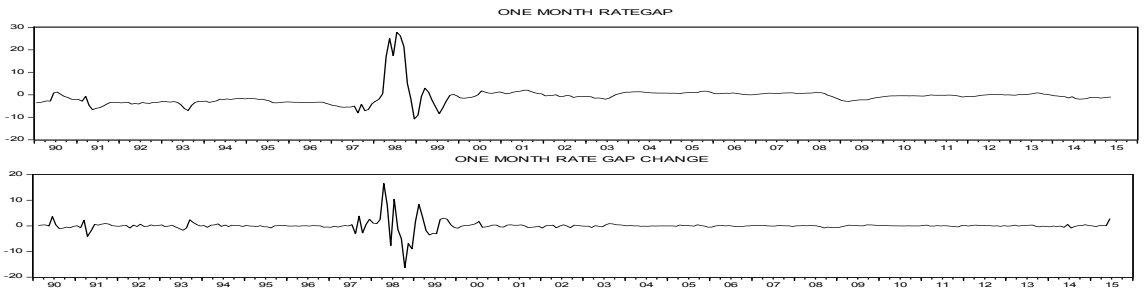
We began the estimation process by first conducting a simple univariate analysis to investigate whether the data series on the rate gap for the four countries depict non-constant variance under a simple AR(1)-GARCH (1,1) model, with a Gaussian distribution for the error terms specification. The expected result will give us a certain degree of justification, albeit not a sufficient one, that there is reasonable "GARCHness" in the variances. The expected results will justify further investigation on the presence of Markov-type regime-switching with conditional variance in the rate gap.

Chart 1A. Monthly Rate Gap and Rate Gap Change of the ASEAN-4, 1995 to 2015

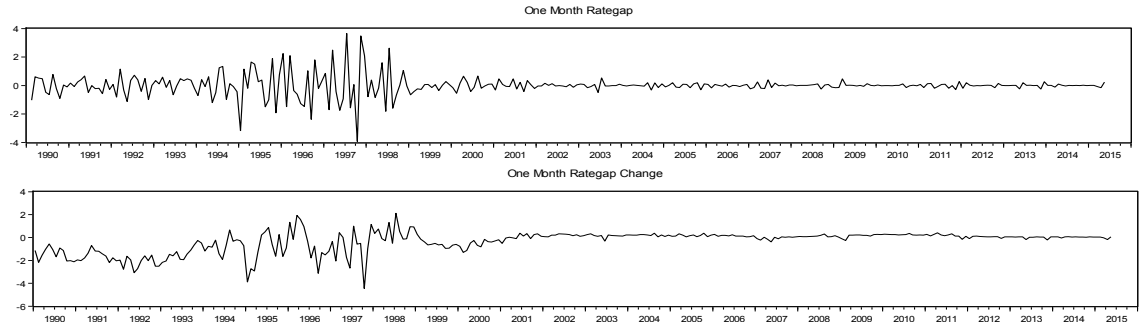
Philippines



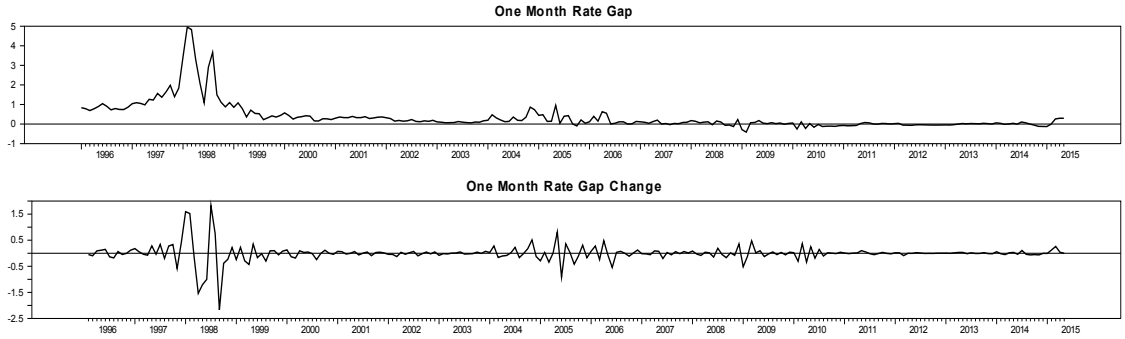
Indonesia



Malaysia



Thailand



Source of basic data: CEIC database and the central banks' websites

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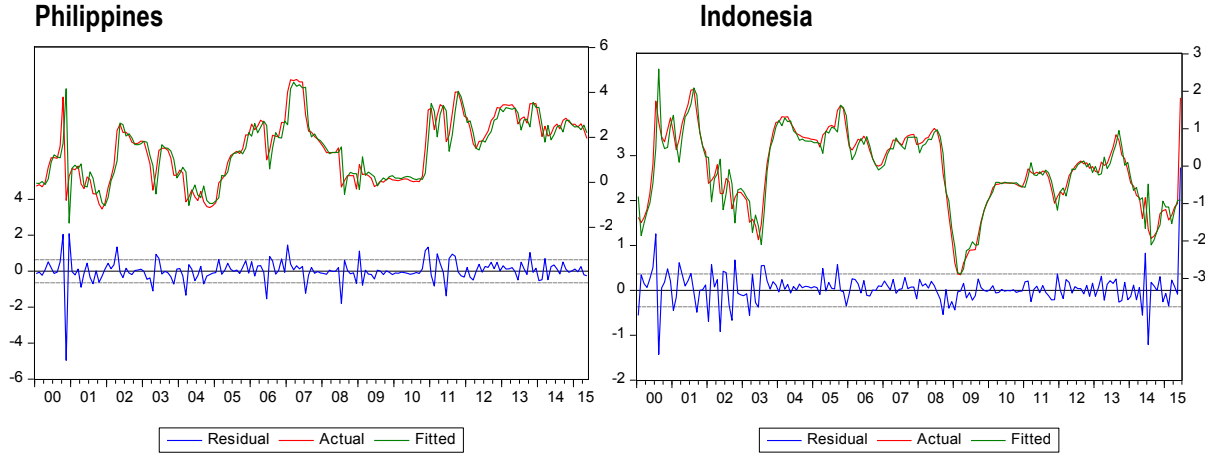
The plot of the residuals in Chart 2 below show that it does not appear to follow a random process. Values of the residuals come in chunks, and the spikes could be caused by sudden high variances or shifts of the mean for the periods. We can also expect the square of these residuals to be chunky and showing the same occasional spikes. This behavior in the residual and squared residuals would be the result of dependence of the variance of the rate gap at time t on the variances in preceding periods.

As expected, heteroskedasticity ARCH-LM test results for the rate gap for the Philippines, Indonesia, Malaysia, and Thailand in Table 2 show unequivocally that, with significance at a p-value of less than 1%, the variance in the time series being reviewed is non-constant or is time varying. For the Philippines, an AR(2), GARCH(1,1) specification fully accounted for the heteroskedasticity in the rate gap series, allowing us to obtain significant results in the ARCH-LM test with this specification. For Indonesia, the Heteroskedasticity ARCH-LM test under an AR(1)-GARCH (1,1) specification did not allow us to reject the null hypothesis initially, so that the test did not support a non-constant variance for Indonesia's time series data on the rate gap. Nevertheless, using an AR(2), removing the ARCH term and adding a second GARCH term—an AR(2)-GARCH(0,2) specification—fully accounted for the conditional

heteroskedasticity in the model, this time giving us test results that allowed us to reject the null of constant variance within a 99.0 percent confidence interval.

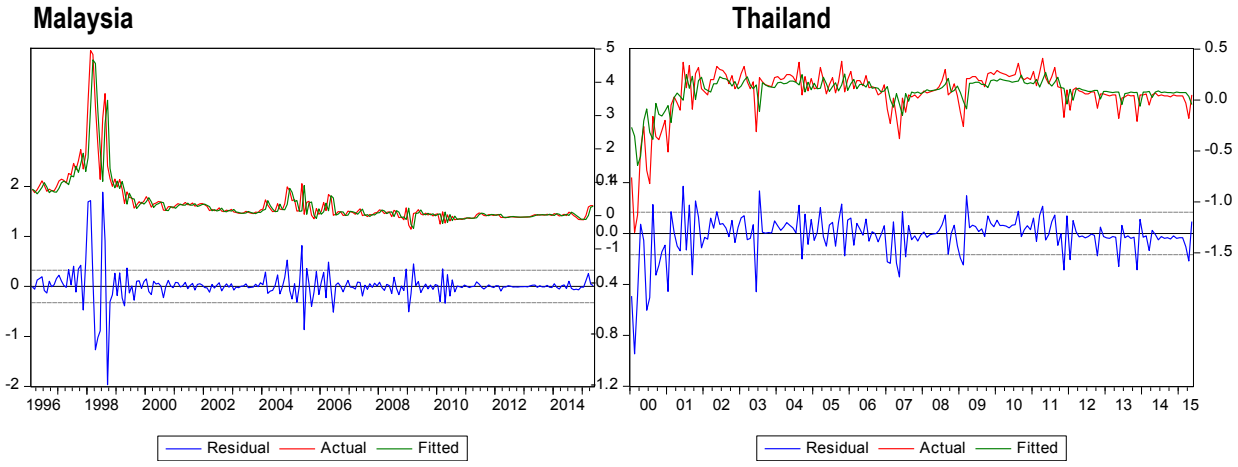
The same was true for Malaysia and Thailand, in that the AR(1)-GARCH(1,1) was not able to account for the conditional heteroskedasticity in its rate gap time series so that the ARCH term was removed and other AR terms were considered. The AR(3)-GARCH(0,2) specification worked this time for Malaysia, whereas an AR(1), GARCH (0,2) became the preferred model for Thailand, as the ARCH-LM test finally accounted for all heteroskedasticity under the revised specification. In addition, the preferred variance equations obtained GARCH terms whose t-statistics and *p*-values show significance within a 99.0 percent confidence interval for the Philippines, Indonesia, Malaysia and Thailand.

Chart 2A. Actual, Fitted, and Residual Charts from the simple AR(1)-GARCH(1,1) of the rate gap



Source: Author's estimates.

Chart 2B. Actual, Fitted, and Residual Charts from the simple AR(1)-GARCH(1,1) of the rate gap



Source: Author's estimates.

The combined evidence from the ARCH-LM test and the chosen AR(*p*)-GARCH(*p,q*) model prompted us to conclude non-constant variance in the rate gap for the ASEAN-4 economies, as the estimation output showing significant coefficients in fact generally takes precedence over the ARCH test alone. Removing the ARCH term, however, means that the conditional variance h_t in both Malaysia's and Indonesia's rate gap does not depend on the square of the lagged error terms—it is not affected by information flows or "news from the past". Moreover, adding a second GARCH term for Thailand, Indonesia and Malaysia means that the conditional variance in the rate gap experiences volatility clustering not only one period back, but up to two periods in the past.

Additional parameters obtained from the simple AR (1)-GARCH (1,1) model yield interesting insights into the central banks' control over short-term market rates. The model we had specified in equation (1) allows considerable flexibility in estimating the persistence and volatility of the divergence of the market rate from the policy rate. First, the mean of the rate gap, which we can view as the mean of the divergence between the policy rate and the benchmark interest rate in each regime, is given by the expression α_0/β_0. Second, the speed of reversion to this long-run mean and its direction is given by the level and sign of β_0, respectively. As Kuan (2002) illustrated, we can let μ denote the long run level of g_{rt}, $\alpha_0 = \rho\mu$ and $\beta_0 = -\rho$, so that (1) becomes $g_{rt} = \rho(\mu_t - g_{rt-1}) + v_t$ which denotes that for as long as $\rho > 0$, (i.e. $\beta_0 < 0$), $\Delta g_{rt} = g_{rt} - g_{rt-1}$ is positive (negative) when g_{rt} is below (above) the long-run level. In this case, g_{rt} will adjust toward the long run level and hence exhibit mean reversion. Persistence is also a feature embedded in the GARCH equation of our model. Persistence refers to how quickly (or slowly) the volatility reverts of "decays" toward the long run average variance. High persistence means slow decay or regression towards the average variance, whereas a lower persistence implies faster regression back to the long run level.

Table 2. Results of Heteroskedasticity Test and Simple AR (1)-GARCH (1,1) Model for the RATEGAP

1990-2015		PHILIPPINES	INDONESIA	MALAYSIA	THAILAND
Heteroskedasticity Test: ARCH LM					
	F-statistic	20.26793	19.11166	66.51607	19.48435
	Obs*R-squared	19.11186	17.48553	51.89556	17.79355
	Prob. F(12,272)	0.0000	0.0000	0.0000	0.0000
	Prob. Chi-Square(12)	0.0000	0.0000	0.0000	0.0000
Estimation Output					
Log Likelihood		-471.6894	-27.34159	7.536706	113.3096
	Mean Equation				
Coefficient	C	1.645169	0.18	0.50	0.11
	AR(1)	0.919224	1.30	0.87	0.53
	AR(p)*	-0.21487	-0.40	0.09	
p-value	C	0.0000	0.48	0.00	0.00
	AR(1)	0.0000	0.00	0.00	0.00
	AR(p)*	0.0000	0.00	0.00	
	Variance Equation				
Coefficient	C	0.01	0.04	0.00	0.00
	RESID(-1)^2	-0.03			
	RESID(-2)^2				
	GARCH(-1)	1.01	1.11	1.98	-0.06
	GARCH(-2)		-0.62	-1.00	0.84
p-value	C	0.00	0.00	0.00	0.00
	RESID(-1)^2	0.00			
	RESID(-2)^2				
	GARCH(-1)	0.00	0.00	0.00	0.07
	GARCH(-2)		0.00	0.00	0.00

*AR(p) : AR(2) for the Philippines and Indonesia and AR(3) for Malaysia

Table 3. Dynamics of the Rate Gap: Deviation of Benchmark Interest Rates from the Policy Rate				
	PHILIPPINES	INDONESIA	MALAYSIA	THAILAND
Long Run Mean of the rate gap = α_0/β_0	2.34	0.20	0.53	0.21
Speed of Reversion to the Mean = $-\beta_0$	-0.70	-0.91	-0.95	-0.53
Persistence of the variance = a+b	0.98	0.50	0.98	0.78
Long Run Variance = c/(1-(a+b))	0.23	0.08	0.08	0.01

Based on the additional parameter dynamics presented in Table 3, the Philippines shows up with the highest long run mean for the rate gap, which is expected from graphical inspection of the historical rate gap in Charts 1A and 1B earlier. In terms of monetary policy, this is a reflection of either one of two scenarios. We are looking at two possible sources of the higher gap: 1. the policy rate is being changed or adjusted, but without an accompanying influence or one-to-one movement in the benchmark interest rates, or 2. the policy rates are simply not being adjusted in the same direction while changes or movements are happening in the benchmark interest rates. Meanwhile, Malaysia, Thailand and Indonesia show relatively smaller long run mean for the rate gap. In terms of the speed of reversion to the mean, the reversion measure is highest for Malaysia, followed by Thailand, Indonesia, and then the Philippines. The relatively faster reversion to the mean for Malaysia and Indonesia is indicative of how monetary policy and benchmark asset markets tend to normalize relatively more quickly in these countries either after any policy change, or after any shock causing the market interest rates to move away from the policy rate, compared to the Philippines and Thailand. Both the higher long run average rate gap and the slower reversion to the mean could be a reflection of how the monetary authorities in the Philippines are either not readily normalizing policy rates after an episode prompting a policy change or movement had passed, or market interest rates are simply not strongly influenced by the policy rate to move back to its levels before the policy change or random shock. Either way, as deviations of the benchmark rates from the policy rates tend to persist over time in terms of level and volatility, this suggests that the influence of the policy rate during the period in review for the Philippines is relatively limited, or weaker compared to that in Indonesia, Malaysia and Thailand. The slowest reversion to the mean during the review period was posted by Thailand, but then again it also registered a much lower mean for the rate gap which means that the generally small rate gaps at certain periods persist longer for this economy.

Meanwhile, as we had noted earlier, the sum of the weights assigned to the lagged variance and the lagged squared residuals in our GARCH(1,1) specification for the ASEAN-4 countries is a measure of persistence in the variance. The Philippines and Malaysia exhibit high persistence, as they have values very close to 1.0, which means very slow reversion towards the long run variance. This implies that periods of high volatility tend to persist for these two economies. Thailand is showing a persistence factor of 0.77 which is still relatively high, but is now showing a slightly faster reversion to the long run variance. Indonesia has the lowest persistence factor at about 0.50 ppts, which implies it has the fastest reversion or "normalization" in terms of its variance. We need to exercise caution in the analysis for Thailand, however, because it has a negative coefficient for the first GARCH term, could indicate that the conditional variance is unstable, or that the model may be nonstationary. Nevertheless, p-values indicate that the results for Thailand are significant within the 90.0 percent confidence interval. It is interesting to discuss Malaysia's parameter estimates further, as it has the fastest mean reversion, but the highest persistence in its variance. This would imply that although its rate gap is small and converges relatively quickly towards its long run average level, any chunks in volatility tend to propagate itself across many periods. This could, in turn, be indicative of the nature of the financial markets in Malaysia—although the policy rate maintains a strong influence over market interest rates, the impact of economic crises and shocks tend to be protracted because Malaysia's domestic bond market is very much linked to the global economy.

Apart from the fact that it has both inflation and exchange rate stability objectives, the large size of Malaysia's local currency bond market and advanced development relative to other regional bond markets make it a preferred

host to foreign investment flows. A recent BNM study found that following pro-active efforts to develop the ringgit bond market and foreign exchange (FX) liberalisation measures that took place in early 2000s, episodes of flattening yield curve were in fact driven by sudden prominent increases in portfolio inflows entering the domestic bond market. Empirically, they found that foreign investors' participation in the domestic bond market has a statistically significant impact in contributing to the decline in bond yields observed during certain periods.[18] Nonetheless, the rate gap on the average remains small as large sales of domestic bonds by foreign investors were absorbed with minimal impacts on domestic yields because the movement of foreign funds are supplemented by domestic capital-- private inflows and outflows from corporates and domestic banks and investors. This is an example of an economy that is attractive to global investors (i.e., why global shocks' impact persists) , but whose financial market characteristics make domestic interest rates relatively more resilient against the impact global perception and the inflow of foreign capital (i.e., why the rate gap remains small).

In terms of the long run average unconditional variance, the rate gap series of Thailand has the smallest value among the ASEAN-4 over the period in review, followed by Indonesia and Malaysia in that order. The Philippines' long-run average variance is the highest for the period 1995 to 2015. This could be a reflection of the higher degree of vulnerability of Philippine financial markets in the face of economic shocks such as the Asian crisis and the GFC, as well as the weakened influence or control of the policy rate in guiding Philippine benchmark interest rates in the face of these shocks[19] given the generally thin financial markets in the country and limited open market operations by the central bank. Credit remains low in the Philippines by international standards, and other capital markets are relatively thinner. The banking sector is the dominant sector but is far smaller than in other emerging markets in the region, and bond issuance remains to be a relatively insignificant source of corporate finance. These have contributed to the small size of the local currency bond market, while foreign exchange markets and the domestic interbank money market remain shallow compared to the other ASEAN-4 economies. Thus, the inflow of foreign funds into any of its asset markets could easily dominate and influence the bond prices in that market, and could potentially crowd out the thin domestic asset market base, ultimately driving the market interest rates down.[20] This is an economy that is highly attractive to foreign capital, and whose financial market characteristics make market rates extremely sensitive to these flows.

2) Results from the Markov-Switching GARCH Model of Conditional Variance

The GARCH (1,1) model, now with a student's t distribution specification for the error terms as in Dueker (1997) in Table 4 below, acts as our base model. The results and the log likelihood value from this estimation will be compared to the results of the Markov-Switching GARCH estimation. This could provide additional basis for our assessment as to whether the latter is indeed superior over a simple GARCH (p,q) estimation.

Results from our Markov-Switching GARCH model with conditional variance in Table 5 indicate much higher log likelihood values for all the four economies than the simple GARCH (1,1) with student's t distribution in the error terms from Table 4. This means that the rate gap for the ASEAN-4 moves in a manner much closer to, or is better represented by, a Markov-switching GARCH model rather than a simple GARCH with constant variance. In this estimation, we find that Regime 2 corresponds to periods when the ASEAN-4 economies experience higher rate gap, or a bigger divergence between the policy rate and the benchmark interest rate, whereas Regime 1 corresponds to periods when these economies experience lower rate gap levels, or a convergence between the policy and market interest rates. Looking at each of the parameters presented in Table 4, we find similarities with the results from our earlier GARCH(1,1) with Gaussian (Normal) distribution for the error terms in Table 2. In terms of the mean or average

[18] Sharifuddin and Ling (2014).
[19] Affandi and Peiris (2012).
[20] For example, during 2010–11, the Philippines's central bank nearly exhausted its holdings of government securities for use as collateral in reverse repo transactions. Given constraints on issuance of its own securities, Bangko Sentral ng Pilipinas had to rely increasingly on other instruments such as nontradable special deposit accounts, which rose precipitously as a result, at least up until limitations on foreign transactions in these instruments were implemented by July 2011. Furthermore, the emergence of excess reserves in the money market in the Philippines contributed to market interest rates falling below the policy rate, affecting monetary policy transmission. Cited from Affandi and Peiris, IMF 2012, *Ibid*.

rate gap, the Philippines still has the highest mean rate gap for both regimes, followed by Thailand and Malaysia under regime 2. Indonesia, however, registered a negative long run mean for the rate gap in Regime 1. Looking at the historical time series on Indonesia's rate gap, we do find that it has turned negative in many periods both in the past and in the more recent period, with the largest negative gap posted during the 1997-98 crisis and the during the GFC in 2008. This could mean that there are periods when the divergence between Indonesia's policy rate and benchmark interest rate not only disappears, but in fact turns negative which would happen when the benchmark rates rise to levels even beyond the policy rate, without an accompanying upward adjustment in the policy rate. Under the Gaussian GARCH specification earlier, this negative rate gap "events" were diluted, so that the average rate gap for Indonesia remained positive in Table 2.

Table 4. Simple GARCH (1,1) Results based on Dueker's (1997) Model with Student's t Distribution

	Philippines	Indonesia	Malaysia	Thailand
Log Likelihood	-432.7443	-408.889	23.0776	-148.9661
Coefficients				
Mean(Y)	0.18	-0.07	0.03	0.10
c (Intercept)	0.10	0.01	0.00	0.00
a (coefficient of ARCH)	1.48	0.88	0.93	0.30
b (coefficient of GARCH)	0.07	0.35	0.35	0.71
shape parameter	5.40	10.29	7.73	8.24
t-statistics				
Mean(Y)	2.48	-0.72	4.61	5.31
c (Intercept)	2.06	1.16	1.43	1.93
a (coefficient of ARCH)	4.96	3.79	4.21	2.72
b (coefficient of GARCH)	1.07	3.27	4.31	8.91
shape parameter	3.88	2.39	2.85	2.67
p-value				
Mean(Y)	0.01	0.47	0.00	0.00
c (Intercept)	0.04	0.24	0.15	0.05
a (coefficient of ARCH)	0.00	0.00	0.00	0.01
b (coefficient of GARCH)	0.28	0.00	0.00	0.00
shape parameter	0.00	0.02	0.00	0.01

Source: Author's estimates.

What is more interesting to discuss, however, is that allowing for an asymmetric or skewed distribution for the error terms via a students' t distribution specification, there is now a significant shift in the configuration of the conditional variance compared to our earlier Gaussian results in Table 2. In terms of the parameters a and b, or the ARCH terms and the GARCH terms in the results table above, we find that it is now generally heavy on $\boldsymbol{a}_i$ (the ARCH term) and light on $\boldsymbol{b}_i$ (the GARCH term) for the ASEAN-4 countries. The large coefficient for the ARCH term is a reflection of a few huge outliers specifically during 1997-1998—the Asian crisis—for the Philippines, Indonesia, and Malaysia[21](Chart 1A) as well as for 2005-06 for Malaysia (Chart 2). Indeed, when we inspect the shape parameter in the model's results, we see large values—indicating significant skewness in the model. The smaller coefficient for the ARCH term suggests

[21] Rate gap data available for Thailand that is used in the estimation begins only in 1999.

generally little volatility clustering or a weak persistence in the lagged conditional variance for the rate gap for these economies.

The two-regime specification for the Markov-switching GARCH under the Dueker (1997) specification we had replicated produced results which are aligned with our earlier expectations. Regime 2, or S_2 in our notations, correspond to the most recent period, where we had expected larger divergence between the policy rate and the benchmark market interest rates in the four ASEAN economies, borne out of their current monetary policy frameworks, macroeconomic features and the global environment. The mean of the rate gap under regime 2 is indeed higher than the mean rate gap for regime 1 for the Philippines, Indonesia, Malaysia and Thailand, and are significant within the 99.0 percent confidence level for all expect one; the mean during regime 1 for the Philippines is significant with a p-value of 0.08, or under a confidence interval of 90.0 percent.

The mean rate gap during the second regime, S_2, between 1995 to 2015—the full sample in our estimation—is highest for the Philippines in this specification at 2.35 ppts, followed by Indonesia at 0.75 ppts. When we look at the historical series depicted in Chart 1A and 1B, we can see this rather clearly in that the gap is indeed large when it is switching to the highs rather than the lows over the period for the Philippines. Meanwhile, the larger rate gaps are more "chunky" or in specific episodes for Indonesia. We view this result as a representation of how, on the average, the control or influence of the policy rate over the benchmark interest rate is relatively weaker for these two countries, compared to the degree of influence of Malaysian and Thailand policy rates during regime 2. Both graphical inspection and the MS-GARCH model outputs show remarkably smaller rate gaps in terms of magnitude in Thailand and Malaysia, in that order, except again for the spikes during the AFC and during the GFC for Thailand. What is interesting to note further, however, is that the "ranking" of the mean rate gaps in these economies completely changed under the other regime, regime 1 or S_1. During regime 1, Thailand records the second highest mean rate gap during the period, followed by Thailand and then Malaysia. Lastly, we see from these results a negative mean rate gap during regime 1 for Indonesia, the same as the result in the Basic GARCH (1,1) with students' t error distribution. Interestingly, there is a very narrow difference between the mean rate gaps under regime 1 and 2 for Thailand and Malaysia, implying that the level of control that the central banks in these economies have on benchmark rates remain relatively consistent under both regimes.

We observe from Table 5 that the ARCH and GARCH terms obtained when we allow for a Markov-type regime-switching in the GARCH model for the rate gap, retains much of its characteristics in the simple GARCH (1,1) model with student's t distribution in the error terms we had estimated beforehand. In terms of the parameters MSG(1) and MSG(2), or the ARCH terms and the GARCH terms, respectively, we find that it is still generally heavy on the ARCH term and light on the GARCH term for the ASEAN-4 countries—the former reflecting a few huge outliers and the latter suggesting little volatility clustering or a weak persistence in the lagged conditional variance for the rate gap for these economies. In terms of the shape parameter, the similar results are also preserved, in that the high value, high significance in the shape parameters of the Philippines, Indonesia, Malaysia and Thailand is consistent with a highly skewed distribution under the MS-GARCH model specification.

A few huge outliers but a quickly diminishing GARCH effect could be reflecting how the ASEAN-4 economies are viewed by global investors as extremely risky during risk-off periods, demanding high risk premia from asset markets. However, once sentiments in the global markets change, these spikes or outliers do not persist very long, and reverts to the long term trend relatively quickly. During regime 1, in order to convince them to invest, foreign investors need much higher interest rate levels, leading to a convergence in the rate gap when market interest rates rise closer to the policy rate level, driving out the wedge. During regime 2, which is prevailing in these economies in the most recent period, policy interest rates either cannot be adjusted downwards by the central bank given limitations set by its objectives and credibility issues, or are purposely not immediately reduced to move towards the low interest

rate levels in both domestic financial markets and in global financial markets perhaps on account of a common objective of credible inflation targeting[22].

Table 5. Markov-switching GARCH Model based on Dueker (1997)'s Model with students' t-Distribution for the error terms				
	Philippines	**Indonesia**	**Malaysia**	**Thailand**
QMLE Function Value	-315.91	-408.54	85.52	-101.00
Coefficients				
MU(1)	0.07	-0.48	0.02	0.04
MU(2)	2.35	0.75	0.34	0.22
MSG(1) ARCH term	1.41	1.46	0.97	0.81
MSG(2) GARCH term	0.04	0.20	0.31	0.50
GV(1)	0.10	0.00	0.00	0.00
GV(2)	0.10	0.00	0.00	0.00
NU	5.15	5.36	7.23	3.86
P(1,1)	0.97	0.99	0.98	0.99
P(1,2)	0.03	0.03	0.02	0.03
t-statistics				
MU(1)	1.72	-18.37	4.35	4.94
MU(2)	25.55	31.72	35.90	20.98
MSG(1) ARCH term	4.78	4.02	4.94	2.13
MSG(2) GARCH term	0.92	3.47	4.34	4.32
GV(1)	2.97	0.76	2.05	1.83
GV(2)	2.30	0.48	1.39	1.61
NU	3.81	3.48	3.01	3.79
P(1,1)	69.97	102.69	77.08	96.18
P(1,2)	1.67	1.65	1.49	1.57
p-value				
MU(1)	0.09	0.00	0.00	0.00
MU(2)	0.00	0.00	0.00	0.00
MSG(1) ARCH term	0.00	0.00	0.00	0.03
MSG(2) GARCH term	0.36	0.00	0.00	0.00
GV(1)	0.00	0.45	0.04	0.07
GV(2)	0.02	0.63	0.16	0.11
NU	0.00	0.00	0.00	0.00
P(1,1)	0.00	0.00	0.00	0.00
P(1,2)	0.10	0.10	0.14	0.12

Source: Author's estimates.

[22] Panigirtzoglou *et al.* (2000) noted that there may be occasions when the central bank may not wish to drive market rates back to policy rates so soon on purpose, so that there may be a bias on the coefficient of the lagged rate gap in the mean or AR(1) equation, for example.

The high coefficient for the lagged error terms (i.e., the ARCH terms) could also be indicating how these economies are highly vulnerable to global financial market shocks such that benchmark interest rates can move towards the policy rate or even beyond it (during regime 1, when there is flight-to-safety or flight-to-quality), or decline at unprecedented magnitude and speeds (during risk-on episodes in regime 2 when there is a surge in portfolio and equity flows into emerging Asian asset markets driving down rates and raising the bond price), but either the framework itself or the improved credibility in ASEAN-4 central banks allow it to either respond immediately or communicate effectively or both, so that lagged variance effects (i.e., the GARCH effects) become less and less prominent.

The mean rate gap results have potentially meaningful interpretations about the control or influence of monetary policy over market interest rates in the ASEAN-4 during two distinct regimes. Regime 2, when the mean divergence is relatively higher for all four economies, coincides with the current macroeconomic and global environment of ultra-low global interest rates, risk-on episodes in global portfolio and equity investments, surging capital inflows in emerging markets, and the monetary policy frameworks that have been set in place by the central banks in the region soon after the onset of the global crisis. Regime 1, on the other hand, when market interest rates converge back to the policy rate level or conversely when monetary authorities normalize policy rates towards the level of the benchmark interest rate (both scenarios are possible because declines in the rate gap can come from either a decline in the policy rate or an increase in the benchmark rate), coincides with what we discussed earlier as the risk-off episodes.

From our estimation results, we found that during regime 1 for the Philippines, the mean divergence between the policy rate and the benchmark interest rate is lower than that in regime 2, and stands as the lowest among the other ASEAN-4 economies. Suffice to say that during risk off episodes—regime 1--the main monetary policy tool of the central bank has the strongest influence over Philippine benchmark rates over time, and when compared to the other economies. Meanwhile, during regime 2, when the mean rate gap in the country is relatively higher over time and is the highest compared to the other three ASEAN countries, is also when monetary policy has the weakest control or influence over the domestic benchmark interest rates. This story is more or less the same when we compare the mean rate gaps during regime 1 versus regime 2 in Indonesia, Malaysia and Thailand. For Malaysia and Thailand, however, the mean rate gaps are of remarkably smaller magnitudes than that in the Philippines and Indonesia. It is interesting to emphasize that the differences in the mean divergences during the two regimes are most prominent for the Philippines. What could be the factors driving this prominent switching in terms of the divergence and convergence in the Philippine's rate gap?

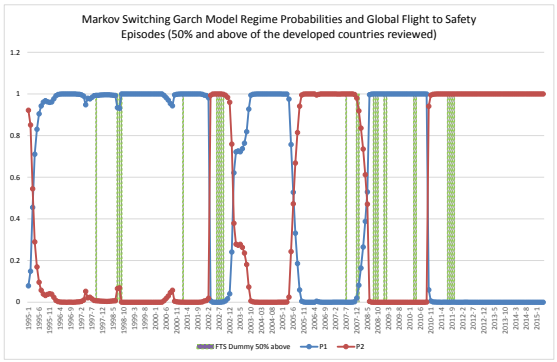
For Thailand, in particular, the mean rate gap during regime 2 is 0.22 ppts and for regime 1 is 0.04 ppts over the period 1995 to 2015, whereas it is 0.34 ppts and 0.02 ppts for Malaysia, respectively. Broadly speaking we can say that the degree of control of Thailand and Malaysia's monetary authorities over market rates are more or less consistent whether the economy is in regime 1 or regime 2. These observations leave us with the need to understand further what factors and characteristics could be relevant why the control of monetary policy over market rates in these ASEAN-4 economies are stronger (and hence the mean divergence smaller) on one hand despite being in a risk on environment of global investment flows in the case of Malaysia and Thailand, and what factors determine why the control of monetary policy over market rates are weaker (and hence the mean divergence larger) during regime 2 in the case of the Philippines and Indonesia? Another key question is: For all four economies, what factor/s is/are driving the regime-switching from regime 1, of lower mean divergence, and into regime 2, of higher mean divergence and vice versa?

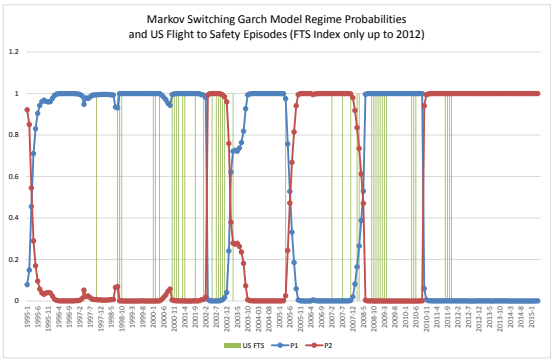
To further our analysis and in order to answer the questions posed above, we plotted the smoothed regime probabilities obtained from the MS-GARCH model results, which will show us the exact timing of the regime shifts, and superimpose in these charts available dummy indicators representing factors and which could potentially drive the transition from regime 1 to regime 2 and vice versa. We looked at four indicators in total: Flight to Safety (FTS) Indexes, both the Global indexes and the US FTS indexes, estimated by Baele, L. *et al.,* (2013), Risk Off Indexes measured by Beber, *et al.* (2014), changes in the Trilemma Indexes of more than 0.20 basis points (bps) by Aizenman, Chinn and Ito (2008) from 1995 to 2014 and finally, dummy variables we identify to represent the peaks and troughs in the chosen risk premium measures for the four countries.

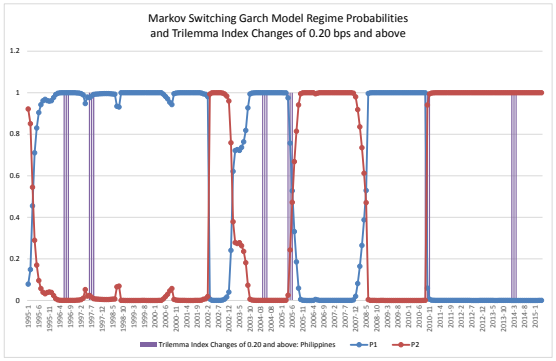
The FTS Index is an empirical characterization of flight-to-safety (FTS) episodes. Periods of market uncertainty and high volatility marred with large and inverse market movements in the bond and equity markets are interpreted as "flights to safety" or "flights to quality". According to Vayanos (2004), risk averse investment managers fear redemptions during these volatile periods so that their risk aversion also increases—meaning that they require higher risk premiums which, in turn, drives down the prices of risky assets—leading to a "flight to quality". FTS episodes, therefore, are synonymous with the risk-off events in global investor sentiment we have described earlier in the study, when funds generally leave emerging markets such as the ASEAN and return to safety havens in the developed countries. Using data on bond and stock returns, Baele, *et al.* (2013) identified and characterized flight-to-safety episodes for 23 countries, and estimated a Global index marking periods as dummy variables that equals to one when the joint probability that at least 3 of the 4 subindicators signal an FTS. The authors found in their study that the majority of FTS events are country-specific rather than global. Another finding in the study is that FTS episodes coincide with increases in the VIX, decreases in consumer sentiment indicators and appreciations of the Yen, Swiss franc, and US dollar. What we used in this study are the dummy variables marking as 1 the months when the FTS Global Index are above 50% or when at least 50% of the countries covered are experiencing an FTS, and the FTS Index for the US.

The second indicator we used are the risk-off switches based on the study of Beber, *et al.* (2014). In their paper, risk-off refers to a change in risk preferences and the associated portfolio rebalancing, and the authors identified these episodes using the switch to a polarized correlation regime of foreign exchange returns. In recent periods, the authors noted that financial markets have experienced relatively frequent cases of abrupt changes in the investors' attitude towards risks, and do not seem to be driven by economic fundamentals and are therefore hard to predict. Based on their findings, the risk-off transitions are relatively infrequent but noticeably rising in number over time, and are persistent and associated with geopolitical events. Traditional asset price indicators, such as the VIX index, are based on persistent level variables that are correlated with levels of risk preference. The risk-off indicator by Beber, *et al.* (2014) refers to a change in risk preferences, associated with portfolio rebalancing. They detect a change in risk attitudes through a concurrent change in the correlation of G10 currency returns, which reflects the herd of arbitrageurs trades in risk-off episodes via a model with regime-switching correlations for G10 exchange rates. The risk-off events identified in Beber, *et al.* (2014) is related to the other indicator we are using--the FTS Index--but the purpose of their analyses are different. FTS Indexes focus on domestic episodes that feature a specific pattern of returns, correlations, and volatility between stocks and bonds, whereas the Risk-off, low-to-high correlation indicators use foreign exchange market dynamics to identify global episodes and global shifts of risk capital. Less than 25 percent of the episodes detected by Baele, *et al.* (2013) are global, and Beber, *et al.* (2014) found that these global FTS events are not significantly correlated with the Risk-off events they identified in their study.

Chart 4a: Philippines







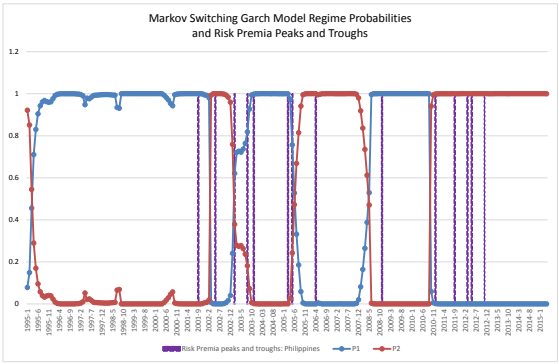
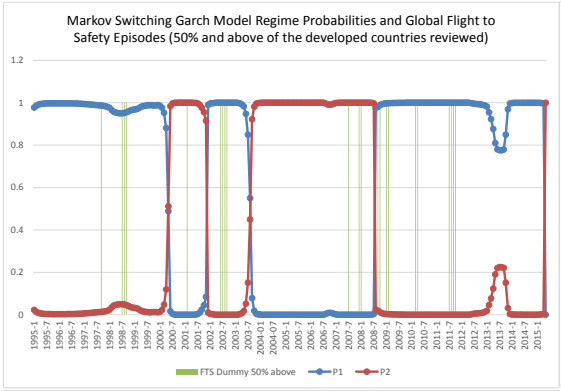
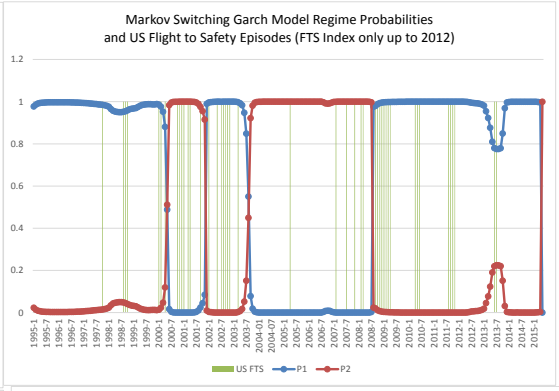
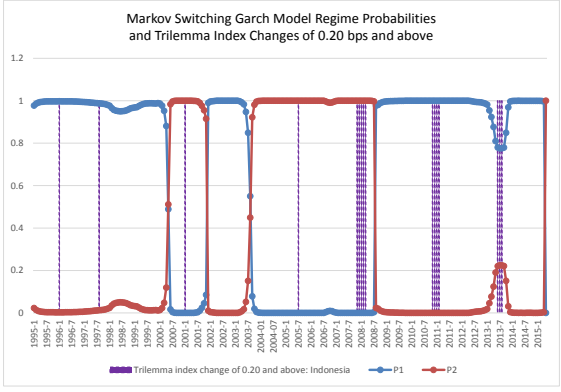


Chart 4b: Indonesia







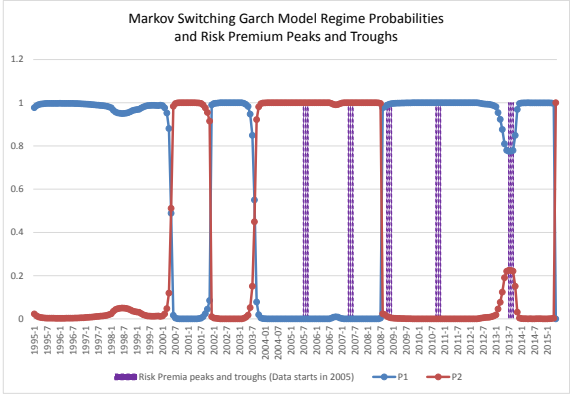
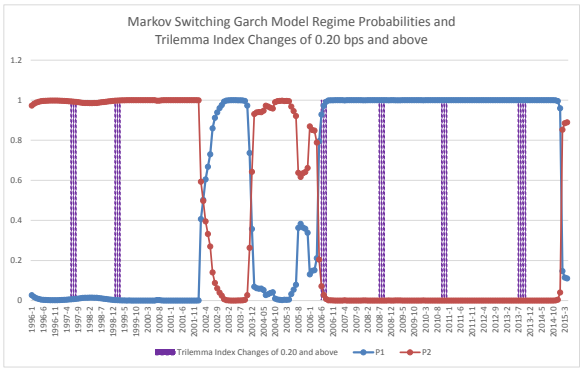
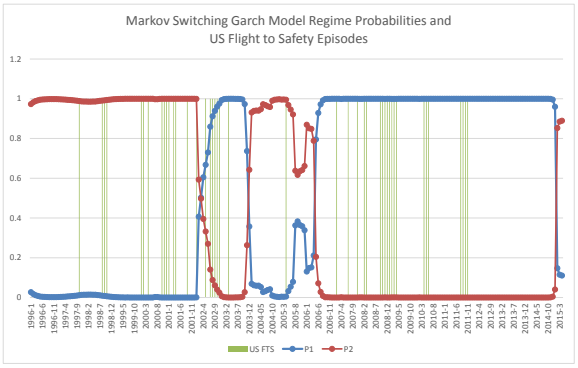
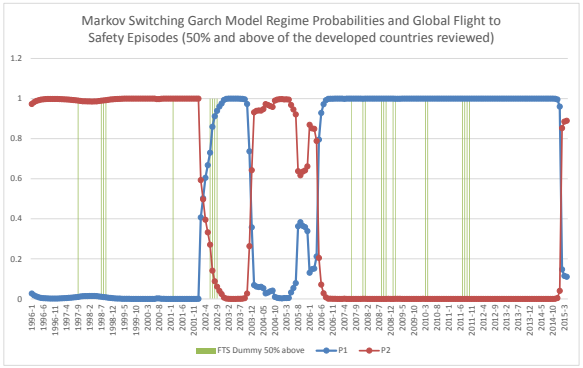


Chart 4c: Malaysia







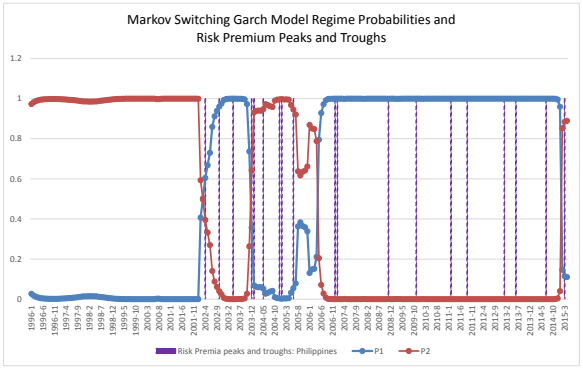
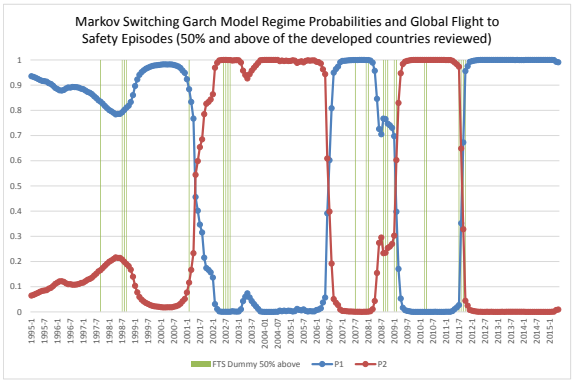
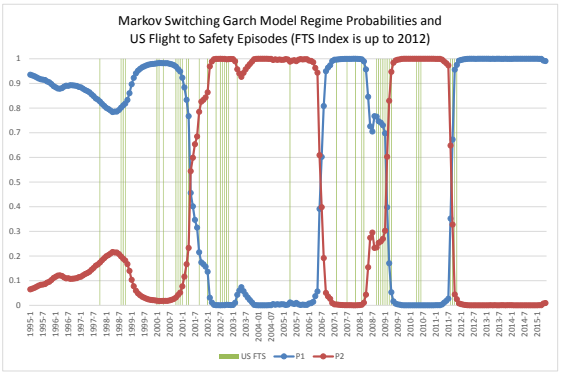
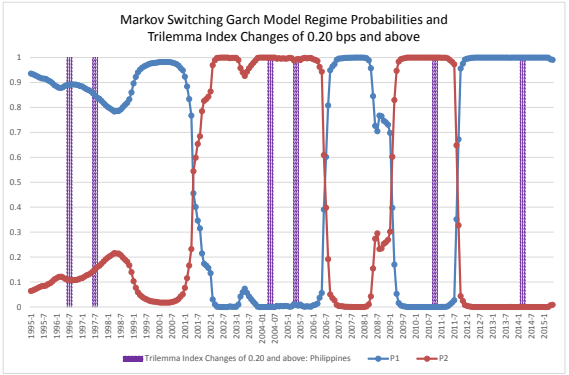
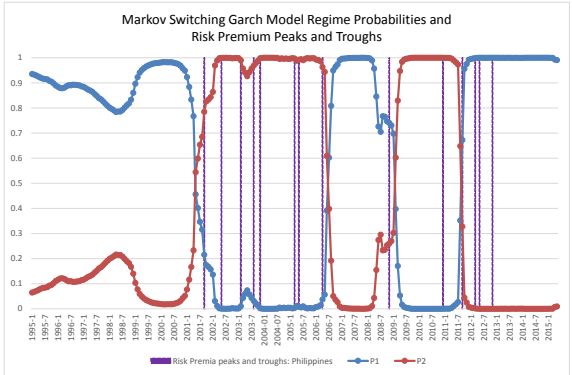


Chart 4d: Thailand









Charts 4a, 4b, 4c and 4d plot the smoothed regime probabilities against the four indicators discussed above for the Philippines, Indonesia, Malaysia, and Thailand, respectively. These charts show us the exact timing of the switches from regime 1 to regime 2 and vice versa for each of the ASEAN-4 economies, and whether the detected switches from the estimated MS-GARCH model coincide with any of the episode identified by the four indicators we have selected. For the Philippines, the FTS Global Index of above 50% is associated with only one of the regime switches detected under the MS-GARCH specification—the switch occurring in 2008, coinciding with the global financial crisis. The MS-GARCH model, however, did not detect the Global FTS indicator for 1997 and 1998 which should have been relevant as it marks the Asian financial crisis. The MS-GARCH results also missed the switch by a few months during 2002/03 and in 2010. When we consider the US FTS model as the indicator of global risk perception, additional switches are detected. The MS-GARCH model detected three: the 2002-03, the 2005, and the 2008 regime switches are coinciding with US FTS Indexes. This would mean that in the case of the Philippines, an MS-GARCH specification is relatively more concurrent to US flights-to-safety episodes, and less to global ones (when 50.0 percent and more of the developed country samples are indicating a flight-to-safety episode). In the case of the Trilemma Index Changes (of more than 0.20 ppts), our MS-GARCH model for the Philippines detects *en pointe* two regime switches: the one in 2005 and the other in 2010. Of the four indicators, however, it is the peaks and troughs in the risk premium indicator for the Philippines which is detected the most in this model specification, as the switches coincide with the relevant months of either a peak or a trough in 2002, 2003, 2005, and 2010 as depicted in Chart 4d in the previous page. If we may recall, this is the main motivation for the study and the output results confirm our earlier contention that changes in global risk premia drive the regime switching in the rate gap. In particular, an MS-GARCH model for the Philippine rate gap corresponds with most periods of significant (i.e., about 0.20 ppt and above) risk-on (troughs) and risk-off (peaks) in global risk premium—the indicator measured as the difference between the 10-year dollar-denominated Philippine bond and the 10-Year US Treasury Note in this case.

In the case of Indonesia, the Global FTS is detected by only one regime switch, in 2008. The US FTS, on the other hand, is corresponding to more switching episodes in the MS-GARCH for Indonesia compared to the Global FTS, as it corresponds to the switches in 2000, 2001, and 2008. Unlike the case for the Philippines, however, the dummy variables for both the Trilemma Index Changes and the Risk premium peaks and troughs we had specified correspond to only one of the regime switching episodes, and that is only for the latter indicator, which is the switch occurring in 2008. For Malaysia, the estimated MS-GARCH model does poorly in detecting switches associated with FTS indicators. Only the Global FTS dummy variable coincides with one regime switch, and that is the one occurring in 2002. The same is true for the indicator on Trilemma Index Changes of more than 0.20 ppts, which has been detected by the Markov regime switching GARCH model only once, in 2006. Risk premium peaks and troughs, however, appear to be the most associated with the preferred GARCH model for Malaysia, as it was detected by the regime switches four times: in 2002, 2003, 2005, and 2015. These may be viewed in Chart 4c. Thailand's rate gap, under an MS-GARCH specification, turned out to be the most concurrent to Global and US FTS indicators, perhaps as a reflection of its highly developed and flexible bond markets.[23] Global FTS and US FTS indicators were detected by Markov-type regime switches in the given model during 2001, 2008-09, and in 2011. Similarly the risk premia peaks and troughs were detected by the model in one more period: in 2001, 2006, 2008, and in 2011. In contrast, changes in the Trilemma Indexes for Thailand have zero detection under the MS-GARCH specification for the Thai rate gap.

Based on the MS-GARCH model output results in Table 5, we can also derive the transition probabilities and expected duration as in Table 6 below.

[23] The issuance of BOT bonds has contributed to a more complete range of securities, and the BOT carefully plans the types of bonds it issues to fill in the tenor gaps, i.e. by issuing only shorter-term bonds with tenors that do not replicate the government's. With a wider range of products to choose from, the domestic bond market has increasingly attracted investors of all types – both local investors and non-residents.

Table 6.	Philippines	Indonesia	Malaysia	Thailand
Transition Probabilities				
P(1,1)	0.973	0.987	0.979	0.986
P(1,2)	0.027	0.033	0.018	0.032
P(2,2)	0.973	0.967	0.982	0.968
P(2,1)	0.027	0.013	0.021	0.014
Expected Duration				
P(1,1)	37.51	74.34	47.28	73.56
P(2,2)	37.14	29.88	54.82	31.01

Source: Author's estimates.

The transition probabilities for the MS-GARCH model for the rate gap during regime 1 to stay in regime 1 (the low rate gap regime), and for the rate gap in regime 2 to stay in regime 2 (the high rate gap regime) are high for all four countries, suggesting that the rate gap is, overall, highly persistent. Expected durations[24] to stay in the same regime when the rate gap is already in that regime are also perceptively high, reflecting the transition probabilities. There are, nonetheless, differences across the four economies in this parameter. For one, the probability to stay in regime 2 is higher than the probability to stay in regime 1 in Malaysia, while it is the reverse for the other three economies. The switching probability from regime 1 to regime 2 is highest for Indonesia, whereas the switching probability from regime 2 to regime 1 is the highest for the Philippines. The transition probability for P(1,1)—the probability to stay in regime 1--is highest in the case of Indonesia and then Thailand, followed by Malaysia and the Philippines, in that order. Meanwhile, the transition probability for P(2,2)—the probability to stay in regime 2—is highest for Malaysia followed the Philippines, and then Thailand and Indonesia comes next in that order.

Second, the expected duration of the two regimes are of almost equal length at about 37 months for the Philippines. For the other three economies, there is a big disparity in the expected duration for the two regimes. The expected duration for Indonesia's rate gap to stay in regime 1 is the longest at 74.3 months, whereas the duration for its rate gap to stay in regime 2 is the shortest at approximately 30 months. This length of duration for regime 1 is followed by that of Thailand, Malaysia and the Philippines, respectively. The expected duration of regime 2, on the other hand, is longest for Malaysia, followed by the Philippines, Thailand, and Indonesia also in that order. The relevance of these parameters will be discussed further in the context of the analysis in the succeeding section, when we look more closely into the role of financial market characteristics or idiosyncracies in each ASEAN-4 economy, as well as relevant global indicators that affect the rate gap in the ASEAN-4, which are potential regressors as well as determinants of the switches or transition probabilities themselves.

From the empirical results, we realize that the ASEAN-4 does not comprise a homogenous set in terms of the behavior or characteristics of the rate gap, the associated factors or variables that affect the transitional probabilities, the significant drivers of the switching or staying probabilities from one regime to another, as well as the monetary policy implications of a regime-switching rate gap. Looking more closely into these heterogeneity among the regime-switching characteristics of the policy rate gap in the four countries, there is what seems to be two subgroupings within the ASEAN-4 economies. From our estimation, we made a graphical or events-type analysis on which among the factors that affect the ***sensitivity*** of asset market yields to international investment flows, such as financial market structure or size and other idiosyncratic characteristics, are associated the most with the regime-switching transitional probabilities of the rate gap in the ASEAN-4 economies. We also looked into whether the perception of risk on these four emerging markets that is prevailing in global markets—indicators that affect the ***attractiveness*** of asset markets to foreign investors—are also closely associated with the regime-switching rate gap in the countries under study. We have seen that among these group of attractiveness factors, the risk premium indicator has the most matches with the regime-switches identified We also saw the model detecting switches which coincided with the risk premia peaks and

[24] The expected duration of the state 1 is: $\Sigma^{\infty}_{k=1}\, k\, p11^{k-1}\,(1\text{-}p11) = 1/\,(1 - p11)$, and the expected duration of the state 2 is $1/(1 - p22)$; see Hamilton (1989, p. 374) as cited in Kuan, C. (2002).

troughs dummy indicator, as well as changes or movements in the Trilemma Indexes of these economies. The important role played by the "natural wall" provided by high risk premia appeared to be more relevant in the case of two of the four countries more vulnerable or sensitive to changes in risk perception—the Philippines and Indonesia—where the switches in the rate gap are more striking or more pronounced.

What factors could possibly account for the heterogeneity? Prior to 2002, the Philippines was viewed by economic analysts as a "basket case" economy, showing on all fronts signs of a small (partially) open developing economy vulnerable to political unrest, fiscal and structural weaknesses, financial sector repression and global economic shocks. The Bangko Sentral ng Pilipinas (BSP) decided to shift fully to a forward-looking inflation targeting framework for monetary policy beginning in 2002. In addition, from persistent current account deficits in the past, the Philippine economy has shifted towards a consistent current account surplus beginning in 2004, due mainly to some idiosyncratic factors: sustained OF remittances, the emergence of the business process outsourcing sector, and a growing international reserve base which established the country's foreign exchange and external account stability, favorable demographic transition resulting in higher national savings, trade liberalization, and fiscal reforms particularly the EVAT Law which was implemented in 2005. There was some form of a paradigm shift—a transformation in the Philippine economy soon after it has become an inflation-targeting and current account surplus economy. Investors' perception on the Philippine economy has completely reversed.

As the Philippine peso became more stable, Philippine peso-denominated assets became accessible and worthwhile for foreign investors. Both dollar- and peso-denominated Philippine assets have become more globally attractive given a more sustainable fiscal position, a credible central bank, and subsequently stronger commercial banks and publicly-listed corporations. Market perceptions of improving Philippine sovereign credit risk were in fact way ahead of the recent upgrades by credit rating agencies—in a sense they were "behind the curve" in their decision to raise the rating for Philippine assets beginning in 2013. Nonetheless, these sovereign rating upgrades signaled improvements in doing business and competitiveness in general to the rest of the world, especially those who do not have direct or first-hand information on the Philippine economy nor would have dedicated the time to get to know its asset and money markets given dismal and highly volatile financial market performance and the high degree of uncertainty in the past.

On 28 October 2010, the BSP, or the central bank of the Philippines, further amended its foreign exchange (FX) regulatory framework to keep FX transactions attuned to current economic conditions. The policy amendments consisted of higher FX transaction ceilings as well as greater flexibility in managing FX exposures, and these facilitated foreign investment payments. During 2010–2011, the Philippines's central bank nearly exhausted its holdings of government securities for use as collateral in reverse repo transactions (called RRPs). Given constraints on issuance of its own securities, the BSP had to rely increasingly on other instruments such as nontradable special deposit accounts (SDAs). As a result, SDA levels rose to unprecedented levels during this time, as the surging foreign funds searching for yield flocked this safe asset with the treasury bill-collateralized reverse repos already "maxing" out. The emergence of excess reserves in the money market in the Philippines in the same period thus contributed to market interest rates falling below the policy rate, affecting the influence of monetary policy on market rates (Affandi and Peiris, 2012).

For Indonesia, the "Big Bang" fiscal decentralization policy has been formally implemented in 2001, and this ushered in some institutional changes in the new democratic government. In addition, a new central banking law, enacted in 1999, established the independence of BI, requiring it to set an inflation target every year, and directing monetary policy to be geared toward the achievement of the inflation target (Bank Indonesia 2000). Following the implementation of the act, the operating target in conducting monetary policy likewise shifted from base money targeting to interest rate targeting. The BI rate was used as the policy instrument to direct monetary policy. Initially, the reference rate was the rate for SBI (30 days), which was then changed into the overnight cash rate on July 2005. Bank Indonesia and the Government also established an Inflation Management Team in 2004, establishing its credibility and commitment to inflation and macroeconomic stability even further. The implementation of BI Rate through the open market operations for SBI relies on a number of reasons. First, one-month SBI has long been used as a benchmark by

banks and market players in Indonesia for their activities. Second, the use of one-month SBI as operational target will reinforce the signalling of the monetary police response. Third, with significant improvements in the banking and financial sector, the important role of SBI in transmitting monetary policy to the financial sector and the economy has been evidenced.

Meanwhile, the Bank of Indonesia (BI) initiated a re-evaluation of its monetary policy framework in mid-2010. Based on this framework, the BI adopted macroprudential measures to manage capital flows and safeguard financial system stability. This was termed as an enhanced inflation targeting framework based on a monetary and macroprudential policy mix. The policy mix aimed to improve in five areas: interest rate response, exchange rate policy, capital flow management, macroprudential policies, and monetary policy communication and coordination. All of these developments could well have begun a new stage in monetary policy for these economies, thus triggering a regime switch in the rate gap.

In Malaysia, Sharifuddin and Ling (2014) pointed out that portfolio flows into the domestic market in the 2000s were influenced by key developments in the Malaysian capital market. For one, the Bank Negara Malaysia and other regulatory agencies undertook large scale efforts to develop a ringgit bond market resulting in its bond market emerging as one of the biggest and most advanced in the region. Moreover, Malaysia also undertook successive stages of foreign exchange liberalization beginning in 2004. These two developments encouraged portfolio investments into the ringgit bond market and an increase on the holdings of ringgit securities by foreign investors, pushing down market interest rates. Sharifuddin and Ling (2014) added that structurally, the Malaysian bond market remains to be a sovereign market, and Malaysian government securities remains to date the largest supply of investible bonds in the country. As demand continued to rise with a surge in portfolio inflows, the amount of available securities remained relatively small so that this mismatch also contributed to the compression of bond yields and a downward shift of the yield curve in Malaysia in 2007, 2010 and 2011.

Starting in November 2010 and continuing, most recently, with the 2014 Budget in October 2013, Bank Negara Malaysia (BNM) has imposed a series of targeted, gradual, and escalating Macroprudential Policies (which they denote as MAPs), which have been mainly directed speculative purchases of homes and unsecured credit, including policies on maximum mortgage terms, debt service ratios and capital risk weights for banks, personal financing products, the real property gain taxes (RPGT) distinguishing between local and foreign as well as corporates, among others. Risk-informed price standards also came into effect in March 2014, requiring banks to articulate costs and expected losses for different retail loan and financing product segments and ensure that these are in line with banks' risk management plans.

On the other hand, the issuance of Bank of Thailand (BOT) bonds in 2011 has contributed to a more complete range of securities for Thailand. The BOT carefully plans the types of bonds it issues to fill in the tenor gaps, i.e. by issuing only shorter-term bonds with tenors that do not replicate national government issues. With a wider range of products to choose from, the domestic bond market has increasingly attracted investors of all types – both local investors and non-residents. The BOT also employed several instruments to sterilize excess liquidity in 2014-2015. BOT bills and bonds represented the largest share of this mix – comprising over 60 percent of the total instruments outstanding. The fact that the largest allocation was to BOT bills and bonds was deliberate, since monetary authorities believed that the allocation of absorption instruments need to be designed such that it takes the effectiveness of monetary policy transmission and financial market developments into account.

5. Conclusion and Policy Implications

We began this study with the hypothesis that the gap between the policy rate and the short-term market interest rate follows a Markov-type regime-switching process in the case of the Philippines and in three other ASEAN economies: Indonesia, Malaysia, and Thailand. In addition, we espoused further that the switching from one regime to

the next is influenced by either variables common to emerging markets (what we denoted as ***attractiveness*** factors), such as global risk perception and global liquidity, or other idiosyncratic factors relating to financial market characteristics of each economy (which we denoted as ***sensitivity*** factors). Based on our estimation of an MS-GARCH model for the rate gap of the four economies, we established that indeed the rate gap could be depicted as a Markov-type regime-switching GARCH of conditional variance and that a 2-regime Markov-switching process is the most plausible specification.

In the literature review, we submitted that whereas central bank objectives affect the level and direction of the policy rate, financial market characteristics affect the ***sensitivity*** of asset market yields to international investment flows. On the other hand, the perception of risk on emerging markets that is prevailing in global markets, US monetary policy and global liquidity are factors that affect the ***attractiveness*** of these asset markets to foreign investors. Because these class of factors affect either the supply, the demand or the price of the relevant benchmark asset, all three therefore affect movements in benchmark yield rates, and hence, the rate gap. The investor profile of the relevant asset markets as well as various global factors including measures of risk perception, are critical components in understanding the movements in the rate gap of the ASEAN-4 because they are the main drivers of non-resident capital flows that affect both the policy rate and the benchmark interest rate and are central to the Impossible Trinity story.

Hence, we plotted the smoothed regime probabilities obtained from the Markov-Switching GARCH model results that show us the exact timing of the regime shifts, and superimpose in these charts available dummy indicators representing ***attractiveness*** and ***sensitivity*** factors which could potentially drive the transition from regime 1 to regime 2 and vice versa. We looked at four indicators in total: Flight to Safety (FTS) Indexes, both the Global indexes and the US FTS indexes, estimated by Baele, *et al.* (2013), Risk Off Indexes measured by Beber, *et al.* (2014), changes in the Trilemma Indexes of more than 0.20 basis points (bps) by Aizenman, Chinn and Ito (2008) from 1995 to 2014 and finally, dummy variables we identify to represent the peaks and troughs in the chosen risk premium measures for the four countries.

The common thread that we have seen from the MS GARCH exercise is that indeed there are ***sensitivity*** and ***attractiveness*** factors which influence the evolution and regime-switching in the degree of influence of monetary policy on market interest rates in the ASEAN-4. Graphically, we have seen that changes in monetary, financial, and foreign exchange policies are often times reflected as a significant change in the Trilemma Indexes and with plots of the four dummy variables enumerated above, we have also seen that the MS GARCH model switches obtained are highly correlated with, or had the most number of matches in, risk premium peaks and trough periods especially in the case of the Philippines, Indonesia and Malaysia.

First, it is important to point out that during both regimes, the Philippines surpasses the other ASEAN-4 economies in terms of the magnitude of the rate gap. By definition, this feature of the Philippines' rate gap is a signal that among the four economies during the period in review, the Philippine policy rate appears to have the weakest influence over market interest rates, as it recorded the highest average rate gap for regime 1 or the high rate gap regime, at 2.6 percent, and has surpassed the second in rank by a significant amount. Under regime 1, Indonesia recorded the second highest average rate gap among the ASEAN-4 in the same period at 0.69 percent, almost 2.0 percent lower than the Philippines. It is followed by Malaysia (0.52 percent) and then Thailand (0.19 percent)[a]. Under regime 2, or the low rate gap regime, the Philippines remained to have the highest positive average rate gap, but the rest of the ranking has changed. Following the Philippines is Malaysia, whose average rate gap is still positive but much lower than the Philippines'. Second, average rate gap for Indonesia and Thailand are both negative, which means that during the low rate gap periods or regime 2, not only do the market interest rates converge closer to the policy rate of these countries, they in fact surpass the levels of the policy rate, resulting in a negative value.

In terms of transition probabilities P(1,1), or the probability that the rate gap will stay in regime 1 when it is already in regime 1, the highest is the P(1,1) for Indonesia at 0.964 followed closely by the Philippines at 0.963. Meanwhile, the P(1,1) levels obtained in the MS Regress model specification for Malaysia (0.692) and Thailand (0.666) show up at very close levels, so that in this respect, there seems to be a subgrouping within the ASEAN-4 where the

Philippines and Indonesia are in one such common grouping, whereas Malaysia and Thailand are in another. Just as was the case for the level of staying probabilities, there seem to be some indication that in terms of the switching probabilities this time, Malaysia and Thailand appear to be obtaining very similar characteristics, in the same way that the Philippines and Indonesia are also obtaining switching probabilities at almost the same level. In terms of expected duration, Regime 1 tends to last the longest in Indonesia at 28 months, while it tends to last 26 months in the Philippines. Meanwhile, regime 1 is expected to last very quickly in Malaysia and Thailand, at only 3 months on the average for both economies. This is consistent with our earlier graphical observation that the magnitude of the policy rate movements and duration of regime-switching is very small in Malaysia and Thailand, compared to that in the Philippines and Indonesia, indicating that the central bank policy rate has a relatively stronger influence or control over the benchmark interest rate in Malaysia and Thailand, compared to the other two economies, the Philippines and Indonesia.

Whereas there is evidence of regime-switching in the rate gaps of Malaysia and Thailand, the switches in the rate gap data for these two economies were less pronounced. When we look at the regime probabilities chart for both Malaysia and Thailand, it appears as if the level of the rate gap has effectively shielded itself from external developments, including risk premium movements, the rate gap transition probabilities remaining stable all throughout 2006 to 2014. During the global financial crisis, the reduction in capital inflows for Malaysia was largely offset by sales of foreign reserves and the repatriation of domestic capital invested abroad. Large sales of domestic bonds by foreign investors were absorbed with minimal impacts on domestic yields, except perhaps for some brief periods when the long-end of the yield curve has shifted downwards and market interest rates have fallen below the policy rate in 2007, and then again in 2010 and 2011. The stabilizing role of reserves and private outflows, coupled with the greater flexibility of the exchange rate and strength of domestic financial institutions, allowed Malaysia to weather the global financial crisis much better, establishing firmly its monetary policy independence during this time. For Thailand, the new BOT Act charged the MPC with legal responsibility on the monetary policy target and exchange rate management policy. The new Act therefore established the managed-float exchange rate regime, together with the inflation targeting framework with short-term interest rates as the operating target. The inflation target performs the role of a nominal anchor for monetary policy, while flexibility in exchange rates helps absorb shocks to the economy, and these bode well for maintaining stability and monetary independence in Thailand during the GFC in 2007-2008. These were the features of monetary policy-making and financial markets in Malaysia and Thailand which could be the reason why regime-switching is less pronounced. These features may have also helped them weather the GFC at the best possible way—in terms of stability in domestic asset market rates—so that no regime-switching occurred in these two countries during the GFC and even in the years thereafter.

For the Philippines and Thailand, we can point out two possible reasons to account for the more pronounced divergence and then convergence in the rate gap. One, is the influx of non-resident capital flows flocking into safe, government securities in search of yield—the RoRo episodes. As expected during the risk-on episodes we have discussed earlier, non-resident capital flows into government securities, raising bond prices, and pushing down yields. The reverse is therefore expected during risk-off episodes: non-resident portfolio flows exit from the government securities market, leading to yields increasing and moving into relatively more “normal” levels, and resuming its close association with the central bank policy rate. We have provided evidence empirically that indeed, both risk premium indicators and foreign ownership of local currency debt securities are the two significant drivers of the regime-switching transition probabilities of the rate gap in the Philippines and Indonesia. A corollary, and certainly not mutually exclusive, explanation is that domestic bond rates are falling relative to the policy rate as a result of the accompanying sterilization efforts from foreign exchange (FX) intervention these central banks have conducted, in response to the speculative portfolio flows. Sterilized intervention is conducted either by selling domestic bonds (i.e., sovereign or central bank bills) or as an indirect result of open market operations, larger interest payments to fixed income or repurchase facilities, and the introduction of nontradable special deposit accounts that (are meant to) attract the additional liquidity in the system.

Sterilized intervention and exchange rate management in general, however, are not exclusive to the Philippines and Indonesia, as it was practiced and are still being practiced by many emerging Asian central banks. Bank Negara Malaysia and the Bank of Thailand, however, are more explicit and transparent in their conduct of foreign

exchange intervention and sterilization and have in fact formally included exchange rate management as part and parcel of their current monetary policy framework. Thus, for these two countries, policy rate adjustments could be made vis-à-vis movements in global and domestic market interest rates even without an accompanying justification from inflation objectives—making movements and the level of the rate gap more stable. In addition, their financial markets are by far more developed and this adds to a certain level of flexibility and stability in terms of domestic interest rate movements so that foreign investors buying into domestic assets are not that disruptive to interest rate levels. In contrast, both Bank Indonesia (BI) and Bangko Sentral ng Pilipinas (BSP) adhere to a certain degree of strict inflation targeting so that policy rate adjustments are only made if they are aligned or justifiable vis-à-vis inflation developments and the inflation target, and exchange rate management is not explicitly or formally announced as an active policy tool in the central bank arsenal. In addition, BI and the BSP rely increasingly on instruments such as nontradeable special deposit accounts in order to absorb excess liquidity in the domestic financial system, driving the yields down even further on these sterilization tools. In addition, financial markets in these two economies are relatively so much thinner, so that surges and stops in foreign funds buying into domestic assets affect market interest rates in a bigger way.

For the Philippines, in particular, there are also remaining structural factors that are keeping Philippine T-bill rates at depressed levels. The following two factors could account for why regime-switching in the rate gap is most pronounced in the case of the Philippines—why it obtained the highest average rate gap under both regimes—even significantly more than that of Indonesia. First, is the limited amount of government securities held by the BSP for repo operations and the inability of the BSP by law to issue its own securities (Affandi and Peiris, 2012). A second factor is the Philippine National Government's significant foreign borrowing abroad, driving down the supply of T-bill issuance and hence resulting in even more depressed rates. This is a potentially interesting topic for future research.

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CHAPTER 3

Heterogeneous Response of Banks to Monetary Policy in the Philippines

1. Introduction

The special role of the banking system in the transmission of monetary policy and the contribution of credit in the economic activity of a country naturally led to a growing literature examining the response of domestic credit and bank lending rates to monetary policy, as well as to other determinants of these two crucial variables which may include demand-side or supply-side factors. Some studies consider both kinds of factors in the same model, while others try to distinguish them into two separate models. The determinants of both the growth in bank lending and the evolution of lending rates have also been studied in the case of developed, developing as well as emerging economies.

In particular, Bernanke and Blinder (1988) suggest that the effect of monetary policy on aggregate demand through interest rates may be enhanced by financial market imperfections and the existence of imperfect substitutability between loans and securities in bank portfolios and also as a means of borrowing for firms. One of the identification approaches for the bank lending channel involves the estimation of reduced-form lending equations, where loan supply shifts are traced by using bank-level data on bank characteristics (see Kashyap and Stein, 2000; Ashcraft, 2006; Brissmiss and Delis, 2010). Factors that drive bank credit in emerging market economies have recently been a subject of a growing body of empirical work, particularly in light of the volatilities some emerging economies experienced before, during and after the global crisis, and has also raised questions anew on the effectiveness or influence of the monetary policy instruments on the setting of banks' lending rates in the transmission process.

Examining factors that drive bank credit and the lending rate have both been interesting and growing subjects on both theoretical and empirical aspects in the literature. However, the factors that drive credit growth and the bank lending rate, and how these two variables are influenced by monetary policy, banking characteristics, global factors and other important variables using bank-level data appear to be more complex. What existing evidence do show is that banks change their lending behavior and set the lending rate in specific ways following a change in monetary policy. But do all banks in the market respond uniformly to monetary policy changes? Following in the footsteps of Kashyap and Stein (2000), and more recently by Brissimis and Delis (2010) and Bluedorn, et al. (2017), among others, a good number of empirical studies have explored the heterogeneity of bank lending responses to monetary policy. The heterogeneity in the response of bank lending rates and in the case of the Philippine domestic financial market, however, has not been dealt with significantly in the literature before this study.

Less attention has also been devoted to examining the heterogeneity of responses to monetary policy between domestically-owned banks versus foreign bank branches in emerging economies. A few studies in the literature has found, nonetheless, that ownership matters for the credit channel. Arena, et al. (2007) argue that foreign banks may have lower sensitivity to changes in the policy interest rate because of their access to a larger deposit base outside the country. Hence, foreign banks would be less likely to be financially constrained in the debt market in the face of monetary policy tightening. Ashcraft (2006) presented evidence that bank holding company affiliation is less correlated with the customer mix and hence loan demand, and thus is a better indicator for loan supply conditions. The Global Financial Crisis revealed the vulnerability of foreign banks to the weaknesses and conditions being faced by their parent companies, in the countries where the bank holding companies are located, and this has raised a question about the impact of bank branches of international bank holding companies on monetary policy choices and the transmission mechanism in an emerging market like the Philippines. This is especially important to examine now, given that foreign ownership limits in local banks have been increased recently in the Philippines. The new banking liberalization law increases foreign ownership limits in local banks from 60% to 100%. Banks in Asia, Europe, and the Middle East are reported to have expressed interest in the Philippine's market in response to the easing of these foreign

ownership limits. As of the end of 2015, in the same year the new banking liberalization law became effective, four foreign bank branches from Japan, Korea and Taiwan have started operations in the Philippines.

For these reasons, we aim in this study to establish that there is heterogeneity in the responses of bank lending growth and the lending rates to monetary policy in the Philippines and, in the process, examine as well whether the bank characteristics we have chosen, among which are those usually tested in the literature, matter in the transmission process. We conduct a Panel regression analysis of monthly bank-level data from 2008 to 2015 for 20 banks: the 10 largest domestic banks and the 10 largest foreign banks in terms of assets operating in the Philippines today, confidential data for which was available to us at the time of the conduct of this study. Our analysis has three key dimensions. The first dimension is the dependent variable being analyzed: the percentage change in net loans, or what we will refer to as bank lending growth, and the low- and high-quoted bank lending rates as the dependent variables. The low and high bank lending rates refer to the averages of the highest and the lowest bank-quoted rates, respectively. As opposed to actual average rates, these two quoted lending rates reflect rate setting by the bank itself, and at the same time depicts how Philippine banks offer higher rates for a category of clients (those with relatively average to high default risk levels) and lower rates for its prime, relationship-based clientele (of relatively lower default risk). The second dimension is the three groupings of banks used in the analysis. For each of the three dependent variables we considered, we first estimated a panel containing all the 20 banks in our sample, and then a panel estimation is conducted for the 10 domestic banks and another for the 10 foreign bank branches in the Philippines separately, to determine not only if there is heterogeneity of responses across each individual bank, but heterogeneity in the response to monetary policy between the category of domestic banks versus that of foreign banks. The combination of these two dimensions gives nine combinations.

The third dimension relates to the bank characteristics included in our analysis. The bank characteristics we have included comprise bank-level indicators of access to non-reservable finance (that is, liabilities that do not require reserves or assets on hand). These include the log of total bank assets in real terms, and three measures of balance sheet composition: equity capital-to-assets (indicator for capitalization), securities-to-assets and cash-to-assets ratios (both indicators of liquidity). Contrary to what has been done in the literature, we add another bank characteristic that have become important in the lending decisions of banks in the Philippines today: the level of placements in the reverse repurchase agreements (or RRP) with the Bangko Sentral ng Pilipinas (BSP), as a share to total Assets. In the aftermath of contractionary monetary policy, banks that can access funds via alternative sources, or via their foreign holding companies as in the case of foreign banks, may shield lending growth from the effects of an erosion of reserves and deposits. RRP placements, meanwhile, has become a strong alternative to lending and other investments for banks, as higher RRP rates would mean higher return on a safe, risk-free investment. Because the responses underlying this characteristic is complex, including it in the regression can help shed light on whether or not the RRP placements of domestic banks or foreign banks, or both, in fact help determine decisions on both the level of bank loans and the bank lending rate, and whether this is a potential source of heterogeneity in the response of banks.

In this study, we also directly control for output growth and inflation in our empirical model for bank lending growth and bank lending rates by including these macroeconomic variables in our Panel data estimation, as well as interactive variables between the macroeconomic and monetary policy variable and the bank characteristics individually. According to Bluedorn, et al. (2017), to the extent that such variables account for the underlying drivers of endogenous monetary policy changes that also affect loan demand and supply, their inclusion in a lending growth regression enables the effects of exogenous monetary policy to be identified. Under the assumption that loan demand is homogenous across banks with similar characteristics, monetary policy's effect on lending through loan supply can be isolated through interactions of monetary policy changes with the relevant bank characteristics.

Our contribution in the literature hinges on three important aspects of our data and estimation. First, and differently from the literature, we use data on both changes in bank loans and bank lending rates as dependent variables. As pointed out by Coelho, et al. (2010), shifts in credit demand and supply caused by monetary policy have, in theory, opposite effects on the bank lending rate. Through the demand channel, a tightening of monetary policy reduces the lending rate. Through the supply channel, bank lending rates increase. Hence, we corroborate our

identification strategy by looking at the sign of the reduced form impact of monetary policy on lending rates. Hence, our empirical model using two Philippine bank lending rates as dependent variables will also include the cross effects between monetary policy and macroeconomic variables, in order to establish and confirm the results we obtain from the model for changes in bank lending levels. At the same time, our estimation methodology allows us to investigate whether bank characteristics matters for the transmission of monetary policy, and helps us obtain information on the impact of bank characteristics, if any, on the setting of bank lending rates in the domestic economy.

The second is a cleaner identification based on data of higher frequency. Identification is cleanest for products with a shorter maturity because the relevant cost of funds is strongly linked to short-term rates. Lending volume and lending rates respond strongly to monetary policy changes in the direction one would expect if we were estimating a supply response: after policy rate increases, bank interest rate increases and bank lending declines. Using monthly bank-level data ensures that we are within a time horizon that is shorter than the time that monetary policy may also be changing (i.e., the BSP conducts its monetary policy meetings every six weeks) in response to other factors in the macroeconomy or from external developments, which could then result in additional endogeneity problems.

Third, in sharp contrast to the existing literature, we differentiate and establish the heterogeneity of response to monetary policy between domestic banks and foreign bank branches in the Philippines. We find that, in the Philippines, foreign banks react more strongly to real GDP growth than domestic banks, for example. This result is also in contrast to the results of Coelho, et al. (2010) which found that responses were similar among foreign and domestic banks. Decomposing the impact of monetary policy according to bank affiliation is interesting and important for the Philippines for two reasons. First and foremost, it is an important policy question per se, in light of recent changes in central bank regulation involving the foreign ownership of banks and the changing bank market structures. In particular, mergers in the Philippines as in other countries have produced larger banks. So the expectation is that monetary policy could have more policy "teeth", so to speak, in the future. The second reason is again on identification. Part of the empirical literature (Kashyap and Stein, 2000 and Arena, et al., 2007) has typically assumed that large banks have better access to deposit substitutes because of informational and monitoring reasons. For the Philippines, and perhaps for other emerging markets in Asia as well, foreign bank branches and internationally affiliated banks operating in the domestic economy has a direct lifeline with their parent holding companies, and in lieu of the low global interest rate environment after the global crisis, they have become the major conduits by which foreign capital can directly come into the economy, and even participate in central bank open market operations. It is also in this way that they are able to take advantage of the arbitrage opportunities available given that interest rates in the Philippines are at least 200 basis points higher than US interest rates.

As an additional contribution of this study in the literature, for all our estimation, we have also included in our empirical analysis an interactive variable between the RRP rate, our measure of monetary policy stance, and a dummy variable representing the periods or timing of the low (or negative) interest rate gap regimes which we have estimated in the first chapter of this dissertation. As indicated in Fermo (2016), there are two alternating regimes based on the gap between the policy rate and the short-term market interest rate—low rate gap versus high rate gap regimes—representing periods when monetary policy had greater influence on the 91-Day Tbill rate and periods when monetary policy had weaker influence on the 91-Day Tbill rate, respectively. Fermo (2016) also established that this regime-switching in the Philippine financial system coincided with the risk-on and risk-off perception of global risk and are driven as well by specific financial market characteristics. Including this dummy variable in interaction with the indicator for monetary policy, will help identify whether the low rate gap periods—which indicate periods of greater influence of the monetary policy on the Tbill rate in the Philippine financial system over the sample period--either shields (or amplifies) changes in bank lending and the lending rates in response to changes in the BSP's main monetary policy instrument: the RRP rate. This can give us some insight on how the impact of global risk perception during risk-on risk-off periods in the global financial environment affects banks at the micro-level—both via changes in the level of bank lending and the changes in the banks' two types of lending rates. Nonetheless, throughout our discussion we are mindful of endogeniety issues and the interpretations that can be given to cross effects between monetary policy and macroeconomic variables and individual bank characteristics, as well as between monetary policy and the rate gap regimes.

Our results are important in terms of policy implications. With the caveat of external validity in mind, we find that domestic banks are more sensitive to monetary policy, bank characteristics, and inflation than foreign banks, while foreign banks are more responsive to real GDP growth than domestic banks. With bank concentration increasing over time, and with the onset of increased entry and competition from foreign bank branches and affiliates, our results suggest that monetary policy could have more power through the credit channel particularly via domestic banks in the future. It is therefore important that the monetary authority is well-informed on how best to tap this power via bank credit as the transmission channel.

The remaining portions of this paper is constructed as follows: Section 2 summarizes the literature in this area of study, and also includes a discussion of the stylized facts on the Philippines banking system today. Section 3 the theoretical considerations and the empirical methodology used. Section 4 presents and analyses the empirical results. In Section 5, we conclude and submit areas for future study.

2. Literature Review

Bernanke and Blinder (1992) first tried to identify the bank lending channel by looking at the relationship between monetary policy shocks and future amounts of loans. Coelho, et al. (2010) argued that the interpretation of these empirical results is blurred by the fact that, several months ahead of a monetary policy shock, aggregate lending changes because of both supply- (bank lending channel) and demand-side aspects (changes in investment and consumption decisions). In other words, one cannot disentangle demand and supply reactions to monetary policy using low frequency data (which was quarterly data in the case of Bernanke and Blinder (1992). Kashyap, Stein and Cox (1993) also used quarterly data but looked into the impact of monetary policy on commercial papers, a substitute for bank loans. Contractions in monetary policy are associated with increases in future quantities of commercial paper, supporting the idea of a supply shock. However, identification remains unsatisfactory. Focusing the empirical analysis on quantities does not exclude the possibility that the demand for bank credit and commercial papers react differently to shocks in monetary policy.

The bank lending channel is evident when tight monetary policy are shown to be related to the decrease in loan supply of banks rather than a decline in loan demand (Kishan and Opiela, 2000). The bank lending channel can only be possible under two conditions: if there are borrowers who depend on banks for their loan requirements, and if the loan supply of these banks are influenced by movements in monetary policy (Coll, Torres and Santander, 2005). Kishan and Opiela (2000) suggests that banks with sufficient capitalisation can absorb the negative effects of monetary policy constraints on the growth of their loan portfolio, so that movements in policy rates have an effect only on the loan growth of smaller banks, thereby providing evidence for bank lending channel in this sector. Guo and Stepanyan (2011) examine the changes in bank credit across a wide sample of 38 emerging economies during the last decade. Their main finding is that domestic and foreign funding contributes positively and symmetrically to credit growth. In another recent study of 24 emerging countries, Gozgor (2013) argues that the essential determinants of domestic credit are loose monetary policy in the domestic market, differences between domestic and global lending rates, and trade openness. On the other hand, external balance and perceptions of global tail risk negatively affect domestic credit levels.

Dissatisfaction with identification based on aggregate information led to the use of bank level data. In a seminal work, Kashyap and Stein (1994) used bank characteristics to identify the bank lending channel. They assume that smaller banks, relative to larger ones, have more difficulty raising funds in money markets. In this case, differences in reactions of small and large banks to changes in monetary policy may be interpreted as evidence of the bank lending channel. Kashyap and Stein (2000) and Arena et al. (2007) are additional examples of such strategy. Kashyap and Stein (1994), Kashyap, et al. (2000) and Arena et al. (2007) all rely on theoretical arguments that bank characteristics are informative about the bank's ability to substitute away from deposits. Thus, they always test a joint hypothesis of "bank lending channel plus larger-banks-can-better-substitute-deposits theory" is correct.

Kashyap and Stein (2000) showed that banks with relatively large and liquid asset bases are better able to shield their lending growth during periods of tight monetary policy. Evidences of bank characteristics that give the same "protection" has been documented for banks with relatively high equity capital-to-assets ratios (Kishan and Opiela, 2000), banks whose loan books are readily securitized (Loutskina, 2011), banks affiliated to a parent holding company (Ashcraft, 2006), and banks that can raise funds from international operations (Cetorelli and Goldberg, 2012). If a bank's characteristics are related to its ability to access non-deposit financing sources, then the existence of a lending channel implies that lending responses to monetary policy are related to bank characteristics and are hence heterogeneous.

A fundamental question confronted by each of these papers, however, is whether or not any differences in lending responses linked to a specific bank characteristic are really the result of differences in loan supply (as in the lending and broad credit channels), or are a mixture of differences in loan supply and loan demand. Many bank characteristics are correlated with drivers of a bank's loan demand which, in turn, is affected by macroeconomic developments. For example, large banks (proxied by equity capital or total assets) may choose among clients whose loan demand is relatively stable, while poorly capitalised banks may be overlooked by safe borrowers and forced to do business with high-risk clients whose loan demand is relatively volatile and sensitive to the business cycle. In other words, loan supply and demand effects of monetary policy changes conditional on bank characteristics may be confounded (Bluedorn, et al., 2017). Berger, et al., (2004) found, for example, that banks with different characteristics also serve different clients. Coelho, et al. (2010) explains that large banks tend to serve large corporations and smaller banks tend to supply credit to Small and Medium Enterprises (SMEs). Large corporations have better access to capital markets than SMEs. Hence, the credit demand of bigger corporations are more elastic than that of SMEs, and large banks would lose market share to bond markets if they tighten credit concession in response to a shock in monetary policy. In this case, differences in bank market structure for SMEs and corporations rationalize Kashyap and Stein (1994, 2000) results without the bank lending channel being operative.

Bluedorn, et al. (2017) also found that the effects of asset composition on lending responses to monetary policy occur only among banks that are not part of a holding company. Affiliated banks appear to be able to smooth lending in the face of monetary policy shocks using the internal capital markets of the holding company, such that balance sheet composition is unrelated to lending responses to monetary policy. Bluedorn, et al. (2017) examined further the possibility that lending responses to actual federal funds rate changes confound the effects of monetary policy and other lending market drivers in the US. Furthermore, if the strength of any effects from confounding variables is related to bank characteristics, the heterogeneity in lending responses to monetary policy will not be correctly estimated. The procedure suggested by Bluedorn, et al. (2017) in deriving an exogenous monetary policy indicator is by differentiating between actual policy announcement and the perceived or the expected policy stance from the Monetary Board members. In this paper, we do not replicate this exogenous measure of the monetary policy rate, but it is a potentially good area for future research. The required information in order to estimate purely exogenous monetary policy decisions in the Philippines, such as in Bluedorn, et. al. (2017), is as yet unavailable.

For the Philippines, a recent study by Guinigundo (2015) used an error-correction model where only the policy rate is assumed to drive the movements in market interest rates, as well as estimated the impact of changes in the main BSP policy rate on the bank lending channel using quarterly data on the aggregate level of loans outstanding estimated against macroeconomic data and the BSP's main policy rate. One of their findings is that the average immediate pass-through of the policy rate is generally weaker and slower than the long-run pass through, and that there is a negative pass through to the bank lending rate--what Guinigundo (2015) termed as an apparent disconnect between the BSP's overnight policy rate and banks' pricing of loans taken at the aggregate level. It is worth noting that Guinigundo (2015) looked at aggregated bank lending rates across the universal and commercial banking sector, rather than the lending rates set by individual bank.

Meanwhile, Aban (2013) used quarterly data from 2008 to 2011 for the Philippines' 35 commercial and universal banks to establish the existence of a bank lending channel. The banks are segregated into six categories

according to the size of their assets, and a panel regression is estimated by ordinary least squares (OLS) method to check the relationship between loan growth and monetary policy. Aban (2013)'s results showed that loan growth of small banks is sensitive to movements in monetary policy, thus providing evidence for a bank lending channel in the Philippines similar to Kashyap and Stein (2000)'s methodology and findings. Nonetheless, the Aban (2013)'s results also showed that the impact of monetary policy was negative and insignificant for the rest of the bigger banks in the other five categories of bank size.

Bayangos (2010) aimed to establish the presence of the bank credit channel in the Philippines via estimation of a dynamic, structural, economy-wide macroeconometric model. The main question she posed is whether the credit channel matters in transmitting impulses to the real economy in the Philippines. The study estimated changes in aggregate private domestic credit that take into account monetary policy indicators and other specific banking indicators such as bank capital. Simulation results from this study suggest that bank credit channel matters in Philippine monetary transmission mechanism. However, another finding from the study is that the relationship between the BSP policy rate and the market interest rates, such as the 91-day Treasury bill (Tbill) and bank lending rates, were relatively weaker than perhaps what one would expect or see in other similar studies.

Tan (2011) estimated a bank lending equation using monthly aggregate private sector credit data and found that credit growth has been sluggish in the Philippines due to weaknesses in bank balance sheets, consumption-led economic growth, and relatively high net interest margins (NIMs). Tan (2011) also estimated the determinants of NIMs in the Philippines using quarterly balance sheet data for universal and commercial banks, and was found to rise with bank size, bank capitalisation, foreign ownership, overhead costs and tax rates. Using annual bank-level data from Bankscope for a number of Asian economies, the study also found that higher growth, lower inflation, higher reserve requirements, greater banking sector development, smaller stock market development and lower government deficits reduce net interest margins in Asia. Doliente (2003) also examined the determinants of net interest margins (NIM) of banks in four Southeast Asian countries, including the Philippines, where the Doliente (2003) used the dealer model (Ho and Saunders, 1981) and run a two-step regression. Results of the first regression indicate that the region's NIM are partially explained by bank-specific factors namely operating expenses, capital, loan quality, collateral and liquid assets.

The Philippine banking system: Some Stylized Facts

In order to place the Philippine banking system within the right context, let us discuss how it fares against other banks in the region. Whilst the global average banking return-on-equity (ROE) was stuck in single digits, Asia Pacific banks averaged 13% over 2010 to 2014. During this time, the best returns for investors in the region came from the Philippines[25] The five-year shareholder returns from 2000 to 2014 was highest for the Philippines at about close to 160 percent, followed by Thailand, Indonesia, Australia and Malaysia, in that order (Ernst and Young, 2016). Today, despite the challenges of market volatility, recent capital outflows and slowing growth in China, banking in the Asia Pacific region including the Philippines is likely to remain a leading growth region for banking.

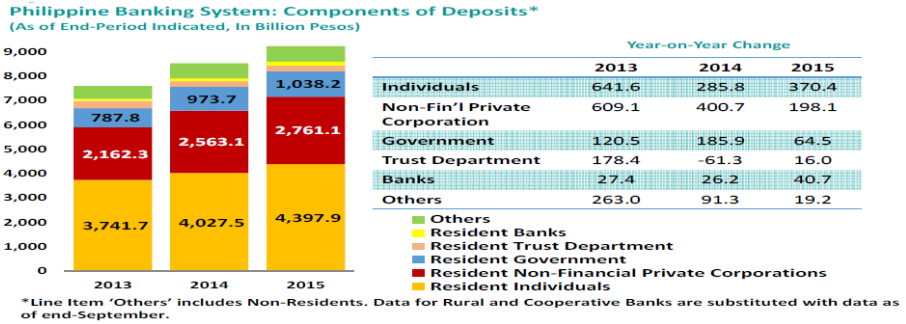
The Philippine banking sector is fragmented, comprising 36 universal and commercial banks, 70 thrift banks and 561 rural and cooperative banks. Domestic universal banks dominate, with an 80 percent market share (based on total assets) compared to other banks and foreign bank branches or affiliates. Philippine banks currently face a wide range of regulatory changes, aimed at preparing them for regional competition and economic integration. In addition to strengthening balance sheets, the main regulator, the BSP or the central bank of the Philippines, is pushing banks to improve their risk management and governance, and to focus on consumer protection. Accelerated adoption of Basel III capital requirements and stricter oversight on mortgage lending has been implemented. Resident Individuals still comprise the bulk of bank deposits in the banking system (Figure 1). Bulk of gross portfolio investments continue to be

[25] These figures are based on the largest 180 banks by assets from 13 markets including Australia, Hong Kong SAR, New Zealand, Singapore, South Korea, Taiwan, China, India, Indonesia, Malaysia, Philippines, Thailand, and Vietnam.

invested in securities held-to-maturity and assets available for sale, but more recently the held-to-maturity type of assets bought by new foreign inflows had increased much faster as of December 2015 relative to the previous year.

Merger and acquisition activity is, in fact, expected to continue in the country. Relatively larger banks will likely acquire smaller banks, either because of pressure on capitalization or to save struggling small banks in exchange for regulatory incentives (for example, waiver of license fees for opening new branches in designated areas). Intense competition, and increasing regulatory compliance and operating costs are putting pressure on banks. With the upcoming ASEAN economic integration and the greater opening up of the market to foreign banks, local banks are struggling to develop sufficient scale to compete with the larger banks both domestically and regionally.

Figure 1.



Year-on-Year Change

	2013	2014	2015
Individuals	641.6	285.8	370.4
Non-Fin'l Private Corporation	609.1	400.7	198.1
Government	120.5	185.9	64.5
Trust Department	178.4	-61.3	16.0
Banks	27.4	26.2	40.7
Others	263.0	91.3	19.2

*Line Item 'Others' includes Non-Residents. Data for Rural and Cooperative Banks are substituted with data as of end-September.

Source: Report on the Philippine Banking System as of end-December 2015, www.bsp.gov.ph

The banking industry in the Philippines can be characterized as one where the sellers (the banks) operate as monopolistically competitive players. A certain category or group of banks cater to a specific niche market and in each niche market, the bank is a lending rate-setter. The pricing of credit can be deemed as an optimal mark-up pricing model where the predominant view is that given the risk-free rate at which a specific bank can lend to the BSP—the RRP rate or the main policy rate of the BSP—the bank is willing to lend out to private non-banks at this risk-free rate plus a premium for default and other risks. Meanwhile, banks' behavior is driven as well by the heterogeneity of borrowers: the markets that banks face is a highly segmented market, where borrowers and the quality of these borrowers can be categorized into multiple segments—which is also essentially why monopolistic competition works. The Philippine banking industry can also reasonably be characterized to be under an asymmetric information model—banks price credit at different rates for different markets, and within a given niche market pricing will be inelastic depending on what other banks in the same niche are offering, and banks will be uncomfortable with new or unknown borrowers so they lend only to borrowers/market segments that the individual bank understands. Hence on direct result is not only that there is mark-up pricing over the risk-free rate, but at the same time you expect differences in the interest rates charged by each individual bank and over time.

The segmentation of the markets in the Philippines is the most distinct for the case of the bigger domestic banks versus foreign bank branches. The five major domestic banks are the biggest in terms of assets, in terms of net income, as well as in terms of the number of branches and the largest in terms of their ATM networks. Clearly, they cater largely to private individual depositors and borrowers and private non-bank firms as well who look out for accessibility (in terms of physical distance and transport costs) and speed, ease and convenience of banking services. Branches of these biggest domestic branches, in turn, offer efficient queue systems and fast consumer and business loan processing, and these remain to be among their top playing fields—the one who has the most efficient systems get the customers.

Meanwhile, the top foreign banks generally offer a package of banking services that are quite distinct and different from that of the bigger domestic banks. This package of services, in turn, cater to a very specific segment of the market as well. In fact, the new foreign bank entrants in the market are those which are developing or are tapping into market segments that they are sure to capture to ensure returns versus relatively lower capital requirements.

Foreign bank branches are generally more prestigious in ambiance, providing individualized, customized service by setting aside private, cozy offices where customer service assistants attend to the needs and queries of its depositors and customers. This set up is very unique to the bigger foreign bank branches, and something you will never see even in the biggest domestic banks, except perhaps in their head offices where conference rooms are for the use of the corporation and its visitors and guests. The captive market of these top foreign banks are hence mostly expatriates who have been stationed in Manila, corporate owners and officers, overseas Filipinos who transact with significant amounts of foreign exchange remittances on a regular basis, as well as the businessmen and women who would want to personally attend to their finances but who would not prefer the busy and usually full domestic bank branches and who would rather spend banking time in a bank with a cozier, quieter atmosphere. At the same time, foreign bank branches would expectedly have the most reliable sources, fastest remittance, and wider variety of foreign exchange—not necessarily the best rates or the best price though—but who offers ease and convenience in dealing with foreign exchange transactions for their market segment or type of customers. Just as the case for domestic banks, interest rate differentials need to compensate for default risks and other costs, and given that different branches have different default risks and costs for the type of and quality of service they provide, it is not surprising as well that individual foreign banks may also have differences in the interest rates that they set for their own customers.

Developments across Asia is also influencing developments in the Philippine banking industry, with the pace of domestic market consolidation is being hastened by the ASEAN Banking Integration Framework, which is scheduled to achieve full banking integration by 2020. It is expected to introduce greater competition by enabling easier access to markets within the region. Being able to operate across borders would enable Philippine banks to take advantage of economies of scale to increase efficiency and reduce costs. In many countries, smaller players recognize the need to consolidate if they are to compete against banks from other markets. Apart from the Philippines, Indonesia and Vietnam are also among the markets undergoing consolidation. In the Philippines, for example, the four largest domestic banks combined are still smaller than any of the major domestic banks in Singapore (Ernst & Young, 2016).

In their push to create “national champions” that can compete with banks in other countries, regulators in Asia are using both positive and negative incentives. In the Philippines, the liberalization of the banking industry following the enactment of the amendments to the Foreign Banks Law in 2015 and the Rural Bank Act of 1992 in 2013, together with the increasing demands of technological innovation, urbanization and regional developments, are gradually shaping the existing banking landscape into a more streamlined, technology-efficient and client-centric financial services industry in the country.

As of end-December 2015, there was a notable further consolidation in the Philippines banking system as the number of operating banks (measured by the number of head offices) declined to 632 banks from 648 banks in 2014. This was 1.6 times lower than the peak of 996 banks in 1998 when the BSP started introducing its merger and consolidation policy in the market. On the other hand, bank networks (as measured by branches, microbanking offices and other bank offices) expanded by 411 additional bank offices to 10,124 branches in 2015 (vs. 9,713 in 2014) and this was 1.5 times wider than the network of 6,650 bank offices recorded in 1998.

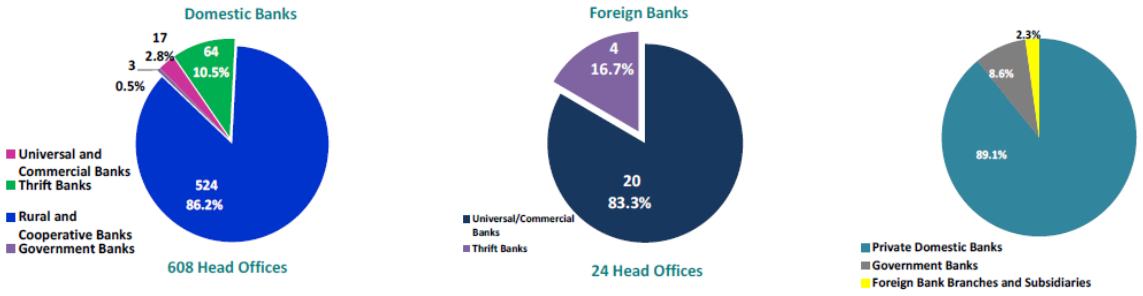
The domestic universal and commercial banks are subject to prudential limitations, and they are allowed to invest in the equity of other financial institutions and, in effect, form financial groups. There are twelve (12) Philippine domestic banks which own financial allied subsidiaries and affiliates, nine (9) are defined as financial conglomerates, whereas three (3) are part of a banking group. Strictly following the definition in the New Central Bank Act, a financial group of bank-related companies may be identified through lateral relationships (common ownership) and not only through vertical relationships (direct or indirect ownership). Moreover, thrift and rural banks may also be part of financial groups, either as parents or affiliates. However, they are much smaller in size.

In terms of asset size, the Top 5 domestic banks in the country hold the bulk of the banking system’s resources. The Top 5 banks in the country–composed of four domestic universal banks and one government bank–accounted for 53.6 percent (unchanged from last year) of the total assets of the Philippine banking system. In terms of deposit share

and capital accounts, these banks also represented a sizeable proportion at 57.0 percent (up from 56.5 percent last year) and 50.3 percent (up from 46.0 percent last year), respectively (BSP, 2015).

Domestic banks by far outnumber the foreign banks (Figure 2) with 608 head offices vis-à-vis the 24 foreign bank branches and subsidiaries which already includes the four foreign bank branches whose applications were approved under Republic Act (R.A.) No. 10641 (An Act Allowing the Full Entry of Foreign Banks in the Philippines, Amending For the Purpose R.A. No. 7721) implemented effective January 2015. These four new foreign bank entrants commenced operations in the Philippines in the second half of 2015, merely months after release of the implementing rules and regulations by the BSP.

Figure 2. Domestic Banks vs. Foreign Bank Branches and Subsidiaries and the Composition of UKBs



Source: Report on the Philippine Banking System as of end-December 2015, www.bsp.gov.ph

The enactment of R.A. No. 10641 affected both the behavior and the regulatory capital of foreign bank branches when the "Net Due to Head Office/Branches/Agencies Abroad" account was no longer recognized as a component of capital. Nevertheless, these four (4) new foreign bank branches brought in fresh funds to the Philippine banking system. The challenging global economic environment, particularly the expectation of further interest rate hike by the US Federal Reserve in 2015 affected foreign banks' investment activities which resulted to slight contraction in the total resources of foreign bank branches and subsidiaries by 4.5 percent. Inherent banking risks were considered manageable as displayed by solvency, asset quality and liquidity indicators. The foreign banks group registered a positive bottom line due to higher net interest income in the same period (BSP 2015).

Global parent banks have used their scale to capture a large share of the investment banking market, and this is the same reason several foreign bank branches which are more into investment banking, rather than the consumer lending business, have situated in the Philippines. However, the investment banking landscape is also changing. As is the case with the BSP for Philippine banks, a host of regulations imposing structural reforms and higher capital and leverage ratios requires foreign investment banks to re-evaluate their business models. Higher capital standards and ring fencing requirements are forcing investment banks to reduce their balance sheets and withdraw from higher margin, higher risk business. With declining revenues across a range of businesses, some investment banks are struggling to be profitable. Improving operational efficiency and decreasing the cost to serve is proving extremely challenging, as the financial impact of regulatory compliance makes it harder to keep costs down — especially in areas where institutions lack sufficient scale (Ernst &Young, 2016).

In the Philippines, it has been observed that in the aftermath of the global financial crisis many of the foreign banks have reduced its consumer-based services (although many never really invested in a consumer loans division nor entered the consumer lending market in the Philippines upon their entry) but many have taken advantage of the arbitrage opportunities between the low interest rates in the US and other developed countries versus the higher rates

offered by the BSP's Reverse Repurchase (RRP) and Special Deposit Account (SDA) facilities instead. The RRP and SDA facilities of the BSP act as safe havens, and are not requiring much cost and manpower to operationalize and maintain. This investment move was, however, at the expense of the central bank's open market operations and hence contributed to a certain extent to its income losses. This prompted the recent prohibition of the BSP of non-residents funds from being invested in the SDA beginning July 2012.

This prohibition, however, also increased the supervisory challenges for the BSP that are quite different from the regulatory purview of the BSP when it comes to domestic banks. Bank data reveal that some of the foreign banks continued to receive funding from their parent bank holding companies abroad, perhaps finding ingenious ways to not fall under the new prohibition and bring in these foreign funds undetected vis-à-vis other balance sheet items not explicitly or directly linked to placements with the BSP. Clearly, the lending and investment behavior of foreign bank branches and internationally affiliated banks and their response to monetary policy and regulation can be expected to be different from that of domestic banks to some, or perhaps a large, degree. This is also another motivation for the conduct of this study—to shed some preliminary light on how different are the responses to monetary policy between domestically-owned banks and banks with foreign holding company affiliation.

3. Theoretical Considerations and Empirical Methodology

Basic textbook theory tells us that monetary policy influences the price and availability of deposit and non-deposit sources of funds for banks. The setting of monetary policy by central banks is based on its objectives, and implicitly assumes that it will affect credit levels and market interest rates, including bank lending rates, in the same magnitude and direction that it is aiming for across financial institutions under its purview, based on the central bank's own forecasts and expectations over the duration of the relevant policy horizon. If there is informational asymmetry in the banking system, however, then it could be that not all banks are affected by monetary policy in the same way. Even assuming all banks would be faced with the same market behavior affecting deposit levels and loan demand from its customers in the general public, there could still be heterogeneity in the response of banks because access to non-deposit forms of funding could as well be driven by bank characteristics that denote differences in size, liquidity, capitalization, and ownership structure or affiliation, among others. In fact, it is the capabilities of banks to address and cope with information asymmetry that depends heavily on the different balance sheet characteristics of banks (x_i), Evidence of this differential response would confirm that there is heterogeneity in the response of banks to monetary policy and, if the heterogeneous response can be disentangled from demand-side effects, this in turn is an indication that the bank lending channel is at work in the system.

Among the bank characteristics which we will be evaluating in this study are indicators that denote size, the share of three different types of liquid assets, capitalization, and the ownership structure or parent holding company status. We model the impact of monetary policy on bank lending growth and bank lending rates to be lower, the higher the bank characteristic size, liquidity, capitalization and in the presence of a foreign bank holding company or international bank affiliation. The basic idea of our empirical exercise can be illustrated with a simple model of a profit-maximising bank which we borrow from Ehrmann, *et al.* (2002). The balance sheet identity of a bank i is defined as[26]:

$$L_i + S_i = D_i + B_i + C_i \tag{1}$$

where L_i is the volume of loans, S_i securities, D_i the volume of (secured) deposits, B_i the level of non-secured funding and C_i the capital of bank i. Bank i acts on a loan market characterised by monopolistic competition. The demand for (nominal) bank loans L^d_i bank i is given by:

$$L_i^d = -a_0 \cdot r_{L,i} + a_1 \cdot y + a_2 \cdot p \tag{2}$$

[26] For ease of exposition, time subscripts are not indicated.

where $r_{L,i}$ is the bank individual lending rate, y denotes aggregate real output, and p the inflation rate. All coefficients are assumed to be positive: a_0, a_1, a_2 > 0.

For simplicity, we assume that bank capital is linked to the level of loans (as in the Basel requirements) and the bank's holding of securities to the level of deposits (liquidity risk):

$$C_i = k \cdot L_i \tag{3}$$

$$S_i = s \cdot D_i \tag{4}$$

Deposits D_i are secured, but do not bear interest. They are demanded because of their role as means of payment. Deposit demand is therefore, according to a "money demand" type of function, negatively related to the interest rate of an alternative risk-free asset, r_S, which we define as the monetary policy rate:

$$D = -b_0 \cdot r_S \tag{5}$$

where $b_0 > 0$. Since we assume that banks do not pay an interest rate on these deposits, they cannot influence the amount of deposits held at their own bank, D_i. This is exogenous to the bank and it will drop after a monetary tightening (i.e., after an increase in r_S).

However, banks have access to an alternative source of funds, which is unsecured and for which the bank has to pay interest. Banks are perceived to be risky, and the suppliers of unsecured finance to banks therefore ask for an external finance premium. The interest rate they pay, $r_{B,i}$, is the risk-free rate r_S plus this premium. The external finance premium depends on a signal of a bank's health, x_i, the higher the x_i, the lower the external finance premium:

$$r_{B,i} = r_S \cdot (\mu - c_{0,i} \cdot x_i), \tag{6}$$

where $\mu - c_0 \cdot x_i \geq 1 \; \forall$ i. to ensure that the rate that banks pay is higher than the risk-free interest rate. This means that each individual bank i cannot raise unsecured funds if it offers less than $r_{B,i}$, whereas it can raise any amount of funds if it pays at least $r_{B,i}$. Given $r_{B,i}$ is a cost factor, bank i will not be ready to pay more than $r_{B,i}$.

The profit of bank i, π_i, assuming $B > 0$, is given by:

$$\pi_i = L_i \cdot r_{L,i} + S_i \cdot r_S - B_i \cdot r_{B,i} - \omega_i, \tag{7}$$

where bank-specific administrative costs and the remuneration costs for the required capital holdings is represented by ω_i. Inserting equations (1) to (5), and assuming an equilibrium in the loan market, yields:

$$\pi_i = L_i \cdot \left(-\frac{1}{a_0} \cdot L_i + \frac{a_1}{a_0} \cdot y + \frac{a_2}{a_0} \cdot p \right) + s \cdot D_i \cdot r_s - \left((1-k) \cdot L_i - (1-s) \cdot D_i \right) \cdot r_{B,i} - \omega_i \qquad (8)$$

Setting the first order condition to zero, and inserting (6) yields:

$$L_i = \frac{a_1}{2} \cdot y + \frac{a_2}{2} \cdot p - \frac{a_0 \cdot \mu \cdot (1-k)}{2} \cdot r_s + \frac{a_0 \cdot c_{0,i} \cdot (1-k)}{2} \cdot x_i \cdot r_s - \frac{a_0}{2} \cdot \frac{\partial \omega_i}{\partial L_i} \qquad (9)$$

If a bank lending channel is working in the financial system, the costs associated with raising unsecured funds by each individual bank depends on the level of information asymmetry it faces in the domestic financial markets. In this model based on Ehrmann, et.al. (2003), this implication is reflected in the assumption that different banks face different costs for raising non-secured deposits (i.e., $c_{0,i} > 0$). This differentiation would force some banks to reduce their lending by a larger extent, namely those that need to pay higher costs in raising non-secured deposits because they have a low value for the specific bank characteristic x_i. If, as assumed in the model, loan demand is homogenous across banks, regardless of their value for x_i, a differential loan reaction to monetary policies identifies the presence of a bank credit channel, that is, via a loan supply movement. The variable which will help us determine whether such a differential reaction is present, is the coefficient on the interaction term $x_i \cdot r_s$, namely,

$$\frac{a_0 \cdot c_{0,i} \cdot (1-k)}{2}$$

If this coefficient is found to be positive and significant, the assumptions of the model imply that monetary policy affects loan supply. What is, however, crucial for the identification of the bank credit channel is the assumption of a homogenous reaction of loan demand across banks. This assumption excludes cases where, for example, large or small banks' customers are more interest rate sensitive. Given that the Philippine financial system remains broadly bank-centric where firms continue to rely on banks as the main source of financing, this assumption is not so unreasonable.

Differences in costs and funding structures, in turn, can also have implications for lending rates (Mbao, *et al.*, 2014). In the case of the Philippine domestic banking system, it is just as interesting and important to understand how monetary policy affects the setting of bank-specific lending rates, whether there is also heterogeneity in the response of bank lending rates, and which balance sheet characteristics drive such a response. A number of theoretical frameworks have been developed to explain the determinants of bank lending rates in an economy. According to classical theory, the real rate of interest is determined by the marginal productivity of physical capital. This basic notion has been extended to include other influences with the time preference theory, the liquidity preference (or cash balances) theory, the loanable funds theory, and the rational expectations theory. The empirical literature, meanwhile, indicates that factors that influence interest rate setting by commercial banks can be classified in three categories: bank-specific factors; factors specific to the banking industry; and broader macroeconomic factors. A wide range of

different variables have been identified as important within each of these categories (Mbao, *et al.*, 2014). We hence proceed with the derivation of the equation for the bank lending rate, $r_{L,i}$ based on our profit maximization above.

From equation (2), we move $r_{L,i}$ to the left hand side and L_i^d to the right, to arrive at Equation (10) for $r_{L,i}$:

$$r_{L,i} = \frac{-L_i^d}{a_0} + \frac{a_1 \cdot y}{a_0} + \frac{a_2 \cdot p}{a_0} \tag{10}$$

Assuming further that the amount of bank loans supplied by each bank is equal to the amount of bank loans demanded from them at each time period, or that $L_i^d = L_i$, we can then substitute L_i from equation (9) into L_i^d in Equation (10):

$$r_{L,i} = \frac{-\left[\frac{a_1}{2} \cdot y + \frac{a_2}{2} \cdot p - \frac{a_0 \cdot \mu \cdot (1-k)}{2} \cdot r_s + \frac{a_0 \cdot c_{0,i} \cdot (1-k)}{2} \cdot x_i \cdot r_s - \frac{a_0}{2} \cdot \frac{\partial \omega_i}{\partial L_i}\right]}{a_0} + \frac{a_1 \cdot y}{a_0} + \frac{a_2 \cdot p}{a_0} \tag{11}$$

which we can then simplify further as:

$$r_{L,i} = \frac{a_1}{2a_0} \cdot y + \frac{a_2}{2a_0} \cdot p + \frac{\mu \cdot (1-k)}{a_0} \cdot r_s - \frac{c_{0,i} \cdot (1-k)}{a_0} \cdot x_i \cdot r_s + \frac{\partial \omega_i}{2\partial L_i} \tag{12}$$

The equation for $r_{L,i}$ we have arrived at has important interpretations. Whereas in equation (9), which is our equation for bank lending levels, there is a negative relationship between bank lending levels and the monetary policy rate so that the coefficient is negative, Equation (11) for the bank lending rate is showing that the coefficient for the monetary policy variable is expected to be positive: the higher the monetary policy rate, the higher the lending rate. This is reasonable to expect both from theory and actual experience. The higher the rate at which banks can lend to the central bank, then banks are expected to pass this on to its customers and raise lending rates as well. Furthermore, it is worthy to note as well that the expected coefficient for the interaction variable between each bank characteristic and the monetary policy variable is positive for the level of bank lending, whereas it is negative for bank lending rates. This would mean that, in our estimation results, when we get a significant and positive coefficient for the interaction variable for both bank lending levels bank lending rate, this would mean that that bank characteristic shields the bank from the impact of monetary policy, whereas a significant and negative coefficient means that the bank characteristic amplifies the effect of monetary policy. In both cases, too, real economic activity and prices have a positive effect, whereas required reserves and administrative costs ω_i has a differential effect: negative for bank lending levels, but positive for bank lending rates which is easy to understand. Higher costs mean the bank would have to raise the lending rates it charges to borrowers, and lower costs would encourage them to lower the lending rate. Meanwhile, higher costs mean lower lending levels as it is more costly for the bank to lend more, and the reverse is also true.

We then pattern our methodological approach from empirical studies in the literature which have conducted similar estimation techniques using Panel data estimation with bank-level data in identifying the bank lending channel. We borrow from the regression model of Ehrmann, *et al.* (2001 and 2002) for banks in the EU, Bluedorn, *et al.*, (2017)

for banks in both the United States and the EU, and refer as well to the estimation process in the earlier studies of Kashyap and Stein (1994 and 2000), who pioneered in looking into the heterogeneity of bank response for the US. We also take guidance from Ashcraft (2006), who looked into and pointed out the role of foreign banks or banks with international holding company affiliation in the bank lending channel.

According to Baltagi (2005), to allow for the possibility of partial adjustments, we determine a reduced form equation for domestic credit which also includes its lagged dependent variable. In addition, given that the total number of time periods (92) in this study is relatively large compared to the number of individual effects (10 or 20), this provides us with reasonable confidence in using Panel Regression using OLS as the chosen methodology. In the empirical model, we also take into consideration that bank lending growth respond asymmetrically to GDP growth and inflation, justifying the inclusion of these variables interacted with the bank characteristics, which is equivalent to allowing for values for the coefficients to have different values among banks whose size, liquidity and capitalisation are different (Ehrmann, *et al.* 2001).

Our regression models are based on equation (9) for bank lending growth and on equation 12 for estimating the two types of bank lending rates, with slight modifications, as we introduce some dynamics and estimate the model in first differences of the log for bank credit and with a one period lag. Beyond interacting the bank characteristic with the monetary policy rate, we furthermore interact it with real GDP growth and inflation. This way, we allow banks with different values of the bank characteristic x_i to respond differently to the business cycle. Furthermore, we assume that given we have controlled for potential cyclical effects by including real GDP growth and inflation, the estimated effects of the policy rate truly capture only monetary policy effects. The underlying idea is that banks react to a change in the policy rate and the macroeconomic variables in the previous period by adjusting new loans in the current period. Since the average maturity of loans in the Philippines is longer than one year, lending volumes approximates the stock of loans for the monthly data, while the first differences approximates the flow (Ehrmann, *et al*. 2002).

We contribute to the empirical understanding of the bank lending channel in the Philippines by employing a sharper identification strategy of using bank-level, higher frequency data in order to isolate supply shocks driven by monetary policy as in Coelho, *et al*., (2010). Our method replicates their study and bypasses any of the remaining concerns with Kashyap and Stein (1994, 2000)'s identification strategy because we have monthly bank-level data on both the lending rate and lending quantity. In addition, the higher frequency of the data is used to isolate supply from demand shocks with the key identifying assumption is that supply reacts faster than demand to monetary shocks.

As pointed out by Coelho, *et al.* (2010), demand for credit depends on investment and consumption decisions that do not react immediately to changes in monetary policy. In contrast, banks' costs of funds increase immediately to an increase in the main policy rate, especially for short maturity loans such as working capital, or some types of consumer credit. Thus, by looking at a shorter window in between the monetary board policy meetings of the BSP (which is conducted every six weeks), we more or less hold demand constant. This is the identification assumption that we borrow from Coelho, *et al.* (2010). If shocks to monetary policy increase the cost of raising capital in all funding markets (equity, bond and bank credit) commensurately, then large corporations and small SMEs would have equal bank credit demand elasticities. Thus, reduced-form estimates of the impact of changes in the monetary policy on equilibrium amounts and interest rates can be interpreted as supply shifts. In addition, as in Coelho, *et al.* (2010), we include in the empirical exercise two additional specifications where the bank lending rate is a dependent variable for establishing heterogeneity in the response of banks in the Philippines.

The regression models are therefore as follows, with only slight modifications, as we use a reduced form and introduce the dynamics where bank lending growth is estimated, as well as two kinds of bank lending rates. $RateHi_i$ represents the high-quoted lending rates that banks charge for borrowers with average to high default risks, whereas the $RateLo_i$ is the low-quoted lending rates that banks charge for prime borrowers who have lo to very low default risks, and/or those which can be characterised to fall under relationship lending. The estimation was conducted for three different cross-section samples: First, for all 20 banks, then for the 10 domestic banks alone, and lastly for the 10 foreign bank branches:

$$\Delta \log\left(L_{i,t}\right) = \alpha_{1i} + \sum_{j=1}^{l} \rho_{1,i} \Delta \log\left(L_{i,t-1}\right) + \sum_{j=0}^{l} \beta_{1,j} R_{t-j} + \sum_{j=0}^{l} \varphi_{1,j} R_{t-j} \cdot Dgap + \sum_{j=0}^{l} \lambda_{1,j} \Delta \log\left(GDP_{t-j}\right)$$
$$+ \sum_{j=0}^{l} \gamma_{1,j} \inf l_{t-j} + \tau_1 x_{i,t-1} + \sum_{j=0}^{l} \delta_{1a,j} x_{i,t-1} \cdot R_{t-j} + \sum_{j=0}^{l} \delta_{1b,j} x_{i,t-1} \cdot \Delta \log\left(GDP_{t-j}\right) + \sum_{j=0}^{l} \delta_{1c,j} x_{i,t-1} \cdot \inf l_{t-j}$$
$$+ \sum_{j=0}^{l} \eta_1 x_{1i,t-1} \cdot DH_i + \sum_{q=1}^{m} \phi_{1q} S_{1q} + \varepsilon_{1i,t}$$

(13)

$$RateHi_{i,t} = \alpha_{2i} + \sum_{j=1}^{l} \rho_{2,i} RateHi_{i,t} + \sum_{j=0}^{l} \beta_{2,j} R_{t-j} + \sum_{j=0}^{l} \varphi_{2,j} R_{t-j} \cdot Dgap + \sum_{j=0}^{l} \lambda_{2,j} \Delta \log\left(GDP_{t-j}\right)$$
$$+ \sum_{j=0}^{l} \gamma_{2,j} \inf l_{t-j} + \tau_2 x_{2i,t-1} + \sum_{j=0}^{l} \delta_{2a,j} x_{i,t-1} \cdot R_{t-j} + \sum_{j=0}^{l} \delta_{2b,j} x_{i,t-1} \cdot \Delta \log\left(GDP_{t-j}\right) + \sum_{j=0}^{l} \delta_{2c,j} x_{i,t-1} \cdot \inf l_{t-j}$$
$$+ \sum_{j=0}^{l} \eta_2 x_{i,t-1} \cdot DH_i + \sum_{q=1}^{m} \phi_{2q} S_{2q} + \varepsilon_{i,t}$$

(14)

$$RateLo_{i,t} = \alpha_i + \sum_{j=1}^{l} \rho_i RateLo_{i,t} + \sum_{j=0}^{l} \beta_{3,j} R_{t-j} + \sum_{j=0}^{l} \varphi_{3,j} R_{t-j} \cdot Dgap + \sum_{j=0}^{l} \lambda_{3,j} \Delta \log\left(GDP_{t-j}\right)$$
$$+ \sum_{j=0}^{l} \gamma_{3,j} \inf l_{t-j} + \tau_3 x_{i,t-1} + \sum_{j=0}^{l} \delta_{3a,j} x_{i,t-1} \cdot R_{t-j} + \sum_{j=0}^{l} \delta_{3b,j} x_{i,t-1} \cdot \Delta \log\left(GDP_{t-j}\right) + \sum_{j=0}^{l} \delta_{3c,j} x_{i,t-1} \cdot \inf l_{t-j}$$
$$+ \sum_{j=0}^{l} \eta_3 x_{i,t-1} \cdot DH_i + \sum_{q=1}^{m} \phi_{3q} S_{3q} + \varepsilon_{i,t}$$

(15)

with i = 1, ...N and t = 1,... T_i and where N denotes the number of banks and l the number of lags. $\Delta log(L_{i,t})$ is the percentage change in Net Loans of bank i in month t to private non-banks. R_t is the monetary policy rate, $\Delta log(GDP_t)$ the growth rate of real GDP, and $infl_t$ the inflation rate. The bank specific characteristics are given as $x_{i,t}$. The model includes S_q which pertains to a seasonal dummy variable equal to 1 in month q and zero otherwise, and ε is a mean error term. As noted earlier, we allow for asymmetric responses of bank lending and the lending rates to real GDP growth and inflation by the inclusion of these variables interacted with the bank characteristics. This is equivalent to allowing for different values for the δ_j associated with these macroeconomic variables among banks with different size, liquidity and capitalisation. This approach is also assuming further that we are incorporating the

relevant time effects with the inclusion of the macroeconomic variables. We include fixed-effects across banks, as indicated by the bank specific intercept α_i.

As discussed in earlier sections, once-lagged bank characteristics are included as controls, to allow for differences in lending growth conditional upon bank size and other balance sheet composition. The growth and inflation controls account for variations in nominal lending growth which can arise from contemporaneous changes in prices and economic activity. The interactions between macroeconomic variables and bank characteristics feature measures of characteristics that are lagged one period as well. This means that we have set it as such so that lending decisions in period t are conditional on characteristics that are pre-determined. They are thus less likely to be influenced by current lending behavior nor the monetary policy measure in the current period. In effect, the interactions between the macroeconomic variables including the monetary policy indicator and bank characteristics capture heterogeneity in bank lending responses to monetary policy, as well as to income growth and inflation. Meanwhile, the lag in the dependent variables control for serial correlation in the data that may not be eliminated by the control variables. In the case of the estimation using the low and high bank lending rates, this is particularly important as it also depicts or persistence or the stickiness in the setting of lending rates by banks which is a reasonable feature of Philippine interest rates in general. Two relevant statistical tests conducted for Panel regression estimation: Variance Inflation Factors to test for Multicollinearity and the Redundant Fixed Effects test to verify our use of fixed effects in the empirical models. The results of these statistical tests are presented in Appendix B.

The coefficients of interest are β_j, λ_j, γ_j, τ , δ_j , φ_j and η_i. The β_j coefficients represents the response of changes in bank lending and two types of bank lending rates to monetary policy, λ_j is the response of the dependent variables to GDP growth and γ_j the response of the dependent variables to inflation. τ is the response of the same dependent variables on each of the bank characteristics we are considering in this study. The δ_j are the responses of lending growth and bank lending rates to the interaction of each bank characteristic to the set of three macroeconomic variables. φ_j is the response of bank lending growth and lending rates to monetary policy interacted with the low rate gap periods based on Fermo (2016), and which was identified as the periods when monetary policy had its strongest influence on market interest rates, particularly the 91-day T-bill rate. Lastly, η_i is the coefficient for the interaction between the bank characteristics and the dummy variable DH which denotes holding company status with a value of 1 for foreign bank branches and 0 otherwise.

If our empirical models are indeed capturing loan supply effects, bank lending growth are expected to have a negative relationship with the policy rate and the inflation rate. A lower policy rate reduces the cost of borrowing by banks from the central bank, increases the interest rate spread, and encourages banks to increase loan supply. A higher inflation rate reduces the real rate of return and the bank's desire to supply loans. Meanwhile, if the factors affecting loan demand dominates, changes in bank lending growth are expected to have a positive relationship with the inflation rate. A higher inflation rate reduces the real interest rate and encourages borrowers to demand for more bank loans.

However, demand side factors also result in a negative response of bank lending to monetary policy. A higher policy rate increases market rates and hence the cost of borrowing and is expected to reduce bank loan demand. This is why it is important to include an interactive term between the monetary policy rate and the bank characteristic, because this is one way by which we can disentangle the supply versus demand effects of monetary policy on the level of bank lending. The interactive coefficient relates the reaction of bank lending to monetary policy to the bank characteristics. Under the assumptions we are using in this model, a significant parameter implies that monetary policy affects loan supply, via the different bank characteristics. A significantly positive coefficient means that the bank characteristics attenuates the impact of monetary policy on the dependent variable being estimated, whereas a significantly negative interactive term means that the bank characteristic amplifies the effect of monetary policy on that

dependent variable. Equivalently, significant interactive terms therefore provide evidence of heterogeneity in the response of different banks with different characteristics on monetary policy changes.

The interpretation which can be given to the cross effects (interactions) between monetary policy and bank characteristics is that if the bank characteristic that proxy access to funds matter for loan supply, then a positive and significant cross effect represents how much the bank characteristics help to shield loan supply or the level of lending from monetary policy changes. Conversely, a negative and significant cross effect means that the bank characteristics amplify the negative effect of monetary policy on bank lending growth. As mentioned earlier, Ashcraft (2006) also contends that the properties of loan demand are similar across banks, conditional upon bank holding company status (i.e., affiliation vs. non-affiliation with a foreign parent holding company). Thus, for the regression of the full sample of 20 domestic and foreign banks, we include a term for the interaction between a dummy variable DH_i representing bank holding status: 1 for foreign banks and 0 otherwise. A significantly positive interaction term indicates that the affiliation to a parent holding company shields the effect of monetary policy on lending and lending rates via the bank characteristics that it is interacting with. In this case, a comparison of lending responses by bank holding company status is more likely to reflect genuine differences in banks' access to alternative finance.

In the first empirical model, Equation (13), the distributional effects of monetary policy should be reflected in a significant interaction term of the bank specific characteristic with the monetary policy indicator (Erhmann, *et al*., 2001). The usual assumption we find in the literature (based on Kashyap and Stein, 1995 and 2000) are that a small, less liquid or less capitalised bank reacts more strongly to monetary policy changes than a bank with a higher value for the same set of bank characteristics. Meanwhile, our two other empirical models involving the high quoted (equation 14) and the low quoted bank lending rates (equation 15), respectively, could help establish heterogeneity of bank responses to monetary policy in terms of the two types of bank lending rates, and could also help corroborate the results we obtained in the first model on bank lending growth.

4. Definition of the Data Used

Macroeconomic variables for March 2008 – December 2015 used in our regression equations are all government data. Real Gross Domestic Product and the Implicit Price Index or the GDP Deflator, which are available in quarterly frequency, are both from the National Income Accounts of the Philippine Statistical Agency or PSA, accessible from the website www.psa.gov.ph. The overnight Reverse Repurchase or RRP Rate, is our measure for the monetary policy in this study. The RRP Rate is used in the BSP's conduct of open market operations and is the rate at which the BSP repays when it "borrows" from the domestic banks when they decide to park their money with the BSP, serving as a safe haven for their funds contingent on government securities as collateral. It is the main policy instrument of the BSP and the data series is available from the BSP website www.bsp.gov.ph. Many of the studies on the bank lending channel have utilized the policy rate as the indicator of monetary policy (Bernanke and Blinder, 1992; Kashyap and Stein, 2000; Kishan and Opiela, 2000; Vera, 2012).

All bank-level data included as bank characteristics are confidential bank-level data from the BSP, and are monthly indicators from March 2008 to December 2015 for ten (10) domestic banks and ten (10) foreign bank branches or banks with international holding company affiliation. However, monthly frequency balance sheet data were provided on anonymous basis as they are confidential and are not shared publicly on bank privacy considerations. Nonetheless, quarterly bank-level balance sheets are available for all universal and commercial banks in the Philippines and are also accessible from the BSP website. Many of the domestic and foreign banks in the country also publish either a monthly, a quarterly and/or an annual consolidated balance sheet report in their own websites.

The monetary policy and macroeconomic variables comprise:

a. Monetary Policy measure. In this study we choose to use the main policy instrument of the BSP, which is the RRP (Reverse Repurchase) Rate, overnight;

b. Real GDP growth in percentage terms. Philippine GDP data is reported in the National Income Accounts (NIA) in quarterly frequency. In order to obtain a monthly series, we make use of interpolation procedures from the ECOTRIM software. We also make use of two versions of this variable in trying to see which one will be significant and/or improves the AIC: either real GDP growth computed based on the levels from the monthly ECOTRIM interpolation, or entering the log dlog of the interpolated constant GDP levels into the regression was also conducted heuristically;

c. The Inflation rate from CPI data and Growth in the Implicit Price Index from the NIA, as the two alternative measure of inflation in percentage points and lagged one period.

d. For the panel data estimation covering all 20 banks, we also include a dummy variable we called DH_i that has the value of one (1) if it is a foreign bank branch or if it is affiliated with an international bank holding company, and zero (0) otherwise. This, in effect, is the dummy variable controlling for whether a bank in the full sample is a domestic bank or a foreign bank, borrowing from Bluedorn, *et al*, (2017) and Ashcraft (2006).

The bank characteristics $X_{i,t}$ we are considering in the empirical exercise include bank characteristics for:

a. Size: The dlog or log of bank Total Assets, deflated by the Implicit Price Index (IPI);
b. Liquidity 1: The ratio of bank securities to nominal assets;
c. Liquidity 2: The ratio of RRP placements of the bank to nominal assets.
d. Liquidity 3: The ratio of cash to nominal assets;
e. Capitalization: The ratio of total equity capital to nominal assets;

5. Presentation and Analysis of Results

a. Bank Lending Growth as Dependent Variable

The results for the Panel regression of model (13), which makes use of the percentage change in Net Loans per bank (what we will refer to hitherto as bank lending growth) as the dependent variable, covering the sample of 20 Universal and Commercial banks (UKBs) are in Table 1 in Appendix A. We see from these results that under all 5 specifications of the bank characteristic variable being estimated, the chosen monetary policy variable for the Philippines, the RRP Rate, turned out as an insignificant explanatory variable for the lending decisions of the 20 banks in our sample. Nevertheless, when we consider the interactive variable between the RRP Rate and the dummy variable marking the periods of low rate gaps—what Fermo (2016) found to be periods when the monetary authority in the Philippines has relatively more influence on the short-term Tbill rate--then the policy rate becomes a significant during these periods in explaining the growth in bank loans. The signs are also as expected: the higher the policy rate interaction with the low rate gap periods of higher degree of influence, the lower the growth in bank lending because higher policy rates would prompt the banks to charge higher lending rates under a mark-up type of market pricing discussed in the earlier section on Stylized facts. This would mean that for all 20 banks taken as a group, the main policy rate does not appear to have any reasonable influence on bank lending decisions. However, when one considers those periods when the policy rate is able to influence or guide market interest rates more effectively, then we are able to capture a reasonable and significant relationship between the main monetary policy instrument and the changes in the level of bank lending.

In addition, we see in this full sample that both Real GDP growth and the Inflation Rate have significant influence on bank lending growth in the current period. Although the magnitudes or degree of influence vary across the

5 specifications, in the full specification at column number 6 of Table 1 we see that when we consider all bank characteristics into the equation, the inflation rate has an estimated coefficient of 1.184, and its positive sign is as we expect from theory: As inflation rates increase, banks tend to supply more loans given that the market's view is that the purchasing power of money has fallen. The coefficient for Real GDP growth, however, has an estimated coefficient of -0.325, a sign we were not expecting based on theory. This result may be due to the fact that because the 20 banks in our sample would have different cost structures and different target markets, this result may be driven by a diluted response due to heterogeneity among the banks, or possibly demand side effects dominating the response of bank lending growth to real GDP growth rather than supply. Higher real GDP growth mean higher economic activity, and so a possible increase in employment which, in turn, could mean higher income or a positive wealth effect from the point of view of customers—they feel less need to borrow from banks or have a lower impetus to add new loans, and perhaps even deem the period as the right time to pay off their existing loans.

The best way to confirm whether we are indeed capturing loan supply effects rather than demand side effects, is to look at the interaction variables between the bank characteristics and the monetary policy and macroeconomic variables. We see in Table 1 that in terms of the real GDP growth variable, the ratio of total securities to assets turned out to be significant, but with a negative sign which means that this bank characteristic actually amplifies the effect of GDP growth on bank lending growth. To illustrate, we can think of a scenario when there is a fall in real GDP growth, say during a crisis, the bank with relatively higher securities to asset ratios would tend to reduce lending growth even more than in the case of those banks with smaller securities-to-assets ratios. Meanwhile, in the case of the impact of the inflation rate on lending growth, the interactive variable of inflation with the equity capital-to-assets ratio is positive and significant—which means that this capitalization indicator shields bank lending growth from the impact of higher inflation. The higher a bank's equity capital relative to assets, the better is that bank able to weather the effects of inflation rate changes so that higher inflation rates do not necessarily translate to higher growth in bank lending for banks whose equity capital ratios are high.

The most interesting result we obtain from the sample of all 20 UKBs, however, is the interaction variable between the RRP Ratio to Assets in Table 1, and the monetary policy and macroeconomic variables as well as the interaction variable between this bank characteristic and our dummy variable DH_i. The RRP Ratio on its own is the only significant bank ratio affecting the decision of the 20 Philippine banks regarding lending volumes, and the sign is as expected at -2.440, which means that loans and RRPs are clear substitutes—higher RRP levels, would weaken bank lending growth. As an interactive variable, the RRP ratio is also significant in shielding the effects of monetary policy and GDP growth on bank lending—higher RRP ratios attenuates the impact of these macroeconomic variables on bank lending. Even more importantly, its significant and positive interaction with our dummy variable DH, which denotes bank affiliation status, means that there is significant heterogeneity in the response of foreign banks versus domestic banks to monetary policy and to the business cycle, and this is particularly true in terms of RRP levels as a share to total assets. These results on the RRP ratio as a bank characteristic is obtained in both the stand alone specification (third column in Table 1) and in the full specification that includes all bank characteristics—its interaction is robust even in consideration of other bank characteristics.

Table 2 in Appendix A presents the results when we narrow down the sample to 10 domestic banks. The results we obtained on the interactive variables between some of the bank characteristics and the dummy variable DH in the full sample of 20 banks in Table 1 confirmed there is heterogeneity in the response of the bank lending growth in foreign banks versus that of domestic banks so that it is reasonable to look into the regression estimation for domestic banks separately from that of foreign banks. This exercise would help corroborate which of the relationships and results we have seen for the sample of 20 banks would hold true or not for domestic banks and that for foreign banks. For the sample of domestic banks, we see that the weak explanatory power of the chosen monetary policy variable, the RRP Rate, on bank lending growth are retained. Nevertheless, similar to what we had obtained for the full sample of 20 UKBs, the interaction between this monetary policy variable, and the low rate gap period we had identified using a dummy variable, remains significant. The estimated coefficient for this interaction variable is negative, which would mean that during the low rate gap regimes, when monetary policy is found to be more influential to market interest

rates, higher policy rates have a significant and negative impact on lending growth, which is what we expect from theory given that higher policy rates would mean higher lending rates charged by banks, and hence lower volumes.

It is noteworthy that the growth in lending volumes of the 10 domestic banks are not responsive to changes in real GDP growth. Meanwhile, the inflation rate is a positive explanatory variable for domestic bank lending growth and is significant in the stand alone specifications for the bank characteristics only for size and capitalization, and becomes a stronger and positive determinant of bank lending growth under the full specification in column 6 where we consider all bank characteristics for size, liquidity and capitalization into the regression equation. In fact, under the full specification, four (4) out of the five (5) bank characteristics have significant coefficients—these would include the growth in real Assets (a measure of bank size), the RRP Ratio (a liquidity measure), the Cash-to-Assets ratio, another indicator of liquidity, and the capitalization measure or Equity Capital as a ratio to Assets.

Based on this specification, RRPs and Cash as a balance sheet component of domestic banks appear to be a substitute for Loans, as they enter the equation for bank lending growth with negative coefficients, whereas real assets and equity capital is as expected from theory—size and capitalization impact on lending decisions positively. In terms of the interaction of the bank characteristics with the monetary policy variable, the RRP- and Cash-to-Assets ratio are both positive and significant interactive variables which means they help shield lending decisions of banks from monetary policy changes. Meanwhile, the interaction between size and capitalization and the RRP rate for domestic banks appear to amplify the effects of monetary policy—negative and significant coefficients would mean that higher levels of these two bank characteristics make lending growth in domestic banks decline even more in the face of a monetary tightening, for example, than what banks which are smaller in terms size and capitalization would have. This could be a reflection that bigger domestic banks in the Philippines are more responsive to monetary policy, as they are the most exposed to local investments and the general public as its domestic deposit base. They are more cautious or watchful at what movements or changes in monetary policy are responding to and what they would mean for their businesses and risk exposure.

Table 3 in Appendix A presents the regression coefficients for the Panel regression involving the 10 foreign bank branches in our sample. The chosen monetary policy variable is also insignificant as an explanatory variable for lending growth in the case of the 10 foreign banks under review. As an interaction variable with the dummy variable for low rate gap periods of higher policy influence, it remains insignificant for three our of the five stand alone specifications in Table 3. This interaction variable only becomes significant and with the expected negative sign under the sixth and last specification where we consider all size, liquidity, and capitalization bank characteristics into the regression. The inflation rate, meanwhile, is now positive in the case of foreign banks as expected from theory whereby higher inflation rates translate to higher bank lending growth, as the spending power or value of money falls with a rise in prices. However, the inflation rate as an explanatory variable is only significant under the stand alone specifications where we estimate each of the bank characteristics one after another, but the significance is lost under the specification where we take into account all the five bank characteristics. In stark contrast to domestic banks, real GDP growth is a significant explanatory variable for the growth in bank lending of foreign banks, however the sign is reverse of what is expected in theory as it is negative under all specification in Table 3.

In terms of the interaction variables, the securities ratio entered the regression results as a significant variable in the stand alone specification which looks into this bank characteristic alone. The Securities to Assets ratio of foreign banks shield lending growth from the effects of inflation rate changes, but amplifies the effects of real GDP growth, and this relationship is only significant under the stand alone specification involving the securities ratio as the result is lost under the full specification. On the other hand, only the RRP ratio enters as a significant and positive explanatory variable in the decisions of foreign banks to lend—higher RRP levels mean higher lending volumes. This bank characteristic, however, amplifies the impact of real GDP growth changes on the percentage change in lending levels, as the interaction obtained has a significantly negative coefficient. Hence, within the category of foreign banks, results show that there is not so much heterogeneity in the response of bank lending growth, and only two bank characteristics matter in the lending decisions of foreign banks: the RRP ratio and the Securities to Assets ratios. This is not surprising given that most of foreign bank branches based in the Philippines are focused on investments in securities, including

with the BSP facilities such as the RRP, rather than into consumer or business lending. In fact, in contrast with the case for domestic banks, the full specification equation for foreign banks obtained only one significant bank characteristic as an explanatory variable affecting lending growth, and that is the RRP-to-Assets ratio. No interaction remained robust in the full specification for foreign banks—an indication that the category of foreign banks appears to be homogenous as no heterogeneity indicator stands out or remains in the full specification.

b. Banks' Lending Rates as Dependent Variable

Tables 4 to 6 in Appendix A presents the results for the Panel regression involving high lending rates as the dependent variable for all 20 banks, for the 10 domestic banks and 10 foreign banks, respectively. For the full sample of 20 banks, the RRP Rate, our chosen monetary policy variable, has estimated coefficients that are positive and significant in all specifications as a determinant of the high-quoted lending rates of our sample of banks in the Philippines. The interaction variable between the monetary policy indicators and the dummy variable for low rate gap periods are also all significant. The signs of these estimated coefficients for this interactive variable is, however, negative which means that during the low rate gap periods when monetary policy has more influence over market interest rates, the 20 Philippine banks tend to adjust high lending rates lower than what they would have set during the other periods where the rate gap is relatively higher. We can surmise from this result that perhaps during the low rate gap periods, risk of default is lower as banks are confident monetary policy can efficiently guide all market interest rates and so in this scenario, banks may have the view that all risks are effectively priced into BSP's and the market rates. Nonetheless, because all the coefficients for the RRP Rate in our estimation are much higher than the interaction coefficient, the net effect of monetary policy on high-quoted lending rates is still positive—higher monetary policy rate leads to higher lending rates in our sample of 20 banks. Real GDP growth as a determinant is also positive and significant for all specifications, as expected from theory.

The estimated coefficients for the inflation rate as an explanatory variable for high lending rates are also all significant under all specifications for the 20 banks. However, the sign of the estimated coefficient for the inflation rate is negative—the reverse of what we would expect from theory. Higher prices mean that the real rate of return falls so that the expected response from banks is a higher nominal lending rate in order to maintain the same real rate of return. However, this result where higher inflation translate to lower lending rates, is robust not only for the specification involving the 20 banks in the full sample, but is retained even in the panel regression for the 10 domestic banks and the 10 foreign banks. This could mean that the negative relationship between inflation changes and the high-quoted lending rate is a predominant feature of the Philippine banking system. All other things being equal, we know from theory that a tightening of monetary policy increases the default risk, because the contraction of demand for goods and services in the economy and the increase in interest charges cause a deterioration in the balance sheet position of borrowers. If we relate this now to the results we have obtained in this study, one possible explanation is that higher inflation rate may be viewed by banks in the Philippines not only as an indication of lower real rate of return, but at the same time translates to an erosion of purchasing power and hence a deterioration as well in the real wealth of borrowers. Hence, in order to avoid the possibility of a complete default and a reduction in the level of loans, banks may be adjusting nominal lending downwards in order to attract safer new borrowers and ease the burden of payment of existing borrowers—much like the case where they offer re-instatement or rescheduling of loans. Clearly, we would need a separate study in order to fully understand this and could be an interesting topic of future research.

We find interesting results when we look at the Panel regressions for the 10 domestic banks versus those for the 10 foreign banks. For domestic banks, the monetary policy variable exhibits a weaker influence over high-quoted lending rates, as it is only significant in three out of the 6 specifications in Table 5. In comparison, the monetary policy variable is a significant variable for the 10 foreign banks under all specifications. Similarly, the interaction variable of the RRP Rate with the low rate gap dummy variable is insignificant under all specifications for foreign banks, whereas they are significant under all specifications for domestic banks. This is a clear indication that the regime-switching rate gap in the Philippine economy does not matter for foreign banks, as their funding and decisions are dependent on alternative financing from the parent holding company and may be driven as well by the conditions in the parent holding

companies' country of origin, rather than conditions in the Philippines particularly as regards the two distinct regimes of low rate gap versus high rate gap periods. In a sense, their affiliation assured them of other means or sources of funds irrespective of the regimes faced and the influence of monetary policy in the country of operations. Another interesting contrast between the responses of high lending rates in foreign banks versus that in domestic banks, ergo a source or proof of heterogeneity in response to macroeconomic variables, is the explanatory power of real GDP growth in the setting of high-quoted lending rates. Real GDP growth is a positive and significant determinant of bank lending rates in foreign banks, but is an insignificant explanatory variable for high lending rates in domestic banks. This result is true under all specifications in Tables 5 and 6.

We obtain the results as well that for the estimation involving all 20 banks, the cash ratio or liquidity 3 in Table 4 is the only significant bank characteristic affecting high-quoted lending rates, and the direction of the relationship is negative: Cash is a substitute for Loans. In terms of the interaction variables, which is our basis or indicator for the presence of heterogeneity in the response of bank lending rates on monetary policy and the business cycle, another significant interactive variable is that between the bank characteristics and our dummy variable denoting bank affiliation or holding company status DH. The presence of heterogeneity in the response of the high lending rates of foreign banks versus domestic banks was confirmed by the interactive variables between DH and Real asset growth and Securities-to-Assets ratio. The interaction between Cash-to-Assets ratio and monetary policy is the only significant interactive variable for the sample of 20 banks, and this ratio effectively amplifies the impact of monetary policy changes as it has a significantly negative coefficient. Estimating domestic banks separately from foreign banks helped giving us a more detailed picture on the other interactions, as grouping the 20 banks together, which we now have seen may be diluting or preventing other relationships to come to fore given the results confirming heterogeneity in their responses. For domestic banks, size and cash liquidity are significant determinants of high lending rates: whereas the cash ratio shields banks' setting of high lending rates from the effects of monetary policy size amplifies the effect of inflation on high lending rates. For foreign banks, we see results that are similar to the estimation involving lending growth as the dependent variable. The securities-to-assets and RRP ratios are additional significant explanatory variables in the setting of high lending rates, and the securities ratios amplifies the effects of real GDP growth in these decisions.

In the case of estimation involving low-quoted lending rates, monetary policy as an explanatory variable is significantly positive and robust for all specifications in the case of the sample for all 20 banks and that for the 10 foreign banks (See Tables 7 to 9 in Appendix A). For the sample of 10 domestic banks, our chosen monetary policy indicator is significant for four out of the six specifications in Table 8. Much as the case for high-quoted lending rates, the interaction variable between monetary policy and low rate gap periods is only significant in the case of all 20 banks and 10 domestic banks, but is insignificant for foreign banks. In contrast, real GDP growth (positive estimated coefficients) and inflation (negative estimated coefficients) are both significant explanatory variables and robust under all specifications for the sample of 20 banks and the subsample of 10 foreign banks. In the case of domestic banks, only the inflation rate is a significant explanatory variable in the setting of low-quoted lending rates, real GDP growth is insignificant in the setting of low-quoted lending rates as it was in high-quoted lending rates. The interactive variable with the dummy indicator DH is significant only in the case of real assets growth (our indicator for size) for the sample of all 20 banks. Meanwhile, the interaction of macroeconomic variables with real assets growth, securities ratios, the cash-to-asset ratios and capitalization of domestic banks are significant, but the sign is negative, indicating that these ratios serve to amplify the effects of the monetary policy and/or macroeconomic variable on the setting of low lending rates, rather than shield them. For foreign banks, only the securities ratio and the cash ratio, both measures of liquidity, matter in the setting of low lending rates, but again they have a negative sign.

6. Conclusion

The existing empirical literature use bank-level data and bank characteristics in a panel estimation to establish heterogeneity of response of bank lending to monetary policy. In order to disentangle the effects of bank characteristics coming from loan demand versus those coming from purely supply effects, there is a need to include monetary policy and macroeconomic variables and their interaction with bank characteristics in the empirical model to ensure that

monetary policy and its effects are identified. The key identifying assumption is that banks differ in their abilities to substitute away from deposits. Furthermore, observable characteristics determine the ability to move to and from deposits. In this case, one may interpret different reactions of banks to monetary policy also as evidence of the bank lending channel. We therefore followed the literature and decomposed the response to monetary policy according to bank characteristics, i.e., size, liquidity, capitalisation and additionally, looking at the heterogeneity of the response of domestic banks versus foreign banks in the Philippine domestic financial market.

One of the estimation results from the panel of all 20 banks indicate that the interaction of the dummy variable for holding company status with bank characteristics has positive and significant coefficients for the decisions of banks on the setting of both bank lending growth and lending rates. These results imply that whether a bank is a foreign bank or not is important in the assessment of monetary policy response and effectiveness. These results also establish the heterogeneity among banks in terms of bank holding status affiliation, and lend support to our motivation to conduct the panel estimation separately for domestic banks and for foreign banks.

In almost all specifications the response of bank lending growth and lending rates to the monetary policy rate is significant and with the signs of the estimated coefficients being as predicted by theory, but for domestic banks only if taken into the empirical model as an interactive variable with the dummy indicator for the low rate gap periods, or the periods when monetary policy has the highest influence on market interest rates based on Fermo (2016). When taken alone, the RRP rate is a significant determinant of bank lending growth only for the sample of all 20 banks and for foreign banks. These results mean that the main policy rate is a significant explanatory variable affecting bank lending volumes and the setting of the lending rates. In the case of domestic banks, where we found a few specifications where the monetary policy variable was insignificant, the interactive variable between this monetary policy indicator and the dummy variable denoting the low rate gap regimes identified in Fermo (2016) when policy had more influence in market interest rates, were significant. This is a representation of how the main monetary policy instrument of the BSP, the RRP rate, retains its influence over the bank lending sector, despite the regime-switching rate gap driven by the shifts in global risk perception of investors.

Even within the category of domestic banks versus that of foreign banks, we also find that there is higher degree of heterogeneity among domestic banks—given significant interactive variables for several bank characteristics in the case of domestic banks and only two at most (the Securities to Assets ratio and the RRP Ratio) for foreign banks—providing additional support that there is indeed heterogeneity in the response of Philippine banks to monetary policy and even to the business cycle indicators such as Real GDP growth and the Inflation rate in terms of this bank characteristic.

A comparison of the other results for the panel estimation of 10 domestic banks with the results for 10 foreign banks on bank characteristic variables and interaction variables further attests to our finding that there is heterogeneity in the response of banks to monetary policy and to other macroeconomic variables. Except for the RRP placements and the Securities as a ratio to Assets, which is entering as a negative and significant variable affecting changes in bank loans, no other bank characteristic matters to the decisions of foreign banks on bank lending growth. These results also imply that there is not much heterogeneity, at least in the sample of 10 foreign banks we have considered, among and between the banks belonging to the category of foreign banks.

As regards the specifications using the low and high quoted bank lending rates as dependent variables, we get the following results. The main policy rate is a positive and significant variable as well for all specifications. Meanwhile, the interaction variable with the dummy for low rate gap periods do not matter for the setting of foreign banks' lending rates. The inflation rate is significant under all specifications and in the three different sample of banks we have estimated. Real GDP growth, however, is a positive and significant variable for the setting of both low and high quoted lending rates of foreign banks, in the case of domestic banks this variable is not a consideration in the setting of both lending rates. Foreign banks can be more responsive to GDP growth because parent holding companies tend to allocate funding based on macroeconomic fundamentals of the countries where it operates, and GDP growth

is also a proxy for exchange rate changes. Meanwhile, domestic banks' definition of profits is in terms of real profits, so this is why they are sensitive to inflation. There is no money illusion since their accounts are in peso.

We can further trace these results to the fact that foreign bank branches in the Philippines comprise banks who have a parent holding company abroad, so that their information on the Philippines rely heavily on macroeconomic data and how they evolve through time as this is the kind of information most available to global investors, including those coming from the parent companies. International investment banks, for example, would view investment opportunities and alternatives based on the fundamentals of each economy where they have a presence within a group of emerging countries, in deciding how much to price loans and how much of the funds go into lending versus other forms of investments within that country. Therefore it is not surprising that while domestic banks do not directly consider real GDP growth in a significant way in setting the level of bank loans or the bank lending rate which they charge, considering that they have a bigger information base and knowledge on the domestic economy, foreign bank branches would tend to still rely on macroeconomic data in the assessment of bank lending growth and bank lending rates.

Based on our results, we also found that domestic banks are generally more responsive to bank characteristics and their interactions than foreign banks. Among the three dependent variables we have estimated, bank lending growth and the high quoted lending rate is also more responsive to bank characteristics and their interactions than is the case for the regression involving low-quoted lending rates as the dependent variable. Many of our interactive terms, however, are significant but negative—indicating that several of the bank characteristics we have considered in this study amplifies rather than shields the impact of monetary policy and the business cycle on bank lending growth and rates—a result that is in contrast to what is commonly found in the existing literature.

Domestic banks appear to have a stronger reliance on the Log of total Assets in real terms (indicator for size), the Cash to Assets ratio (indicator for high liquidity), and the Bank securities to Assets ratio (also an indicator for liquidity, but in terms of asset substitutes) as standalone variables, as they both have positive and significant coefficients in the empirical models. Meanwhile, the interactive variables for two bank characteristics in the estimation for 10 domestic banks—the Cash to Assets ratio and the RRP placements to Assets ratio—has a positive coefficient and is significant indicating that these bank characteristics shield the changes in bank loans from the effects of monetary policy and the inflation rate. This result confirms, therefore, that there is heterogeneity even among the banks within the category of domestic banks.

Nevertheless, for the banking sector as a whole, RRP placements to Assets is a significant explanatory variable, as it matters both to decisions on bank loan growth as well as on both low and high quoted lending rates of banks both for the panel estimation of 10 domestic banks and that for 10 foreign banks. This attests to recent observations that the RRP placements and lending to the public are now two strongly competing destinations of banks' funds, both in the case of domestic banks and foreign banks.

In contrast with the literature, our main identification strategy to establish heterogeneity of responses is data-driven. A well-established fact in monetary economics is that output and inflation are only slowly affected by the traditional monetary policy mechanism (see Christiano, et. al., 1999). In the short run, consumption and investment decisions have some inertia. Since monetary policy affects banks' marginal cost immediately for several products, credit supply should react faster to monetary policy than credit demand. Using monthly and bank level data, we are confident we are recovering only systematic supply shifts.

In addition to high frequency, another advantage vis-à-vis the literature, we have data on two quoted bank lending rates, which corroborates that we are indeed capturing supply shocks: supply and demand shocks to monetary policy have similar implications for quantities, but opposite implications for lending rates. Our results indicate that under most of the specifications, monetary policy has a positive and significant effect on bank lending rates in the Philippines—a purely supply side effect.

Typically, one assumes that larger, more liquid and foreign-owned banks (in emerging countries) are better equipped to move to and from deposits and non-deposits for funding. Liquidity matters because, if banks have very liquid instruments in the asset part of the balance sheet, they may sell position when facing funding shortage. As our panel regression results have shown, many bank characteristics denoting size, liquidity, and capitalization does matter for Philippine domestic banks, whereas they matter less so for foreign banks. This may be an indication that foreign banks are able to source their funds from parent companies that enter another item in their balance sheet, one that we have not considered in this study, but which can be examined further as area of future research.

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Appendix A: Panel Data Estimation Results

Table 1. Bank Lending Growth Equation for All Banks						
	Models estimated with the following bank characteristic variables					
EQUATION	1A	1B	1C	1D	1E	1
EXPLANATORY VARIABLES	Size: Real Asset Growth	Liquidity 1: Securities Ratio	Liquidity 2: RRP Ratio	Liquidity 3: Cash Ratio	Capitalization: Equity Capital Ratio	Size, Liquidity and Capitalization
Monetary Policy (MP)	**-0.002**	**0.008**	**-0.011**	**-0.008**	**-0.007**	**0.002**
	0.8792	*0.6696*	*0.3215*	*0.5530*	*0.6875*	*0.9885*
MP*DummyLowRateGap	**-0.007****	**-0.008****	**-0.011*****	**-0.007****	**-0.006***	**-0.010*****
	0.0595	*0.0308*	*0.0019*	*0.0565*	*0.0753*	*0.0020*
Real GDP Growth	**-0.115****	**-0.099***	**-0.174*****	**-0.128****	**-0.000****	**-0.325****
	0.0388	*0.0922*	*0.0014*	*0.0246*	*0.054*	*0.0232*
Inflation	**0.441***	**0.583****	**0.610****	**0.348**	**-0.275***	**1.184*****
	0.0625	*0.0313*	*0.0169*	*0.5370*	*0.0960*	*0.0138*
Real Asset Growth	**-0.501**					**-0.023**
	0.3739					*0.6729*
Real Asset Growth* MP	**0.043**					**-0.003**
	0.3743					*0.8148*
Real Asset Growth* GDP Growth	**0.000**					
	0.2539					
Real Asset Growth*Inflation	**0.971**					
	0.2175					
Real Asset Growth DH	**-0.065**					**-0.058**
	0.7154					*0.2382*
Securities Ratio		**0.173**				**0.208**
		0.6524				*0.6481*
Securities Ratio*MP		**-0.024**				**0.003**
		0.7922				0.9751
Securities Ratio* GDP Growth		**-1.043***				
		0.0918				
Securities Ratio* Inflation		**-0.005**				
		0.8021				
Securities Ratio* DH		**0.119**				**-0.104**
		0.4991				*0.5755*
RRP Ratio			**-2.440*****			**-1.832*****
			0.000			*0.0000*
RRP Ratio*MP			**0.223*****			**0.154****
			0.000			0.0336
RRP Ratio* GDP Growth			**0.081*****			
			0.0003			
RRP Ratio* Inflation			**-2.169**			
			0.2435			
RRP Ratio* DH			**0.479***			**0.631****
			0.0811			*0.0258*
Cash Ratio				**-2.529**		**-12.661**
				0.6123		*0.1265*
Cash Ratio*MP				**0.460**		**2.593**
				0.6239		*0.1588*
Cash Ratio* GDP Growth				**0.000**		
				0.2296		
Cash Ratio* Inflation				**-2.284**		
				0.9438		
Cash Ratio* DH				**2.145**		**-7.624**
				0.8325		*0.5448*
Equity Capital Ratio					**-4.012**	**0.032**
					0.6233	*0.9705*
Equity Capital Ratio*MP					**-0.120**	**-0.066**
					0.3927	*0.7404*
Equity Capital Ratio* GDP Growth					**0.335**	
					0.5722	
Equity Capital Ratio* Inflation					**5.356****	
					0.0210	
Equity Capital Ratio* DH					*0.291*	**0.221**
					0.5360	*0.6370*
Adjusted R^2	14.83%	14.96%	19.58%	14.62%	16.12%	21.17%
Durbin Watson	2.19	2.19	2.19	2.19	2.19	2.18
Akaike Criterion	-0.162	-0.163	-0.219	-0.159	-0.161	-0.212
No. of Observations	1840	1840	1840	1840	1840	1840
Note: */**/*** denotes significance at the 10%/5%/1% level. Number in italics and parenthesis are p-values						

Table 2. Bank Lending Growth Equation for Domestic Banks						
	Models estimated with the following bank characteristic variables					
EQUATION	1A	1B	1C	1D	1E	1
EXPLANATORY VARIABLES	Size: Real Asset Growth	Liquidity 1: Securities Ratio	Liquidity 2: RRP Ratio	Liquidity 3: Cash Ratio	Capitalization: Equity Capital Ratio	Size, Liquidity and Capitalization
Monetary Policy (MP)	**0.009**	**-0.004**	**-0.004**	**-0.019**	**0.063****	**-0.017**
	0.1445	*0.8832*	*0.5151*	*0.3506*	*0.0440*	*0.6567*
MP*DummyLowRateGap	**-0.003****	**-0.004****	**-0.003****	**-0.004***	**-0.003**	**-0.004****
	0.0360	*0.0235*	*0.0475*	*0.0781*	*0.2299*	*0.0305*
Real GDP Growth	**-0.001**	**0.001**	**-0.001**	**0.0004**	**0.009**	**-0.001**
	0.5060	*0.8429*	*0.5336*	*0.9443*	*0.3213*	*0.3352*
Inflation	**0.316****	**-0.289**	**0.050**	**-0.336**	**0.531***	**0.321*****
	0.0189	*0.5077*	*0.7183*	*0.1192*	*0.0952*	*0.0123*
Real Asset Growth	**0.812**					**1.344*****
	0.2384					*0.0022*
Real Asset Growth* MP	**-0.178**					**-0.306*****
	0.1830					*0.0045*
Real Asset Growth* GDP Growth	**0.019**					
	0.6233					
Real Asset Growth*Inflation	**-6.637****					
	0.0185					
Securities Ratio		**-0.047**				**0.039**
		0.9194				*0.9079*
Securities Ratio*MP		**0.039**				**0.056**
		0.6790				*0.5116*
Securities Ratio* GDP Growth		**-0.007**				
		0.7540				
Securities Ratio* Inflation		**1.946**				
		0.2441				
RRP Ratio			**-2.840*****			**-3.818*****
			0.002			*0.0000*
RRP Ratio*MP			**0.427*****			**0.634*****
			0.0145			0.0001
RRP Ratio* GDP Growth			**0.009**			
			0.8686			
RRP Ratio* Inflation			**7.494****			
			0.0432			
Cash Ratio				**-14.222**		**-12.264*****
				0.1317		*0.0015*
Cash Ratio*MP				**1.372**		**2.485*****
				0.2182		*0.0047*
Cash Ratio* GDP Growth				**-0.071**		
				0.8176		
Cash Ratio* Inflation				**20.470***		
				0.0907		
Equity Capital Ratio					**4.676****	**1.569****
					0.0326	*0.0537*
Equity Capital Ratio*MP					**-0.505***	**-0.384****
					0.0618	*0.0508*
Equity Capital Ratio* GDP Growth					**-0.090**	
					0.2391	
Equity Capital Ratio* Inflation					**-4.180***	
					0.0948	
Adjusted R^2	23.42%	22.02%	29.22%	21.49%	21.96%	30.62%
Durbin Watson	2.20	2.19	2.06	2.20	2.20	2.03
Akaike Criterion	-2.06	-2.04	-2.14	-2.04	-2.04	-2.16
No. of Observations	920/B	920/B	920/B	920/B	920/B	920/B
All equations estimated with cross-section fixed effects						
Note: */**/*** denotes significance at the 10%/5%/1% level. Number in italics and parenthesis are p-values						

Table 3. Bank Lending Growth Equation for Foreign Banks						
	Models estimated with the following bank characteristic variables					
EQUATION	1A	1B	1C	1D	1E	1
EXPLANATORY VARIABLES	Size: Real Asset Growth	Liquidity 1: Securities Ratio	Liquidity 2: RRP Ratio	Liquidity 3: Cash Ratio	Capitalization: Equity Capital Ratio	Size, Liquidity and Capitalization
Monetary Policy (MP)	**0.003**	**0.014**	**0.001**	**0.009**	**0.013**	**0.101**
	0.8863	*0.6203*	*0.9450*	*0.7268*	*0.5576*	*0.6415*
MP*DummyLowRateGap	**-0.003**	**-0.012***	**-0.010***	**-0.004**	**-0.003**	**-0.016*****
	0.5792	*0.0646*	*0.0705*	*0.5610*	*0.6199*	*0.0106*
Real GDP Growth	**-0.000*****	**-0.188***	**-0.557****	**-1.288*****	**-0.629****	**-0.638****
	0.0058	*0.0809*	*0.0442*	*0.0011*	*0.0297*	*0.0210*
Inflation	**1.24****	**0.726**	**1.395****	**3.627*****	**1.002***	**1.506**
	0.0278	*0.2951*	*0.0256*	*0.0052*	*0.0748*	*0.1146*
Real Asset Growth	**-0.153**					**-0.050**
	0.5630					*0.6189*
Real Asset Growth* MP	**0.052**					**-0.014**
	0.3463					*0.5342*
Real Asset Growth* GDP Growth	**0.000**					
	0.6649					
Real Asset Growth*Inflation	**-6.153***					
	0.0867					
Securities Ratio		**0.796**				**-0.083**
		0.1447				*0.9168*
Securities Ratio*MP		**-0.132**				**0.052**
		0.3032				0.7878
Securities Ratio* GDP Growth		**-4.826*****				
		0.0019				
Securities Ratio* Inflation		**2.646**				
		0.5389				
RRP Ratio			**24.208*****			**-1.102****
			0.0045			*0.0228*
RRP Ratio*MP			**-0.095**			**0.119**
			0.3494			0.3059
RRP Ratio* GDP Growth			**-1.837*****			
			0.0032			
RRP Ratio* Inflation			**-2.052**			
			0.4698			
Cash Ratio				**26.495**		**-87.37**
				0.5831		*0.1582*
Cash Ratio*MP				**-4.332**		**18.730**
				0.6716		*0.1581*
Cash Ratio* GDP Growth				**0.001*****		
				0.0144		
Cash Ratio* Inflation				**-927.90****		
				0.0329		
Equity Capital Ratio					**1.084**	0.272
					0.9638	0.8562
Equity Capital Ratio*MP					**-0.216**	**-0.074**
					0.3178	0.8339
Equity Capital Ratio* GDP Growth					**0.026**	
					0.9891	
Equity Capital Ratio* Inflation					**-0.615**	
					0.8889	
Adjusted R^2	14.98%	15.56%	19.71%	15.85%	15.41%	20.14%
Durbin Watson	2.18	2.20	2.17	2.20	2.20	2.19
Akaike Criterion	0.45	0.44	0.38	0.44	0.44	0.39
No. of Observations	920	920	920	920	920	920
All equations estimated with cross-section fixed effects						
Note: */**/*** denotes significance at the 10%/5%/1% level. Number in italics and parenthesis are p-values						

Table 4. High Bank Lending Rate Equations for All Banks						
	Models estimated with the following bank characteristic variables					
EQUATION	2A	2B	2C	2D	2E	2
EXPLANATORY VARIABLES	Size: Real Asset Growth	Liquidity 1: Securities Ratio	Liquidity 2: RRP Ratio	Liquidity 3: Cash Ratio	Capitalization: Equity Capital Ratio	Size, Liquidity and Capitalization
Monetary Policy (MP)	**0.103*** **	**0.137*** **	**0.102*** **	**0.174*** **	**0.113*** **	**0.095** **
	0.0000	*0.0019*	*0.0002*	*0.0000*	*0.0024*	*0.0325*
MP*DummyLowRateGap	**-0.021*** **	**-0.021** **	**-0.022*** **	**-0.008*** **	**-0.019** **	**-0.020** **
	0.0113	*0.0163*	*0.0097*	*0.3498*	*0.0272*	*0.0234*
Real GDP Growth	**0.629*** **	**0.370***	**0.581** **	**0.754** **	**0.729** **	**0.628** **
	0.019	*0.2082*	*0.0293*	*0.0279*	*0.0169*	*0.0189*
Inflation	**-1.389*** **	**-1.730*** **	**-1.073*** **	**-1.153*** **	**-1.575*** **	**-1.613*** **
	0.0000	*0.0021*	*0.0004*	*0.0845*	*0.0001*	*0.0000*
Real Asset Growth	**32.451**					**0.221**
	0.1774					*0.6919*
Real Asset Growth* MP	**0.080**					**0.129**
	0.4905					*0.1979*
Real Asset Growth* GDP Growth	**-2.641**					
	0.1723					
Real Asset Growth*Inflation	**5.454**					
	0.1395					
Real Asset Growth DH	**-0.752**					**-0.753***
	0.0552					*0.0624*
Securities Ratio		**13.555**				**-1.360**
		0.2323				*0.1771*
Securities Ratio*MP		**-0.160**				**0.098**
		0.3839				0.6663
Securities Ratio* GDP Growth		**-1.053**				
		0.2071				
Securities Ratio* Inflation		**3.477**				
		0.3851				
Securities Ratio* DH		**0.918** **				**0.895** **
		0.0234				*0.0279*
RRP Ratio			**-16.841**			**-1.223**
			0.4714			*0.2026*
RRP Ratio*MP			**0.014**			**0.210**
			0.9372			*0.2095*
RRP Ratio* GDP Growth			**1.505**			
			0.4234			
RRP Ratio* Inflation			**-6.670***			
			0.0991			
RRP Ratio* DH			**0.032**			**0.1332**
			0.9592			*0.8405*
Cash Ratio				**-27.905**		**1.879**
				0.9071		*0.8966*
Cash Ratio*MP				**-5.035** **		**-1.128**
				0.0443		*0.7037*
Cash Ratio* GDP Growth				**5.518**		
				0.7786		
Cash Ratio* Inflation				**-48.932**		
				0.2574		
Cash Ratio* DH				**11.427**		**-7.408**
				0.6158		*0.7632*
Equity Capital Ratio					**-12.897**	**1.526**
					0.492	*0.4295*
Equity Capital Ratio*MP					**-0.131**	**-0.204**
					0.6777	*0.6265*
Equity Capital Ratio* GDP Growth					**1.059**	
					0.4372	
Equity Capital Ratio* Inflation					**-6.586**	
					0.1995	
Equity Capital Ratio* DH					**-0.061**	**-0.189**
					0.9539	*0.8611*
Adjusted R^2	91.62%	91.61%	91.63%	91.53%	91.61%	91.64%
Durbin Watson	1.89	1.48	1.90	1.91	1.89	1.90
Akaike Criterion	1.44	1.44	1.44	1.45	1.44	1.45
No. of Observations	1823/U	1823/U	1823/U	1823/U	1823/U	1823/U
Note: */**/*** denotes significance at the 10%/5%/1% level. Number in italics and parenthesis are p-values						

Table 5. High Bank Lending Rate Equations for Domestic Banks						
	Models estimated with the following bank characteristic variables					
EQUATION	2A	2B	2C	2D	2E	2
EXPLANATORY VARIABLES	Size: Real Asset Growth	Liquidity 1: Securities Ratio	Liquidity 2: RRP Ratio	Liquidity 3: Cash Ratio	Capitalization: Equity Capital Ratio	Size, Liquidity and Capitalization
Monetary Policy (MP)	**0.154*** **	**0.026**	**0.088** **	**0.042**	**0.002**	**1.167***
	0.0000	*0.8204*	*0.0548*	*0.6641*	*0.9874*	*0.1039*
MP*DummyLowRateGap	**-0.026** **	**-0.024** **	**-0.016**	**-0.019***	**-0.028** **	**-0.022***
	0.0211	*0.0356*	*0.1294*	*0.0682*	*0.0161*	*0.0614*
Real GDP Growth	**0.264**	**-1.468**	**-0.310***	**0.211**	**0.010**	**0.035**
	0.3684	*0.2256*	*0.0776*	*0.6742*	*0.2036*	*0.9182*
Inflation	**-1.654** **	**0.023** **	**0.030*** **	**0.032*** **	**-1.935*** **	**-1.516*** **
	0.0169	*0.0480*	*0.0111*	*0.0076*	*0.0033*	*0.0011*
Real Asset Growth	**-113.31**					**0.414** **
	0.2197					*0.0465*
Real Asset Growth* MP	**-1.693** **					**-0.104** **
	0.0147					*0.0331*
Real Asset Growth* GDP Growth	**10.276**					
	0.1714					
Real Asset Growth*Inflation	**-29.083***					
	0.0624					
Securities Ratio		**0.744**				**-2.385**
		0.7071				*0.2658*
Securities Ratio*MP		**0.237**				**0.379**
		0.5844				0.4725
Securities Ratio* GDP Growth		**5.787**				
		0.2036				
Securities Ratio* Inflation		**-5.231*** **				
		0.0003				
RRP Ratio			**-183.14***			**3.003**
			0.0639			*0.3839*
RRP Ratio*MP			**-0.700**			**-0.829**
			0.4794			0.3216
RRP Ratio* GDP Growth			**15.100***			
			0.0564			
RRP Ratio* Inflation			**-27.043***			
			0.0889			
Cash Ratio				**-114.01**		**-55.820** **
				0.8004		*0.0186*
Cash Ratio*MP				**0.747**		**13.031** **
				0.8892		*0.0154*
Cash Ratio* GDP Growth				**12.544**		
				0.7143		
Cash Ratio* Inflation				**-107.09*** **		
				0.0077		
Equity Capital Ratio					**-41.754**	**2.11**
					0.1677	*0.6669*
Equity Capital Ratio*MP					**1.269**	**-0.628**
					0.2475	*0.6020*
Equity Capital Ratio* GDP Growth					**2.732**	
					0.2051	
Equity Capital Ratio* Inflation					**0.366**	
					0.9424	
Adjusted R^2	91.00%	90.84%	90.73%	90.78%	90.69%	90.82%
Durbin Watson	1.79	1.77	1.79	1.77	1.77	1.76
Akaike Criterion	1.19	1.18	1.19	1.18	1.20	1.19
No. of Observations	903/U	903/U	913/U	913/U	903/U	903/U
All equations estimated with cross-section fixed effects						
Note: */**/*** denotes significance at the 10%/5%/1% level. Number in italics and parenthesis are p-values						

Table 6. High Bank Lending Rate Equations for Foreign Banks						
	Models estimated with the following bank characteristic variables					
EQUATION	2A	2B	2C	2D	2E	2
EXPLANATORY VARIABLES	Size: Real Asset Growth	Liquidity 1: Securities Ratio	Liquidity 2: RRP Ratio	Liquidity 3: Cash Ratio	Capitalization: Equity Capital Ratio	Size, Liquidity and Capitalization
Monetary Policy (MP)	**0.092****	**0.106****	**0.087****	**0.124****	**0.096****	**0.127****
	0.0157	*0.0408*	*0.0481*	*0.0176*	*0.0362*	*0.0290*
MP*DummyLowRateGap	**-0.007**	**-0.005**	**-0.010**	**-0.006**	**-0.007**	**0.014**
	0.5610	*0.6862*	*0.4397*	*0.6443*	*0.5841*	*0.2786*
Real GDP Growth	**0.000*****	**1.351*****	**1.170*****	**1.082*****	**1.331*****	**1.618*****
	0.0110	*0.0040*	*0.0047*	*0.0095*	*0.0027*	*0.0018*
Inflation	**-1.470*****	**-0.968***	**-1.187****	**-1.573*****	**-1.522*****	**-2.164****
	0.0028	*0.0800*	*0.0358*	*0.0104*	*0.0066*	*0.0402*
Real Asset Growth	**-1.276**					**-0.775**
	0.3432					*0.1439*
Real Asset Growth* MP	**0.17**					**0.178**
	0.1583					*0.1251*
Real Asset Growth* GDP Growth	**0.000**					
	0.7868					
Real Asset Growth*Inflation	**1.121**					
	0.5707					
Securities Ratio		**25.888***				**0.004**
		0.0622				*0.9976*
Securities Ratio*MP		**-0.075**				**-0.029**
		0.7564				*0.9271*
Securities Ratio* GDP Growth		**-1.961***				
		0.0587				
Securities Ratio* Inflation		**-3.094**				
		0.5597				
RRP Ratio			**-16.721**			**-1.438***
			0.5315			*0.1050*
RRP Ratio*MP			**0.0184**			**0.315**
			0.9295			0.1433
RRP Ratio* GDP Growth			**1.477**			
			0.4921			
RRP Ratio* Inflation			**-6.090**			
			0.1963			
Cash Ratio				**-1944.38**		**78.574**
				0.4086		*0.3876*
Cash Ratio*MP				**-23.128**		**-19.751**
				0.3114		*0.3083*
Cash Ratio* GDP Growth				**164.330**		
				0.3954		
Cash Ratio* Inflation				**-261.66**		
				0.5673		
Equity Capital Ratio					**0.392**	**0.901**
					0.9881	*0.6861*
Equity Capital Ratio*MP					**-0.138**	**-0.153**
					0.7396	*0.7716*
Equity Capital Ratio* GDP Growth					**0.046**	
					0.9806	
Equity Capital Ratio* Inflation					**-10.092**	
					0.2496	
Seasonality - June	**0.067**	**0.0889**	**0.049**	**0.051**	**0.065**	
	0.3131	*0.1866*	*0.4724*	*0.4619*	*0.3323*	
Adjusted R^2	91.94%	91.96%	91.98%	91.95%	91.95%	91.88%
Durbin Watson	1.96	1.96	1.97	1.97	1.97	1.97
Akaike Criterion	1.64	1.63	1.63	1.63	1.63	1.65
No. of Observations	920/B	920/B	920/B	920/B	920/B	920/B
All equations estimated with cross-section fixed effects						
Note: */**/*** denotes significance at the 10%/5%/1% level. Number in italics and parenthesis are p-values						

Table 7. Low Bank Lending Rate Equations for All Banks						
	Models estimated with the following bank characteristic variables					
EQUATION	3A	3B	3C	3D	3E	3
EXPLANATORY VARIABLES	Size: Real Asset Growth	Liquidity 1: Securities Ratio	Liquidity 2: RRP Ratio	Liquidity 3: Cash Ratio	Capitalization: Equity Capital Ratio	Size, Liquidity and Capitalization
Monetary Policy (MP)	**0.103*** **	**0.140*** **	**0.120*** **	**0.140*** **	**0.140*** **	**0.145*** **
	0.0000	*0.0003*	*0.0000*	*0.0000*	*0.0000*	*0.0001*
MP*DummyLowRateGap	**-0.028*** **	**-0.017** **	**-0.019*** **	**-0.019*** **	**-0.017** **	**-0.018** **
	0.0001	*0.0159*	*0.0076*	*0.0081*	*0.0174*	*0.0173*
Real GDP Growth	**0.673*** **	**0.900** **	**0.674*** **	**0.628*** **	**0.835*** **	**0.751*** **
	0.0033	*0.0469*	*0.0029*	*0.0059*	*0.0011*	*0.0009*
Inflation	**-0.957*** **	**-1.549*** **	**-1.190*** **	**-1.512*** **	**-1.810*** **	**-1.580*** **
	0.0002	*0.0002*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
Real Asset Growth	**-0.154**					**0.841***
	0.8868					*0.0755*
Real Asset Growth* MP	**0.102**					**0.053**
	0.2706					*0.5325*
Real Asset Growth* GDP Growth	**2.413**					
	0.1817					
Real Asset Growth*Inflation	**1.119**					
	0.4571					
Real Asset Growth DH	**-1.150*** **					**-0.988**
	0.0006					*0.0038*
Securities Ratio		**-0.642**				**-0.561**
		0.6125				*0.5051*
Securities Ratio*MP		**-0.097**				**-0.018**
		0.5439				0.9269
Securities Ratio* GDP Growth		**-0.0000021**				
		0.5846				
Securities Ratio* Inflation		**0.644*** **				
		0.6823				
Securities Ratio* DH		**0.819** **				**0.498**
		0.0176				*0.1476*
RRP Ratio			**-22.788**			**-1.229**
			0.2513			*0.1297*
RRP Ratio*MP			**0.0388**			**0.165**
			0.7938			0.2415
RRP Ratio* GDP Growth			**1.942**			
			0.2241			
RRP Ratio* Inflation			**-6.600** **			
			0.0552			
RRP Ratio* DH			**0.121**			**0.322**
			0.8218			*0.5633*
Cash Ratio				**-274.95**		**1.295**
				0.1654		*0.9126*
Cash Ratio*MP				**-1.397**		**-0.090**
				0.5350		*0.9704*
Cash Ratio* GDP Growth				**22.468**		
				0.1649		
Cash Ratio* Inflation				**-23.096**		
				0.5447		
Cash Ratio* DH				**36.413***		**34.035**
				0.0640		*0.1029*
Equity Capital Ratio					**-19.186**	**2.231**
					0.2160	*0.1723*
Equity Capital Ratio*MP					**-0.232**	**-0.336**
					0.3845	*0.340*
Equity Capital Ratio* GDP Growth					**1.578**	
					0.1611	
Equity Capital Ratio* Inflation					**-5.428**	
					0.2135	
Equity Capital Ratio* DH					**0.071**	**-0.095**
					0.9365	*0.9169*
Adjusted R^2	93.98%	94.05%	94.07%	94.06%	94.07%	94.12
Durbin Watson	1.84	1.798	1.80	1.80	1.79	1.79
Akaike Criterion	1.125	1.124	1.121	1.122	1.120	1.117
No. of observations	1840/B	1840/B	1840/B	1840/B	1840/B	1840/B
Note: */**/*** denotes significance at the 10%/5%/1% level. Number in italics and parenthesis are p-values						

Table 8. Low Bank Lending Rate Equations for Domestic Banks						
	Models estimated with the following bank characteristic variables					
EQUATION	3A	3B	3C	3D	3E	3
EXPLANATORY VARIABLES	Size: Real Asset Growth	Liquidity 1: Securities Ratio	Liquidity 2: RRP Ratio	Liquidity 3: Cash Ratio	Capitalization: Equity Capital Ratio	Size, Liquidity and Capitalization
Monetary Policy (MP)	**0.118*** **	**0.090**	**0.092** **	**0.069**	**0.222** **	**1.204** **
	0.0000	*0.3425*	*0.0165*	*0.3342*	*0.0508*	*0.0536*
MP*DummyLowRateGap	**-0.049*** **	**-0.032** **	**-0.023*** **	**-0.031*** **	**-0.026*** **	**-0.021**
	0.0000	*0.0010*	*0.0091*	*0.0010*	*0.0088*	*0.0275*
Real GDP Growth	**0.257**	**0.000**	**-0.274**	**0.324**	**0.000** **	**0.007**
	0.3010	*0.8132*	*0.063*	*0.2550*	*0.0418*	*0.3100*
Inflation	**-1.530*** **	**0.026*** **	**0.030*** **	**0.031*** **	**0.026** **	**-0.175**
	0.0089	*0.0093*	*0.0029*	*0.0023*	*0.0143*	*0.7524*
Real Asset Growth	**-108.60**					**0.126**
	0.1651					*0.7524*
Real Asset Growth* MP	**-1.945*** **					**-0.078***
	0.0009					*0.0643*
Real Asset Growth* GDP Growth	**10.09**					
	0.1131					
Real Asset Growth*Inflation	**-30.99** **					
	0.0192					
Securities Ratio		**2.252**				**-0.798**
		0.1763				*0.6601*
Securities Ratio*MP		**-0.076**				**0.078**
		0.8335				0.8614
Securities Ratio* GDP Growth		**0.000**				
		0.5219				
Securities Ratio* Inflation		**-4.805*** **				
		0.0001				
RRP Ratio			**-140.76***			**2.091**
			0.0921			*0.4730*
RRP Ratio*MP			**1.276**			**-0.584**
			0.1277			0.4065
RRP Ratio* GDP Growth			**12.123***			
			0.0701			
RRP Ratio* Inflation			**-28.40** **			
			0.0356			
Cash Ratio				**-270.59**		**-29.02**
				0.1483		*0.1286*
Cash Ratio*MP				**-0.904**		**7.440***
				0.8050		0.0894
Cash Ratio* GDP Growth				**25.69***		
				0.0966		
Cash Ratio* Inflation				**-119.80*** **		
				0.0005		
Equity Capital Ratio					**34.50** **	**7.447***
					0.0369	*0.0804*
Equity Capital Ratio*MP					**-1.21**	**-2.071** **
					0.1804	*0.0452*
Equity Capital Ratio* GDP Growth					**-2.251** **	
					0.0485	
Equity Capital Ratio* Inflation					**-7.55**	
					0.1533	
Adjusted R^2	93.70%	93.72%	93.70%	93.74%	93.58%	93.62%
Durbin Watson	1.79	1.72	1.74	1.71	1.71	1.72
Akaike Criterion	0.86	0.87	0.86	0.86	0.89	0.89
No. of observations	920/B	920/B	930/B	920/B	920/B	920/B
All equations estimated with cross-section fixed effects						
Note: */**/*** denotes significance at the 10%/5%/1% level. Number in italics and parenthesis are p-values						

Table 9. Low Lending Rate Equations for Foreign Banks						
	Models estimated with the following bank characteristic variables					
EQUATION	3A	3B	3C	3D	3E	3
EXPLANATORY VARIABLES	Size: Real Asset Growth	Liquidity 1: Securities Ratio	Liquidity 2: RRP Ratio	Liquidity 3: Cash Ratio	Capitalization: Equity Capital Ratio	Size, Liquidity and Capitalization
Monetary Policy (MP)	**0.121*** **	**0.161*** **	**0.118*** **	**0.177*** **	**0.129*** **	**0.135*** **
	0.0003	*0.0002*	*0.0019*	*0.0001*	*0.0011*	*0.0104*
MP*DummyLowRateGap	**0.0009**	**0.013**	**0.000**	**-0.001**	**0.001**	**-0.003**
	0.9373	*0.2267*	*0.9999*	*0.9304*	*0.8934*	*0.8302*
Real GDP Growth	**0.847** **	**1.073***	**0.835** **	**0.784***	**1.024*** **	**0.881** **
	0.0184	*0.0853*	*0.0198*	*0.0988*	*0.0062*	*0.0139*
Inflation	**-1.329*** **	**-1.902**	**-0.974** **	**-1.021** **	**-1.648*** **	**-1.822*** **
	0.0024	*0.1942*	*0.0499*	*0.0539*	*0.0006*	*0.0002*
Real Asset Growth	**-1.266**					**-0.397**
	0.2750					*0.3792*
Real Asset Growth* MP	**0.139**					**0.106**
	0.1775					*0.2839*
Real Asset Growth* GDP Growth	**1.977**					
	0.341					
Real Asset Growth*Inflation	**1.358**					
	0.4251					
Securities Ratio		**2.356***				**-0.062**
		0.0852				*0.9558*
Securities Ratio*MP		**-0.169**				**-0.040**
		0.4181				0.8812
Securities Ratio* GDP Growth		**0.000**				
		0.8774				
Securities Ratio* Inflation		**-3.796** **				
		0.0394				
RRP Ratio			**-22.397**			**-0.825**
			0.3179			*0.2757*
RRP Ratio*MP			**0.017**			**0.156**
			0.9250			0.3957
RRP Ratio* GDP Growth			**1.921**			
			0.2869			
RRP Ratio* Inflation			**-6.344**			
			0.1122			
Cash Ratio				**261.47**		**96.63**
				0.1150		*0.2184*
Cash Ratio*MP				**-32.501***		**-17.660**
				0.0938		*0.2864*
Cash Ratio* GDP Growth				**79.496**		
				0.7214		
Cash Ratio* Inflation				**-210.40**		
				0.3617		
Equity Capital Ratio					**-5.281**	**1.559**
					0.8116	*0.4112*
Equity Capital Ratio*MP					**-0.220**	**-0.161**
					0.5348	*0.7188*
Equity Capital Ratio* GDP Growth					**0.523**	
					0.7456	
Equity Capital Ratio* Inflation					**-5.482**	
					0.4639	
Adjusted R^2	93.74%	93.70%	93.78%	93.75%	93.90%	93.79%
Durbin Watson	1.85	1.86	1.86	1.86	1.86	1.83
Akaike Criterion	1.32	1.33	1.32	1.32	1.32	1.32
No. of observations	920/B	920/B	920/B	920/B	920/B	920/B
All equations estimated with cross-section fixed effects						
Note: */**/*** denotes significance at the 10%/5%/1% level. Number in italics and parenthesis are p-values						

Appendix B: STATISTICAL TESTS

I. Variance Inflation Factors

A. ALL 20 Banks

EQUATION 1 - Bank Lending Growth Equation

Variance Inflation Factors

Sample: 2008M03 2015M12

Included observations: 1840

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.277422	11013.68	NA
Bank Lending Growth (t-1)	0.000487	1.105280	1.103709
Monetary Policy (MP)	0.011767	8163.708	180.9085
MP*LowRateGapDum	0.000011	2.990723	2.074002
Real GDP Growth	0.020420	1.645508	1.617600
Inflation Rate	0.230685	1.713492	1.659699
Real Assets Growth	0.003036	15241.32	10.65344
Securities to Assets	0.207361	396.3568	68.13986
Equity Capital to Assets	0.776019	324.5897	57.68356
Cash to Assets	68.58965	244.2301	16.81886
RRP to Assets	0.174523	87.94970	58.12263
Real Assets Growth*MP	0.000117	10215.56	198.7363
Securities to Assets*MP	0.011524	387.2795	74.28127
Equity Capital to Assets*MP	0.039431	292.0458	62.53017
Cash to Assets* MP	3.385232	226.5678	31.05613
RRP to Assets *MP	0.005237	51.45286	36.29949
Real Assets Growth *DH	0.002407	2449.476	5.680756
Securities to Assets*DH	0.034240	16.91583	9.871511
Equity Capital to Assets * DH	0.219627	23.27689	14.95799
Cash to Assets* DH	158.4478	5.027242	1.897368
RRP to Assets*DH	0.079945	35.59115	25.50423

EQUATION 2 – High Bank Lending Rate Equation

Variance Inflation Factors

Sample: 2008M03 2015M12

Included observations: 1823

	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
C	0.092397	692.9660	NA
High Bank Lending Rate (t-1)	0.000107	51.03537	1.820300
Monetary Policy (MP)	0.001957	256.1389	5.663496
MP*LowRateGapDum	7.56E-05	3.720174	2.600021
Real GDP Growth	0.071460	1.086577	1.067571
Inflation Rate	0.099702	185.9788	3.002601
Real Assets Growth	0.312070	49.16203	49.08573
Securities to Assets	1.014894	367.4917	63.54623
Equity Capital to Assets	3.730234	295.7204	52.75894
Cash to Assets	208.7675	134.2919	8.432201
RRP to Assets	0.920887	88.64845	58.44996
Real Assets Growth*MP	0.010044	35.24813	35.21304
Securities to Assets*MP	0.052082	331.1858	63.89162
Equity Capital to Assets*MP	0.175642	246.4164	53.06916
Cash to Assets* MP	8.798757	105.8040	13.79777
RRP to Assets *MP	0.027922	52.37010	36.87720
Real Assets Growth *DH	0.001842	1.204598	1.099532
Securities to Assets*DH	0.163063	24.50755	24.50261
Equity Capital to Assets * DH	0.165467	15.64762	9.096106
Cash to Assets* DH	1.167393	23.66973	15.15991
RRP to Assets*DH	604.6403	3.679146	1.380558
RRPTOA(-1)*DH	0.438378	37.31119	26.66631

EQUATION 3- Low Bank Lending Rate Equation

Variance Inflation Factors

Sample: 2008M03 2015M12

Included observations: 1840

	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
C	0.060108	631.6989	NA
Low Bank Lending Rate (t-1)	0.000110	37.36081	2.521310
Monetary Policy (MP)	0.001462	268.5551	5.951207
MP*LowRateGapDum	5.51E-05	3.884036	2.693495
Real GDP Growth	0.050935	1.086560	1.068132
Inflation Rate	0.074540	194.3095	3.175106
Real Assets Growth	0.223729	48.95990	48.88284
Securities to Assets	0.709663	359.0877	61.73272
Equity Capital to Assets	2.670168	295.6580	52.54204
Cash to Assets	138.9489	130.9737	9.019484
RRP to Assets	0.656744	87.61276	57.89996
Real Assets Growth*MP	0.007224	35.21652	35.18073
Securities to Assets*MP	0.036669	326.2229	62.57043
Equity Capital to Assets*MP	0.124229	243.5677	52.15050
Cash to Assets* MP	5.872624	104.0473	14.26198
RRP to Assets *MP	0.019778	51.43581	36.28746
Real Assets Growth *DH	0.001318	1.204441	1.099707
Securities to Assets*DH	0.116021	24.20906	24.20424
Equity Capital to Assets * DH	0.118169	15.45446	9.018709
Cash to Assets* DH	0.833806	23.39337	15.03284
RRP to Assets*DH	435.0666	3.654163	1.379144
RRPTOA(-1)*DH	0.310470	36.58986	26.21989

B. 10 DOMESTIC BANKS

EQUATION 1 - Bank Lending Growth Equation

Variance Inflation Factors

Sample: 2008M03 2015M12

Included observations: 920

	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
C	0.024837	3468.266	NA
Bank Lending Growth (t-1)	0.001216	1.597110	1.572201
Monetary Policy (MP)	0.001480	3612.588	80.05493
MP*LowRateGapDum	2.82E-06	2.641278	1.831670
Real GDP Growth	1.96E-06	9.056656	1.357196
Inflation Rate	0.016334	1.216957	1.180841
Real Assets Growth	0.191753	51.80110	50.30637
Securities to Assets	0.115347	1083.242	32.70857
Equities to Assets	0.659582	1453.555	28.86788
Cash to Assets	14.76759	610.8783	24.23048
RRP to Assets	0.432369	63.09901	42.54013
Real Assets Growth *MP	0.011541	51.86969	50.38553
Securities to Assets*MP	0.007166	1176.767	59.34182
Equities to Assets*MP	0.038576	1434.837	34.35418
Cash to Assets*MP	0.769015	579.3170	47.99734
RRP to Assets*MP	0.024741	61.21699	41.38226
Seasonality (6)	0.000092	1.120490	1.023056
Seasonality (12)	0.000095	1.153986	1.053639

EQUATION 2- High Bank Lending Rate Equation			
Variance Inflation Factors			
Sample: 2008M03 2015M12			
Included observations: 903			

	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
C	9.182799	44272.25	NA
High Bank Lending Rate (t-1)	0.000406	129.4164	2.604570
Monetary Policy (MP)	0.513855	43152.63	951.9802
MP*LowRateGapDum	0.000135	4.164478	2.933844
Real GDP Growth	0.113588	1.108969	1.088960
Inflation Rate	0.214052	257.3834	4.104388
Real Assets Growth	0.043133	31744.70	11.87198
Securities to Assets	4.588482	1503.783	45.51218
Equities to Assets	24.11719	1858.432	36.19822
Cash to Assets	560.8966	778.5685	27.73913
RRP to Assets	11.87820	60.46006	40.64593
Real Assets Growth *MP	0.002371	30173.83	569.0634
Securities to Assets*MP	0.277949	1589.441	80.13807
Equities to Assets*MP	1.441734	1871.853	44.73782
Cash to Assets*MP	28.83743	724.7633	56.53314
RRP to Assets*MP	0.697980	59.92794	40.36888
Seasonality (6)	0.002897	1.221722	1.114835

EQUATION 3 - Low Bank Lending Rate Equation			
Variance Inflation Factors			
Sample: 2008M03 2015M12			
Included observations: 920			

	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
C	6.824094	45347.41	NA
Low Bank Lending Rate (t-1)	0.000304	72.86601	2.818294
Monetary Policy (MP)	0.388240	45085.30	999.0900
MP*LowRateGapDum	9.38E-05	4.180478	2.899072
Real GDP Growth	4.28E-05	9.420606	1.411736
Inflation Rate	0.306552	1.086843	1.054588
Real Assets Growth	0.031084	31605.28	11.95134
Securities to Assets	3.289803	1470.205	44.39294
Equities to Assets	18.09761	1897.895	37.69254
Cash to Assets	363.9444	716.4215	28.41684
RRP to Assets	8.479059	58.88499	39.69912
Real Assets Growth *MP	0.001789	31563.73	599.0718
Securities to Assets*MP	0.200080	1563.636	78.85082
Equities to Assets*MP	1.065611	1886.131	45.15947
Cash to Assets*MP	19.14273	686.2367	56.85582
RRP to Assets*MP	0.494537	58.22872	39.36221
Seasonality (6)	0.001943	1.122543	1.024931
Seasonality (12)	0.001967	1.136645	1.037807

C. 10 FOREIGN BANKS			
EQUATION 1- Bank Lending Growth Equation			
Variance Inflation Factors			
Sample: 2008M03 2015M12			
Included observations: 920			

	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
C	0.975163	10641.62	NA
Bank Lending Growth (t-1)	0.000969	1.109700	1.109330
Monetary Policy (MP)	0.046723	8910.138	197.4486
MP*LowRateGapDum	4.10E-05	2.998092	2.079112
Real GDP Growth	0.076139	1.686544	1.657940
Inflation Rate	0.909387	1.856740	1.798450
Real Assets Growth	0.010037	11219.54	13.02513
Securities to Assets	0.636773	244.9686	100.9265
Equities to Assets	2.248526	177.8320	84.18871
Cash to Assets	3827.034	108.3134	25.19400
RRP to Assets	0.233329	73.27799	40.91506
Real Assets Growth *MP	0.000520	10089.96	198.6619
Securities to Assets*MP	0.037426	254.2259	108.3983
Equities to Assets*MP	0.126121	191.3015	101.1792
Cash to Assets*MP	175.8763	96.98020	29.19287
RRP to Assets*MP	0.013560	81.74792	49.89592
Seasonality (6)	0.001364	1.294303	1.181755
Seasonality (12)	0.001221	1.158939	1.058162

EQUATION 2- High Bank Lending Rate Equation			
Variance Inflation Factors			
Sample: 2008M03 2015M12			
Included observations: 920			

	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
C	0.062044	192.4756	NA
High Bank Lending Rate (t-1)	0.000154	29.10213	1.518782
Monetary Policy (MP)	0.003382	183.3698	4.063474
MP*LowRateGapDum	0.000158	3.277649	2.272979
Real GDP Growth	0.267115	1.682025	1.653497
Inflation Rate	1.109850	1.836940	1.782425
Real Assets Growth	0.281366	34.66772	34.65390
Securities to Assets	1.739657	190.2544	78.38441
Equities to Assets	4.971816	111.7822	52.91960
Cash to Assets	8262.623	66.47885	15.46316
RRP to Assets	0.785867	70.16174	39.17509
Real Assets Growth *MP	0.013511	37.54360	37.53643
Securities to Assets*MP	0.103064	199.0218	84.86001
Equities to Assets*MP	0.277939	119.8467	63.38682
Cash to Assets*MP	375.4757	58.85768	17.71727
RRP to Assets*MP	0.046193	79.16571	48.31984
Seasonality (6)	0.004827	1.302230	1.188993
Seasonality (12)	0.004325	1.166762	1.065304

EQUATION 3- Low Bank Lending Rate Equation			
Variance Inflation Factors			
Sample: 2008M03 2015M12			
Included observations: 920			

	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
C	0.147272	633.7228	NA
Low Bank Lending Rate (t-1)	0.000215	26.55038	2.732044
Monetary Policy (MP)	0.002752	206.9187	4.585318
MP*LowRateGapDum	0.000136	3.933182	2.727577
Real GDP Growth	0.127933	1.117434	1.098482
Inflation Rate	0.240506	256.7024	4.194633
Real Assets Growth	0.203535	34.78525	34.77138
Securities to Assets	1.243177	188.5853	77.69673
Equities to Assets	3.594192	112.0888	53.06478
Cash to Assets	6155.523	68.69643	15.97897
RRP to Assets	0.572211	70.86162	39.56587
Real Assets Growth *MP	0.009769	37.65573	37.64853
Securities to Assets*MP	0.073498	196.8679	83.94162
Equities to Assets*MP	0.199501	119.3236	63.11019
Cash to Assets*MP	274.1179	59.60221	17.94139
RRP to Assets*MP	0.033634	79.95357	48.80071
Seasonality (6)	0.003387	1.267414	1.157204
Seasonality (12)	0.003754	1.404510	1.282378

II. REDUNDANT FIXED EFFECTS TESTS

A. ALL 20 BANKS

Redundant Fixed Effects Tests
Equation: EQ01
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	1.571324	(19,1800)	0.0551
Cross-section Chi-square	30.268267	19	0.0485

Redundant Fixed Effects Tests
Equation: EQ02
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	1.480878	(19,1782)	0.0825
Cross-section Chi-square	28.559168	19	0.0732

Redundant Fixed Effects Tests
Equation: EQ03
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	2.406581	(19,1799)	0.0006
Cross-section Chi-square	46.182682	19	0.0005

B. 10 DOMESTIC BANKS

Redundant Fixed Effects Tests
Equation: EQ01
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	2.180739	(9,893)	0.0213
Cross-section Chi-square	20.001065	9	0.0179

Redundant Fixed Effects Tests
Equation: EQ02
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	4.458727	(9,877)	0.0000
Cross-section Chi-square	40.400805	9	0.0000

Redundant Fixed Effects Tests
Equation: EQ03
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.

Cross-section F	3.055630	(9,893)	0.0013
Cross-section Chi-square	27.904657	9	0.0010

C. 10 FOREIGN BANKS

Redundant Fixed Effects Tests
Equation: EQ01
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	1.765804	(9,893)	0.0709
Cross-section Chi-square	16.228759	9	0.0623

Redundant Fixed Effects Tests
Equation: EQ02
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	0.493638	(9,893)	0.8795
Cross-section Chi-square	4.565720	9	0.8704

Redundant Fixed Effects Tests
Equation: EQ03
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	1.843023	(9,893)	0.0572
Cross-section Chi-square	16.931950	9	0.0498

IMPLICATIONS OF THIS EMPIRICAL STUDY TO MONETARY POLICY IN THE PHILIPPINES

I have been fortunate that in the course of writing this dissertation, my findings even at its earliest stages, have been instrumental in influencing monetary policy decisions at the Bangko Sentral ng Pilipinas. As a technical staff and Home Advisee of BSP Monetary Board Member Felipe M. Medalla, his vast and invaluable experience as a monetary policymaker and technical expertise as a seasoned economist, was able to help me select these research topics that were and still are very relevant to issues that are prevailing, and challenging to monetary policy decision-making, at the central bank. Combined with the expertise and careful guidance of my Japanese Advisor, Professor Colin McKenzie, I was able to develop and put in fruition these research endeavors which, at many times in the course of writing them, had been daunting in the face of the many demands at the workplace and my family life. The financial assistance of the JSPS, and the support of my superiors, top management, and the institution as a whole at the BSP, have been the best mix of people and institutions that made all of this happen.

My first chapter, in its preliminary and then again in its final stages, had been instrumental in supporting crucial policy advocacies at the Monetary Board level of discussions. Just the motivation to look into the reality of a policy rate gap—the gap between the BSP's main policy rate and the main market interest rate, the T-bill interest rate—and understanding the factors driving this policy rate divergence not only in the Philippines but in the other ASEAN-4 economies as well, has opened up and helped stir discussions towards developing the best policy mix and/or changes in regulation that would allow for this policy rate divergence to be understood better and within the context of its implications regarding the degree of influence over market interest rates. "Why is there such a divergence? What factors, as represented by available indicators, are driving such a divergence? Why is the rate gap regime-switching more pronounced for the Philippines and Indonesia, and why less so for Malaysia and Thailand? What accounts for this heterogeneity in the magnitude and timing of the rate gap considering as emerging economies we face the same global risk perception and to a certain extent similar financial market characteristics?" were just a few of the questions we were able to raise, and most we were able to answer and present to the BSP vis-à-vis the findings in this study. Better still, even more policy questions for future research arose: "Is it important for this rate gap to converge? Is the lower degree of influence during the high rate gap regime we are currently falling under necessarily bad? Does this divergence automatically mean lower effectiveness in monetary policy? Which market interest rates matter for monetary policy control anyway?" are only some of those potential research questions.

As a result of the first and second chapters, whether directly or merely in part, the Interest Rate Corridor (IRC) was introduced for the Philippine financial system by the BSP in 2016, with the aim of developing further and expanding the financial markets and at the same time help market interest rates better able to price in risk and return more appropriately for the full range of assets available in the economy. We have yet to see the fruits of this new policy, and the assessment of its operationalization and intended benefits and future evolution is continuously being reviewed ever since its implementation and up to the writing of this paper. In fact, this provides us with a good segway about the policy implications of the third and last chapter of this study—the heterogeneous response of Philippine banks to monetary policy. The IRC and other new policy changes involving the various facilities of the BSP are being assessed in terms of what seems to the BSP arbitrageur tendencies of foreign bank branches, at the expense of the BSP's overnight repo and deposit facilities. And the relevance of this issue is front and center in our findings and results in Chapter 3.

Policy questions arose on whether it is correct to develop policies which aim to prohibit the access of non-resident funds in one, some, or all of BSP's facilities. One view is that implementing regulation which appears to "segment" the markets into foreign versus domestic financial institutions were being viewed to have the potential to aggravate the segmentation, and hence distortions, in the financial markets and, ergo, contribute to a stifling of financial market development and the weakening of monetary policy effectiveness the real economy. It is, however, very clear from my third essay that Philippine financial markets have been highly segmented to begin with, and was not borne out of current or any future BSP policy, but is a result of the nature and behavior of foreign banks in response to

monetary policy and macroeconomic changes that are not necessarily the same as what is expected from domestic banks. Indeed, there is heterogeneity in the response of banks' lending growth and lending rate setting between the category of foreign banks versus domestic banks, and this heterogeneity is still strongly evident empirically even within the category of domestic banks. There are bank characteristics that do matter very much to both lending growth and the two types of bank lending rates at varying degrees—some bank ratios attenuates the response of credit and lending rates to monetary policy whereas others in fact amplifies the impact of monetary policy to bank credit and lending rates—and this is a clear indication that the bank credit channel is operational and important in the Philippine banking system today, and even perhaps more so in the future.

What is most important to point out that the results in this dissertation has one common theme: despite the regime-switching in the policy rate gap and the heterogeneous response of banks to monetary policy—there remains significant policy space whereby the BSP retains its monetary policy control and influence. Bank lending growth and most especially bank lending rates continue to respond to the main monetary policy rate especially in consideration of the full specification where we take into account all bank characteristics pertaining to size, liquidity, and capitalization—the specification closest to reality whereby all of these bank characteristics occur and persist at the same time rather than in isolation. In addition, there is also policy space in assessing how best to address the differential response of foreign bank branches—a main channel by which non-resident funds or foreign capital flows enter the domestic financial system—and a review of what its impact means to monetary policy setting.