Bank Competition and International Financial Integration: Evidence using a new index

Gurnain Kaur Pasricha*
Bank of Canada
Ottawa, ON, K1A 0G9, Canada
Email: gpasricha@bankofcanada.ca
Ph: +1 (613) 782 7159

June 11, 2010

Abstract

In the debate on the benefits of international financial integration, recent literature has emphasized the development of domestic markets as a precondition. This paper offers an alternative view. Lack of competition in domestic financial systems may prevent countries from reaping the benefits of international integration simply because it prevents them from being integrated in a meaningful way - that of price equalization. A new index of de-facto financial integration is used to explore this question and confirms a strong link between domestic financial sector competitiveness and its integration with the rest of the world. The results acquire greater significance in the light of the recent crisis. The crisis has led to a consolidation of the financial sector in some economies and this paper shows that this consolidation would have negative implications for their de-facto international financial integration. Another important result of the paper is that level of de-jure controls have a limited association with de-facto integration, particularly for developing economies.

Keywords: Financial Integration Index, Covered Interest Parity, Threshold Autoregressive Models, Bank Competitiveness. Capital Controls. JEL Codes: F32, G15, G21

*This paper was written while I was a post doctoral fellow at Honk Kong Institute for Monetary Research (HKIMR). My thanks to HKIMR for research support. I would also like to thank Joshua Aizenman, Yin-Wong Cheung, seminar participants at HKIMR, Eric Santor and an anonymous referee for useful comments and suggestions, and to Hiro Ito and Rajeshwari Sengupta for help with data. The views expressed in the paper are personal and do not reflect those of HKIMR or of Bank of Canada.

The recent financial crisis has re-energized the contentious debate on the benefits of financial globalization and has also led to increased concerns about competition in the financial sector. On October 20, 2009, Brazil became the first emerging market to tighten capital controls after the crisis, with the re-introduction of Imposto sobre Operaes Financeiras (IOF), a 2% tax on all foreign purchases of Brazilian fixed and variable rate instruments. The International Monetary Fund (IMF) staff reversed a longstanding position of supporting unfettered financial openness to endorse capital controls in response to inflow surges (Ostry et. al., 2010). Simultaneously, the crisis has led to a financial sector more dominated by bigger firms, with explicit backing by the governments (for example, in the US). This paper uses a new measure of de-facto international integration to answer two questions arising from these developments: to what extent are the envisioned capital controls are likely to be effective? What impact would a less competitive domestic banking sector have on a country's international integration?

How effective are capital controls? I find that for emerging and developing markets, capital controls play a small role in determining price convergence with the rest of the world. The literature on effectiveness on capital controls has thus far been dominated by country-specific studies (Magud and Reinhart, 2006; Garcia and Carvalho, 2006). This paper uses a broad panel of economies and a novel measure of de-facto integration to directly address this question.[1] The paper also makes a contribution to understanding the apparently ambiguous results in the literature studying the macroeconomic impact of financial openness. Studies that use de-facto openness measures or micro-level data have found a positive impact of openness on growth, whereas studies using de-jure measures provide ambiguous results.[2] If de-jure capital controls are poor measures of the degree of de-facto integration, they would be poor measures of the impact of de-facto openness on growth or on macroeconomic volatility.

What impact would a less competitive domestic banking sector have on a

[1] See also, Ito and Chinn, 2007.

[2] See Kose et. al. (2009), Obstfeld (2009) and references therein.

country's international integration? I find that less competitive financial sectors are associated with lower de-facto integration, particularly for emerging and developing economies. There is a large literature on the implications of domestic banking sector competitiveness for growth (Claessens and Laeven, 2005; Cetorelli, 2001), access to finance (Beck et. al, 2004) and stability (Boyd et. al., 2007; Boyd and Nicola, 2005; Allen and Gale, 2004; Hartmann and Carletti, 2002). However, the link between bank competitiveness and the degree of international integration has not been adequately explored. Such a link is important because if it exists, countries with partially open capital accounts should see greater price convergence with international markets if they liberalized their domestic banking sector, even without opening it to foreign players. Countries with less than fully open capital accounts may also further restrict flows of international capital without appearing to do so, through tightening domestic banking regulation.

Moreover, the result that financial sector competition is more important than de-jure openness in determining de-facto integration[3] has important implications for our understanding of the benefits and costs of financial openness. Recent literature has failed to find an unambiguous link between de-jure openness and economic growth. It has therefore focussed on the possibility that financial development serves as a catalyst in the relationship between financial integration and growth. This literature argues that a minimum level of financial development is a pre-condition to benefitting from financial openness. In this paper, I focus on a previously ignored aspect of financial development - financial sector competitiveness and find that for emerging and developing economies, greater financial sector competitiveness is associated with greater de-facto integration for any given level of de-jure openness. This suggests that the lack of competitiveness may prevent countries from reaping the benefits of financial integration simply because it prevents them from being integrated in a meaningful way - that of price equalization.

There are several reasons why one would expect a link between domestic

[3]for emerging and developing economies.

financial market structure and international price convergence[4]. Freixas and Holthausen (2005) show that even with fully liberalized capital accounts, asymmetric information between domestic and foreign markets may lead to a segmented market equilibrium, with no interbank activity across the borders. They further show that when an integrated equilibrium does occur, interbank market integration will not be perfect (the interbank rates will not be equalized), even in the presence of correspondent banking. In their model, the signal that banks obtain about foreign banks' type is more noisy than the signal about domestic banks, leading to an interest differential at which a bank may borrow domestically and the interest rate at which it may borrow abroad (or from a correspondent bank that borrows abroad to lend domestically). Adding imperfect competition in domestic banking sector to their model will exacerbate the domestic-foreign interest differentials and may increase the range of possibilities where a segmented equilibrium is the only possibility.

While Freixas and Holthausen (2005) assume a fully open capital market, other explanations for the link between domestic bank competition and international price convergence assume the presence of at least some capital controls. When foreign and domestic markets are partially segmented, market power in the domestic interbank market would lead to greater bid-ask spreads directly (Khemraj and Pasha, 2008; Pasricha, 2008b) and through its impact on market liquidity. Carletti, Hartmann and Spagnolo (2007) show that bank consolidation may lead to greater variance in aggregate liquidity demand and Acharya, Gromb and Yorulmazer (2008) demonstrate that surplus banks may under-provide liquidity when outside options of illiquid banks are weak. Several empirical studies in the foreign exchange market have shown that thinner markets or those with greater volatility have higher bid-ask spreads (Cheung and Chinn, 2001; Boller-

[4]In the absence of capital controls and any kind of friction such as asymmetric information that prevents all domestic participants from accessing foreign market and vice versa, price-convergence will occur, irrespective of the structure of domestic financial markets. It is only when either capital controls or some other frictions are present (as in the real world) that the structure of the domestic financial market becomes relevant.

slev and Melvin, 1994). The higher spreads would add to the measured wedge between domestic and foreign interest rates.

The results of this paper indeed confirm a strong link between the lack of financial sector competitiveness (banking and non-banking) and the lack of price convergence, particularly for low and middle income countries. Capital controls explain only a small part of deviations from covered interest parity indicating that de-jure integration influences but does not determine de-facto integration. Controlling for the level of legal restrictions, countries with greater domestic bank competitiveness, more developed institutions and lower exchange and interbank market volatility see greater de-facto integration.

The next section explains the construction of the index of integration, section 2 discusses the macroeconomic variables used to explain de-facto integration, section 3 presents the results and section 4 concludes.

1 Measuring Price Convergence

When markets are financially integrated, the law of one price holds; i.e., all potential agents in domestic and foreign markets (with the same relevant characteristics) will face identical prices for identical assets. In this paper, price convergence is measured by the index introduced in Pasricha (2008a). The index compares interest rates on interbank loans across countries. It captures the size of no-arbitrage band for deviations from covered interest parity as well as the speed of reversion to the no-arbitrage band when deviations lie outside the band (and are therefore profitable). The index is constructed on a yearly basis for 54 countries for an average of 13 years per country[5]. Previous attempts at measuring price convergence in financial markets have focused on either average absolute deviations (Chinn-Ito, 2007), which do not capture the speed of arbitrage, or the beta-convergence measure (Baele et. al, 2004), which captures integration between a group of countries but does not allow one to rank different countries on their degree of convergence. The index developed here is the

[5]The list of countries and the years for which data is available are listed in Table 1.

first time-varying index that allows one to rank countries in terms of de-facto integration and takes into account both the size of their no-arbitrage bands and the speed with which the arbitrage occurs, once it is profitable[6].

1.1 Covered Interest Deviations in the Presence of Frictions

In a fully integrated world with perfectly competitive profit maximizing agents and no transactions costs or other frictions, the following Covered Interest Parity (CIP) condition holds in equilibrium:

$$\delta_t = P\big(\frac{F_{t+k} - S_t}{S_t}\big) - (i_{t+k} - i^*_{t+k}) = 0 \tag{1}$$

where δ_t is the covered interest differential, i_{t+k} and i^*_{t+k} are respectively returns on comparable domestic and foreign assets between time t and t+k, expressed as per cent per annum. S_t is the domestic currency price of foreign currency, F_{t+k} is the forward rate or the k^{th} period domestic currency price of foreign exchange delivered in that period. P is a scaling factor, used to convert the first term into annualized percentage terms[7]. Since all the variables in the above equation are known a priori, any deviation from this equality in our model world represents pure profits and therefore cannot exist in equilibrium.

However, as discussed in Frenkel and Levich (1975) and Pasricha(2008a), in a world with transactions costs, exchange or capital controls (or risk of such controls) and/or differential taxation, the measured covered differential lies in a no-arbitrage band, even with efficient and risk neutral markets. This happens because the econometrician's measure of the covered differential, which is based on the average of the forward and spot rates (rather than the bid-ask rates) and the average of the interest rates does not capture the actual profits, net of taxes, and other costs of arbitrage. One should then expect the measured differential,

[6]The no-arbitrage band captures the minimum deviation required for arbitrage to be profitable and increases with the size of transactions costs and capital controls.

[7]for example, if the forward rates are of maturity 1 month, then $P = 1200$

$\hat{\delta}$ to satisfy:

$$\kappa_n \leq \hat{\delta} \leq \kappa_p \tag{2}$$

where

$$\hat{\delta} = \frac{F - S}{S} - \frac{i - i^*}{1 + i^*}$$

and the precise forms of κ_n and κ_p depend on the transactions costs and capital controls (as well as the levels of exchange and interest rates)[8]. The measured deviations within the no-arbitrage bands are therefore consistent with equilibrium and with covered interest parity, and may be unit root processes. Further, when the supply of arbitrage capital is less than perfectly elastic, due either to quantitative controls, asymmetric information, or imperfect competition in markets, profitable deviations may not be immediately arbitraged away[9](Cheng and Cheung, 2008; Fong, Valente and Fun, 2008).

1.2 Empirical Model for Covered Interest Deviations

These considerations lead one to the choice of an Asymmetric, Self-Exciting Threshold Autoregressive Model (ASETAR) model as the empirical model to estimate the boundaries of the no-arbitrage band (called the thresholds) and the speed of reversion outside the band. This model is called 'self-exciting' because the thresholds are lags of δ itself, and asymmetric because the negative threshold is allowed to differ from the positive threshold. The ASETAR model takes the form:

$$\delta_t = \rho_i \delta_{t-1} + \epsilon_t \qquad \text{for} \quad \kappa_n < \delta_{t-1} < \kappa_p, \tag{3}$$

$$\delta_t - \kappa_n = \rho_n(\delta_{t-1} - \kappa_n) + \epsilon_t \quad \text{for} \quad \delta_{t-1} \leq \kappa_n, \tag{4}$$

$$\delta_t - \kappa_p = \rho_p(\delta_{t-1} - \kappa_p) + \epsilon_t \quad \text{for} \quad \delta_{t-1} \geq \kappa_p, \tag{5}$$

where $\epsilon_t \sim N(0, \sigma^2)$, and κ_n and κ_p are the negative and positive thresholds, respectively. In theory, the deviations inside the band are unit-root processes,

[8]These are described in Pasricha(2008a).

[9]In rational markets, the deviations would eventually be arbitraged away.

so the model is estimated with $\rho_i = 1$. Note that this model implies that speculative activity will push the deviations to the edges of the band, rather than its center. The hypothesis of efficient arbitrage states that the AR(1) process outside the bands be stationary. If the thresholds were known, the model could be estimated by ordinary least squares applied separately to the inner regime and outer regime observations. Since the thresholds are not known, they may be estimated either by a grid search, or by a sequential method suggested in Hansen(1999) that yields confidence intervals for the thresholds. In Hansen's method, a grid search is first made for a single threshold, yielding a minimum residual sum of squares, $S_1(\tilde{\kappa_1})$, where the function S everywhere denotes the residual sum of squares function. In a two regime model, the first search would yield the stronger of the two threshold effects. Fixing the first-stage estimate $\tilde{\kappa_1}$, the second-stage criterion is:

$$S_2(\kappa_2) = \begin{cases} S(\tilde{\kappa_1}, \kappa_2) & \text{if} \tilde{\kappa_1} < 0 \\ S(\kappa_2, \hat{\kappa_1}) & \text{if} \tilde{\kappa_1} > 0, \end{cases} \tag{6}$$

and the second-stage threshold estimate is the one that minimizes the above function, i.e.:

$$\hat{\kappa_2} = argmin\ S_2(\kappa_2). \tag{7}$$

The estimate of the first threshold is then refined as follows:

$$S_1^r(\kappa_1) = \begin{cases} S(\hat{\kappa_2}, \kappa_1) & \text{if} \hat{\kappa_2} < 0 \\ S(\kappa_1, \hat{\kappa_2}) & \text{if} \hat{\kappa_2} > 0, \end{cases} \tag{8}$$

and the refinement estimator for the first threshold is:

$$\hat{\kappa_1} = argmin\ S_1^r(\kappa_1). \tag{9}$$

As a practical matter, the search is conducted over all unique values of the actual observations between the 5^{th} and the 95^{th} percentiles and is restricted so that at least 5% of the observations fall in each of the three regimes. When the model is estimated for every year using daily observations, this restricts the minimum number of observations in each regime to be between 10 and 12.

This process of optimization also yields confidence intervals for the thresholds. Define

$$L_2^r(\kappa_2) = \frac{S_2(\kappa_2) - S_2(\hat{\kappa_2})}{\sigma^2}$$

and

$$L_1^r(\kappa_1) = \frac{S_1^r(\kappa_1) - S_1^r(\hat{\kappa_1})}{\sigma^2}$$

. The asymptotic $(1-\alpha)\%$ confidence intervals for κ_1 and κ_2 are the set of values of each such that $L_1^r(\kappa_1) \leq c(\alpha)$ and $L_2^r(\kappa_2) \leq c(\alpha)$. Hansen(1999) also shows that

$$c(\alpha) = -2log(1 - \sqrt{1-\alpha}).$$

1.3 Integration Index

To construct the Integration Index, Pasricha (2008a) takes into account five different measures that are derived from the model. The first is the bandwidth, which measures the size of the no-arbitrage band, and is expected to be wider the greater the transactions costs or the effective controls in an economy. To capture how frequent are profitable deviations from interest parity, and how fast they revert back to the band, Pasricha (2008a) considers the following measures: (1) the percentage of observations lying in the outer regimes, $OutObs$ (2) the median positive deviation outside the measured band, $MedDevP$ (3) the median negative deviation outside the measured band, $MedDevN$ and (4) the third quartile of continuous runs outside the band, $3rdQrt$. The more elastic the supply of capital and the less effective the controls, the faster the reversion speed[10]. One could also use the AR coefficients in outer regimes or the half lives, but the results should be similar. Using the percentage of observations rather than number of observations takes care of the concern about uneven sample sizes influencing the latter. Lastly, medians and quartiles are preferable to average deviations as they are immune to outliers.

[10]Note that the paper uses daily data, and thus measured deviations are those that were present at the end of the day.

Each of the indicators mentioned above are first normalized by subtracting from them their inter-country mean and dividing by the standard deviation. This centers the resulting index at zero and also converts the components into pure numbers so they can be averaged. The normalizations are done separately for the two maturities, one and three months. For countries for which data on one of the maturities is not available, the available maturity's data is used to approximate for the missing maturity model. The Integration Index for country j time t, I_{jt} is:

$$I_{jt} = \frac{\sum_{k=1,2} I_{jkt}}{K}$$

where

$$I_{jkt} = -\frac{\widetilde{Bandwidth}_{jkt} + \widetilde{OutObs}_{jkt} + \widetilde{MedDevN}_{jkt} + \widetilde{MedDevP}_{jkt} + \widetilde{3rdQrt}_{jkt}}{5} \tag{10}$$

$$\widetilde{X}_{jkt} = \frac{X_{jkt} - \overline{X_k}}{\sigma_k}, \tag{11}$$

where k indexes maturity of the underlying contracts (here, 1-month and 3-month contracts) and $K = 2$. $\overline{X_k}$ and σ_k are, respectively the mean and standard deviation over all country-time observations of maturity k of X for $X = Bandwidth$, $OutObs$, $MedDevN$, $MedDevP$, $3rdQrt$. Equation (11) normalizes each of the variables ($Bandwidth$, $OutObs$ etc) so that the resulting normalized variables are numbers and can be averaged.

Since there are no theoretical priors that allow one to assign different weights on the different components of the index based on their contribution to 'openness', this index uses a simple average. A simple average is chosen for transparency and tractability. It is based on the premise that greater openness means that there are smaller deviations from parity, and that the deviations are arbitraged away more quickly. The negative sign in (10) allows larger values of the index to be interpreted as greater integration.

1.4 Data and Summary Statistics of Integration Index

To construct the index, interest rates on interbank loans of 1- and 3-month maturities were used. For Brazil, interbank interest rates were unavailable, so the Certificate of Deposit rates were used. The data on interbank rates are from Bloomberg and Thomson Financial's Datastream databases for all countries except South Africa and Columbia, whose rates were sourced from Global Financial Database (as these were unavailable in Bloomberg or Datastream). The exchange rate data is from Bloomberg and Datastream. The forward exchange rates are onshore forward rates of 1 and 3 month maturities, except for Chile where onshore forward data was unavailable so non-deliverable forwards were used. For countries that had adopted the Euro, the exchange rates pertain to the Euro after January 1, 1999 or their date of accession, whichever is later.

Table 1 lists the countries and years for which the index is available and Table 2 summarizes the index for the whole sample and for high income and low and middle income country groupings respectively (World Bank Classification). High income countries have on average, greater openness than low and middle income countries (0.6 compared to average openness of -0.18 for the low and middle income group) and lower variability. Figure 1 plots the index over time for high, middle and low income country groups. The figure highlights the fact that the level of price convergence is not static. It fluctuates from year to year, even for high income countries, much more than say the degree of legal restrictions. Clear evidence of these fluctuations was provided by the recent financial crisis of 2007-08. However, it is important to keep in mind that the figure is not based on a balanced panel. New countries are added to each of the income groups as their data becomes available and this may contribute to some of the fluctuations, especially since the total number of countries in the sample is not too large. The large dip in openness around the year 1998 in the low and middle income countries is due to the Asian crisis which saw the imposition of capital controls in these countries (most notably in Malaysia). The dip in 2001 is due to Turkey's financial crisis. Figure 4 shows the low and middle

income countries' average openness excluding Malaysia, Thailand and Turkey. Noteworthy is the large dip in openness in 2008, corresponding to the recent financial crisis. Figure 1 also suggests that while the high income countries show a positive trend in openness on average, the same is not true for low and middle income countries. Figure 4 plots the integration index for each of the BRIC countries. An interesting result here is that India and Brazil reverse their relative standing in de-facto openness, with India everywhere more open than Brazil, whereas Brazil is more open than India in terms of Chinn-Ito measure of de-jure openness.

2 Determinants of Price Convergence

This section examines the determinants of de-facto openness as measured by price convergence. The emphasis is on the relationship between de-facto openness on the one hand and de-jure capital controls and competitiveness of domestic banking sector on the other. Greater domestic bank competitiveness is expected to lead to greater de-facto openness, for any given level of capital controls. The foreign interest rate is the interest rate that would prevail in the domestic economy in the absence of capital controls and monopolistic competition in the domestic economy. The greater the extent of monopoly power in the domestic market, the greater the disconnect between domestic and foreign interest rates, over and above that implied by the level of capital controls.

The relationship between de-facto openness and bank competitiveness is examined in a panel framework:

$$Index_{it} = \alpha + \beta X_{it} + \gamma t + \mu_i + \epsilon_{it} \tag{12}$$

where $Index_{it}$ is the integration index for country i at time t, X_{it} are a set of country characteristics detailed below, μ_i denote country specific fixed effects and t is a time trend. The analysis is done first for the entire sample of countries and then separately for the two groups: (1) High Income and (2) Low and Middle Income countries. The reason for looking at separate samples is that the high

income countries have very few capital controls and in the absence of market segmentation that these controls enable, the structure of the domestic banking sector should not matter for price convergence. The list of countries included in each group are indicated in Table 1.

For each sample group, panel heteroskedasticity and serial correlation tests were conducted[11]. The results of these tests are presented in appendix table 4. The null of heteroskedasticity was rejected in all samples. For the low and middle income countries sample, there was evidence of serial correlation in the errors in all specifications. Although the serial correlation did not always show up in the sample with all countries in the tests, perhaps because there is not sufficient evidence against lack of serial correlation in the high income group sample, the regressions for full sample correct for serial correlation. The serial correlation in low and middle income countries may simply reflect the fact that financial openness as well as other macroeconomic variables in these countries exhibit greater persistence. Accordingly, the regressions for low and middle income countries and for the full sample were estimated using a Prais Winston procedure allowing for panel specific AR(1) correction[12].

The explanatory variables, X_{it}, include measures of banking competitiveness, measures of legal restrictions to cross-border capital flows, macroeconomic variables and measures of transactions costs and liquidity in the interbank and foreign exchange markets. These are described in detail below.

[11]Panel heteroskedasticity tests were likelihood ratio tests that compared likelihood statistics from a GLS regression assuming panel specific heteroskedasticity with an unrestricted model. To test for serial correlation, Wooldridge (2002) test was applied using the xtserial command in Stata.

[12]The Prais Winston procedure is an FGLS procedure that uses as the initial value, the autocorrelation coefficient in the residuals from the first stage OLS regression to quasi-difference the data and estimate the model(and includes a correction for the first time period). The process is iterated until convergence of estimated autocorrelations. See Wooldridge (2006) for details.

2.1 Banking Competitiveness Measures

Four different proxies were used to measure domestic banking sector competitiveness - (1) the net interest margins, which equal the accounting value of banks' net interest revenue as a share of their total assets, (2) bank overhead costs to total assets ratio, (3) return on equity in the banking sector and (4) Herfindahl-Hirschman Index (HHI), defined as the sum of squares of market shares of total assets of the top 50 firms. This index was constructed using Bankscope data supplemented with information on total industry assets from Bank for International Settlements (BIS). Details of the data sources for each of these variables and of HHI construction are in the data appendix.

A higher level of each of the banking sector competitiveness measure denotes greater monopoly power in domestic banking and therefore, as argued earlier, should be associated with lower de-facto international integration. Neither of the four measures is a perfect measure of competitiveness. However, each of these has been used as proxy for the bank competitiveness in the literature. Banks with market power can charge higher rates on loans and pay lower rates on deposits (Berger and Hannan, 1989; Hannan 1991) implying that net interest margins would be higher in less competitive markets. Demirguc, Laeven and Levine (2003) find that regulatory restrictions on banking activity, including freedom of entry and lack of institutional development substantively increase net interest margins. They also find that the net interest margins increase with state control of the banking sector, and decline with development of the stock markets, which would compete with banks as a source of funding. Higher profits of a less competitive industry may be reflected in higher return on equity (ROE) or higher overhead costs (Berger and Hannan, 1998; Jayaratne and Strahan, 1998; Martinez Peria and Mody, 2004). The downside of these three measures is that they may also be influenced by country tax structures, quality of institutions, and bank risk preferences. The HHI ratio varies between 0 and 1 and in theory, is higher for less competitive systems. However, the HHI does not take into account the fact that banks may compete with other financial markets, nor

that threat of entry matters for effective competition (Panzar and Rosse, 1987, Claessens and Laeven, 2004; Beck et. al, 2006).

In order to account for the competition banks may face from the stock market, I use a measure of equity market development, which is the first principal component of stock market capitalization ratio to GDP and stock market total value traded as ratio to GDP. I include equity market development alone as well as its interaction with HHI, to allow for non-linear effects. The data are from World Bank's financial structure database (Beck et. al., 2006).

2.2 Measure of De-jure Openness

While the level of capital controls determines de-facto financial integration, market players often find ways to evade such controls, so the relation need not be one-to-one. Moreover, even in the absence of capital controls, other imperfections - transactions and information costs, asymmetric information, imperfect competition etc - impinge on the price convergence with international markets, so that even in the absence of capital controls, price convergence may not be perfect. Therefore, the coefficient on de-jure measure of openness is expected to be positive, but less than one. I use the Chinn-Ito measure of capital account openness (De-jure Openness), which takes higher values for fewer legal restrictions on capital flows across borders. This measure is commonly used in the literature as a measure of de-jure openness and is available for a large set of countries and time periods[13].

2.3 Other Explanatory Variables

The degree of development of institutions in the country may influence the speed of arbitrage, particularly when arbitrage involves lending in the domestic currency. Better institutions imply a lower country risk. Bank competitiveness may

[13]Another widely used de-jure index is the Edwards(2004) index. However, the Edwards index is only available through 2004, leading to a serious loss of observations for developing economies.

itself be positively related to institutional development (Claessens and Laeven, 2004; Ito and Chinn, 2007). On the other hand, for any given level of capital controls, lower institutional development, for example, higher corruption, would allow easier evasion of the de-jure controls. For these reasons, the sign of an institutional variable (with higher values measuring better institutions) may be positive or negative. I include a measure of institutional development, which is the first principal component of corruption and political risk indices from PR Group's International Country Risk Guide. Higher values of these variables reflect lower corruption or political risk.

As a proxy for transactions costs in currency markets, I compute the percentage bid-ask spread (as a percentage of the mean rate) in the spot exchange rate markets using daily data. An average of these for the year for each currency is included as an explanatory variable (Exchange Mkt Spread). One would expect higher average spreads to be associated with lower openness. Similar spreads on interbank interest rates were not available for most of the countries in the sample.

Volatility in the prices in a financial market may be used to proxy for the lack of liquidity in the market, as well as for the risk premia. I add to the regressions a measure of volatility each for the interbank market and for the foreign exchange market. Volatility in the interbank market is measured by the average (over the two maturities) of the coefficient of variation in the daily 1- and 3- month interbank interest rates (Interbank Mkt Volatility). Similarly, volatility in the forward exchange market is the average of the coefficient of variation over the year in the daily 1- and 3- month forward exchange rates (Exchange Mkt Volatility).

Crisis periods often see either new capital controls being imposed or renewed enforcement of existing regulations. Banking crisis periods, additionally, are periods of heightened counterparty risk and lower liquidity in interbank markets, and serve here to control for these risk premia. I include two dummy variables for crisis periods in the regressions, one for banking crisis and another for currency crisis. Currency Crisis dummy uses the Kaminsky and Reinhart (1999) index

of currency market turbulence (a weighted average of exchange rate and reserve changes) to identify crisis months and takes the value 1 for years in which there was one or more crisis month. The Bank Crisis dummy variable takes the value 1 for years in which there was a systemic banking crisis and is taken from Laeven and Valencia (2008). Both kinds of crisis periods are therefore expected to be associated with lower price convergence.

Finally, a trend variable is included to test if the world has indeed become more globalized over time, GDP per capita in thousands of 2000 US dollars (real GDP per capita) to test if higher income countries are more integrated after controlling for their level of financial development, institutions etc, and the ratio of trade to GDP. Greater trade integration should make it easier to evade capital controls as over invoicing of imports and under invoicing of exports are popular ways of exporting capital in countries with controls (Aizenman 2008; Aizenman and Noy, 2009; Prasad and Rajan, 2008; Claessens and Naude, 1993).

2.4 Summary statistics for explanatory variables

Table 3 presents the summary statistics of each of the regressors for all countries and by income group. Several of the variables have different mean values by income group. Table 4 presents the results of difference in means tests for some variables of interest, by income group. For each variable of interest, Table 4 presents the results of an Ordinary Least Squares (OLS) regression on the High Income dummy variable and a constant. The estimated constants are then the mean values of the dependent variable for Low and Middle Income group. High income countries have net interest margins and overhead costs that are significantly lower than low and middle income countries. Moreover, the correlation between net interest margins and overheads is 0.62, underscoring the validity of these two variables as proxies for lack of competitiveness in banking rather than for bank efficiency.

The return on equity is not significantly different between the two groups, and HHI in financial institution assets is actually significantly larger for high

income countries than for low and middle income countries. This, combined with the significantly higher level of equity market development in the high income economies, suggests that HHI may not fully capture the competition faced by the banking sector. This observation is consistent with the results of Claessens and Laeven (2004) who create a measure of bank competitiveness based on contestability of the market and find that it is not negatively related to concentration[14].

3 Results on Determinants of International Financial Integration

3.1 Full Sample

The estimates from equation 12 are presented in Tables 5 to 10. Table 5 presents the results for the entire sample. De-jure financially open countries are also de-facto more open. The coefficient for de-jure openness is positive, significant and roughly the same size in all columns of Table 5. These results indicate that although capital controls do lead to lower price convergence, the relationship is far from one to one. A one standard deviation increase in de-jure openness is associated with a 0.21-0.24 standard deviation increase in de-facto openness, and vice versa. This is consistent with the widely held view that market players find ways around controls and with other studies on the effectiveness of capital controls[15].

Also negative in sign and significant are exchange market volatility, currency crisis dummy and exchange market spread, implying that thinner markets, periods with greater uncertainty and heightened liquidity or counterparty risk and higher transactions costs are associated with lower de-facto integration. There

[14]The concentration measure they use is narrower - it is the combined market share of the five largest banks.

[15]See, for example, Garber 1998, Garcia 2006 and Aizenman 2004 for studies on evasion of capital controls.

is a significant positive trend in openness, indicating that the recent wave of globalization has led to price convergence. Also positive and significant are the coefficients on institutional development, indicating that better legal environments are more likely to promote tighter financial integration with the rest of the world.

As far as the bank competition measures are concerned, only net interest margins and the interaction term between equity market development and the concentration measure, HHI, enter significantly. However, the results here may be driven by the relationships in high income countries, as roughly 73 percent of all observations in Table 5 belong to high income countries. While the impact of volatility or counterparty risk need not depend on the level of de-facto openness, domestic banking competitiveness matters for international integration only in the presence of some segmentation between the domestic and foreign markets.

The significant and negative coefficient on Trade/GDP ratio is largely due to the fact that most countries that had currency crises in the sample were also more open to trade (had were richer). The crises periods typically involve a sharp decline in de-facto integration that outlasts the crisis period. Figure 4 shows this pattern in Malaysia, Thailand and Turkey. Table 4 lists the mean and range of Trade/GDP ratio and real GDP per capita for countries that had at least one currency crises during the sample period (except the 2008 crisis) and those that did not. Countries that had at least one crisis during the sample period had average trade/GDP ratio of 0.97 (median ratio of 0.74) whereas countries that did not have any currency crises had a lower average trade/GDP ratio of 0.90 (median ratio of 0.70). The crisis countries were also richer on average.

Table 6 shows the regressions results for all countries when trade growth and GDP per capita growth are included as explanatory variables. The coefficient of Trade/GDP ratio is not significantly different from zero, and that of GDP growth is significant and positive. The standardized coefficient on de-jure openness is now lower, about 0.15 and those on bank competitiveness are larger.

3.2 Results by Income Group

The results on the high income group are presented in Table 7 and 8. In this group, the level of de-jure openness and the positive trend are practically the only consistently significant arguments. Both have a positive sign, indicating that the fewer the restrictions on flows, the higher the level of integration; and that de-facto integration has increased over time. A one standard deviation increase in de-jure openness increases de-facto openness by 0.23-0.28 standard deviations on average. Given the high level of de-jure openness in these countries, and perhaps also the relatively similar underlying contracts, it is not surprising that most of the banking competitiveness variables are not significant. As discussed in the introduction, when there are no or few constraints on access to overseas financial markets, the level of domestic banking competition becomes irrelevant. The positive and significant coefficient on return on equity may only reflect greater efficiency in these markets. The R^2 in the high-income country regressions are also quite low.

In contrast, the R^2 for low and middle income country sample are very high, above 0.5 for each specification (Tables 9 and 10). The coefficient on de-jure openness is positive in all specifications, but significant in only 3. The point estimates of the standardized coefficient for de-jure openness vary from 0.02 to 0.18. In contrast, the banking sector competitiveness indicators, net interest margins, overheads and return on equity, all have negative coefficients that are larger in magnitude than for the full sample, and are significant in Table 9. In Table 10, which adds trade and GDP growth variables, the HHI is also negative and significant.

These results indicate that less competitive banking systems are in fact, associated with lower price convergence with the rest of the world. The standardized coefficient on net interest margin is -0.37 in Table 9. This value means that a one standard deviation decrease in net interest margin would lead to a rise in the integration index of .37 standard deviations[16]. As an example, if Argentina's

[16]In this section, all mean and standard deviations refer to their respective values in the

net interest margins fell from 0.061 in 2005 to 0.020 which was roughly level of net interest margins in Hong Kong in the same year (a 1.6 standard deviation fall) other things being equal, its integration index would rise from -0.26 to 0.13, roughly the level for Ireland in 2005. Moreover, the standardized coefficient on net interest margins is about twice the absolute size of the largest point estimate for standardized coefficient on de-jure openness (0.18). The point estimate of standardized coefficients of overheads are in the range -0.06 to -0.09, that for return on equity lie between -0.15 to -0.18 and on HHI from -0.06 to -0.11.

The last columns of Tables 9 and 10 explore the interactions between the two variables in determining de-facto integration. The results indicate that both higher equity market development and more competitiveness in financial sector lead to greater de-facto international integration on average, though the impact is non-linear. Estimates in Table 9 indicate that at the mean value of HHI, a marginal increase in stock market development increases financial integration by a positive value (0.018) but in more competitive systems, the impact is larger. At mean values of stock market development, a marginal increase in concentration in the financial sector reduces de-facto integration by 1.74.

Currency crisis and greater volatility in the interbank and foreign exchange markets are both associated with significantly low levels of de-facto openness, whereas institutional quality is associated with higher de-facto openness. De-jure restrictions matter, but the coefficients are smaller than for the high income country sample and not always significant. Trade and GDP enter with negative signs and are both significant, but may just reflect the fact that there were several crisis episodes in the emerging markets with higher incomes and trade-openness in the sample under consideration and that we have a smaller time series for these countries than for higher income countries. Trade growth and GDP per capita growth are either not significant or positive and significant.[17]

regression sample.

[17]The measures of banking competitiveness may be endogenous in the regressions. Therefore, I re-ran the regressions with lagged values of these variables for emerging and developing countries. The main results are robust to using lagged values. The coefficients on net interest margins and HHI remain negative and significant. The coefficient on overheads is now

Moreover, there may be threshold effects involved. Increasing trade openness may increase convergence but only when the level of de-jure controls are high and when corruption is high. The impact of tightening of capital controls on de-facto integration may also depend on the level of institutional development. As more data becomes available, it may be possible to fully explore threshold effects.

4 Concluding Remarks

This paper develops a price based measure of financial openness for 54 countries and for an average of 13 years per country. This index captures an important aspect of international financial integration - the degree to which interest rates are aligned with international markets - that has so far been missing in the studies of impact of financial openness on growth, macroeconomic volatility, as well as contagion. While there is a clear trend of increasing openness in the high income countries before the onset of current crisis, the same is not true for the developing countries.

Further, this paper makes a contribution to the literature on determinants of de-facto integration and looks at a previously ignored angle - the relationship between banking sector competitiveness and de-facto integration. Although none of the measures used are perfect, they all point to a strong link between bank competitiveness and price convergence in international markets, especially for low and middle income countries. This has several policy implications. The restrictions on international integration are not the sum total of controls on cross border transactions - domestic regulations also impinge on international integration. Liberalizing domestic financial sectors may provide all the benefits

significant (it is negative and higher in absolute value), but the reverse is true for ROE. The coefficients on other variables remain about the same size and significance. The main results are also robust to including other potentially endogenous variables, i.e. volatility in inter-bank and exchange markets, the spread in exchange markets, financial development, GDP per capita and GDP growth, with one lag.

of more efficient domestic allocation of resources, but in addition would provide the benefits from greater international integration. Schaeck et. al. (2006) find that more competitive banking systems are more stable and Fecht et. al. (2007) that greater international integration of interbank markets enhances resilience to idiosyncratic shocks[18]. The link between the two may be that more competitive systems are also more integrated with the rest of the world.

The paper also finds that the determinants of price integration differ between developed and developing countries. Periods of volatility and currency crisis are periods of low price-integration for developing countries. Moreover, for this group, while the link between capital controls and price-convergence exists, it is less than perfect, providing evidence that capital controls do get evaded.

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[18]Although, as the 2007-08 crisis made clear, it may also increase vulnerability to systemic shocks.

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Table 1. Integration Index Availability

Market	N	Begin Year	End Year
High Income			
Australia	23	1986	2008
Austria	20	1989	2008
Belgium	19	1990	2008
Canada	24	1985	2008
Czech Republic	12	1997	2008
Denmark	21	1988	2008
Estonia	10	1999	2008
Finland	17	1992	2008
France	20	1989	2008
Germany	18	1991	2008
Greece	12	1997	2008
Hong Kong	23	1986	2008
Iceland	5	2004	2008
Ireland	20	1989	2008
Israel	8	2001	2008
Italy	18	1991	2008
Japan	13	1996	2008
Kuwait	7	2002	2008
Netherlands	20	1989	2008
New Zealand	23	1986	2008
Norway	23	1986	2008
Portugal	16	1993	2008
Saudi Arabia	7	2002	2008
Singapore	23	1986	2008
Slovenia	5	2004	2008
Spain	20	1989	2008
Sweden	22	1987	2008
Switzerland	25	1984	2008
United Arab Emirates	2	2007	2008
United Kingdom	25	1984	2008
Low and Middle Income			
Argentina	5	2004	2008
Brazil	6	2003	2008
Bulgaria	5	2004	2008
Chile	7	2002	2008
China	7	2002	2008
Colombia	5	2004	2008
Croatia	6	2003	2008
Hungary	11	1998	2008
India	10	1999	2008

Table 1 (cont'd)

Market	N	Begin Year	End Year
Indonesia	9	2000	2008
Kazakhstan	5	2004	2008
Latvia	8	2001	2008
Lithuania	9	2000	2008
Malaysia	19	1990	2008
Mexico	12	1997	2008
Pakistan	5	2004	2008
Philippines	12	1997	2008
Poland	10	1999	2008
Romania	5	2004	2008
Russian Federation	5	2004	2008
Slovakia	7	2002	2008
South Africa	12	1997	2008
Thailand	13	1996	2008
Turkey	10	1999	2008
Total	704	1984	2008

Table 2. International Integration Index: Summary Statistics

	N	Mean	Std_Dev	Max	Min	CV
All Countries	704	0.00	0.48	0.54	-4.88	..
High Income Countries	519	0.06	0.33	0.54	-2.20	5.32
Low and Middle Income Countries	185	-0.18	0.73	0.50	-4.88	-4.11

Table 3. Summary Statistics

	N	Mean	Std_Dev	Max	Min	CV
De-Jure Openness	637	1.68	1.18	2.53	-1.13	0.70
Interbank Mkt Volatility	704	0.12	0.11	0.99	0.00	0.88
Exchange Mkt Volatility	704	0.04	0.03	0.43	0.00	0.73
Exchange Mkt Spread	648	0.06	0.09	0.66	0.00	1.42
Institutions	702	0.00	1.30	2.34	-4.05	..
Trade	681	0.93	0.66	4.57	0.19	0.71
real GDP per capita	702	16.45	10.63	42.43	0.44	0.65
Overheads	593	0.03	0.02	0.12	0.00	0.55
Net Interest Margins	593	0.03	0.02	0.18	0.01	0.60
HHI	556	0.16	0.13	0.90	0.00	0.85
ROE	585	0.09	0.14	1.03	-1.44	1.59
Equity Mkt Development	607	0.00	1.33	8.52	-1.27	
High Income Countries						
De-Jure Openness	474	2.14	0.69	2.53	-1.13	0.32
Interbank Mkt Volatility	519	0.12	0.11	0.99	0.00	0.94
Exchange Mkt Volatility	519	0.04	0.02	0.22	0.00	0.56
Exchange Mkt Spread	490	0.05	0.07	0.66	0.00	1.38
Institutions	517	0.56	0.93	2.34	-2.26	1.67
Trade	497	0.96	0.72	4.57	0.19	0.75
real GDP per capita	517	21.11	8.33	42.43	3.75	0.39
Overheads	433	0.03	0.02	0.12	0.00	0.52
Net Interest Margins	433	0.03	0.01	0.08	0.01	0.39
HHI	389	0.18	0.15	0.90	0.00	0.85
ROE	425	0.09	0.10	1.03	-0.50	1.19
Equity Mkt Development	444	0.14	1.41	8.52	-1.27	10.44
Low and Middle Income Countries						
De-Jure Openness	163	0.33	1.26	2.53	-1.13	3.82
Interbank Mkt Volatility	185	0.13	0.09	0.46	0.00	0.71
Exchange Mkt Volatility	185	0.04	0.04	0.43	0.00	0.99
Exchange Mkt Spread	158	0.09	0.12	0.66	0.00	1.29
Institutions	185	-1.56	0.84	0.50	-4.05	-0.54
Trade	184	0.85	0.46	2.20	0.25	0.55
real GDP per capita	185	3.43	1.99	9.89	0.44	0.58
Overheads	160	0.04	0.02	0.12	0.01	0.52
Net Interest Margins	160	0.05	0.03	0.18	0.01	0.56
HHI	167	0.11	0.07	0.37	0.00	0.59
ROE	160	0.08	0.21	1.01	-1.44	2.46
Equity Mkt Development	163	-0.37	0.97	3.51	-1.26	-2.64

Note. — GDP per capita is in thousands of 2000 US dollars.

Table 4. Difference in Means Tests

	Net Int Margin	Overhead	ROE	HHI	EqMktDevpt	Instn	De-jure Open
High Income	-0.02***	-0.01***	0.00	0.06***	0.50***	2.11***	1.81***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.12)	(0.08)	(0.08)
Constant	0.05***	0.04***	0.08***	0.11***	-0.37***	-1.56***	0.33***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.10)	(0.07)	(0.07)
Observations	593	593	585	556	607	702	637
R-squared	0.27	0.08	0.00	0.05	0.03	0.52	0.45

Note. — Net Int Margin refers to Net Interest Margins, ROE is the return on equity, EqMktDevpt is the Equity Market Development index, Instn refers to Institutional index, De-jure Open is the Chinn-Ito index of de-jure openness. The table shows the output of OLS regression of the variable in the column header on the dummy variable High_Income and a constant. The estimated constant term is the mean of the dependent variable for Low and Middle income countries. Standard errors in parentheses. $*$ $p < 0.1$, $**$ $p < 0.05$, $***$ $p < 0.01$.

Table 5. Explaining De-facto Integration, I

	1	2	3	4	5
De-Jure Openness	0.08***	0.09***	0.08***	0.09***	0.08***
	(0.028)	(0.026)	(0.026)	(0.029)	(0.029)
Interbank Mkt Volatility	-0.09	-0.12	-0.12	-0.15	-0.14
	(0.128)	(0.132)	(0.137)	(0.125)	(0.126)
Exchange Mkt Volatility	-4.10***	-4.93***	-4.97***	-5.01***	-5.03***
	(1.195)	(1.193)	(1.186)	(1.205)	(1.207)
Exchange Mkt Spread	-0.56	-0.64*	-0.64*	-0.67*	-0.65*
	(0.369)	(0.365)	(0.375)	(0.356)	(0.354)
Bank Crisis Dummy	-0.11	-0.11	-0.12	-0.15	-0.15
	(0.088)	(0.088)	(0.091)	(0.110)	(0.109)
Crisis Dummy	-0.27***	-0.27***	-0.27***	-0.33**	-0.32**
	(0.083)	(0.084)	(0.083)	(0.133)	(0.132)
Trend	0.02***	0.02***	0.02***	0.02***	0.02***
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
Institutions	0.04*	0.06**	0.06**	0.05*	0.05*
	(0.027)	(0.027)	(0.028)	(0.027)	(0.026)
Equity Mkt Development	0.01	0.00	0.00	-0.00	0.03
	(0.018)	(0.017)	(0.018)	(0.017)	(0.028)
Trade/GDP	-0.09**	-0.08**	-0.08**	-0.07**	-0.07**
	(0.039)	(0.036)	(0.037)	(0.034)	(0.034)
real GDP per capita	-0.00	-0.00	-0.00	-0.00	0.00
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Net Interest Margin	-4.09***				
	(1.134)				
Overheads		-0.58			
		(0.764)			
Return on Equity			-0.03		
			(0.199)		
HHI				0.06	0.02
				(0.094)	(0.083)
EquityMktDevpt*HHI					-0.19**
					(0.087)
Constant	-0.07	-0.20	-0.20	-0.20	-0.20
	(0.146)	(0.140)	(0.144)	(0.162)	(0.157)
Observations	521	521	511	464	464
R-squared	0.277	0.271	0.269	0.291	0.296
Number of Countries	52	52	52	49	49

Note. — Regressions use Prais-Winston 2SLS procedure with panel specific AR(1) error processes. Standard errors in parentheses.$*$ $p < 0.1$, $**$ $p < 0.05$, $***$ $p < 0.01$.

Table 6. Explaining De-facto Integration, II

	1	2	3	4	5
De-Jure Openness	0.06*	0.07**	0.07**	0.07**	0.06*
	(0.031)	(0.031)	(0.031)	(0.034)	(0.035)
Interbank Mkt Volatility	-0.07	-0.10	-0.10	-0.08	-0.06
	(0.135)	(0.135)	(0.140)	(0.130)	(0.130)
Exchange Mkt Volatility	-3.74***	-4.37***	-4.34***	-4.09***	-4.18***
	(1.189)	(1.164)	(1.155)	(1.180)	(1.190)
Exchange Mkt Spread	-0.62	-0.71*	-0.67	-0.78**	-0.73**
	(0.378)	(0.390)	(0.407)	(0.372)	(0.365)
Bank Crisis Dummy	-0.08	-0.08	-0.09	-0.07	-0.08
	(0.082)	(0.083)	(0.087)	(0.101)	(0.102)
Crisis Dummy	-0.21***	-0.21***	-0.21***	-0.30***	-0.30***
	(0.078)	(0.078)	(0.078)	(0.116)	(0.115)
Trend	0.02***	0.02***	0.02***	0.02***	0.02***
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
Institutions	0.07**	0.08***	0.08**	0.07**	0.07**
	(0.031)	(0.031)	(0.033)	(0.032)	(0.030)
Equity Mkt Development	-0.00	-0.00	0.00	-0.01	0.02
	(0.016)	(0.015)	(0.016)	(0.015)	(0.026)
Trade Growth	0.04	0.03	0.04	-0.08	-0.06
	(0.227)	(0.230)	(0.229)	(0.237)	(0.241)
GDP per capita growth	0.03***	0.03***	0.04***	0.05***	0.04***
	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)
Trade/GDP	-0.11***	-0.10***	-0.10***	-0.09***	-0.10***
	(0.035)	(0.033)	(0.033)	(0.027)	(0.028)
real GDP per capita	0.00	0.00	0.00	0.00	0.00
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Net Interest Margin	-3.18***				
	(1.119)				
Overheads		0.69			
		(0.866)			
Return on Equity			-0.11		
			(0.191)		
HHI				-0.19*	-0.12
				(0.111)	(0.095)
EquityMktDevpt*HHI					-0.17*
					(0.090)
Constant	-0.20	-0.32**	-0.30**	-0.37**	-0.35**
	(0.146)	(0.141)	(0.146)	(0.167)	(0.163)
Observations	496	496	486	446	446
R-squared	0.304	0.296	0.296	0.324	0.325
Number of Countries	52	52	52	49	49

Note. — Regressions use Prais-Winston 2SLS procedure with panel specific AR(1) error processes. Standard errors in parentheses.$*$ $p < 0.1$, $**$ $p < 0.05$, $***$ $p < 0.01$.

Table 7. Explaining De-facto Integration: High Income Countries, I

	1	2	3	4	5
De-Jure Openness	0.20***	0.20***	0.19***	0.23***	0.23***
	(0.035)	(0.035)	(0.035)	(0.044)	(0.044)
Interbank Mkt Volatility	0.10	0.10	0.13	0.03	0.03
	(0.156)	(0.155)	(0.157)	(0.155)	(0.155)
Exchange Mkt Volatility	1.54	1.51	2.66**	1.35	1.36
	(1.218)	(1.219)	(1.302)	(1.308)	(1.310)
Exchange Mkt Spread	-0.18	-0.19	-0.14	0.16	0.18
	(0.725)	(0.720)	(0.739)	(0.750)	(0.757)
Bank Crisis Dummy	-0.11*	-0.11*	-0.10	-0.10	-0.10
	(0.069)	(0.068)	(0.072)	(0.088)	(0.088)
Crisis Dummy	-0.11	-0.12	-0.12	0.07	0.07
	(0.076)	(0.076)	(0.077)	(0.114)	(0.114)
Trend	0.04***	0.03***	0.04***	0.03***	0.03***
	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)
Institutions	0.06	0.06	0.08*	0.04	0.04
	(0.041)	(0.041)	(0.042)	(0.041)	(0.041)
Equity Mkt Development	-0.04	-0.04	-0.04	-0.03	-0.04
	(0.028)	(0.028)	(0.029)	(0.028)	(0.038)
Trade/GDP	0.11	0.12	0.10	0.11	0.11
	(0.128)	(0.131)	(0.128)	(0.128)	(0.129)
real GDP per capita	-0.03**	-0.03**	-0.04**	-0.03	-0.03
	(0.015)	(0.015)	(0.015)	(0.018)	(0.018)
Net Interest Margin	0.53				
	(2.421)				
Overheads		0.64			
		(1.240)			
Return on Equity			0.36*		
			(0.202)		
HHI				-0.22	-0.23
				(0.237)	(0.239)
EquityMktDevpt*HHI					0.03
					(0.130)
Constant	-0.47*	-0.48*	-0.46*	-0.54*	-0.54*
	(0.263)	(0.257)	(0.257)	(0.278)	(0.278)
Observations	385	385	375	340	340
R-squared	0.243	0.243	0.251	0.180	0.180
Number of Countries	30	30	30	29	29

Note. — Regressions use fixed effects estimators. Standard errors in parentheses.$*$ $p < 0.1$, $**$ $p < 0.05$, $***$ $p < 0.01$.

Table 8. Explaining De-facto Integration: High Income Countries, II

	1	2	3	4	5
De-Jure Openness	0.20***	0.21***	0.20***	0.21***	0.21***
	(0.038)	(0.038)	(0.038)	(0.047)	(0.047)
Interbank Mkt Volatility	0.11	0.11	0.13	0.04	0.04
	(0.158)	(0.157)	(0.159)	(0.158)	(0.158)
Exchange Mkt Volatility	1.37	1.33	2.34*	1.12	1.12
	(1.210)	(1.210)	(1.289)	(1.301)	(1.304)
Exchange Mkt Spread	-0.51	-0.54	-0.46	-0.14	-0.15
	(0.742)	(0.739)	(0.759)	(0.771)	(0.779)
Bank Crisis Dummy	-0.12*	-0.12*	-0.11	-0.06	-0.06
	(0.071)	(0.071)	(0.074)	(0.092)	(0.092)
Crisis Dummy	-0.08	-0.08	-0.09	0.05	0.05
	(0.079)	(0.079)	(0.079)	(0.114)	(0.114)
Trend	0.04***	0.04***	0.04***	0.03***	0.03***
	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
Institutions	0.06	0.06	0.08*	0.03	0.03
	(0.042)	(0.042)	(0.044)	(0.043)	(0.043)
Equity Mkt Development	-0.04	-0.04	-0.04	-0.04	-0.04
	(0.029)	(0.029)	(0.030)	(0.030)	(0.040)
Trade Growth	-0.07	-0.05	-0.10	-0.25	-0.25
	(0.196)	(0.197)	(0.201)	(0.204)	(0.205)
GDP per capita growth	0.01	0.01	0.01	0.01	0.01
	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
Trade/GDP	0.12	0.14	0.13	0.13	0.13
	(0.139)	(0.141)	(0.140)	(0.142)	(0.142)
real GDP per capita	-0.03**	-0.03**	-0.04**	-0.03	-0.03
	(0.015)	(0.015)	(0.016)	(0.018)	(0.018)
Net Interest Margin	0.25				
	(2.443)				
Overheads		0.80			
		(1.246)			
Return on Equity			0.30		
			(0.202)		
HHI				-0.13	-0.13
				(0.226)	(0.227)
EquityMktDevpt*HHI					-0.01
					(0.130)
Constant	-0.44	-0.46*	-0.42	-0.56*	-0.56*
	(0.271)	(0.263)	(0.264)	(0.288)	(0.289)
Observations	376	376	366	336	336
R-squared	0.228	0.228	0.235	0.155	0.155
Number of Countries	30	30	30	29	29

Note. — Regressions use fixed effects estimators. Standard errors in parentheses.$*$ $p < 0.1$, $**$ $p < 0.05$, $***$ $p < 0.01$.

Table 9. Explaining De-facto Integration: Low and Middle Income Countries, I

	1	2	3	4	5
De-Jure Openness	0.09**	0.08*	0.08**	0.07	0.06
	(0.041)	(0.042)	(0.036)	(0.050)	(0.046)
Interbank Mkt Volatility	-1.13**	-0.98**	-1.00**	-0.91*	-0.75
	(0.516)	(0.496)	(0.459)	(0.491)	(0.483)
Exchange Mkt Volatility	-0.76	-3.57*	-2.97*	-3.77**	-3.65**
	(1.976)	(1.930)	(1.696)	(1.923)	(1.810)
Exchange Mkt Spread	-0.05	-0.22	-0.05	-0.01	-0.16
	(0.443)	(0.467)	(0.370)	(0.459)	(0.404)
Bank Crisis Dummy	-0.14	-0.12	-0.08	-0.11	-0.08
	(0.137)	(0.148)	(0.155)	(0.165)	(0.152)
Crisis Dummy	-1.96***	-1.87***	-2.05***	-1.89***	-1.71***
	(0.525)	(0.572)	(0.565)	(0.586)	(0.527)
Trend	-0.01	-0.01	-0.01	-0.01	0.02
	(0.019)	(0.019)	(0.018)	(0.022)	(0.025)
Institutions	0.10*	0.13**	0.12**	0.16**	0.07
	(0.056)	(0.061)	(0.062)	(0.075)	(0.074)
Equity Mkt Development	0.09*	0.07	0.09*	0.05	0.48***
	(0.049)	(0.053)	(0.052)	(0.061)	(0.149)
Trade/GDP	-0.46***	-0.38***	-0.31**	-0.30**	-0.33***
	(0.116)	(0.117)	(0.122)	(0.132)	(0.126)
real GDP per capita	-0.02	-0.03*	-0.05***	-0.06***	-0.05***
	(0.014)	(0.016)	(0.013)	(0.011)	(0.013)
Net Interest Margin	-9.49***				
	(1.731)				
Overheads		-2.95*			
		(1.522)			
Return on Equity			-0.91**		
			(0.354)		
HHI				-0.67	-3.29***
				(0.622)	(1.223)
EquityMktDevpt*HHI					-4.20***
					(1.437)
Constant	1.42***	1.25***	1.20***	1.22**	0.58
	(0.422)	(0.438)	(0.398)	(0.485)	(0.514)
Observations	136	136	136	124	124
R-squared	0.549	0.509	0.523	0.522	0.551
Number of Countries	22	22	22	20	20

Note. — Regressions use Prais-Winston 2SLS procedure with panel specific AR(1) error processes. Standard errors in parentheses.$*$ $p < 0.1$, $**$ $p < 0.05$, $***$ $p < 0.01$.

Table 10. Explaining De-facto Integration: Low and Middle Income Countries, II

	1	2	3	4	5
De-Jure Openness	0.06	0.04	0.03	0.01	0.01
	(0.042)	(0.045)	(0.039)	(0.051)	(0.048)
Interbank Mkt Volatility	-1.27**	-1.13*	-1.20*	-0.95	-0.93
	(0.642)	(0.621)	(0.649)	(0.663)	(0.641)
Exchange Mkt Volatility	-0.65	-2.83	-2.07	-2.68	-2.75
	(2.125)	(1.946)	(1.779)	(1.902)	(1.743)
Exchange Mkt Spread	-0.33	-0.46	-0.19	-0.13	-0.12
	(0.376)	(0.367)	(0.293)	(0.359)	(0.341)
Bank Crisis Dummy	-0.14	-0.10	-0.03	-0.07	-0.02
	(0.150)	(0.166)	(0.161)	(0.173)	(0.156)
Crisis Dummy	-1.91***	-1.84***	-1.94***	-1.76***	-1.47***
	(0.556)	(0.587)	(0.572)	(0.583)	(0.531)
Trend	-0.03	-0.03	-0.03	-0.03	-0.00
	(0.024)	(0.025)	(0.023)	(0.027)	(0.027)
Institutions	0.16**	0.22***	0.19**	0.26***	0.13
	(0.074)	(0.079)	(0.087)	(0.082)	(0.094)
Equity Mkt Development	0.07	0.04	0.05	-0.02	0.50***
	(0.056)	(0.069)	(0.059)	(0.059)	(0.189)
Trade Growth	0.10	-0.23	-0.10	-0.28	0.05
	(0.522)	(0.579)	(0.531)	(0.576)	(0.564)
GDP per capita growth	0.01	0.03	0.04	0.05**	0.06**
	(0.022)	(0.025)	(0.026)	(0.027)	(0.027)
Trade/GDP	-0.52***	-0.43***	-0.39***	-0.35***	-0.35***
	(0.123)	(0.127)	(0.127)	(0.130)	(0.110)
real GDP per capita	-0.00	-0.03*	-0.03	-0.05***	-0.03*
	(0.014)	(0.015)	(0.019)	(0.017)	(0.018)
Net Interest Margin	-8.01***				
	(1.539)				
Overheads		-1.93			
		(1.711)			
Return on Equity			-1.07***		
			(0.413)		
HHI				-1.24*	-4.46***
				(0.665)	(1.470)
EquityMktDevpt*HHI					-5.26***
					(1.839)
Constant	1.75***	1.59***	1.53***	1.65***	0.81
	(0.500)	(0.525)	(0.471)	(0.559)	(0.581)
Observations	120	120	120	110	110
R-squared	0.569	0.547	0.559	0.567	0.593
Number of coden	22	22	22	20	20

Note. — Regressions use Prais-Winston 2SLS procedure with panel specific AR(1) error processes. Standard errors in parentheses.$*$ $p < 0.1$, $**$ $p < 0.05$, $***$ $p < 0.01$.

Figure 1 . Integration Index, by Income Group

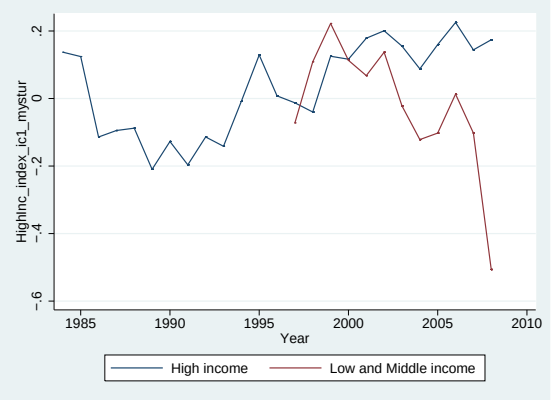

Figure 2 . Integration Index, by Income Group.
Excluding Malaysia, Thailand and Turkey.

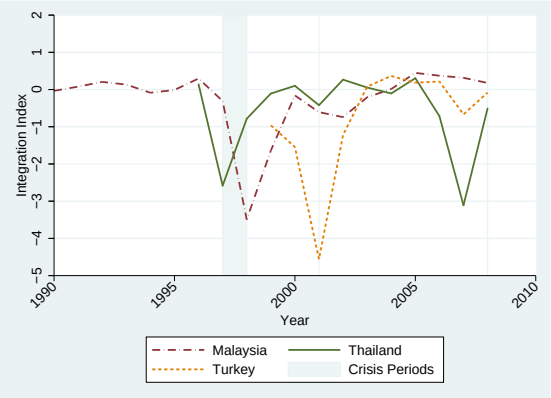

Figure 3 . Integration Index: Crisis Countries.

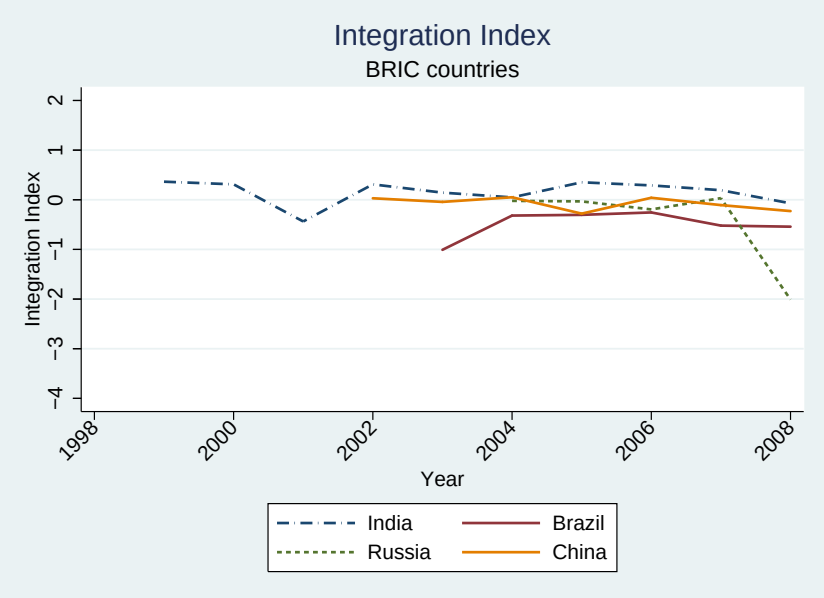

Figure 4 . Integration Index, BRICs.

Appendix

Table A.1 Trade/GDP Ratio and GDP per capita for Crisis and Non-Crisis Countries

	Countries with	
	No Crisis	≥ 1 **Crises**
Trade-GDP ratio		
Mean	0.90	0.97
Range	[0.19 - 4.14]	[0.32 - 4.57]
GDP per capita		
(Thousands of 2000 USD)		
Mean	13.09	20.19
Range	[0.44 - 40.72]	[0.93 - 42.43]

Crisis countries are those with at least one currency crisis in the sample (except the year 2008 which is considered a crisis year for all countries in the sample).

Table A.2 Heteroskedasticity and Serial Correlation Tests

Model with	All Countries	High Income	Low and Middle Income
LR Test for Heteroskedasticity			
χ^2- Statistics (p-values) for H0: Panel Heteroskedasticity			
Net Interest Margin	500.63	312.32	118.72
	(0.00)	(0.00)	(0.00)
Overheads	510.23	310.69	124.40
	(0.00)	(0.00)	(0.00)
Return on Equity	490.25	292.51	128.89
	(0.00)	(0.00)	(0.00)
HHI	512.04	287.91	119.93
	(0.00)	(0.00)	(0.00)
HHI*Equity Mkt Develpment	510.86	286.31	120.22
	(0.00)	(0.00)	(0.00)
Wooldridge (2002) Test for Autocorrelation in Panel Data			
F-Statistics (p-values) for H0: No first order autocorrelation			
Net Interest Margin	3.25	1.08	6.55
	(0.08)	(0.31)	(0.02)
Overheads	3.28	1.08	5.27
	(0.08)	(0.31)	(0.03)
Return on Equity	3.26	1.04	4.98
	(0.08)	(0.32)	(0.04)
HHI	1.75	0.10	4.67
	(0.19)	(0.76)	(0.04)
HHI*Equity Mkt Development	1.71	0.10	4.22
	(0.20)	(0.75)	(0.05)

Table A.3 Data Sources

Variable Name	Description & Source
HHI	Sum of squared shares of top 50 firms in industry assets. Individual firm data was collected from bankscope on all banks (commercial, savings, cooperative and islamic), bank holding companies and investment banks. Consolidated statements were used where available. Bankscope provides data on individual firms and to compute the share of each firm in industry assets, the firm level data was aggregated for each country-year observation. The coverage of bankscope data is uneven, due to which some filters were applied. First, wherever BIS data on industry assets was available (and larger than bankscope totals), the BIS data was used. Second, (country-year) observations where industry assets or number of banks available were less than the 1^{st} percentile of all observations were dropped. Third, observations for which there were extreme changes in number of banks or industry assets (outside the (1 99) percentile range) were dropped. For example, if the number of banks in the next year jumped by an extremely large value, the current year's observations were dropped, but if the next year's number of banks was unusually lower than the current year's then the next year's observations were dropped. The percentiles were defined for the whole sample (all country-year observations). Finally, the same extreme value and extreme changes filters were applied to the HHI. In cases where the resulting HHI series had gaps, the data was interpolated using linear interpolation. *Source*: BvDep's Bankscope database and Bank for International Settlements
Bank Crisis	Dummy Variable, 1 if the year is a banking crisis year. *Source*: Laeven and Valencia (2008)
Currency Crisis	Dummy Variable, 1 if the year has a crisis month. Crisis month identified as months where an index of currency market pressure (defined as a weighted average of exchange rate and reserve changes) exceeds the mean by 3 or more standard deviations, as in Kaminsky and Reinhart (1999). Data on exchange rates, inflation rates and reserve assets from IMF International Financial Statistics database.
De-jure Openness	Chinn Ito (2007) measure of de-jure openness, higher values indicate greater legal restrictions on flows of capital.
Exchange Mkt Spread	Yearly average of daily closing bid-ask spread on the spot exchange rate, as a percentage of the mean rate. *Source*: Thomson Financial's Datastream
Exchange Mkt Volatility	Average of the within-year coefficient of variation in 1 and 3 month forward exchange rates. *Source*: Bloomberg and Datastream

Table A2 (contd.) Data Sources

Variable Name	Description & Source
Equity Mkt Development	Equity market development index, constructed as first principal component of stock market capitalization and stock market value traded as % of GDP. Higher values indicate greater development. *Source*: Beck et. al. (2000)
Index	Integration index constructed using TAR models on CIP differentials. The index is centered at 0 and higher values indicate greater openness. The US is assumed to be the home country in the construction of CIP deviations. Differentials are based on onshore forward rates, except for Chile, where NDF rates were used. The daily data on onshore forward rates, spot rates and interbank interest rates on 1 and 3 month maturity loans are from Bloomberg, Datastream and Global Financial Database. Closing prices used in all calculations.
Institutions	Institutional variable, first principal component of ICRG Corruption and Political Risk variables. Data on the ICRG variables was available upto 2006 and interpolated for 2007 and 2008 using linear interpolation. *Source*: PRG International Country Risk Guide.
Interbank Mkt Volatility	Average of the within-year coefficient of variation in 1 and 3 month interbank interest rates. *Source*: Bloomberg, Global Financial Database and Datastream
Net Interest Margin.	Net Interest Margins in Banking. This variable equals the accounting value of banks' net interest revenue as a share of its total assets. *Source*: Beck et.al (2000)
Overheads	Accounting value of a country's banks' overhead costs as a share of their total assets. *Source*: Beck et. al. (2000)
real GDP per capita	Per capita GDP in thousands of 2000 USD. *Source*: World Bank's World Development Indicators.
Return on Equity (ROE)	Banks' return on equity. *Source*: Beck et.al. (2000)
Trade	Trade as % of GDP. *Source*: World Bank's World Development Indicators database