BANK INTEGRATION AND SYSTEMIC RISK: PANACEA OR PANDEMIC?

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ABSTRACT

In light of the increasing interconnectedness between banks and the rising threat of financial volatility, this study aims to determine whether bank integration mitigates cross-border systemic risk or acts as a conduit for systemic risk. The effect of the business cycle and the real interest rate in facilitating the spread of systemic risk is also examined. In addition, we investigate the long-term effect of bank integration on systemic risk resulting from habit-persistence in bank lending behaviour. The cross-border systemic risk is measured using a bivariate GARCH constant conditional correlation model. Panel data regression methods are employed to examine the impact of bank integration, the Christiano-Fitzgerald filtered business cycle and the real interest rate on cross-border systemic risk in the region. A panel 2-stage least squares instrumental variable estimation is used to examine the long-term effect of bank integration on systemic risk. We present strong empirical evidence that intensified bank integration increases cross-border systemic risk between a country-pair. The study also finds that banks in vis-à-vis countries become more vulnerable to the macroeconomic environment of the reporting country as bank integration between the country-pair increases. The study also reveals that habit-persistence in bank lending behaviour causes cross-border systemic risk to be accumulated over time and leads to a longer-term effect of bank integration on systemic risk.

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INTRODUCTION

The nightmare of the Asian Financial Crisis (AFC) lead to many hastily implemented financial sector reforms among the Asia-Pacific emerging markets. The reforms were aimed at preparing their banking sectors from future shocks and vulnerabilities emanating from the international financial markets. However, the reforms also led to a rapid increase in the speed and scope of penetration of foreign financial institutions in the Asia-Pacific banking landscape. The recent Global Financial Crisis (GFC) has further emphasized weaknesses in the financial development of the Asia-Pacific economies. The recent crisis revealed the limitations of the export-led growth strategy of the Asia-Pacific economies and their over-dependence on the developed Western economies and financial markets for growth and development. The diligence of the Asia-Pacific economies in accumulating large amounts of foreign reserves to guard themselves from the volatility of the international financial market also reflects their growing concern for the stability of their respective financial systems. The devastating effect of past financial crises has heightened the public policy focus on preserving the stability of the financial system. An important aspect of financial stability is the resilience of the banking sector. Banks play a central role in the money creation process and in the payment system. Falttering banking systems have been associated with hyperinflations and depressions in economic history. Momin & Jokipi (2010) show that the stability of the banking system affects real output growth of an economy. In light of these, central banks and supervisory authorities have developed a special interest in assessing banking system stability.

Studies\(^1\) have shown that cross-border interbank transactions in the Asia-Pacific region have increased substantially in the decade since the AFC. This trend reflects the role of Asia-Pacific banks as the key intermediaries of the large national savings and inflows of foreign funds that enter the region from the United States (US) and Europe (EU). In line with their position as key financial intermediaries, Asia-Pacific banks are also a major source of finance for companies in the private sector. Although banks in the region have remained relatively stable in the wake of the GFC, the outlook for the global financial system is not positive especially for the US and EU. The weak outlook in the developed economies may have repercussions for the region’s banks as they no longer have the option to invest their deposits in the developed capital markets of the West. Against this backdrop, there is a need to expedite efforts towards fostering stronger regional bank integration. Increasing bank integration in the region will provide a strong framework for the management of the region’s large national savings and facilitate the efficient allocation and mobilization of liquidity amongst the banks in the region.

Regional bank integration is also important because regional financial stability is required to spur further economic growth in the region. Claessens et al. (2001), Bacle et al. (2004) and Chai & Rhee (2005) argue that bank integration can assist in mitigating the risks that banks face and strengthen the overall resilience of the banking system. The efficient allocation and mobilization of liquidity amongst banks in the region will provide a stable environment that preserves the credit creation abilities of banks and promote stability in the banking system. However, intensified financial linkages in a world of high capital mobility may also increase the risk of cross-border financial contagion. In the October 2009 Turner Review, the Financial Services Authority (Financial Services Authority, 2009) noted that one of the ways a bank could be of systemic importance is through its interconnectedness. The post-AFC financial reforms have seen an increasing number of large banks dominating the Asia-Pacific regional financial landscape. Although the expansion of these banks has driven market-led bank integration and facilitated the movement of bank liquidity in the region, the growth of these banks also extend the risk of financial contagion from the national level to the regional financial system. The result of the increased size of these institutions and the increase in bank integration is the severe consequences that the defaults by any of these banks now have on their cross-border counterparts.

Spillover effects and externalities resulting from increased economic interdependence in the region result in an increased potential for cross-border contagion effects. The contagion effect could be exacerbated if it alters the confidence of investors in a particular banking system leading to a confidence crisis in the system. This is especially true if investors perceive the banks to be exposed to similar risks. Fung et al. (2008) argue that such contagion effects may have devastating implications on banking sector stability. These arguments are supported by the experience of many developing countries where the progress of financial integration has been complemented with problems in the respective banking sectors. The problems in some of these banking systems have erupted into full-fledged systemic crises as documented in Laeven & Valencia (2008). These experiences suggest that the benefits of financial integration may have to be weighed against the cost of increased financial fragility (Detragiache and Demirguc-Kunt).

Early attempts to theoretically map the relationship between bank integration and financial instability or systemic risk were done by Rochet & Tirole (1996), Allen & Gale (2000) and Freixas (2004). A recent theoretical model by Fecht et al. (2012) incorporates the endogeneity of inter-temporal bank lending behaviour
on bank integration. The model showed that bank integration under a secured interbank market is optimal as it encourages specialization and reduce the probability of individual bank failures. However, bank integration under an unsecured interbank market provides banks with the incentive to diversify and has a worsening effect on systemic risk. The empirical literature on systemic risk has grown in recent years but only a handful address the relationship between the interconnectedness of banks and systemic risk. These include Demirguc-Kunt & Detragiache (1998), De Nicolo & Kwast (2002), De Nicolo & Tieman (2006), Hartmann et al. (2007) and Mihaljek (2008). Among these studies, none, to our knowledge, have considered the Asia-Pacific region and have focused mainly on the US and EU. These studies provide empirical evidence to show that cross-border systemic risk indeed rises as bank integration strengthens. The notion that systemic risk increases with bank integration is supported by Bautista et al. (2007) who argued that a high share of interbank activities in banks’ balance sheet induce a higher risk of the bank becoming illiquid and thus trigger contagion to the network of banks linked to them.

Fecht et al.’s (2012) theoretical model also indicates that the macroeconomic health of a country can affect the stability of the financial system and exacerbate systemic risk in the banking sector. Fecht et al.’s (2012) model shows that bank integration fails when there is a national slowdown that affects the banks’ investment portfolio. A non-favourable deposit rate can also potentially weaken the bank and increase its vulnerability. The deposit rate offered by the bank can be represented by the real interest rate in an economy. Through their empirical work, Detragiache & Demirguc-Kunt (2005) also found that a calm macroeconomic environment, favourable economic growth and low inflation contributed to financial stability. In particular, the business cycle and central bank monetary policy have a significant impact on systemic risk through their effect on consumer risk appetites and asset prices respectively. This in turn affects the risk exposure of banks thus aggravating or mitigating the level of systemic risk exposure.

Bank integration may also have a longer-term effect on systemic risk. Such a concern arises due to habit-persistence in the banking system. Habit-persistence is common in bank lending behaviour due to the high switching and information costs that banks incur. Banks gain the competitive advantage by obtaining proprietary information about clients that other banks may not have and alleviating the challenge of information asymmetry in the banking business. This habit-persistence phenomenon has been linked to the accumulation of bank risk during periods of economic expansion. Altunbas et al. (2009) argue that the accumulated bank risk from the habit-persistence behaviour manifests as systemic risk when the country is hit with a macroeconomic shock or liquidity shortage. Another reason for bank integration to have a longer-term effect on systemic risk is that the effect of changes in bank lending behaviour due to new regulations, macroeconomic circumstances or information asymmetries may not manifest as systemic risk immediately. The effect may be accumulated and appear after a period of time.

Against this backdrop, we question if an integrated bank network is effective in overcoming the vulnerabilities Asia-Pacific economies experience as a result of their participation in the international financial market. In doing so, we also discuss the role of bank integration in causing financial volatility by leaving banks vulnerable to contagion effects of a financial shock. The focus on the issue of systemic risk is a timely consideration as it has important implications for the sustainability of the banking sector as well as the Asia-Pacific regional economy. This study intends to determine whether bank integration mitigates systemic risk or is a conduit for systemic risk. The study also aims to investigate the long-term effect of bank integration on systemic risk resulting from habit-persistence in bank lending behaviour. Finally, it seeks to examine the effect of the business cycle and the conduct of monetary policy in facilitating the spread of systemic risk.

Despite the increased focus on systemic risk by policy makers in recent years, there remains a gap in the literature on systemic risk, especially on risk in the cross-border interbank network. Although the level of bank integration in Asia-Pacific lags that of the United States and Europe, the region is fast catching up. The effect of bank integration on systemic risk will have important implications for the region’s policy makers as they move towards deeper regional integration. These policy issues include the transmission of systemic risk across borders, the governance and supervision of multi-national banks and finally the extent to which bank integration can offer relief in the form of capital and liquidity during a temporal capital crunch. Being able to respond appropriately to these concerns is very relevant to the Asia-Pacific community of policymakers in today’s highly volatile financial environment. These issues are discussed and meaningful insights into these concerns are provided in this study. The rest of the paper is organized as follows: Section 2 describes the data and methodology of our empirical analysis. Our main results and robustness checks are presented in Section 3 and Section 4 concludes the paper.
DATA AND METHODOLOGY

De Nicolo & Kwast (2002, pp 863) defines systemic risk as “the risk that an event or shock will trigger a loss of economic value or confidence in, and attendant increases in uncertainty about, a substantial portion of the financial system that is large enough to, in all probability, have significant adverse effects on the real economy.”

Two key features of this definition is first the loss of confidence in the financial system as a result of the increased uncertainty and secondly, the negative impact on the real economy associated with a severe disruption in the financial system. The definition implies that the financial system is interconnected with each player being interdependent on one another in essence, implying the notion of bank integration. The adoption of De Nicolo & Kwast’s (2002) approach to quantifying systemic risk by using the correlations of stock returns overcomes the difficulty in measuring the often intricate and complex interbank relationships in which contagion originates. This approach is deemed superior by many including Billio et al. (2012) who argue that even if regulatory reforms do require banks to report information regarding their interbank activities to supervisory authorities, the forward-looking nature of equity markets may still provide data that is more immediate and actionable as a measure of systemic risk. Others such as Gropp et al. (2009) argue that market-priced based indicators such as De Nicolo & Kwast’s (2002) measure captures contagion as perceived by banks’ equity holders. The measure is able to summarize all available information about a given bank and is sufficiently broad-based to cover all possible transmission channels of contagion.

The novelty of our approach however, is that the comparison of the correlations of the national banking sector’s stock index of both countries as opposed to De Nicolo & Kwast’s (2002) study of large banking organizations in the United States. In doing so, we are able to assess the co-movement of systemic risk across economies rather than that of a few banks only. It is important to note that in using market price data, it is assumed that bank stocks are priced efficiently. The volatility of the return from the national banking sector stock index is suspected to be changing through time. Using a bivariate generalized autoregressive conditional heteroskedasticity (GARCH) model, we determine the scale at which the financial volatilities of a country-pair move in tandem with one another. This enables us to measure the systemic risk resulting from the interconnectivity of the banking sector between a country-pair. A GARCH model maps the conditional variance at time t, \( h_t \), as a linear combination of past values of the conditional variance and the squared process. Since it is not possible to identify the number of lagged volatilities that the volatility depends on and there is a need to minimize the number of parameters to be estimated, a GARCH model is preferred to a standard autoregressive conditional heteroskedasticity (ARCH) model. This feature also makes the GARCH model more parsimonious than the standard ARCH model. The GARCH model is also able to model the moving average structural characteristic of the time series dimension of the data. The cross-border systemic risk is modeled using a bivariate GARCH constant conditional correlation (CCC) model introduced by Bollerslev (1990). In Bollerslev’s (1990) model, it is assumed that the time-varying conditional covariances are proportional to the square root of the product of the two conditional variances thus ensuring that \( \rho_{ij} \) is constant through time. Bollerslev (1990) noted that the conditional variance can be rewritten as

\[
\begin{align*}
  h_{it} &= \omega_i \sigma_{it}^2 \\
  H_t &= D_t \Gamma D_t
\end{align*}
\]

Where \( D_t \) denotes the \( N \times N \) stochastic diagonal matrix with elements \( \sigma_{1t}, \ldots, \sigma_{Nt} \) and \( \Gamma \) represents an \( N \times N \) time-invariant matrix with the element \( \sqrt{\omega_i \omega_j} \). In the bivariate CCC model, the country-pair conditional covariance is obtained by,

\[
\begin{align*}
  R_{it}^b &= a_i + R_{it}^n + \varepsilon_{it} \\
  R_{jt}^b &= a_j + R_{jt}^n + \varepsilon_{jt} \\
  h_{it} &= b_i + c_i \varepsilon_{it-1}^2 + d_i h_{it-1} \\
  h_{jt} &= b_j + c_j \varepsilon_{jt-1}^2 + d_j h_{jt-1} \\
  h_{ijt} &= \rho_{ij} \sqrt{h_{it} h_{jt}}
\end{align*}
\]
Equations 3 and 4 show the return on the banking sector index of country i, $R_{it}$, and j, $R_{jt}$, as a function of the return of the national stock index, $R_{it}^n$ and $R_{jt}^n$. In the context of measuring the systemic risk across borders, it would be incorrect to estimate the correlations between the pairs of banking sector stock indices without controlling for country-specific factors that may influence the respective countries’ banking sector stock index. As such, the estimation of the excess returns of the banking sector stock index is also controlled for the return from the national stock market index. The reasons for doing so are clear. It is widely accepted that the events in national stock market is a key determinant of the indices of all the other sub-indices including the banking sector index. The residuals $e_{it}$ and $e_{jt}$ represent the errors or excess returns from the country’s banking sector index. Since the national stock market index also captures macroeconomic influences, it is assumed that the residuals or excess returns are representative of the banking sector systemic risk.

Equations 5 and 6 show the conditional variances produced by the respective univariate GARCH models of country i, $h_{it}$, and j, $h_{jt}$. The final equation, equation 7 shows the conditional covariance of the returns from country i and j’s banking sector index. This equation is estimated with a bivariate GARCH CCC model using the Berndt et al. (1974) BHHH algorithm. The diagonal elements of the bivariate CCC GARCH model, $h_{it}$ and $h_{jt}$, are the conditional variances modelled using univariate GARCH and $\rho_{ij}$ refers to a time-invariant weight interpreted as a conditional correlation. Hence, the changes in the conditional correlation, $h_{itj}$, can be interpreted as changes in the cross-border systemic risk of the banking sector. Consequently, one can then conclude that a higher value of $h_{itj}$ implies a higher level of potential systemic risk while no change in $h_{itj}$ or a decrease would indicate that the potential for systemic risk is stagnant or has declined respectively.

A key issue in the use of GARCH models is selection of the lag structure of the GARCH model. A GARCH (p,q) model can be represented as

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_i h_{t-i}$$

(8)

Where $p$ is the lag structure of the conditional variance, $h$, and $q$ the number of lags of the errors, $\varepsilon$, included in the model. The question here is which GARCH (p,q) model best describes the volatility of the bank stock index returns. The appropriate lag structure of the ARCH errors is tested using the Lagrange multiplier (LM) test as suggested by Engle (1982). The chi-squared distributed LM test tests for the null hypothesis of no ARCH effects for the specified lag. To select the best-fit GARCH model, the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) is used to compare the various univariate GARCH models measuring $h_i$. The results of the tests show that the GARCH (1,1) is the most appropriate specification to model the returns from the national banking sector stock indices.

The daily end-of-day price of the banking sector stock index in each country is used as a proxy for financial volatility. The daily end-of-day price of the national stock index is also collected to control for market wide idiosyncratic shocks that are unrelated to the banking sector. The data spanning from 1st of July 1997 to 31st of March 2010 is the taken from the Datastream database. All the indices are in local currency. This is because the use of stock indices of a common currency may expose the empirical results to distortions from movements in the exchange rate. The use of local currency indices is based on the reasonable assumption that the indices are corrected for currency risk. The return, $R_i$ is then computed using the index price, $P$, as follows,

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}}$$

(9)

The daily returns used to obtain $h_i$ result in the conditional covariances obtained from the bivariate CCC GARCH model that are of daily frequency. The conditional covariances are transformed into quarterly data for the second stage of estimation by using the last observation for every quarter. The end-of-quarter observation is used to form the quarterly systemic risk variable as the other variables in the econometric specification such as bank integration, real interest rate and GDP are stock or end-of-period variables. In doing so, the measurement of systemic risk in our study is consistent with and conforms to the principles by which the other relevant variables are measured.

The proposed hypotheses are tested using the following econometric specification, where $X$ refers to the i country-specific variables and $Y$ the j country-specific variables.
\[ Risk_{ijt} = \alpha_t + BankInt_{ij(t-1)} + X_{it} + Y_{jt} + \varepsilon_t \] \hspace{1cm} (10)

\( X_{it} \) in equation 10 consists of the terms \( macrovolatility_{i} \) and \( realir_{i} \), where \( macrovolatility_{i} \) refers to the business cycle of the ‘i’ or reporting country and \( realir_{i} \) refers to the real interest rate, a proxy for the Central Bank’s monetary policy. \( Y_{jt} \), on the other hand consists of \( macrovolatility_{j} \) and \( realir_{j} \) which represent the business cycle and the real interest rate of the vis-à-vis country respectively. Equation 10 is estimated using linear panel data regression methods. The context of this empirical analysis does not provide any theoretical or circumstantial reason for the country-pair specific and time effects to be correlated with the explanatory variables. Hence, the equation is estimated using both random effects and fixed effects estimations. The estimates are then tested for any statistically significant differences using the Hausman specification test.

Adopting the theoretical framework proposed by Fecht et al. (2012), the first lag of bank integration, \( BankInt_{ij(t-1)} \) is used as a proxy for bank integration. The use of lagged bank integration is to correct for endogeneity that arises from the increased scope for diversification following increased bank integration. Moreover, a strictly cross-sectional analysis of the systemic risk – bank integration relationship will underestimate the welfare advantages of bank integration and also underestimate the risk stemming from financial contagion. This concept of explicitly taking into account the presence of an interbank network when analyzing the effect of bank integration on systemic risk is also emphasized by Drehmann & Tarashev (2011, pp 1) who note that “a bank contributes to systemic risk not only via its exposure to exogenous shocks but also by propagating such shocks to through the system and by being itself vulnerable to propagated shocks.”

Bank integration is measured using data provided by the Bank of International Settlements (BIS). The data consists of quarterly observations, starting from the last quarter (q4) of 1997 to the first quarter (q1) of 2010. Due to insufficient coverage and confidentiality reasons, only the interbank holdings of assets from 4 “i” (reporting) countries to 10 “j” (vis-à-vis) countries are used. To ensure the robustness of the conclusions of this study, two measures of bank integration are used and compared. The first measure denoted by \( Assets \) is the amounts outstanding external position of banks in reporting country “i” to banks in vis-à-vis country “j.” The second measure denoted by \( Flows \) is the BIS computed quarterly changes in stocks of assets i.e. flows which excludes the effects of exchange rate changes. The volume-based measure of bank integration used in this study is then computed as follows:

\[ BankInt^\text{Bank}_{ijt} = BankInt^\text{All sector}_{ijt} - BankInt^\text{Non-bank}_{ijt} \]

\[ BankInt^\text{Bank}_{ijt} = \ln(BankInt^\text{Bank}_{ijt}) \] \hspace{1cm} (11) \hspace{1cm} (12)

Where \( BankInt^\text{All sector}_{ijt} \) refers to the external position of reporting banks resident in country “i” vis-à-vis all sectors in country “j” and \( BankInt^\text{Non-bank}_{ijt} \), the external position of reporting banks resident in country “i” vis-à-vis the non-bank sector in country “j.” Following Kalemli-Ozcans et al. (2013), the natural logarithm is applied to the resulting \( BankInt^\text{Bank}_{ijt} \) to obtain the bank integration measure used in our study, \( BankInt^\text{Bank}_{ijt} \).

As shown in equation 10, the business cycle and Central Bank conduct of monetary policy are also included as explanatory variables in the estimation to control for the macroeconomic health of the respective economies. The business cycle is obtained by applying the Christiano-Fitzgerald (CF) (Christiano & Fitzgerald, 2003) filter to the country’s quarterly GDP. Meanwhile the real interest rate is used as a proxy for the Central Bank’s conduct of monetary policy. The real interest rate is computed as the difference between the deposit rate and inflation. Both of these macroeconomic indicators are included to control for their influence on systemic risk that is independent of the level of bank integration. The quarterly GDP, deposit rate and Consumer Price Index are taken from the IMF’s International Financial Statistics Database while comparable data for Taiwan is obtained from quarterly publications of the Economic Research Department (ERD) of the Central Bank of the Republic of China (Taiwan).

Finally, we test for the habit-persistent effect of bank integration on systemic risk using a panel data 2-stage least squares instrumental variable (2SLSIV) estimation. Equation 10 is re-estimated with the 2nd and 4th lag of bank integration as instruments for the 2SLSIV estimation. The 2SLSIV estimation was chosen in consideration of the strong correlation between the different lags of bank integration. This characteristic is especially evident for the bank integration measure \( Assets \). Using the 2SLSIV estimation, we would be able to obtain consistent estimates of the joint effect of the longer lags of bank integration on systemic risk.
ESTIMATIONS AND RESULTS

We examine the relationship between systemic risk and bank integration by estimating the linear relationship between the correlation of the national banking sector stock returns and the external position of banks in the reporting country to banks in the vis-à-vis country. Since the issue of interest is the cross-border systemic risk, the unit of observation for both systemic risk and bank integration is for a country-pair of reporting and vis-à-vis countries. A dummy variable for each quarter in the sample period was also included in the estimation to account for time related common factors affecting all the 44 country-pairs. Table 1 presents estimates of equation 10. Only the fixed effect estimates are reported as both the Breusch-Pagan Lagrange Multiplier (LM) and Hausman diagnostic tests point to the appropriate use of the fixed effects estimation. We also use a stock measure of bank integration (Assets) and a flow measure of bank integration (Flows) for comparison to ensure our conclusions are not affected by the inherent characteristics of the data.
TABLE 1: DETERMINANTS OF CROSS-BORDER SYSTEMIC RISK

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<tr>
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<tr>
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<td>aBP LM Test</td>
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<tr>
<td>bHausman Test</td>
<td>36.74***</td>
<td>48.91***</td>
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Notes:
The table reports estimates of the panel data fixed effects estimation of the equation risk_{ijt} = α + θ Assets_{ijt-1} + θ X_{it} + θ Y_{jt} + ε_{ijt}. The dependent variable risk is used to proxy cross-border systemic risk. The measure is computed such that an increase in the value risk signifies an increase in systemic risk. Assets and Flows refer to the two measures of bank integration used in this study. The first lag of Assets and Flows is used in this estimation to address the endogeneity of bank integration. The sample includes 4 reporting (i) countries and 10 vis-à-vis (j) countries resulting in 40 country-pairs. Vietnam was removed from the sample due to the lack of data for risk. The panel data sample also covers a period spanning 49 quarters from q11998 to q12010. The models were estimated using both the panel data random effects and fixed effects estimation method. The BP LM test and the Hausman test was then conducted to determine the most appropriate estimation method for each model. Only the selected estimates are reported in this table. The standard error of each estimated coefficient is reported in parentheses below the coefficient. The reported standard errors have been corrected for country-pair heteroskedasticity and autocorrelation. *** and * mark the significance of the estimates at the 1, 5 and 10 percent levels respectively.

The Breusch-Pagan Lagrange Multiplier (BP LM) test reports a chi²-statistic that tests the null hypothesis that there are no statistically significant differences across the country-pairs. A non-rejection of the null hypothesis implies that a panel data approach to estimating the empirical model is not necessary and a pooled regression should be used.

The null hypothesis of the Hausman test is that the unobserved fixed effect is uncorrelated with the explanatory variables. A rejection of the null hypothesis of the Hausman test is commonly accepted to indicate the appropriate use of the fixed effects estimation. The F-statistic of the robust Hausman test is reported. Wooldridge’s (2002) method of the Hausman test, commonly known as the robust Hausman test was used to overcome the weakness of the standard Hausman test which assumes that the random effects estimator is efficient to begin with.

The estimates presented in Table 1 clearly confirm the hypothesis that bank integration will have a worsening effect on systemic risk. The implications of the estimates also echo the evidence from previous...
studies⁷. The estimates are strongly significant regardless of the bank integration measure. Although there is a lack of anecdotal evidence from the region to reflect our findings, there is no room for complacency among policymakers. Lee et al. (2013) argues that the good health of the region’s banks resulting from the heightened levels of Central Bank supervision and regulation has cushioned the potential adverse fallout from the recent Global Financial Crisis. Furthermore, banks in the region where found to be more integrated with banks in Europe than their regional counterparts despite making remarkable progress towards regional integration. Our finding is also relevant in the context of the increasing use of the regional interbank network as a source of funds by larger Asia-Pacific banks due to the intensified competition for domestic deposits in the home market. This would increase the interconnectedness of the Asia-Pacific banks and increase the cross-border systemic risk rendering these banks vulnerable to contagion.

Both measures of bank integration (Assets and Flows) were able to explain the effect of bank integration on systemic risk equally well as the difference in the adjusted-R² of both estimations is minimal. The size of the estimate however, is larger when bank integration is measured as Assets compared to Flows. This result makes sense as Flows only capture the banks’ lending behavior for one period while Assets is able to capture the persistence in banks’ lending behavior thus controlling for any habit-formation in bank lending behavior. Banks gain the advantage by obtaining much-valued information about clients through long-term relationships thereby alleviating the high switching and information costs.

Moving on to the control variables, the estimates reported in Table 1 imply that the real economy has a counter-cyclical effect on systemic risk i.e. the banking system is more likely to collapse during an economic recession than during an economic boom. This result is consistent with previous empirical studies such as Demirgüç-Kunt & Detragiache (1998), Hendricks et al. (2006), Segoviano & Goodhart (2009) and Wong & Fong (2011). It is argued that the adverse economic environment dampens asset prices below their fundamental value and slows down demand for loans. Banks’ portfolios are weakened and banks that are not prepared with sufficient quality capital may find themselves vulnerable to further shocks. The bust periods of the business cycle also affects the productivity of consumers and investments thus aggravating systemic risk. Our estimated model also controlled for the effect of the respective Central Banks’ conduct of monetary policy through the real interest rate. The implication of the estimate that high interest rates exacerbate systemic risk, is in concordant agreement with evidence found by Detragiache & Demirgüc-Kunt (2005) and Angeloni et al. (2010). The result is expected since high real interest rates during a depression deters borrowing and further tightens liquidity which increases systemic risk (Allen et al., 2011).

A closer look at the estimates however reveal that the effect of macroeconomic and Central Bank conduct of monetary policy on systemic risk only apply to the macroeconomic and monetary environment of the reporting country. The estimates for macrovolatility_j and realir_j were not statistically significant implying that the macroeconomic and monetary policy environment of the vis-à-vis country does not have any effect on the cross-border systemic risk between the country-pair. This result could be due to the one-directional nature of the data obtained from the BIS locational banking statistics. The BIS data are only collected from banks in the reporting country. The data accurately reflects bank integration from the perspective of the banks in the reporting country only. It is also possible that there exists an imbalanced relationship between the country-pair where the more developed reporting countries carry more influence in intensifying bank integration and in spreading systemic risk as well.

We also examined the effect of habit-persistence in bank lending behaviour on systemic risk. As previously discussed, habit-persistence in bank lending behaviour could lead to a lag in the effect of bank integration on systemic risk. Table 2 reports the results from the panel 2SLSIV estimation using the 2⁰ and 4⁰ lag of bank integration as instruments. The estimates show that bank integration continues to induce an increasing effect on systemic risk even in the longer term while the effect of real interest rate and the business cycle remains the same as in the benchmark estimations. The effect of bank integration in the longer-term however is larger than the short-term effect of bank integration. This finding reflects Altunbas et al. (2009) argument that bank systemic risk due to the habit-persistence behaviour of banks accumulates over time. The adjusted-R² for the instrumental variable estimations compared to the corresponding adjusted-R² for the benchmark estimations is higher when bank integration is measured as Assets, and is lower when bank integration is measured as Flows. The result is expected since Assets is a stock measure and thus more informational when reflecting longer-term information due to its long-memory characteristic. The stability of the variable Assets also allows for a more accurate inference of bank integration in the long-term as compared to the highly volatile Flows measure. The results of the diagnostic tests imply that the instruments chosen to estimate the long-term effect of bank integration on systemic risk is appropriate for model 2 but not for model 1. This suggests that although the instruments chosen to estimate the long-term effect of Assets are highly correlated
with the endogenous BankInt-Lag, the 2nd and 4th lag of bank integration may not be uncorrelated with the error term.
# TABLE 2: LONG-TERM EFFECT OF BANK INTEGRATION ON SYSTEMIC RISK

<table>
<thead>
<tr>
<th></th>
<th>(1) Assets</th>
<th>(2) Flows</th>
</tr>
</thead>
<tbody>
<tr>
<td>BankInt-Lag</td>
<td>0.000000963*** (0.00000188)</td>
<td>0.00000222*** (0.00000386)</td>
</tr>
<tr>
<td>macrovolatility_i</td>
<td>-0.00000186*** (0.000000263)</td>
<td>-0.00000184*** (0.000000269)</td>
</tr>
<tr>
<td>macrovolatility_j</td>
<td>0.00000000892 (0.000000547)</td>
<td>0.0000000137 (0.000000055)</td>
</tr>
<tr>
<td>realir_i</td>
<td>0.0000395*** (0.00000437)</td>
<td>0.0000421*** (0.00000453)</td>
</tr>
<tr>
<td>realir_j</td>
<td>-0.000000273 (0.000000848)</td>
<td>-0.000000667 (0.000000877)</td>
</tr>
<tr>
<td>N</td>
<td>1656</td>
<td>1656</td>
</tr>
<tr>
<td>Adjusted-R²</td>
<td>0.318</td>
<td>0.296</td>
</tr>
<tr>
<td>Weak Instruments</td>
<td>1251.868**</td>
<td>181.111**</td>
</tr>
<tr>
<td>Overidentification</td>
<td>32.442**</td>
<td>0.002</td>
</tr>
<tr>
<td>Exogeneity</td>
<td>16.976**</td>
<td>24.014**</td>
</tr>
</tbody>
</table>

Notes:
- The table reports estimates from the Instrumental Variable 2-stage Least Squares (IV2SLS) estimation of the equation risk\(_{it} = α + \theta_1 Assets_{it-1} + \theta_2 X_{it} + \theta_3 Y_{jt} + \varepsilon_{ijt}\) (4-60). The dependent variable risk is used to proxy systemic risk. The measure is computed such that an increase in the value of risk signifies an increase in systemic risk. The 2nd and 4th lag of bank integration is used as instruments for the endogenous BankInt-Lag in this estimation. Assets and Flows refer to the two measures of bank integration used in this study.
- The standard error of each estimated coefficient is reported in parentheses below the coefficient. The reported standard errors have been corrected for country-pair heteroskedasticity and autocorrelation. ***, ** and * mark the significance of the estimates at the 1, 5 and 10 percent levels respectively.
- The weak identification test computes the Kleibergen-Paap Wald rk F-statistic. The F-statistic is then compared against the Cragg-Donald critical values to determine the rejection of the null hypothesis of a weakly identified equation.
- The overidentifying restrictions test otherwise known as the Sargan-Hansen test computes the Hansen J-Statistic which tests the null hypothesis of an overidentified equation. A rejection of the null hypothesis implies that the selected instrumental variable may be correlated with the error term.
- The Endogeneity test is a robust alternative to the Durbin-Wu-Hausman Test and tests the null hypothesis that the specified endogenous regressors can be treated as exogenous.

## CONCLUSION

In this study, we investigate the impact of bank integration on cross-border systemic risk between the Asia-Pacific banking systems. The results of our study produced several key findings. Firstly, increased levels of bank integration result in higher levels of systemic risk between country-pairs. We also examined the effect of the respective economies' business cycle and the conduct of monetary policy in facilitating the spread of systemic risk. An adverse economic environment and high real interest rate in the reporting country tend to exacerbate cross-border systemic risk between a reporting and vis-à-vis country-pair. These results imply that banks in vis-à-vis countries become more vulnerable to the macroeconomic environment of the reporting country as bank integration between the country-pair increases. Finally, we investigate the long-term effect of bank integration...
on systemic risk resulting from habit-persistence in bank lending behaviour. Further analysis using panel 2SLSIV estimation found that bank integration has a longer-term effect on cross-border systemic risk. The result confirms our hypothesis that the presence of habit-persistence in bank lending behaviour causes cross-border systemic risk to be accumulated over time and manifest only at a later period.

As it was documented in section 1 earlier, the deepening regionalism in the Asia-Pacific banking sector is important in order to establish a foundation for the region’s financial intermediation needs. It is also apt the Asia-Pacific governments have spent much effort in bolstering the strength of their respective banking sectors to protect the key financial intermediaries of the region, the banking sector, from economic and financial shocks. However, the onset of the GFC has brought about a novel concern of cross-border systemic risk. The results of this empirical work show that as the volume of these cross-border transactions grow, so does the risk that their cross-border portfolios pose on the region’s financial system. The level of bank integration in the Asia-Pacific region is increasing rapidly. Thus, the effect of bank integration on systemic risk will have important implications for the region’s policy makers as they move towards deeper regional integration.

The finding from this study alerts the region’s policy makers to the need to develop a sustainable framework for effective cross-border bank supervision and regulation. The Asia-Pacific countries can no longer restrict supervision and regulation of the banking system within their own borders as the domestic bank activities spread quickly across the region into cross-border transactions. The multi-national, multi-product financial conglomerates that are rapidly growing across the Asia-Pacific region will most likely be the key transmitters of cross-border systemic risk. It would be difficult to supervise and regulate these financial conglomerates without committed cooperation from the relevant authorities. The challenge brought on by these issues highlight the need not only to discuss regional financial co-operation in terms of cross-border supervision and regulation but also with regard to the provision of liquidity and the protection of these lines of liquidity from the risks that threaten it. The manner, in which these issues are dealt with especially in developing countries that are in the midst of reform, is of particular importance to ensure the continued robustness of the respective national financial systems and the regional financial system as a whole.

The evidence gained from our empirical work unveil the challenge that Asia-Pacific policy makers are faced with in light of increasing bank integration in the region. Important insights gained from our study will prepare policy makers to react to these challenges to ensure the sustainability of Asia-Pacific regional growth. Being able to respond in an appropriate and timely manner to these concerns is very relevant to the Asia-Pacific community of policymakers, especially in today’s highly volatile financial environment.

ENDNOTES

* We thank Mohamed Ariff and Kin Boon Tang for their useful comments. We would also like to thank the Bank of International Settlements (BIS) and the Central Banks’ of the respective countries for kindly providing the data to undertake this study.
7 See Hendricks et al. (2006), Segoviano & Goodhart (2009) and Wong & Fong (2011)
8 See Detragiache & Demirgüç-Kunt (2005), Angeloni et al. (2010) and Allen et al. (2011)
9 See also Hartmann et al. (2007) and Patro et al. (2013)
10 The assumption that bank stock prices are efficient implies that the price of the banking sector indices reflects all publicly available information about each individual banks’ asset and liability side risks and the relationships between different banks’ risks where possible.
11 Reporting countries are Australia, Japan, South Korea and Taiwan while the vis-à-vis countries consists of Australia, China, India, Indonesia, Japan, South Korea, Malaysia, Philippines, Thailand and Taiwan. The classification of reporting and vis-à-vis countries follows the BIS Locational Banking Statistics database.
12 See Hartmann et al. (2007); Gropp et al. (2009), Drehmann & Tarashev (2011) and Cihak et al. (2011)
13 See Eichengreen & Park (2003), Kim et al. (2006), Lee (2008)
REFERENCES


