Does Trade Openness Affect Bank Risk-Taking Behavior? Evidence from BRICS Countries

Mohammed Mizanur Rahman [1] **, Munni Begum** [2] **, Badar Nadeem Ashraf** [3]
and Md. Abdul Kaium Masud [4,*]

[1] Department of Accounting & Information Systems, Comilla University, Cumilla 3506, Bangladesh; mizancu@yahoo.com
[2] School of Management, Huazhong University of Science and Technology, Wuhan 430074, China; munnirahman11@yahoo.com
[3] School of Finance, Jiangxi University of Finance and Economics, Nanchang 330000, China; badarfcma@gmail.com
[4] Department of Business Administration, Noakhali Science and Technology University, Noakhali 3814, Bangladesh
* Correspondence: masud@nstu.edu.bd; Tel.: +88-0171-8509-951

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Abstract: In this paper, we examine the impact of trade openness on bank risk-taking behavior employing a panel dataset of 899 banks from the BRICS (i.e., Brazil, Russia, India, China, and South Africa) countries over the period 2000–2017. We find that higher trade openness lowers bank risk-taking. Our results are robust when we use alternative proxies of trade openness and bank risk-taking, estimate country-wise regressions, or use alternative estimation methods such as system Generalized Methods of Moments (GMM), fixed effects, pooled Ordinary Least Square (OLS), and Vector Error Correction Model (VECM) models. We also observe higher trade openness decreases bank risk-taking in both the short and long run. Moreover, banks in more open countries perform relatively better during the crisis period further signifying the diversification benefits of openness. Together, our findings imply the beneficial impact of trade openness for financial sector stability.

1. Introduction

The large part of world trade is dependent on the availability of reliable and efficient sources of financing. This means that banks and other financial institutions play a vital role in facilitating trade-led growth and development. The results of the 2016 Trade Register provide the basis for strong advocacy for favorable treatment of Trade Finance as an asset class by the Basel Accords. Trade Register puts forward persuasive advocacy messages to the Basel Committee and to other regulatory bodies. Current developments in the area of capital adequacy and bank regulation suggest that the Basel Committee is looking to reconsider certain aspects of current capital regulation. If so, effective, fact-based, and data-supported advocacy around the characteristics of Trade Financing becomes urgent once again. To further augment the preliminary findings of the Trade Register, in this study, we aim to examine the impact of trade openness on bank stability for major emerging markets countries.

We build on the openness theory of financial development, which argues that the globalization of a country can impact its financial sector development. Specifically, the integration of a country in global goods (i.e., trade openness) and capital markets (i.e., financial openness) can promote its' financial development (Rajan and Zingales 2003). This theory argues that in underdeveloped countries, the established incumbent industrial and financial interest groups oppose financial development

because it breeds competition by easing the entry of new firms into the market and, thus, erodes the monopolistic rents of the incumbent groups. Trade and financial openness bring in foreign competition and reduce the power of incumbent groups who oppose financial development (Bui and Bui 2020). Openness to trade and capital flows not only limits the incumbents' ability to oppose financial development, but it also generates incentives for them to support and promote financial development.

A number of studies have examined the arguments of openness theory empirically (Baltagi et al. 2009; Hauner et al. 2013; Law 2009; Hossain et al. 2020) and largely support that higher trade and financial openness of developing countries is positively correlated with financial development. One drawback of all these studies is that they are at the macro-level and measure the financial development of a country with aggregate bank credit to the private sector to GDP ratio (i.e., bank credit to private sector/gross domestic product). What remains unclear in the macro-level analysis is the impact of trade openness on individual banks at the micro-level. Most important of this is how openness affects bank risk-taking behavior. A recently expanding strand of theories suggests that there is always an optimal level of private credit depending upon the economic situation of a country, and excessive lending, beyond the optimal level and accompanied with lower credit standards, just accumulates higher financial sector risks (Cecchetti and Kharroubi 2012; Ductor and Grechyna 2015). Consistently, recent empirical studies have shown that financial crises are more likely when private credit to GDP ratio is larger (Borio and Drehmann 2009; Jordà et al. 2013).

In this context, recent studies have examined the impact of financial openness on bank risk-taking behavior at the micro-level and find that higher financial openness increases bank risk-taking (Bourgain et al. 2012; Cubillas and González 2014). However, Hossain et al. (2020) examine the impact of trade openness on bank risk-taking of Bangladeshi banks and show there is a negative relationship between trade openness and bank risk-taking. More interesting, Bui and Bui (2019) find the relational directions of financial openness and bank risk-taking behave differently in developing and developed nations. These inconclusive and openness diversity lead us to raise the question again. To the best of our knowledge, none of the studies focus on the micro-level impact of trade openness on bank risk-taking behavior. In this paper, we fill this important research gap.

There are two mainstream literature strands on trade-openness and economic development nexus for developing countries (see, for example, Montalbano (2011) for a review of these literature strands). One strand of the literature suggests that higher trade-openness provides diversification opportunities, lowers prices for consumers, improves resource allocation, and leads to more efficient production and economic growth. On the contrary, critics argue about the destabilizing effects of trade-openness. This alternative viewpoint argues that higher trade openness increases the exposure of the domestic economy to international business cycles, particularly to economic conditions in partner countries. Since different countries may have different economic conditions, the higher trade-openness results in higher volatility in a wider set of outcome variables, such as aggregate consumption, income, prices, employment, and wages in a country. Following the same line of arguments, we hypothesize that trade openness may provide diversification opportunities to banks in the loans market and result in lower bank risk-taking. We also suggest an alternative hypothesis where higher trade openness may expose domestic bank borrowers to international, more volatile economic conditions, and, consequently, result in higher bank risk in the lending market.

For empirical analysis, we collected a sample of bank-level data from BRICS countries that have experienced significant trade openness over the period from 2000 to 2017. Previewing the main results, we find robust evidence that higher trade openness is negatively associated with bank risk-taking. We also observe that higher trade openness provides banks the diversification opportunities and helps them to moderate the adverse effects of a financial crisis.

This study contributes to the existing literature in at least three ways: First, we contribute to currently expanding literature that tries to explain the determinants of cross-country variation in bank risk-taking behavior. Extant literature has focused on banking industry structure (Boyd and De Nicolo 2005; Martinez-Miera and Repullo 2010), banking regulations (Ashraf et al. 2016a; Haq et al. 2014;

Haq and Heaney 2012; Rahman et al. 2015; Rahman et al. 2018), macroeconomic indicators such as GDP per capita, GDP growth, and inflation (Ali and Daly 2010; Bouvatier et al. 2014; Castro 2013; Chaibi and Ftiti 2015; Festić et al. 2011), level of financial development (Vithessonthi 2014), legal institutions (Cole and Turk 2013; Houston et al. 2010), financial openness (Bourgain et al. 2012; Cubillas and González 2014), national culture (Ashraf et al. 2016b), and political institution (Ashraf 2017a), as significant determinants of cross-country variation in bank risk-taking. We analyze the impact of trade openness on bank risk-taking behavior and add to this literature.

Second, this study contributes to the openness theory of financial development (Baltagi et al. 2009; Braun and Raddatz 2008; Hauner et al. 2013; Law 2009; Rajan and Zingales 2003). Rajan and Zingales (2003) initiated the theory that trade and financial openness can help in financial development by reducing the rents of incumbent industrial and financial interest groups. Later studies have examined the impact of openness on financial development at the macro-level (Baltagi et al. 2009; Hauner et al. 2013; Law 2009). We contribute to this debate by examining the impact of trade openness on bank risk-taking behavior at the micro-level.

Third, this study measures, for the first time, the trade openness with "*de facto*" (exports plus imports to GDP ratio) (Hossain et al. 2020) and "*de jure*" (decrease in average tariffs and country-specific trade freedom index) method. Hence, this study could become the bench of trade and economic openness research domain.

The rest of the study proceeds as follows. Section 2 presents the literature review and hypotheses development. Section 3 describes the data, variables, and research methods. Section 4 presents the empirical results. The final section concludes the study.

2. Literature Review and Hypotheses Development

Ashraf et al. (2017b) argue that trade openness can affect bank risk-taking both negatively and positively. Higher trade openness might decrease bank risk-taking by providing the diversification opportunities and improving the borrowers' selection (they name it 'diversification-stability effect'). For example, banks can diversify their investments between domestic and exporting firms. Borrowers, which are involved in international trade, spread their sales over multiple markets with different business cycles. Ample macro-level evidence is available that the sectors more integrated with international goods markets benefit from international diversification and are less affected by domestic financial conditions (Braun and Raddatz 2007; Wagner 2013; Luo et al. 2016). The flow of international finance could create a higher velocity of the money market. These speedy nature of the money flow aids banks to select the participating borrowers (Hossain et al. 2020; Bui and Bui 2020). Similarly, micro-level evidence suggests that the firms participating in international trade have higher productivity and survival chances than non-participating firms (see, for example, a literature survey by Wagner (2012)). Thus, these borrowers are less likely to default on bank loans decreasing the bank risk. Similarly, Hossain et al. (2020) study the Bangladeshi banking also witness as higher trade openness may increase the loan diversification opportunities between internationally trading firms and domestic firms. Several recent macro-level studies find that globally integrated industries assist in international diversification, which is less exposed to the local economic ailment. Moreover, these diversification opportunities aid banks and decrease the influence of the domestic financial crisis on bank risk (Ashraf et al. 2017b). As a result, trading borrowers become rarer defaulters of bank loans, which assist in reducing bank risk-taking behavior.

Trade openness is expected to reduce the cost of bank credit by fostering the reforms that liberalize the domestic financial sector, such as bank privatizations, deregulations, interest rate liberalization, or policies to develop capital markets (Hauner et al. 2013). Further banks would be able to pursue better collateral standards due to the higher demand for bank financing caused by trade openness, which would increase the bank lending power in regards to borrower selections.

Bui and Bui (2020) study the 42 emerging economies and argue as the domestic financial market becomes more open, trade and financial openness can help discipline the risk-taking behavior of banks,

and the consequence is making them more stable. Bui and Bui (2019) also support the concept of the 'diversification-stability effect' theory after analyzing the 21 advanced economies. They argue that the advanced economies are matured enough to know the open market operation compared to developing nations. The developed economies not only depend on the banks for external financial needs as their capital markets are strong enough to deliver the facility of borrower's external financial opportunities. These different alternative sources of financial opportunity could create a diverse path of investment regimes. If so, the banks enjoy the roaming to reduce the chance of adverse selections of borrowers. Hence, we write the following alternative hypothesis:

Hypothesis 1a (H1a). *Higher trade openness decreases bank risk-taking.*

On the contrary, trade openness might increase bank risk-taking due to higher competition and volatility (Ashraf et al. (2017b) name it 'volatility-fragility effect'). Since the liberalization reforms caused by the trade openness increase competition and decrease the cost of bank credit, the banks are likely to increase average loans to compensate for reduced rents. While in a competitive environment, the banks extend more loans by loosening the credit standards (Bushman et al. 2014) that result in more poor credit quality loans on bank balance sheets. Further, the tendency of these poor credit quality risks to materialize on bank balance sheets will be higher due to the higher uncertainty and income volatility (Newbery and Stiglitz 1984), the frequent domestic economic fluctuations (Arora and Vamvakidis 2005; Blankenau et al. 2001); the unnecessary flow of money supply in developing countries (Bui and Bui 2019) and the vulnerability of the domestic economy to international/external shocks (Loayza and Rancière 2006) in higher trade openness countries. Similarly, Trade openness increases product market competition by fetching in foreign more efficient industrial firms. The entry of foreign firms decreases the profits and cash holdings for domestic firms, on the one hand, and outside opportunities as well as the need to defend domestic markets against superior foreign technologies increase the need for domestic firms to invest more, on the other hand. If so, the banks might lose credibility in investment decisions due to the intense competition among foreign and domestic firms. This fierce competition among foreign and domestic firms creates a chance for the borrower to borrow from international sources, in addition to borrow loans from domestic banks. If all else is equal, the banks lose their power to select the right borrowers to lending money, and that assists in increasing bank risk-taking.

Likewise, Bui and Bui (2019) study the 37 emerging markets and 21 advanced economies and conclude with an interesting view: Developing economies suffer the 'competition-fragility' problem, and developed economies enjoy the 'competition-stability' opportunity in regards of higher trade and financial openness. That means emerging economies are facing the force of international competition, and that would make them volatile to control the bank risk management mechanism. Recently, Moudud-Ul-Huq (2020) examine the BRICS banking and find an increasing trend of competition reduces the bargaining power of bank lending that would aid in accumulate the higher amount of non-performing loan. Thus, we write an alternative hypothesis in the following form:

Hypothesis 1b (H1b). *Higher trade openness increases bank risk-taking.*

3. Data, Variables and Research Methods

The data that has been used in this study were collected from various sources; bank-level control variables data were collected from Bureau Van Dijk's BankFocus database version 2017 and made user-specified as required. In the case of trade openness proxies, data for Trade Exposed and Average Tariffs were collected from World Development Indicators (WDI) of World Bank, whereas data for Trade Freedom were compiled from Freedom House, 2017. Data for the banking industry-level determinants, marker concentration, were downloaded from Bureau Van Dijk's BankFocus database, and calculated as to formula, while data for Capital Stringency and Activity Restrictions were taken

from Barth et al. (2013). The governance variables Govt. Effectiveness, Political Stability, Regulatory Quality, Rule of Law, and Voice and Accountability were from the World Governance Indicators database of Kaufmann et al. (2011). Data for other country-level variables were amassed from World Development Indicators (WDI) of the World Bank. Finally, financial crisis data were taken from Fabian and Laeven (2013). Moreover, the details about the variables and data sources are presented in Table A1 (see in Appendix A).

3.1. Sample

The active bank accounting data from the financial statement for commercial, investment, savings, cooperative, foreign, and bank holdings companies in the five sample countries over the period 2000–2017 were collected from Bureau Van Dijk's BankFocus database. We considered only the active bank to avoid misleading information. The values for all bank-level variables were measured in a million US dollars and were computed at fiscal year-end.

Sample constructions were started by erasing the missing observation from financial data. Then, we also deleted the zero and negative values to calculate cost inefficiency with SFA (Stochastic Frontier Analysis). We needed this because of all the input and output variables required to convert in the natural logarithm form. Banks that had less than three years of valid data over the sample period were deleted.

Finally, we collected data on trade openness, other industry, and country-level control variables and combined allied bank-level annual data with industry and country-level annual data. After all, the final dataset was comprised of 6646 annual observations of 899 banks from five emerging economies (Brazil, Russia, India, China, and South Africa) over the period of 2000 to 2017.

3.2. Measurement of Bank Risk-Taking

Following recent literature (Laeven and Levine 2009; Ashraf 2017a; Ashraf et al. 2017a; Ashraf et al. 2017b; Ashraf et al. 2016b; Ashraf et al. 2017b; Bui and Bui 2019; Bui and Bui 2020), bank ZSCORE was used as the proxy of bank-risk taking behavior. ZSCORE = (ROA + CAR)/σ(ROA), where ROA and CAR are the annual return on average assets before loan loss provisions plus annual taxes, and shareholders' equity to total assets ratio, respectively. δ(ROA) is the standard deviation of the annual values of the return on assets before loan loss provisions and taxes calculated over a three-year rolling window starting from 2000 and ending in 2017 (i.e., 2000–2002, 2001–2003 and so on). The idea of ZSCORE goes back to Roy (1952), and it relates to the "safety first" principle: An economic agent with uncertainty will optimize expected profits by choosing a level of assets and liabilities to minimize the probability of insolvency (caused when the value of liabilities will higher than the value of assets). By what follows, ZSCORE represents the likelihood of bank default, as it measures the intensity of standard deviations or distance from the mean value by which the bank return has to fall to exhaust all owners' equity. Following the arguments of Lepetit and Strobel (2015), we take the log of ZSCORE because logged z-score defines insolvency risk on the domain of all real numbers and it is an attractive and straightforward bank insolvency risk measure to use as a dependent variable in standard regression analysis. Moreover, taking the log of ZSCORE helps to smooth the effect of extreme values. Finally, we multiply all values of ZSCORE by −1 to convert it in a similar direction, where a higher value of ZSCORE represents higher risk-taking and vice versa. More specifically, higher ZSCORE denotes the greater probability of default risk.

Following this (Altunbas et al. 2007; Hossain et al. 2020), we also employ credit risk (LLPTA) as another proxy of risk-taking; measured as the ratio of loan loss provision over total assets, where a higher ratio represents higher bank risk-taking in lending, and vice versa. Similarly, Ashraf (2017a) considered this as a bank-level control variable and found a positive association with ZSCORE (risk-taking) to justify the relevance as a proxy of risk-taking.

3.3. Measurement of Trade Openness

Three variables are employed as proxies of trade openness:

Trade Exposed is measured as the export plus import divided by GDP, where exports, imports, and GDP are all measured in annual current US dollars. Alternatively, it is expressed as the total trade as a percentage of GDP, where a higher ratio represents higher openness in trade, and vice versa. Among other proxies, Total trade to GDP is a well-defined and clear measurement of trade openness (Kim et al. 2010). Several recent studies have used 'export plus import as a percentage of GDP' to capture the trade openness (Chowdhury et al. 2016; Saadisedik 2006; Chen and Emile 2013; Balavac and Pugh 2016; Zhang et al. 2015; Ashraf et al. 2017b; Ashraf et al. 2017b; Hossain et al. 2020). Since trade openness helps to spread the export and import, we thus expect a negative relationship with bank risk-taking. For brevity, we refer to it as TRDEX throughout the rest of this paper.

Trade freedom index showed the extent of trade openness based on trade-weighted average tariff and non-tariff barriers. A higher index is associated with lower trade-weighted average tariff and non-tariff obstacles, and thus it would represent higher trade openness. Since trade freedom measures the extent of freedom in international trade among the countries, which might assist in diversifying the banking activities, essentially, we expect a negative relationship with bank risk-taking. For simplicity, we refer to it as TRFRDM throughout the rest of this paper.

Average Tariffs is measured as the simple mean of unweights average tariffs for all traded goods in a country. A higher value of average tariffs represents the lower trade openness. In other words, higher tariffs imposed on goods in a country signify the intense of trade lock of that country. We thus expect a positive relationship between average tariffs and bank risk-taking. For brevity, we refer to it as TARIFF for the rest of this study.

3.4. Bank-Level Control Variables

Bank-level control variables include Cost Inefficiency (CINEY), Bank Size (SCOPE), Implicit Income (NIITI), and Management Efficiency (MANEFF).

Cost Inefficiency scores are generated through Stochastic Frontier Analysis (SFA), version 4.1. The presence of inefficiency in the cost structure induces the cost of lending. Thus, higher cost inefficiency accelerates the banking systems' instability. Recently, Rahman et al. (2018) examine Bangladeshi banking and find a positive association between cost inefficiency and bank risk-taking behavior. The model and detail about the selection of dependent, input, and output variables are explained in 3.7 Model specifications.

Bank Size is considered as one of the most substantial elements in the risk-taking behavior of banks (Hossain et al. 2020). Several studies find that banks of large size are better at evaluating hard information loan applicants, and small banks are good at assessing soft information loan applicants. Since the previous literature does not contain any consensus about the relationship between bank size and risk, it thus becomes urgent again. For example, Roy (2008) argues big banks are enjoying capital roaming to spread their investment diversity that would aid in reducing the bank risk. However, Hossain et al. (2020) finds it to be positive as big banks are less concerned about the borrowers due to their abundance of equity capital.

Implicit income represents how much revenue is generated from other activities, except interest investment. Recently, banks have tended to become more market based rather than bank based. A higher ratio of implicit income indicates the banks are more expanded than general interest-based banking. The critic argues that since the banks operate more outbound activities than general banking, the banks might face the volatility in lending. However, we explain that when banks operate more outbound activities, they may enjoy the opportunity of investment diversity and borrower selections. As a result, banks might reduce risk-taking behavior. Similarly, Rahman et al. (2018) examine Bangladeshi banking and find a negative relationship between implicit income and bank risk-taking.

Management Efficiency represents the portion of earning assets over total assets. To maintain a higher amount of earning assets in the asset structure, the bank's trends increase the poor quality

lending, and thus it would assist in increasing bank risk-taking. On the contrary, a higher volume of earning assets could reduce the overall risk-weighted assets in the asset structure (i.e., lower bank risk-taking).

The predicted signs between bank risk-taking and bank-level control variables are as follows: Cost Inefficiency (+), Bank Size (+), Implicit Income (−), and Management Efficiency (+/−).

3.5. Bank Industry-Level Control Variables

Bank industry-level control variables include Market Concentration (HHI), Capital Stringency (CAPR), and Activity Restrictions (ACTR).

Hirschman–Herfindahl Index as a proxy of market concentration calculated as the sum of the square of the market share of each countries individual bank. Previous studies found the significant influence of market concentration on individual bank risk-taking behavior (Fiordelisi et al. 2011; Boyd and De Nicolo 2005; Martinez-Miera and Repullo 2010; Hossain et al. 2020). Furthermore, Chen et al. (2015) find the effect of market concentration on bank risk-taking is insignificant. Due to the inconclusive nature of previous literature, we include (HHI) as a proxy of market concentration in Equation (1). Since the market power allows the bank to engage in monopoly behavior, we expect a positive relationship with bank risk-taking.

To ensure the banking systems stability, regulatory authorities of concern countries imposed several regulatory restrictions (Basel I, II, III) on banking capital requirements and activities as well. As bank failures have negative externalities and can cost huge amounts of taxpayer funds, the importance of regulatory existence has been proved. Some scholars used the regulatory capital ratios as a proxy of capital requirements, such as Rahman et al. (2018), while some used Bank Regulation and Supervision Database from the World Bank, such as Ashraf et al. (2017b) and Chen et al. (2015), but their findings are controversial, like negative and positive relationships with bank risk-taking using 37 and 35 emerging economies, respectively. We thus include Capital Stringency (CAPR) in our model Equation (1) to reach a conclusion. The Capital Stringency Index measures whether minimum risk-based capital requirements are executed in banks in a country and whether these regulatory restrictions are in line with the guidelines of the Basel accords. The index ranges from 0 to 10, where a higher value indicates more stringent capital requirements for banks in a country.

The Activity Restrictions (ACTR) reflects the level of regulatory restrictiveness for bank participation in securities, insurance, real estate activities, and owning other firms. Several past studies tested the impact of this variable on bank risk-taking (Chen et al. 2015; Ashraf 2017a; Ashraf et al. 2016b) and found negative relationships with bank risk-taking, whereas Ashraf et al. (2017b) found it to be positive with bank risk-taking. These contested findings in previous literature influence us to include ACTR in Equation (1). Variables range from 4 to 16, with higher values indicating greater restrictiveness and vice versa. We expect a positive association with risk-taking.

3.6. Country-Level Control Variables

Country-level control variables include Govt. Effectiveness (GVTEFF), Political Stability (POLSTA), Regulatory Quality (REGQTY), Rule of Law (ROL), Voice and Accountability (VOC), GDP growth (GDP), Inflation (INF), Log of GDP Per Capita (GDPPER), Market Capitalization (MKTGDP), and Foreign Direct Investment (FDI). Among them, Govt. Effectiveness, Political Stability, Regulatory Quality, Rule of Law, and Voice and Accountability are considered the governance variables. The details regarding of measurement and data sources are explained in Table A1 (see in Appendix A). There is still a dearth of using governance variables to explain the bank risk-taking behavior. However, Ashraf (2017a) employed govt. effectiveness and political stability in their model and found a positive association with bank risk-taking. Meanwhile, most of the previous literature tested the impact of the rule of law on bank risk-taking (Ashraf et al. 2017b; Ashraf et al. 2017a; Ashraf et al. 2017b; Ashraf et al. 2016b; Chen et al. 2015) and found robust negative drivers of bank risk-taking. Thus, the partial implication of governance determinants on bank risk-taking in previous literature influences us to include the

other determinants in Equation (1), which might have a significant impact on bank risk-taking. So, we expect a higher index of governance variables can reduce the bank risk-taking behavior.

Since macroeconomic conditions play an important role to determine within, as well as across, country variation in bank risk-taking behavior (Rahman et al. 2018; Ashraf et al. 2017b; Ashraf 2017a; Cubillas and González 2014; Chen et al. 2015; Ali and Daly 2010; Bouvatier et al. 2014; Castro 2013; Festić et al. 2011; Bui and Bui 2020), we employ three variables, GDP growth (GDP), Inflation (INF), and GDP Per Capita (GDPPER) to control its effect. GDP growth calculated as each country's year-on-year GDP growth rate. Inflation is measured as an annual percentage change in consumer prices in a country. GDP Per Capita equals the natural logarithm of the annual GDP per capita (current US$) of each country. Reviewing the previous literature, we expect a positive impact on bank risk-taking.

Annual Market Capitalization (MKTGDP) represents the stock market capitalization of concern country. Vithessonthi (2014) argues that the level of stock market capitalizations is an alternative form of financial development and might have a substantial impact on bank risk-taking behavior. Alternatively, Market capitalization largely depends on trade openness, since higher trade openness is associated with higher informational efficiency of emerging stock markets (Lim and Kim 2011). For this reason, the effect of market capitalization on bank risk-taking deserves special attention. That is the reason that we include MKTGDP in Equation (1) to control its impact. The negative sign is expected.

Since this study focused on trade openness on bank risk-taking behavior, essentially, we check the international openness ratio of FDI inflows as a percentage of FDI outflows of the individual country in Equation (1) to control its effect. A higher ratio represents a higher FDI surplus, whereas a lower ratio represents the FDI deficit of concern country. Thus, we expect a negative association with bank risk-taking.

Finally, bank risk-taking behavior was largely affected during the 'bad times,' meaning in financial crisis periods (Ashraf 2017a; Ashraf et al. 2017b; Ashraf et al. 2017b; Chen et al. 2015), therefore we create two dummy variables, Financial Crisis (CRISISD) and Financial Crisis (CRISS) to include in all models. Specifically, CRISISD is used for baseline results, whereas CRISIS is used for crisis period analysis. Financial Crisis (CRISISD) measured as 1 for the period of crisis (2007–2009) and 0 otherwise. Furthermore, Financial Crisis (CRISS) equals 1 if a country is in the financial crisis in a year and 0 otherwise, with the dataset provided by (Fabian and Laeven 2013).

3.7. Model Specification

In this study, our main objective is to examine the impact of trade openness on bank risk-taking behavior; essentially, we specify the following linear baseline empirical model:

$$\text{Risk}_{ij,\,t} = C + \beta_1 \text{Trade Openness j}, t + \sum_{b=1}^{B} \beta_b Y_{it}^b + \sum_{i=1}^{I} \beta_i Y_{it}^i + \sum_{c=1}^{C} \beta_c Y_{it}^c + TD_t + \epsilon_{ijt} \qquad (1)$$

where i, j, and t subscripts stand for the bank, country, and year, respectively. Risk means bank risk-taking is a dependent variable proxied by ZSCORE and LLPTA. C_{is} a constant term. Y_{it} with superscripts *b*, *i* and *c*are the vectors of bank, industry, and country-level determinants, respectively, and ϵ_{ijt} is an i.i.d. random error. Bank specific heterogeneity is captured by the fixed effects intercept term C, and the time-specific variation is captured by a vector of time dummies TD. Detailed definitions and data sources of the variables are presented in Table A1 (see in Appendix A).

We use three alternative measures of trade openness as the main independent variable in alternative models as follows:

$$\text{Risk}_{ij,\,t} = C + \lambda TRDEXi, t + \sum_{b=1}^{B} \beta_b Y_{it}^b + \sum_{i=1}^{I} \beta_i Y_{it}^i + \sum_{c=1}^{C} \beta_c Y_{it}^c + TD_t + \epsilon_{ijt} \qquad (2)$$

TRDEX is the total trade (export plus import) as a percentage of the GDP of each country.

$$\text{Risk}_{ij,\,t} = C + \lambda TRFRDMi, t + \sum_{b=1}^{B} \beta_b Y_{it}^b + \sum_{i=1}^{I} \beta_i Y_{it}^i + \sum_{c=1}^{C} \beta_c Y_{it}^c + TD_t + \in_{ijt} \tag{3}$$

TRFRDM measures the extent of trade openness based on trade-weighted average tariff and non-tariff barriers.

$$\text{Risk}_{ij,\,t} = C + \lambda TARIFFi, t + \sum_{b=1}^{B} \beta_b Y_{it}^b + \sum_{i=1}^{I} \beta_i Y_{it}^i + \sum_{c=1}^{C} \beta_c Y_{it}^c + TD_t + \in_{ijt} \tag{4}$$

TARIFF is the simple mean of unweights average tariffs for all traded goods in a country.

Moreover, we perform the following Hausman and White tests for the econometric model.

We checked whether the effects of the individual determinants are fixed or random with relevant Hausman test. The null hypothesis is that the individual effects of the control variables are random in nature, and we reject the null hypothesis[1] for Equation (1) that supports the evidence in favor of a fixed effect modeling.

Next, we examined whether the bank level heterogeneity exists in the model with the relevant White test. The null hypothesis is that the individual effects are homogeneous in nature, and we reject the null hypothesis[2] for Equation (1) that justified the estimated regression with robust standard error and clustered at the individual bank level.

Since we test the effect of structural (Stochastic Frontier Analysis) calculation of production function (Cost Inefficiency) on bank risk-taking behavior of sample countries, we need to develop the following production function model:

$$\begin{aligned}
\ln TC_{it} = \quad & C + \sum_{n=1}^{3} \beta_n \ln P_{nit} + \sum_{k=1}^{3} \delta_k \ln Y_{kit} + \sum_{n=1}^{3} \sum_{m=1}^{3} \beta_{nm} \ln P_{nit} \ln P_{mit} \\
& + \sum_{k=1}^{3} \sum_{j=1}^{3} \delta_{kj} \ln Y_{kit} \ln Y_{jit} + \sum_{n=1}^{3} \sum_{k=1}^{3} \gamma_{nk} \ln P_{nit} \ln Y_{kit} + \in_{it}
\end{aligned} \tag{5}$$

Here, the dependent variable is the total cost (TC), which is defined as the sum of total interest, personal, and other operating expenses. In the specification of the inputs and outputs, we follow the intermediation approach and specify input prices (*p*) as the price of the fund (PF), the price of labor(PL), and the price of capital (PC)[3]. The outputs (*Y*) are defined as total loans (TN), other earning assets (OEA), and total assets (TA), also followed by (Rahman et al. 2017).

4. Empirical Analysis

4.1. Summary Statistics and Correlation Matrix

Summary statistics of the main variables are presented in Table 1 (Panel-B). Moreover, the summary statistics of individual sample countries are presented in Table 2. Regarding bank risk-taking, the overall mean of ZSCORE, is −3.5, with a standard deviation of 1.23. The mean of ZSCORE is largely comparable with previous literature such as those by Ashraf et al. (2017b) where the reported mean is −3.36 with S.D. of 1.05, Kanagaretnam et al. (2013) where the reported mean is −3.49 with S.D. of 1.08, and Ashraf (2017a) where the reported mean is −3.64 with S.D. of 1.09. In the case of an individual country, the lowest mean is in China is −4.16 and the highest is in Brazil −2.97, which implies that the

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[1]   Please go through main specified results, Section 4.2 and Table 3, Hausman test *p*-value is 0.00.
[2]   Please go through main specified results, Section 4.2 and Table 3, White test *p*-value is 0.00.
[3]   Price of fund = Interest expenses/total deposit, price of labor = personal expenses/total assets, price of capital = other operating expenses/total assets.

Chinese banks are more stable in terms of default risk in the BRICS region. Regarding another proxy of risk-taking, LLPTA, the mean is 0.01, where. the highest is in Brazil 0.02 and lowest is in China 0.003, which also shows Chinese banks are more stable in terms of credit risk in BRICS region. The similar findings of two proxies of bank risk-taking justify the use of an alternative measure. The mean of trade openness proxies TRDEX, TRFRDM, and TARIFF is 0.45, 0.64, and 10.90, with S.D. of 0.12, 0.11, and 3.85, respectively. Among the sample countries, South Africa is more trade opened and shows the highest TRDEX and TRFRDM of 0.62 and 0.76 respectively, whereas the lowest TARIFF is 7.06. Again, the similar findings of three proxies of trade openness rationalize the use of an alternative measure. In sum, Chinese banks are more stable than others, whereas South Africa is more open trade than others in the BRICS region. The overall mean cost inefficiency is 54%, which means substantial efficiency in the banks averaging to 46% of the total cost, suggesting that there is a large opportunity to reduce the bank cost by increasing the efficiency of up to 54% of the total cost. Among the sample countries, Chinese banking efficiency is the highest at 66%, while Brazil suffers from the lowest efficiency at 30%. Other variables also show substantial variant transversely mean values. By country, among the samples Brazil, Russia, India, China, and South Africa represent 22.23%, 43.76%, 15.84%, 13.24%, and 4.93%, respectively.

Table 1. Summary statistics and correlation matrix (total sample).

VARIABLES		1	2	3	4	5	6	7	8	9	10	11	12
Panel-A													
ZSCORE	(1)	1.00											
LLPTA	(2)	0.19	1.00										
TRDEX	(3)	−0.21	−0.13	1.00									
TRFRDM	(4)	−0.01	−0.08	0.04	1.00								
TARIFF	(5)	0.10	0.00	−0.53	−0.73	1.00							
CINEY	(6)	0.17	0.08	−0.32	0.01	0.12	1.00						
SCOPE	(7)	0.09	−0.06	−0.14	0.12	−0.12	0.05	1.00					
NIITI	(8)	−0.05	0.01	0.01	0.02	0.00	−0.02	−0.04	1.00				
MANEFF	(9)	−0.07	−0.06	−0.06	−0.09	0.10	0.06	0.06	0.01	1.00			
HHI	(10)	−0.02	−0.02	0.03	−0.03	0.01	−0.04	0.25	0.00	0.04	1.00		
CAPR	(11)	−0.02	0.00	0.29	−0.18	−0.05	0.07	−0.11	−0.01	0.03	−0.02	1.00	
ACTR	(12)	−0.22	−0.18	0.13	−0.21	−0.03	−0.20	0.42	0.00	0.11	0.04	−0.21	1.00
GVTEFF	(13)	−0.12	−0.02	−0.20	0.20	−0.09	−0.06	0.51	0.00	−0.01	0.06	−0.10	0.50
POLSTA	(14)	0.12	0.13	−0.58	0.41	0.00	0.11	0.16	−0.01	−0.03	0.03	−0.27	−0.12
REGQTY	(15)	0.09	0.09	−0.39	0.24	0.13	0.07	0.04	0.01	−0.04	0.06	−0.12	−0.16
ROL	(16)	−0.06	−0.01	−0.43	−0.09	0.29	0.10	0.49	0.00	0.05	0.05	0.04	0.35
VOC	(17)	0.11	0.09	−0.47	−0.21	0.48	0.29	0.02	0.00	0.08	0.03	0.32	−0.21
GDP	(18)	−0.22	−0.24	0.35	−0.23	−0.03	−0.29	−0.06	0.01	0.16	0.00	−0.07	0.51
INF	(19)	0.09	0.06	0.39	−0.16	−0.06	0.08	−0.45	−0.02	−0.04	−0.01	0.31	−0.44
GDPPER	(20)	0.14	0.13	−0.07	0.68	−0.47	0.02	−0.14	−0.01	−0.16	−0.06	−0.22	−0.59
MKTGDP	(21)	−0.10	0.00	0.24	0.17	−0.20	−0.13	0.18	0.01	−0.06	0.07	0.28	0.11
FDI	(22)	0.02	0.00	−0.23	−0.07	0.16	0.09	0.08	−0.01	0.09	0.00	0.08	0.01
Panel-B													
MEAN		−3.50	0.01	0.45	0.64	10.9	0.54	7.20	0.09	0.86	0.00	6.44	8.96
S.D.		1.23	0.02	0.12	0.11	3.85	0.28	2.80	1.83	0.09	0.01	1.48	2.11
MIN[4]		−10.7	−0.26	0.22	0.22	4.85	0.01	−1.90	−122	0.19	0.00	3.00	6.00
MAX		4.11	0.32	0.73	0.78	31.1	3.05	15.1	22.4	1.18	0.45	9.00	15.0
OBS		6646		6646		6646		6646		6646		6646	
VARIABLES		**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**		
Panel-A													
ZSCORE	(1)												
LLPTA	(2)												
TRDEX	(3)												
TRFRDM	(4)												
TARIFF	(5)												
CINEY	(6)												
SCOPE	(7)												
NIITI	(8)												

Table 1. *Cont.*

VARIABLES		13	14	15	16	17	18	19	20	21	22
MANEFF	(9)										
HHI	(10)										
CAPR	(11)										
ACTR	(12)										
GVTEFF	(13)	1.00									
POLSTA	(14)	0.51	1.00								
REGQTY	(15)	0.52	0.65	1.00							
ROL	(16)	0.69	0.39	0.45	1.00						
VOC	(17)	0.22	0.30	0.52	0.67	1.00					
GDP	(18)	−0.05	−0.35	−0.28	−0.15	−0.30	1.00				
INF	(19)	−0.56	−0.43	−0.21	−0.49	0.04	−0.15	1.00			
GDPPER	(20)	−0.21	0.37	0.14	−0.47	−0.38	−0.30	−0.03	1.00		
MKTGDP	(21)	0.56	0.27	0.51	0.49	0.37	−0.05	−0.20	−0.13	1.00	
FDI	(22)	0.07	0.07	0.04	0.13	0.12	−0.02	0.10	−0.13	−0.18	1.00
Panel-B											
MEAN		−0.16	−0.71	−0.19	−0.48	−0.40	5.48	7.71	8.60	60.15	2.58
S.D.		0.26	0.44	0.24	0.39	0.77	3.59	3.57	0.84	45.33	6.49
MIN		−0.55	−1.50	−0.53	−1.00	−1.69	−7.82	−0.77	6.10	17.58	−26.1
MAX		0.64	0.28	0.68	0.23	0.65	14.23	21.46	9.65	277	44.25
OBS		6646		6646		6646		6646		6646	

Note: The detailed explanations of the variables and data sources are presented in Table A1 (see in Appendix A).

Table 2. Summary statistics of variables (individual country whole sample period).

Variables	Brazil				Russia				India			
	Mean	Max	Min	S.D.	Mean	Max	Min	S.D.	Mean	Max	Min	S.D.
Dependent Variables												
ZSCORE	−2.97	2.33	−9.39	1.27	−3.39	4.11	−10.72	1.21	−3.88	0.82	−8.89	1.09
LLPTA	0.02	0.32	−0.21	0.04	0.01	0.21	−0.26	0.02	0.01	0.06	0.00	0.01
Main Variables												
TRDEX	0.26	0.30	0.22	0.02	0.53	0.61	0.48	0.03	0.46	0.56	0.26	0.08
TRFRDM	0.67	0.72	0.57	0.05	0.64	0.77	0.44	0.06	0.51	0.68	0.22	0.17
TARIFF	13.55	15.00	12.10	0.87	9.81	11.93	4.85	1.60	13.91	31.03	8.31	7.11
Bank-Level												
CINEY	0.70	3.05	0.06	0.33	0.52	1.38	0.02	0.23	0.59	1.69	0.01	0.24
SCOPE	7.21	13.11	2.09	2.17	5.58	13.23	−1.91	2.46	8.73	12.97	4.14	1.63
NIITI	0.08	22.43	−4.21	0.72	0.10	2.72	−122.2	2.72	0.09	0.44	−0.07	0.05
MANEFF	0.87	1.10	0.34	0.10	0.85	1.18	0.32	0.09	0.90	1.00	0.49	0.05
Industry-Level												
HHI	0.00	0.09	0.00	0.01	0.00	0.45	0.00	0.02	0.00	0.14	0.00	0.01
CAPR	5.78	8.00	4.00	1.42	6.64	8.00	5.00	0.98	7.83	9.00	6.00	1.11
ACTR	7.70	10.00	6.00	1.50	7.79	8.00	7.00	0.41	11.12	12.00	10.00	0.53
Country-Level												
GVTEFF	−0.08	0.19	−0.24	0.10	−0.39	−0.08	−0.55	0.09	−0.06	0.12	−0.20	0.10
POLSTA	−0.11	0.28	−0.38	0.21	−0.96	−0.74	−1.46	0.17	−1.17	−0.92	−1.52	0.15
REGQTY	0.08	0.33	−0.21	0.14	−0.32	−0.11	−0.52	0.09	−0.37	−0.24	−0.46	0.07
ROL	−0.23	0.00	−0.49	0.16	−0.88	−0.71	−1.00	0.08	0.00	0.19	−0.11	0.10
VOC	0.43	0.53	0.27	0.06	−0.86	−0.43	−1.07	0.14	0.40	0.45	0.31	0.03
GDP	2.76	7.53	−3.77	2.81	5.65	8.54	−7.82	3.81	7.29	10.26	3.80	1.87
INF	6.58	14.72	3.64	2.35	10.12	21.46	5.07	2.78	7.45	11.99	3.68	2.76
GDPPER	8.91	9.49	7.94	0.53	8.99	9.65	7.65	0.43	6.97	7.39	6.10	0.42
MKTGDP	49.53	98.04	24.95	19.68	42.42	62.38	18.70	8.84	73.12	151.45	45.96	24.94
FDI	5.33	44.25	−15.60	11.21	1.03	1.34	0.29	0.27	4.26	15.95	1.43	4.08
Obs. (Banks)	1318 (127)				3212 (530)				926 (82)			

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[4] The mean and minimum value of HHI is 0.00183 and 2.58×10^{-13}, respectively.

Table 2. *Cont.*

Variables	China				South Africa			
	Mean	**Max**	**Min**	**S.D.**	**Mean**	**Max**	**Min**	**S.D.**
Dependent Variables								
ZSCORE	−4.16	−0.38	−8.64	0.94	−3.86	−0.17	−6.34	1.02
LLPTA	0.00	0.03	−0.01	0.00	0.01	0.14	0.00	0.02
Main Variables								
TRDEX	0.47	0.66	0.40	0.05	0.62	0.73	0.53	0.05
TRFRDM	0.71	0.72	0.49	0.03	0.76	0.78	0.74	0.01
TARIFF	7.86	11.81	7.55	0.51	7.06	8.74	6.25	0.71
Bank-Level								
CINEY	0.34	0.86	0.03	0.16	0.36	1.05	0.04	0.19
SCOPE	10.32	15.05	3.46	2.00	8.18	12.21	3.44	2.71
NIITI	0.07	0.37	−0.15	0.06	0.19	0.47	0.02	0.09
MANEFF	0.86	1.00	0.69	0.06	0.81	0.98	0.19	0.16
Industry-Level								
HHI	0.00	0.09	0.00	0.01	0.01	0.08	0.00	0.01
CAPR	4.58	5.00	3.00	0.79	8.17	9.00	6.00	0.82
ACTR	12.66	15.00	12.00	1.20	8.12	10.00	7.00	1.39
Country-Level								
GVTEFF	0.17	0.42	−0.09	0.16	0.41	0.64	0.27	0.09
POLSTA	−0.55	−0.36	−0.66	0.05	−0.04	0.20	−0.18	0.10
REGQTY	−0.24	−0.13	−0.53	0.05	0.41	0.68	0.30	0.10
ROL	−0.39	−0.32	−0.55	0.07	0.11	0.23	0.03	0.05
VOC	−1.59	−1.46	−1.69	0.04	0.59	0.65	0.55	0.03
GDP	8.39	14.23	6.90	1.59	2.51	5.60	−1.54	1.79
INF	2.58	5.86	−0.77	1.54	6.04	11.54	3.40	2.00
GDPPER	8.68	9.00	7.05	0.39	8.79	8.99	8.60	0.12
MKTGDP	55.03	126.09	17.58	17.33	237.49	276.60	168.32	33.03
FDI	3.50	9.11	1.33	1.76	−3.94	7.17	−26.98	10.78
Obs. (Banks)	893 (129)				297 (31)			

Note: The detailed explanations of the variables and data sources are presented in Table A1 (see in Appendix A).

Moreover, Table 1 (Panel-A) represents the pairwise Pearson correlations between employed variables. The correlation between the bank risk-taking proxies is positive and not equal indicating that two proxies largely measure different aspects of bank risk. The correlation between bank risk-taking and trade openness variables primarily supports our regression findings, as TRDEX and TRFRDM are negatively associated with ZSCORE and LLPTA, whereas TARIFF is positively associated with ZSCORE and LLPTA. Likewise, the correlation between other variables being less than 0.80 proves that the issue of multicollinearity is not undermining our findings.[5]

4.2. Trade Openness and Bank Risk-Taking: Main Specification

To analyze the effect of trade openness on bank risk-taking, Equation (1) is estimated with fixed effect regression to address all proxies of bank, industry, and country-level variables that have been presented in Table 3. The dependent variable is ZSCORE in the model (1–3) and LLPTA in the model (3–6), where a higher value of two proxies represents greater risk-taking and vice versa. Trade openness is the main independent variable, captured by three proxies TRDEX, TRFRDM, and TARIFF, where a higher value of TRDEX and TRFRDM represents higher trade openness; furthermore, lower value of TARIFF represents higher trade openness, and vice versa. As expected, all proxies of trade openness result as negative and statistically significant with all proxies of bank risk-taking. These findings are consistent with the negative correlation observed in Table 1 (Panel-A) and suggest that higher trade openness has a substantial adverse effect on bank risk-taking in emerging economies and is complementary to the previous literature of (Ashraf et al. 2017b; Ashraf et al. 2017b; Hossain et al. 2020).

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[5] Gujarati (2007) and Kennedy (2003) indicate that multicollinearity is a serious problem if correlation coefficient between two independent variables is above 0.80, which is not the case here.

The negative correlation of TRDEX and TRFRDM with ZSCORE and LLPTA implies that higher trade openness could assist in reducing the bank default and credit risk, and similarly, positive association between TARIFF, ZSCORE, and LLPTA shows similar findings. As mentioned, the lower value of TARIFF represents higher trade openness. The above results confirm our initial hypothesis and produce supporting evidence in favor of the diversification stability effect of trade openness for bank risk-taking. We argue that trade openness can create diversified portfolio investment facilities for banks and would assist in reducing the probability of bank default and credit risk as well (Bui and Bui 2019).

Table 3. Main specification: Trade openness and bank risk-taking.

Variables	ZSCORE	ZSCORE	ZSCORE	LLPTA	LLPTA	LLPTA
	(1)	(2)	(3)	(4)	(5)	(6)
TRDEX	−1.798 ***			−0.930 **		
TRFRDM		−0.618 **			−0.285 *	
TARIFF			0.029 ***			0.033 **
Bank-Level						
CINEY	1.273 ***	1.480 ***	1.832 ***	0.024 ***	0.024 ***	0.025 ***
SCOPE	0.125 ***	0.128 ***	0.130 ***	0.017 **	0.019 **	0.015 **
NIITI	−0.025 ***	−0.025 ***	−0.025 ***	−0.002 *	−0.003 *	−0.003 *
MANEFF	0.392	0.352	0.354	0.002	0.003	0.002
Industry-Level						
HHI	4.692 **	4.623 **	4.658 **	0.039 *	0.032 *	0.035 *
CAPR	−0.043 **	−0.032 *	−0.046 ***	−0.003 **	−0.004 **	−0.006 **
ACTR	0.108 ***	0.095 ***	0.102 ***	0.004 *	0.003 **	0.002 **
Country-Level						
GVTEFF	−0.219	−0.068	−0.070	−0.006 *	−0.006 *	−0.006 *
POLSTA	−0.210 **	−0.245 **	−0.178 *	−0.001 *	−0.001 *	−0.001 *
REGQTY	−1.242 ***	−1.249 ***	−1.389 ***	−0.011 ***	−0.011 ***	−0.011 ***
ROL	−1.607 ***	−1.628 ***	−1.699 ***	−0.061 **	−0.065 **	−0.061 **
VOC	−0.271	−0.287	−0.176	−0.002	−0.002	−0.001
GDP	0.025 ***	0.017 **	0.022 ***	0.001 ***	0.001 ***	0.001 ***
INF	0.024 **	0.006	0.017 **	0.002	0.0003	0.0006
GDPPER	−0.361 ***	−0.316 ***	−0.297 ***	−0.003 *	−0.003 *	−0.002 **
MKTGDP	−0.002 **	−0.002 *	−0.001	−0.019 **	−0.016 **	−0.012 **
FDI	0.009 ***	0.010 ***	0.008 ***	0.004 **	0.005 **	0.006 **
CRISISD	0.295 ***	0.293 ***	0.303 ***	0.014 **	0.017 **	0.001 **
Constant	−2.794 ***	−3.368 ***	−4.642 ***	−0.027 **	−0.029 **	−0.025 **
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.505	0.502	0.508	0.361	0.364	0.371
F-statistics	11.45 ***	10.88 ***	11.36 ***	9.24 ***	9.89 ***	9.51 ***
Hausman Test	237.60 ***	240.50 ***	250.12 ***	38.19 ***	39.25 ***	38.69 ***
White Test	235.98 ***	269.96 ***	274.41 ***	65.45 ***	65.01 ***	64.76 ***
Observations	6646	6646	6646	6646	6646	6646
No of Banks	899	899	899	899	899	899

Note: Dependent variable is ZSCORE in models (1–3) and LLPTL in models (4–6), where higher values of ZSCORE and LLPTL represent higher bank risk-taking, and vice versa. The table represents the regression output from Fixed Effect estimation of trade openness and bank risk-taking behavior. Trade openness captured by the three proxies, such as Trade Exposed (TRDEX), Trade Freedom (TRFRDM), and Average Tariffs (TARIFF). Other bank-level, industry-level, and country-level variables are used as control variables. *p*-values are computed by the heteroskedastic-robust standard errors clustered at the bank level are reported in parenthesis. ***, **, * represent statistical significance at 1%, 5%, and 10% levels, respectively. F-statistics (*p*-value) is the test for the goodness of fit of the model, while Hausman test confirms the justification of using fixed-effect estimation and White heteroskedasticity test justify the use of robust standard error clustered at the bank level for the models. Detailed definitions of the variables and data sources are presented in Table A1 (see in Appendix A).

Econometrically speaking, in models 1 and 4, a one standard deviation change in Trade Openness (TRDEX) (0.12) is associated with a change in the ZSCORE of −0.216 (−1.798 × 0.12) and LLPTA of −0.112 (−0.930 × 0.12), where the mean value of ZSCORE and LLPTA is −3.50 and 0.01, respectively. These results suggest that the probability of default (ZSCORE) and credit (LLPTA) risk decrease by 6.17% and 11.2%, respectively, when trade openness (TRDEX) increases by one standard deviation.

Similarly, in models 2 and 5, a one standard deviation change in Trade Openness (TRFRDM) (0.11) is associated with a change in the ZSCORE of −0.068 (−0.618 × 0.11) and LLPTA of 0.031 (0.285 × 0.11), where the mean value of ZSCORE and LLPTA is 3.50 and 0.01, respectively. These results imply that the probability of default (ZSCORE) and credit (LLPTA) risk decrease by 1.94% and 3.10%, respectively, when trade openness (TRFRDM) increases by one standard deviation. Finally, in models 3 and 6, a one standard deviation change in Trade Openness (TARIFF) (3.85) is associated with a change in the ZSCORE of 0.112 (0.029 × 3.85) and LLPTA of 0.127 (0.033 × 3.85), where the mean value of ZSCORE and LLPTA is 3.50 and 0.01, respectively. These results indicate that the probability of default (ZSCORE) and credit (LLPTA) risk increase by 3.20%% and 12.70%, respectively, when trade openness (TRFRDM) increases by one standard deviation. Note that higher Average Tariff (TARIFF) represents lower trade openness, and therefore it would assist in increasing default (ZSCORE) and credit (LLPTA) risk. Overall, the above findings suggest that higher trade openness aid in reducing the probability of bank risk-taking. Specifically, bank credit risk (LLPTA) decreases more intensely than default risk (ZSCORE) in response to higher trade openness of emerging economies.

Findings of other bank-level control variables are also consistent with our expectations. As can be seen, Cost Inefficiency (CINEY) results as positive and statistically significant with bank risk-taking behavior, suggests that cost-efficient banks are more stable in terms of default and credit risk. This is consistent with the findings of (Fiordelisi et al. 2011) in 26 EU countries banking, but contrary with (Altunbas et al. 2007) in 15 EU countries banking. Bank Size (SCOPE) results as positive and highly significant with bank risk-taking, entailing that big banks tend to take more risk, (Cubillas and González 2014; Hossain et al. 2020) found across 83 countries worldwide including Bangladesh, however this is contrary to the findings of (Chen et al. 2015; García-Kuhnert et al. 2013; Ashraf et al. 2017b), whereas (Altunbas et al. 2007) find its irrelevance. Implicit Income (NIITI) shows negative and highly significant with bank risk-taking behavior, indicating that when banks are more market based rather than bank based, this might reduce the bank risk-taking (Cubillas and González 2014; Fiordelisi et al. 2011), however this is in opposition with (Ashraf 2017a; Ashraf et al. 2017b). Finally, Management Efficiency (MANEFF) results as positive but statistically insignificant with bank risk-taking in emerging economies.

Among the bank industry-level variables, Market Concentration (HHI) results as positive and statistically significant with bank risk-taking, showing that banks with greater market power take more risk because of a monopoly position. This result is consistent with recent studies (Ashraf 2017a; Hossain et al. 2020; Bui and Bui 2019), but contrary with (Fiordelisi et al. 2011), where most of the scholars find it to be trivial with bank risk (Ashraf et al. 2017b; Ashraf et al. 2016b; Ashraf et al. 2017b; Chen et al. 2015). Capital Stringency (CAPR) is negative and significant with bank risk, showing that rigorous risk-based capital regulation for the banking industry promotes safer individual banks. These findings are largely consistent with recent studies (Ashraf et al. 2017b; Ashraf 2017a; Ashraf et al. 2016b; Cubillas and González 2014; García-Kuhnert et al. 2013; Hossain et al. 2020), however contrary to the findings of (Chen et al. 2015). Lastly, Activity Restrictions (ACTR) is positive and significant with bank risk-taking, arguing that higher restrictions on the bank participation in securities, insurance, real estate activities, and owning other firms encourage banks to take more risk because that might create diversified investment facility (Ashraf et al. 2017b); however, this is in contrary to (Chen et al. 2015).

Next, among the country-level control variables, governance index, Govt. Effectiveness (GVTEFF), Political Stability (POLSTA), Regulatory Quality (REGQTY), Rule of Law (ROL), and Voice and Accountability (VOC) all result as negative with bank risk-taking. However, the impact is significant in the case of Political Stability (POLSTA), Regulatory Quality (REGQTY), and Rule of Law (ROL) (Bui and Bui 2019; Chen et al. 2015). The finding demonstrates the 'sand the wheel hypotheses' of corruption, rather than the 'grease the wheel effect'. These results stated that higher governance practices in a country promote banks to operate with higher stability. Moreover, higher govt. effectiveness with political stability, overall private-sector regulatory quality, existence of better contract enforcement,

and transparency create a favorable environment for the borrowers that would reduce the likelihood of default on loans (Chen et al. 2015; Ashraf et al. 2016b; Ashraf et al. 2017a; Ashraf et al. 2017b)[6]. Lecturing the macroeconomic variables, GDP Growth and Inflation is positively associated with bank risk, where inflation enters statistically insignificant (Cubillas and González 2014). The GDP finding shows that the boost up GDP growth creates spread of investment opportunity for banks (increase the interest-bearing assets compare to total assets) that would motivate banks to take the excessive risk (Ashraf et al. 2017a; Ashraf 2017a; Ashraf 2018; Chen et al. 2015), which is nonetheless contrary with (Lee and Hsieh 2013; Cubillas and González 2014). Log of GDP Per Capita (GDPPER) is negative and significant with bank risk-taking, implying that higher per capita income creates favorable economic conditions for the potential borrowers (Cubillas and González 2014), which is nevertheless dissimilar with (Ashraf et al. 2017b). Market Capitalization (MKTGDP) represents the condition of stock market development, where a higher ratio indicates a more developed stock market. As shown, there was a negative and significant association with bank risk, suggesting that bank risk-taking is lower when capital markets are more developed in a country. We argue that developing the capital market is an alternative source of debt for potential borrowers that might reduce the dependency on bank finance. If all is equal, in such a situation, the borrowers enjoy freedom in collecting capital, therefore could create an easy way of returning borrowed money to reduce the probability of default on loans (Cubillas and González 2014); however, this is in opposition to (Ashraf et al. 2017b). FDI surplus is positive and significant with bank risk-taking, suggesting that higher cross-border investment outflows as a percentage of inflows increase the velocity of capital and may create a puzzle environment for borrowers, and they are likely to default. This variable disproves our initial hypothesis.

Finally, The Financial Crisis (CRISISD) is positive with a significant coefficient, indicating that during the global financial crisis (GFC), bank default, as well as credit risk, was increased due to liquidity shortage (Ashraf et al. 2017b).

4.3. Robustness Check: Alternative Control Variables and Dropped Russia from the Whole Sample

We perform several robustness tests to confirm our main results further. Among them, in Table 4, models (1–3) represents the robust results of our main specified model of trade openness impact on bank risk-taking by employing Operating Cost Ratio (OPCR), Size of Operation (LNLOAN), and Market Concentration (CR3) as the substitute proxy of Cost Inefficiency (CINEY), Bank Size (SCOPE), and Hirschman–Herfindahl Index (HHI), respectively. Operating Cost Ratio is calculated as the annual value of operating expenses to total assets of each bank, Size of Operation is measured as the natural logarithm of total loans of each bank, and Market Concentration (CR3) is measured as the size of banks' assets in the three largest banks to total banking assets. Consistent with the main results, all models are estimated using Fixed Effect regression and are reported in Table 4, models (1–3).

However, as can be seen, using Operating Cost Ratio (OPCR), Size of Operation (LNLOAN), and Market Concentration (CR3) as an alternative measure of Cost Inefficiency (CINEY), Bank Size (SCOPE), and Market Concentration (HHI), we find neither changes in sign nor significant changes in coefficient values of the explanatory variables. Thus, the reported results in Table 4, models (1–3) confirm that the findings obtained for the main specified model, Equation (1) remain valid.

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6   All the authors use the Rule of Law as a proxy of governance practice.

Table 4. Robustness check: Alternate control variables and dropped Russia from the whole sample.

Variables	Alternate Control Variables			Dropped Russia		
	ZSCORE					
	(1)	(2)	(3)	(4)	(5)	(6)
TRDEX	−1.811 ***			−1.496 ***		
TRFRDM		−0.307 **			−0.224 *	
TARIFF			0.016 **			0.027 ***
Bank-Level						
OPCR/CINEY	0.770 **	0.767 **	0.751 **	0.572 **	0.468 *	0.111 *
LNLOAN/SCOPE	0.067 **	0.064 **	0.066 **	0.044 **	0.044 **	0.048 **
NIITI	−0.025 ***	−0.025 ***	−0.025 ***	−0.041 **	−0.041 **	−0.041 **
MANEFF	0.378	0.311	0.324	0.203	0.317	0.238
Industry-Level						
CR3/HHI	0.237 **	0.132 *	0.160 *	8.797 *	8.091 *	8.379 *
CAPR	−0.042 **	−0.034 **	−0.041 **	−0.036 **	−0.016 *	−0.036 **
ACTR	0.137 ***	0.124 ***	0.133 ***	0.119 ***	0.114 ***	0.117 ***
Country-Level						
GVTEFF	−0.037	−0.191	−0.228	−0.415 *	−0.265	−0.312
POLSTA	−0.177 *	−0.200 *	−0.161 **	−0.084 *	−0.151 **	−0.048 *
REGQTY	−1.145 ***	−1.139 ***	−1.194 ***	−0.366 **	−0.318 **	−0.425 **
ROL	−1.240 ***	−1.315 ***	−1.293 ***	−0.565 *	−0.580 *	−0.566 *
VOC	−0.532 **	−0.579 **	−0.560 **	−0.791	−0.836	−0.488
GDP	0.017 **	0.009 **	0.011 **	0.033 **	0.023 *	0.028 **
INF	0.026 **	0.005 *	0.011	0.001	0.022	0.004
GDPPER	−0.180 **	−0.183 **	−0.149 *	−0.033 *	−0.022 *	0.034 *
MKTGDP	−0.002 *	−0.001	−0.001 *	−0.002 **	−0.001 **	−0.001 *
FDI	0.009 ***	0.010 ***	0.009 ***	0.012 ***	0.013 ***	0.011 ***
CRISISD	0.219 ***	0.233 ***	0.225 ***	0.221 ***	0.179 **	0.205 ***
Constant	−3.669 ***	−3.770 ***	−4.657 ***	−4.147 ***	−4.356 ***	−5.855 ***
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.501	0.478	0.492	0.379	0.354	0.386
F-statistics	10.36 ***	9.60 ***	9.80 ***	4.60 ***	4.25 ***	4.63 ***
Observations	6646	6646	6646	3434	3434	3434
No. of Banks	899	899	899	369	369	369

Note: Dependent Variable is ZSCORE across all models, where higher values of ZSCORE represent higher bank risk-taking, vice versa. Operating Cost Ratio (OPCR), Size of Operation (LNLOAN), and Market Concentration (CR3) considered as the alternative proxy of Cost Inefficiency (CINEY), Bank Size (SCOPE) and Hirschman-Herfindahl Index (HHI) respectively for robustness test in models (1–3). The variables used in Models (4–6) are like the main specification but dropped Russia from the whole sample. All models are estimated using Fixed Effect regressions. Trade openness captured by the three proxies, such as Trade Exposed (TRDEX), Trade Freedom (TRFRDM) and Average Tariffs (TARIFF). Other bank-level, industry-level, and country-level variables are used as control variables. *P*-values are computed by the heteroskedastic-robust standard errors clustered at the bank level are presented in parenthesis. ***, **, * represent statistical significance at 1%, 5%, and 10% levels respectively. Detailed definitions of the variables and data sources are presented in Table A1 (see in Appendix A).

Furthermore, there could be a question that arises as the results may be biased due to large observations from Russia (43.76% of total observation). Thus, we re-estimate Equation (1) using fixed-effect regression with dropping Russia from the whole sample, and the results are reported in Table 4, model (4–6). However, estimating the separate regression after dropping Russia, we found no changes in signs and no significant changes in coefficient values of determinants, confirming our main results are unbiased due to the large sample from Russia.

4.4. Issue of Estimation Method

To confirm that our main results reported in Table 3 are unbiased due to the estimation method issue, we further re-estimate Equation (1) using a number of additional estimation technique, such

as pooled panel OLS, random effect, and dynamic panel system Generalized Methods of Moments (GMM)[7] estimation, and the results are reported in Table 5.

Table 5. Methodological issue.

	Pooled Panel OLS			Random Effect Estimation			Two-Step System GMM		
Variables	**ZSCORE**								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Zscore$_{(-1)}$							0.627 *** (0.000)	0.626 *** (0.000)	0.625 *** (0.000)
TRDEX	−2.352 *** (0.000)			−2.314 *** (0.000)			−0.137 * (0.078)		
TRFRDM		−1.961 *** (0.000)			−1.379 *** (0.000)			−0.033 * (0.093)	
TARIFF			0.038 *** (0.000)			0.038 *** (0.000)			0.029 * (0.076)
Bank-Level variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry-Level variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country-Level variables	yes	yes	yes	yes	yes	yes	yes	yes	Yes
Year Dummies	yes	yes	yes	yes	yes	yes	yes	yes	Yes
Constant	−2.957 *** (0.000)	−5.712 *** (0.000)	−6.150 *** (0.000)	−3.778 *** (0.000)	−5.519 *** (0.000)	−6.716 *** (0.000)	−7.364 *** (0.000)	−7.909 *** (0.000)	−7.923 *** (0.000)
R-squared	0.493	0.503	0.475	0.612	0.584	0.559	-	-	-
F-statistics (*p*-value)	34.76 (0.00)	35.11 (0.00)	33.71 (0.00)	-	-	-	-	-	-
Wald Chi^2 (*p*-value)	-	-	-	228.29 (0.00)	214.19 (0.00)	212.13 (0.00)	-	-	-
Sargan test (*p*-value)	-	-	-	-	-	-	0.37	0.29	0.33
AR(1) *p*-value	-	-	-	-	-	-	−10.98 (0.00)	−9.47 (0.00)	−10.05 (0.00)
AR(2) *p*-value	-	-	-	-	-	-	−0.68 (0.35)	−1.04 (0.23)	−0.86 (0.29)
Instruments	-	-	-	-	-	-	46	46	46
Observations	6646	6646	6646	6646	6646	6646	6646	6646	6646
No. of Banks	899	899	899	899	899	899	899	899	899

Note: Dependent Variable is ZSCORE across all models, where higher values of ZSCORE represent higher bank risk-taking, and vice versa. Models (1–3) estimated using Pooled Panel OLS regression, where models (4–6) estimated using Random Effect regression and models (7–9) assessed using Two-step System Generalized Methods of Moments (GMM) estimation. Trade openness captured by the three proxies, such as Trade Exposed (TRDEX), Trade Freedom (TRFRDM), and Average Tariffs (TARIFF). Other bank-level, industry-level, and country-level variables are used as control variables. *P*-values are computed by the heteroskedastic-robust standard errors clustered at the bank level are presented in parenthesis. ***, * represent statistical significance at 1%, 5%, and 10% levels, respectively. Detailed definitions of the variables and data sources are presented in Table A1 (see in Appendix A).

As shown, the finding that trade openness impact on bank risk-taking are qualitatively unchanged proves that the issue of estimation method does not undermine the results reported in Table 3. Moreover, the consistent results using pooled OLS, random effect, and system GMM estimation proved that our estimated model is fit in any circumstances, and the findings derived from estimated Equation (1) can be generalized to other emerging countries with similar economic conditions.

4.5. Endogeneity Test: Instrumental Variable (IV) Approach

Next, we turn to the endogeneity test; it is a research problem that arises from the reverse causality between trade openness and bank risk-taking. Even though previous literature has no evidence

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[7]   To estimate the system GMM, we execute the xtbond2 command developed by (Arellano and Bover 1995), suggesting employs a system of first-differenced and level equations, where lags of levels and lags of the first differences are employed as instruments. We use finite-sample correction Windmeijer (2005) to report standard errors of the two-step estimation. Moreover, we employ instrument collapse option to eliminate the problem of instruments proliferation.

regarding reverse causality between them, we hypothesized that there is an endogenous relationship between trade openness and bank risk-taking. To address this possibility, we follow the Instrumental variable approach for the main specification Table 3 and re-estimated Equation (1) using polled panel OLS, and the results are reported in Table 6, recently used by (Bourgain et al. 2012; Ashraf 2017a). Addressing the arguments of Baum et al. (2003), an instrument must satisfy the relevance and homogeneity conditions[8]; we use FDI Inflows (FDI/GDP) as an instrument for Trade Openness (TRDEX, TRFRDM, and TARIFF).

Table 6. Instrumental variable approach: (IV) Endogeneity test.

Variables	TRDEX (First Stage)	ZSCORE (Second Stage)	TRFRDM (First Stage)	ZSCORE (Second Stage)	TARIFF (First Stage)	ZSCORE (Second Stage)
	(1)	(2)	(3)	(4)	(5)	(6)
TRDEX		−2.352 ***				
TRFRDM				−1.961 ***		
TARIFF						0.038 ***
FDI/GDP	0.007 ***		0.009 ***		−0.065 *	
Bank-Level						
CINEY	−0.012 ***	0.305 ***	−0.005 *	0.332 ***	0.353 ***	0.354 ***
SCOPE	0.001 ***	0.006	0.001	0.005	−0.096 ***	0.008
NIITI	0.000	−0.030 ***	0.002 ***	−0.027 ***	−0.040 **	−0.030 ***
MANEFF	0.003	0.892 ***	0.044 ***	0.811 ***	−0.415	0.884 ***
Industry-Level						
HHI	0.068 *	0.584 *	0.018	0.966 *	−1.797	0.902 *
CAPR	0.014 ***	−0.016 **	−0.002 ***	−0.057 ***	−0.415 ***	−0.037 **
ACTR	0.005 ***	0.033	0.037 ***	0.094 ***	−1.491 ***	0.074 ***
Country-Level						
GVTEFF	0.033 ***	−0.313 *	0.138 ***	−0.127	−6.078 ***	−0.021
POLSTA	0.068 ***	−0.004	0.048 ***	−0.036	−0.972 ***	−0.115
REGQTY	0.019 ***	−0.116	−0.050 ***	−0.054	5.578 ***	−0.158
ROL	−0.006	−0.639 ***	−0.087 ***	−0.889 ***	3.672 ***	−0.777 ***
VOC	0.099 ***	−0.177 **	0.087 ***	−0.612 ***	−1.541 ***	−0.464 ***
GDP	0.004 ***	0.037 ***	0.001 *	0.052 ***	−0.043 ***	0.046 ***
INF	0.015 ***	0.024 **	0.005 ***	0.002	−0.500 ***	0.008
GDPPER	−0.009 ***	−0.062	0.183 ***	−0.427 ***	−5.544 ***	−0.278 ***
MKTGDP	0.002 ***	−0.001	0.000 ***	−0.001 **	−0.031 ***	−0.001
FDI	0.002 ***	0.002	0.001 ***	0.006 **	0.033 ***	0.004
CRISISD	−0.038 ***	0.174 ***	−0.061 ***	0.109 **	1.976 ***	0.183 ***
Constant	0.062 ***	−2.957 ***	1.338 ***	−5.712 ***	3.377 ***	−6.150 ***
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.877	0.493	0.724	0.503	0.755	0.475
F-statistics	104.33	34.76	89.12	35.11	94.89	33.71
(*P*-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	6646	6646	6646	6646	6646	6646

Note: Dependent variable is ZSCORE in models (2, 4, and 6). TRDEX, TRFRDM, and TARIFF are the dependent variables in models (1, 3, and 5), respectively. The table represents the regression output from the Pooled Panel OLS estimation. Trade openness captured by the three proxies, such as Trade Exposed (TRDEX), Trade Freedom (TRFRDM), and Average Tariffs (TARIFF). FDI Inflows (FDI/GDP) consider as the instrumental variable of trade openness. Other bank-level, industry-level, and country-level variables are used as control variables. *p*-values are computed by the heteroskedastic-robust standard errors clustered at the bank level are reported in parenthesis. ***, **, * represent statistical significance at 1%, 5%, and 10% levels, respectively. F-statistics (*p*-value) is the test for the goodness of fit of the model. Detailed definitions of the variables and data sources are presented in Table A1 (see in Appendix A).

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8   To measure the relevance of the instrument, we depend on the Kleibergen–Paap under-identification test and the Stock–Yogo weak identification test. The relevant Lm test for the Kleibergen–Paap under-identification delivers a zero *p*-value suggesting that the model is identified and the FDI Inflows (FDI/GDP) of any economy is an appropriate external instrument for Trade Openness (TRDEX, TRFRDM, and TARIFF). Similarly, Stock–Yogo weak identification test is executed to test that FDI Inflows (FDI/GDP) is not a weakinstrument for Trade Openness (TRDEX, TRFRDM, and TARIFF). Relevant F-test of the excluded exogenous variable is accomplished in the first-stage regression for examining the null hypothesis that the FDI Inflows (FDI/GDP) does not explain differences in Trade Openness (TRDEX, TRFRDM, and TARIFF). The null hypothesis is rejected at the 1% level advising that FDI Inflows (FDI/GDP) is not weakly correlated with the endogenous variables, Trade Openness (TRDEX, TRFRDM, and TARIFF). The results of these tests both prove that the instrument is relevant and satisfy the exogeneity conditions as well. Since we consider one endogenous plus one instrumental variable, the regression is exactly identified and thus the relevant over-identification test to check the exogeneity of the instrument is invalid here.

Using first-hand logic, more FDI Inflows of a particular economy represents more international openness in the form of trade and finance of that economy (Larrain and Tavares 2008), as FDI Inflows largely signifies the foreign investment adoption capacity of an economy and it represents the investment openness rather trade and finance, which is second-hand logic. However, first-hand logic is straightforward. Since the ultimate goal of foreign investment is to strengthen the trade relationship with the target economy, that might assist in increasing the cross-border trade between the countries. In particular, higher FDI inflows contribute to increasing the export and import as a percentage of GDP, Trade Exposed (TRDEX), and apparently, it would help to reduce the trade-weighted average tariff and non-tariff barriers, Trade Freedom (TRFRDM). Also, higher FDI inflows may have a noteworthy negative relation with Average Tariffs (TARIFF) to generate a more open relationship in the form of trade.

Consistent with the above arguments, FDI Inflows (FDI/GDP) variable result as positive and significant with Trade Openness (TRDEX and TRFRDM), and negative and significant with (TARIFF) in first stage regression, in models 1, 3, and 5 of Table 5. On the other hand, the Trade Openness (TRDEX and TRFRDM) results as positive and significant with bank risk-taking (ZSCORE), while the trade openness proxy (TARIFF) results as negative and significant with bank risk-taking (ZSCORE) in second-stage regression, in models 2, 4, and 6 of Table 5. These findings confirm that the endogeneity is less of a concern in the main specification.

4.6. Trade Openness and Bank Risk-Taking: Check with VECM (Vector Error Correction Model) Estimation

To identify the cointegrated long and short-run association between trade openness and bank risk-taking, we perform VECM analysis, and the Johansen co-integration test presents in Table 7. The VECM estimation results are reported in Table 8. The VECM analysis consists of four sequential structural processes (Zheng et al. 2017); stationarity test, lags level criteria, Johansen co-integration test, and the VECM analysis.

First, time-series stationarity is the statistical feature of a series, such as its mean and variance over time. If both are constant over time, then the series is said to be a stationary process (i.e., is not a random walk/has no unit root); otherwise, the series is termed as being a non-stationary process (i.e., a random walk/has unit root). We have checked our employed variables with ADF (augmented dickey fuller test-fisher type), and none were selected as an option to be included in the test equation. We find our variables are non-stationary at the level and stationary after first differencing. Thus, the variables are stationary and integrated of the same order, i.e., I (1).

Second, Lags level criteria direct us to select four-period lags for conducting the Johansen co-integration test.

Third, in this stage, we run the Johansen co-integration test and find the co-integration between trade openness and bank risk-taking behavior; results are reported in Table 7. Since the lag level at most 1–3 becomes insignificant at 5% level, we have no restrictions to run the VECM estimation.

Table 7. Johansen co-integration test regarding trade openness and banks' risk-taking (trace and maximum eigen value).

Hypothesized No. of CE(s)	Fisher Stat. (From Trace Test)	Prob.	Fisher Stat. (From Max-Eigen Test)	Prob.
None	561.00	0.0000	561.00	0.0000
At most 1	141.59	0.0439	111.27	0.0784
At most 2	71.2	0.2248	71.2	0.2248
At most 3	93.7	0.1254	82.5	0.1729

Fourth, the estimated model is a four-variable model, which hypothesizes the bank's risk-taking (LLPTA) as a function of trade openness (TRDEX, TRFRDM, andTARIFF).

$$LLPTA_t = f\ (TRDEX_t, TRFRDM_t,\ TARIFF_t) \qquad (6)$$

The existence of cointegration between trade openness and bank risk-taking tells us that there is a long-run relationship under consideration. Now, we run the VECM estimation. The long-term as well as the short-term association between trade openness and bank risk-taking of the cointegrating vector for the BRICS economies in the period 2000–2015 are estimated by the following model.

VECM model for the openness of trade and bank risk-taking

$$
\begin{aligned}
D(LLPTA) = C(1)*(LLPTA(-1) + 21.6272439654*TROPEN(-1) + \\
29.9124639224*TRFRDM(-1) + 1.29324005226*TARIFFS(-1) - \\
43.0302515049) + C(2)*D(LLPTA(-1)) + C(3)*D(LLPTA(-2)) + \\
C(4)*D(TROPEN(-1)) + C(5)*D(TROPEN(-2)) + C(6)*D(TRFRDM(-1)) \\
+ C(7)*D(TRFRDM(-2)) + C(8)*D(TARIFFS(-1)) + \\
C(9)*D(TARIFFS(-2)) + C(10)
\end{aligned}
\tag{7}
$$

Table 8. Vector Error Correction Model (VECM) analysis of trade openness and banks' risk-taking.

Regressors	LLPTA
C(1), (Cointegrated equation)	−0.00055 *** (−2.66)
C(2), LLPTA$_{(-1)}$	−0.41777 *** (−21.99)
C(3), LLPTA$_{(-2)}$	−0.2959 *** (−15.41)
C(4), TRDEX$_{(-1)}$	0.046542 *** (3.47)
C(5), TRDEX$_{(-2)}$	−0.00151 (−0.13)
C(6), TRFRDM$_{(-1)}$	−0.02742 *** (−3.64)
C(7), TRFRDM$_{(-2)}$	−0.00847 (−1.11)
C(8), TARIFF$_{(-1)}$	0.000204 (0.73)
C(9), TARIFF$_{(-2)}$	0.000446 * (1.73)
C(10), Constant	0.001989 *** (4.07)
Wald test, TRDEX (*p*-value)	12.32 (0.00)
Wald test, TRFRDM (*p*-value)	13.31 (0.00)
Wald test, TARIFF (*p*-value)	3.03 (0.22)
F-statistics (*p*-value)	65.79 (0.00)

Note: Dependent variable is (LLPTA), where a higher value of LLPTA represents higher bank risk-taking, and vice versa. The analysis method is the VECM estimation. The numbers in parentheses are *t*-statistics. ***, and * indicate significance at the 1% and 10% levels, respectively.

As shown in Table 8, C (1) regressor is the co-integrated variable that enters negative, and 1% level of significance tells us that there is a long-term relationship that exists between trade openness and bank risk-taking behavior (Pesaran et al. 2000). Moreover, we have performed the Wald test to find out the joint lag short-term relationship between bank risk-taking (LLPTA) and trade openness (TRDEX, TRFRDM, and TARIFF). We reject the null hypothesis of C(4) = C(5) = 0 and C(6) = C(7) = 0 that indicates that there is a short-term association we can derive from (TRDEX) and (TRFRDM) with (LLPTA). However, we accept the null hypothesis in the case of the relationship between (LLPTA) and (TARIFF) showing that C(8) = C(9) = 0, where there is no short-term association between them. Finally, the F-statistics coefficient and *p*-value confirm the goodness of fit of the VECM estimation. In sum, the results derived from the VECM estimation support our GMM estimation of Arellano–Bond order 1 (2) are tested for first (second)-order correlation, reported in Table 5 models (7, 8, and 9).

4.7. Trade Openness and Bank Risk-Taking: Crisis Period Analysis

The above findings proved to us there is a substantial negative relationship between trade openness and bank risk-taking, arguing that higher trade openness can create more diversified investment opportunities of banks, and borrowers also enjoy the different portfolio investment facilities. Thus, it would create a strong win–win bonding between lenders and borrowers. The result is lower bank risk-taking. However, there is a challenge with our above analysis that the impact of trade openness on bank risk by providing diversification opportunities may not be equal in 'good' and 'bad' times. Though it is a difficult task, the incidence of the financial crisis in different economies led us to analyze the sensitive issue in more detail. Ashraf et al. (2017b) pointed out that, during the adverse shock period (bad times), for the financial sector, especially banks, risks materialize, the intensity of credit risk increases, and, consequently, the probability of bank defaults increases. Consistent with our findings,

if trade openness delivers diversification facilities, principally, we should expect that higher trade openness will restrain the effects of the domestic financial crisis.

To test it empirically, we use Financial Crisis (CRISIS) in the analysis, calculated as 1 if a country is in the financial crisis in a year and 0 otherwise (Fabian and Laeven 2013). Moreover, we have generated some interact variables, such as Trade Openness (i.e., Trade Exposed*Crisis, Trade Freedom*Crisis, and Average Tariffs*Crisis) with Financial Crisis variable. For simplicity, we convert all three proxies of Trade Openness into a dummy variable like Trade Exposed Dummy, Trade Freedom Dummy, and Average Tariffs Dummy. We set the Trade Openness dummy variable as equal to 1 if the value of Trade Exposed (TRDEX) and Trade Freedom (TRFRDM) is above its sample median and 0 otherwise. However, in the case of Average Tariffs (TARIFF), we take it as equal to 1 if the value of (TARIFF) is below its sample median and 0 otherwise, as the lower value of average tariffs represents the higher trade openness. Thus, the Trade Openness Dummy variable epitomizes the countries that are more open to trade. The interaction of Trade Openness (i.e., Trade Exposed*Crisis, Trade Freedom*Crisis, and Average Tariffs*Crisis) with the Financial Crisis variable represents the countries that have above (below for Average Tariffs) sample median trade openness and are in financial crisis.

Meanwhile, the main findings of this study reported in Table 3, Section 4.2, indicate that bank risk is lower in more trade-open countries. We thus expect a negative relationship between all three proxies of Trade Openness Dummy and bank risk-taking. As shown in Table 3, the Financial crisis (CRISISD) results as positive with bank risk in the recent global financial crisis period 2007–2009; we also expect a positive relation between new Financial Crisis (CRISIS) and bank risk, implying that bank risk was higher during the crisis period. If all is equal, trade openness can create more diversified investment opportunity of banks, and borrowers also enjoy the different portfolio investment facility. In that situation, higher trade openness will restrain the effect of the domestic financial crisis on banks, and hence we expect a negative coefficient on all three interacting variables of Trade Openness Dummy* Financial Crisis.

The reported results in Table 9 prove our expectations. As can be seen, all three proxies of Trade Openness Dummy (i.e., Trade Exposed Dummy, Trade Freedom Dummy, and Average Tariffs Dummy) result as negative and significant at the 5% level with bank risk-taking, models 1, 4, and 7. Similarly, the Financial Crisis (CRISIS) is positive, and significant at the 1% level with bank risk-taking models 2, 5, and 8. Finally, the interaction term, Trade Exposed* Crisis, Trade Freedom*Crisis, and Average Tariffs*Crisis result as negative and significant at the 1% level with bank risk-taking models 3, 6, and 9. These findings suggest that as more trade opened, the economy undergoes lower-income volatility; as a consequence, the probability of default is also lower in the crisis period.

4.8. Trade Openness and Bank Risk-Taking: Country-Wise Estimation

In this part, we re-estimate Equation (1) to reveal the country-wise variation of our employed variables using fixed-effect regression, and the results are reported in Table 10. Since our fixed effect estimation model does not determine the country-specific variation (if any) by employing country dummies in the regression equation, we have to specify the country-wise variation with separate regression. As shown in Table 10, Trade Exposed (TRDEX) is negative and significant with bank risk in all sample countries, models(1, 4, 7, 10, and 13. Similarly, Trade Freedom (TRFRDM) is also negative and significant with bank risk in all sample countries, models 2, 5, 8, 11, and 14. Finally, Average Tariffs (TARIFF) is positive and significant with bank risk in all sample countries, except Brazil is positive but insignificant, models 3, 6, 9, 12, and 15. Other bank-level, industry-level, and country-level variables are used as control variables. These above findings justify our main findings that higher trade openness has a substantial negative relationship with bank risk-taking in BRICS region banking as a whole and the individual country as well. We have performed several robustness tests to prove it. Finally, the findings of this study could generalize other emerging economies in similar economic conditions. Overall, the results of this study generate clear directions for policymaking, citation for future research, and assurances for bank management itself.

Table 9. Crisis period analysis: Trade openness and bank risk-taking (Pooled Panel OLS Regression).

Variables	ZSCORE								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Trade Exposed Dummy	−0.265 ***		−0.127 **						
	(0.000)		(0.045)						
CRISIS		0.814 ***	0.771 ***						
		(0.000)	(0.000)						
Trade Exposed*Crisis			−0.319 ***						
			(0.000)						
Trade Freedom Dummy				−0.167 **		−0.293 ***			
				(0.010)		(0.000)			
CRISIS					0.816 ***	0.867 ***			
					(0.000)	(0.000)			
Trade Freedom*Crisis						−0.531 ***			
						(0.000)			
Average Tariffs Dummy							−0.063 **		−0.496 ***
							(0.034)		(0.000)
CRISIS								0.813 ***	1.066 ***
								(0.000)	(0.000)
Average Tariffs*Crisis									−0.449 ***
									(0.000)
Bank-Level variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry-Level variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country-Level variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	−4.562 ***	−3.404 ***	−2.654 ***	−5.380 ***	−3.404 ***	−3.313 ***	−4.080 ***	−3.404 ***	−4.276 ***
R-squared	0.442	0.437	0.468	0.498	0.502	0.527	0.412	0.479	0.507
Observations	6646	6646	6646	6646	6646	6646	6646	6646	6646

Note: The reported results in this table are the impact of trade openness on bank risk-taking behavior during a global financial crisis (GFC) period. Dependent Variable is ZSCORE across all models, where higher values of ZSCORE represent higher bank risk-taking, vice versa. Trade Exposed Dummy, Financial Crisis Dummy (CRISIS), Trade Exposed*Crisis, Trade Freedom Dummy, Financial Crisis Dummy (CRISIS), Trade Freedom*Crisis, Average Tariffs Dummy, Financial Crisis Dummy (CRISIS), and Average Tariffs*Crisis are the main explanatory variables. Other bank-level, industry-level, and country-level variables are used as control variables. All models are estimated using pooled panel OLS regressions. *p*-values are computed by the heteroskedasticity-robust standard errors clustered at the bank level are presented in parenthesis. ***, ** represent statistical significance at 1%, 5%, and 10% levels, respectively. Detailed definitions of the variables and data sources are presented in Table A1 (see in Appendix A).

Table 10. Country-wise regression: Trade openness and bank risk-taking (Fixed Effect Estimation).

Variables	Brazil			Russia			India			China			South Africa		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
TRDEX	−3.711 **			−4.32 ***			−1.357 **			−1.489 **			−0.879 **		
	(0.042)			(0.007)			(0.034)			(0.019)			(0.028)		
TRFRDM		−1.512 **			−4.48 ***			−2.683 **			−1.196 **			−1.274 **	
		(0.042)			(0.007)			(0.034)			(0.018)			(0.015)	
TARIFF			0.151			0.690 ***			0.035 **			0.449 **			0.212 *
			(0.142)			(0.007)			(0.035)			(0.025)			(0.087)
Bank-Level variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry-Level variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country-Level variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	−2.258 **	−1.686 *	−0.254 *	−1.70 ***	−2.304 **	−1.689 **	−4.256 **	−3.335 **	−1.558 *	−2.368 **	−2.688 **	−2.244 **	−2.972 *	−2.031 **	−1.196 *
	(0.040)	(0.090)	(0.096)	(0.008)	(0.031)	(0.029)	(0.028)	(0.048)	(0.063)	(0.023)	(0.021)	(0.032)	(0.096)	(0.035)	(0.095)
R-squared	0.291	0.281	0.287	0.479	0.471	0.482	0.334	0.345	0.324	0.689	0.671	0.679	0.754	0.761	0.757
F-statistics	3.82	3.79	3.80	12.56	12.49	12.58	4.98	5.06	4.59	9.89	9.51	9.64	5.41	5.59	5.43
(*p*-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	1318	1318	1318	3212	3212	3212	926	926	926	893	893	893	297	297	297
No of Banks	127	127	127	530	530	530	82	82	82	129	129	129	31	31	31

Note: This table reports results for the effects of trade openness on bank risk-taking depending upon individual countries dataset. Dependent Variable is ZSCORE across all models, where higher values of ZSCORE represent higher bank risk-taking, and vice versa. All Models are estimated using Fixed Effect regressions. Trade openness captured by the three proxies, such as Trade Exposed (TRDEX), Trade Freedom (TRFRDM), and Average Tariffs (TARIFF). Other bank-level, industry-level, and country-level variables are used as control variables. *p*-values are computed by the heteroskedasticity-robust standard errors clustered at the bank level are presented in parenthesis. ***, **, * represent statistical significance at 1%, 5%, and 10% levels, respectively. Detailed definitions of the variables and data sources are presented in Table A1 (see in Appendix A).

5. Conclusions and Policy Implications

This study aims to examine the impact of trade openness on bank risk-taking behavior. Using a panel dataset of 899 banks from the BRICS region throughout 2000–2017, we produce robust evidence in favor of the 'diversification-stability effect' that trade openness has a robust negative impact on bank risk-taking. This study applies several regression methodologies (i.e., System GMM, Fixed Effect, Pooled OLS, and VECM) to prove the negative association between trade openness and bank risk-taking. We argue that higher trade openness can create a more diversified investment opportunity for banks, and borrowers also enjoy the different portfolio investment facilities, and therefore it would create a strong win–win bonding between lenders and borrowers. The result is lower bank risk-taking. We performed several robustness tests to confirm our findings.

Moreover, the extension of openness theory by employing micro-level data from BRICS economies contributes to making an end of the debate. Further, this study measures, for the first time, the trade openness with "*de facto*" (exports plus imports to GDP ratio) and "*de jure*" (decrease in average tariffs and country-specific trade freedom index) then finds a negative impact on bank risk. However, Ashraf et al. (2017b) use "*de facto*" (exports plus imports to GDP ratio) measure of trade openness to test the impact of trade openness on bank risk-taking in 37 emerging economies and find a substantial negative impact on bank risk, in the line of our findings. Additionally, we test the short- and long-run association between trade openness and bank risk-taking using VECM estimation, and we find the existence of a long- and short-term relationship between trade openness and bank risk-taking.

Among the bank-level control variables, Cost Inefficiency results as positive and significant with bank risk-taking; indicating that cost-efficient banks are more stable. Bank Size also positively determines the bank risk. That means big banks take more risks in lending compared to small banks. However, Implicit Income has a negative and significant effect on bank risk, which implies that market-based banking is associated with lower risk-taking compared to interest-based banking.

Industry-level variables also result as robust drivers of bank risk-taking. As can be seen, Market Concentration positively determines the bank risk-taking, indicating that the existence of a monopoly in BRICS banking fosters the banking systems' instability. Activity Restriction positively and significantly determines the bank risk, meaning that the higher restrictions on diversified banking activities could positively influence the bank risk. Furthermore, intense Capital Stringency induces banking systems stability, and the result is lower bank risk (Rahman et al. 2018).

Regarding the above findings, among the country-level determinants, governance index variables like Govt. Effectiveness, Political Stability, Regulatory Quality, Rule of Law, Voice and Accountability are all negatively related to bank risk-taking. However, the impact is significant in the case of Political Stability, Regulatory Quality, and Rule of Law. The better political environment fosters trade and international openness, the presence of regulatory standard assists in building trust on state policies, and the existence of law and transparency increase the collateral relationship between lenders and borrowers. GDP Growth and Foreign Direct Investment positively and significantly determine the bank risk-taking, indicating the trade openness could boost up the GDP growth and FDI inflows. The ultimate result is banking systems stability. Nonetheless, GDP Per Capita and Market Capitalization result as negative and significant with bank risk-taking in BRICS region banking.

Despite the several strengths of this study, there are also some limitations we have faced in sample constructions. We consider commercial, investment, savings, cooperative, foreign, and bank holdings companies as a sample. Thus, the banking systems uniformity may have been lost in this concern. Moreover, we only consider the active bank over the sample period, and there may be some banks that become inactive at the end of our sample period. Lastly, regarding the sample constructions, we need to delete zero and negative values for calculating the natural logarithm form of input and output variables in stochastic Frontier Analysis (SFA). In this backdrop, the total number of observation decreased compared to the number of banks.

Finally, for policy formulation, we test the impact of trade openness on bank risk-taking during financial crises. We witness that higher trade openness delivers international participation to disclose

the diversified investment opportunities to banks and decreases the impact of the domestic financial crisis on bank risk.

Overall, the findings of this study support that trade openness assists in ensuring financial stability through increasing spread venture facilities and decreasing the probability of bank risk-taking.

Regarding policy implication, first, we suggest creating more cross border collaboration among the emerging economies to ensure financial stability, which is one of the crucial criteria for the financial development of any economy. Second, since emerging economies' capital markets are relatively weak, the firm and households are mostly dependent on bank finance to meet their external financing needs. Thus we suggest increasing stock market capitalization to reduce the pressure on bank funding, which might assist in reducing the 'bad finance' and likelihood of default risk as well. Third, we suggest liberalizing the activity restrictions with higher capital stringency of the bank to ensure the perfectly competitive environment in banking. Fourth, we recommend developing "one currency" for the BRICS countries to foster prompt trade and financial openness among the nations.

Future research may address the following outlines: Other bank-level variables such as information asymmetry, merger, taxation, dividend, and deposit insurance policy would be tested as the addition of the model. Another concern is that someone may identify which types of the firm are more likely to default on bank loans in a matter of higher trade openness through making comparative study among commercial, savings, cooperative, investment, and foreign banks. The comparative analysis between BRICS and G6 economies (France, Germany, Italy, Japan, the United Kingdom, and the United States) regarding trade and financial openness concerns of bank risk deserve special attention. Last but not least, from the BRICS perspective, the formation of the BRICS Development Bank creates a new path for future research direction focusing on trade and development compared to the IMF and World Bank.

Author Contributions: Conceptualization, M.M.R. and B.N.A.; Methodology, M.M.R.; Software, M.M.R.; Validation, M.M.R., M.B. and M.A.K.M.; Formal Analysis, M.M.R.; Investigation, M.M.R.; Data curation, M.M.R. and M.B.; Writing—original draft, M.M.R., M.B.; visualization and supervision, M.M.R.; Writing—review & editing, M.M.R., M.B., B.N.A. and M.A.K.M. All authors have read and agree to the published version of the manuscript.

Appendix A

Table A1. Trade openness and bank risk-taking: Variable definitions.

Variables	Symbol	Definition	Data Source
Dependent Variables			
Risk-Taking	ZSCORE	Equals −1*[log [(ROA + CAR)/δ(ROA)]], where ROA is the annual return on average assets before loan loss provisions and taxes, CAR is equity to total assets ratio. δ (ROA) is the standard deviation of the annual values of the return on assets before loan loss provisions and taxes calculated over a three-year rolling window. Higher values of the Z-score measures higher bank risk-taking, vice versa.	BankFocus and Authors' calculations
	LLPTA	The ratio of loan loss provision over total assets of each bank	BankFocus
Independent Trade Openness Variables			
Trade Exposed	TRDEX	Equals [(imports + exports)/GDP], where imports, exports, and GDP are measured annually in current US dollars. Higher the ratio implies higher trade openness	World Development Indicators (WDI), World Bank

Table A1. *Cont.*

Variables	Symbol	Definition	Data Source
Trade Freedom	TRFRDM	Measures the extent of trade openness based on trade-weighted average tariff and non-tariff barriers. The index ranges from 0 to 1, where a higher value indicates more Trade openness.	Freedom House, 2017
Average Tariffs	TARIFF	Equals the simple mean of unweights average tariffs for all traded goods in a country. Higher values represent lower trade openness, vice versa.	World Development Indicators (WDI), World Bank
FDI Inflows	FDI/GDP	Equals Foreign Direct Investment inflows as a percentage of GDP, where higher the ratio represents higher international openness and vice versa. This variable used as an instrumental variable of trade openness.	World Development Indicators (WDI), World Bank
Bank-Level			
Cost Inefficiency	CINEY	Use stochastic frontier 4.1	BankFocus and Authors' calculations
Operating Cost Ratio	OPCR	Equals operating expenses over total assets ratio of each bank	BankFocus
Bank size	SCOPE	Natural logarithm of total assets of each bank	BankFocus
Size of Operations	LL	Natural logarithm of total loans of each bank	BankFocus
Implicit Income	NIITI	The ratio of noninterest income to total revenue of each bank	BankFocus
Management Efficiency	MANEFF	Measured by the ratio of earning assets to total assets of each bank	BankFocus
Industry-Level			
Market Concentration	HHI	Hirschman-Herfindahl Index measured as the sum of the square of the market share of each countries individual bank.	BankFocus and Authors' calculations
	CR3	The size of banks' assets in the three largest banks to total banking assets	BankFocus and Authors' calculations
Capital Stringency	CAPR	CAPR is an index of required capital that accounts for both initial and overall capital stringency. The index ranges from 0 to 10, where a higher value indicates more stringent capital requirements for banks in a country.	Barth et al. (2013)
Activity Restrictions	ACTR	This variable score reflects the level of regulatory restrictiveness for bank participation in securities, insurance, real estate activities, and owning other firms. Variable ranges from 4 to 16, with higher values, indicate greater restrictiveness	Barth et al. (2013)
Country-Level			
Govt. Effectiveness	GVTETV	The index that reflects the public perceptions on civil services, the degree of its independence from political pressure, the excellency of policy formulation and implementation, and the integrity of the government's obligation to such policies. Variable ranges from −2.5 to 2.5, with higher values indicating more Govt. Effectiveness	(Kaufmann et al. 2011)
Political Stability	POLSTA	The index that reflects the possibility of politically motivated violence, including terrorism. Variable ranges from −2.5 to 2.5, with higher values, indicating more Political Stability	

Table A1. *Cont.*

Variables	Symbol	Definition	Data Source
Regulatory Quality	REGQTY	The index that reflects the quality of regulatory policies formulation and implementation that promote the private sector including banking arena. Variable ranges from −2.5 to 2.5, with higher values indicating more Regulatory Quality.	
Rule of Law	ROL	The index that reflects the degree of people's confidence in rules of society and in particular the quality of property rights, the police, the court and the contact prosecution, as well as the possibility of crime and violence. Variable ranges from −2.5 to 2.5, with higher values, indicating more public-friendly law and enforcement	
Voice and Accountability	VOC	The index that reflects the degree of citizen's role in selecting their government, as well as freedom of expression, association, and a free media. Variable ranges from −2.5 to 2.5, with higher values, indicating more Voice and Accountability	
GDP Growth	GDP	Each country year-on-year GDP growth rate	World Development Indicators (WDI)
Inflation	INF	Annual percentage change in consumer prices in a country.	
GDP Per Capita	GDPPER	Natural logarithm of the annual GDP per capita (current US$) of each country	
Market Capitalization	MKTGDP	Equals annual percentage of total market capitalization on GDP of each country.	
Foreign Direct Investment	FDI	Calculated as the ratio of net FDI inflows over FDI outflows annually.	
Financial Crisis	CRISISD	Equals to 1 for the period of crisis (2007–2009) and 0 otherwise	Authors' calculations
	CRISIS	The dummy variable equals 1 if a country is in financial crisis in a year and 0 otherwise	(Fabian and Laeven 2013)

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