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Capital Flows and Bank Risk-Taking Behavior: Evidence From Indonesia[1]

Abstract: This paper investigates the impact of capital flows on bank risk-taking behavior. It undertakes two levels of empirical estimations, namely (i) single-country industry-level; and (ii) multi-country industry-level estimations, covering emerging market economies. The results suggest that capital inflows, in the form of portfolio investment, is significant in raising risk-taking behavior. Large banks are less aggressive in their risk-taking behavior vis-à-vis smaller banks. Such impact of portfolio investment on risk-taking behavior is also shown in the multi-country level estimates.

Key words: Capital flows; Bank risk-taking behavior; Panel data.

JEL Classification: E0; F0; F1.

1. Introduction

The paper explores the impact of capital flows on bank risk-taking in Indonesia. In the aftermath of the Lehman crisis, advanced countries implemented an extensive accommodative monetary policy to revive economic growth (Claessens,

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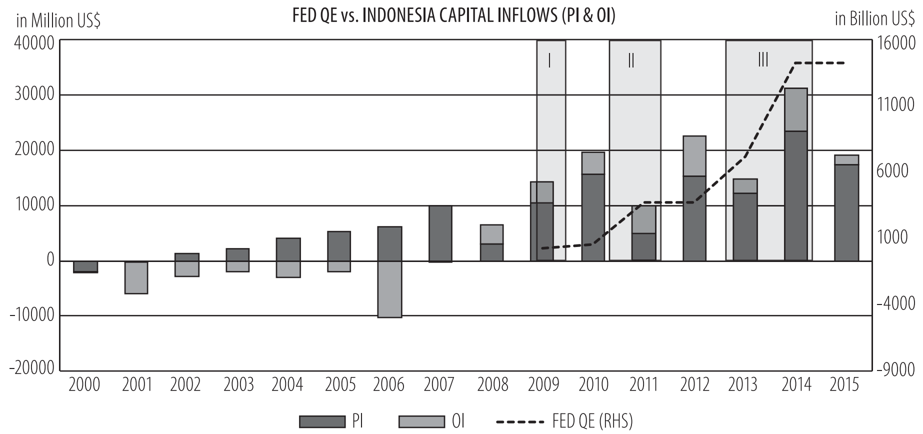
Kose, Laeven & Valenci, 2013). This has become important given the implications of a weakened financial system on general economic activity and social welfare (Apergis, 2019).[2] As a result, central banks in those countries employed unconventional methods of monetary policy through assets purchase programs, known as quantitative easing.[3] This phenomenon induced large and volatile international capital flows, including to emerging economies (Ahmed and Zlate, 2014), such as Indonesia (Figure 1).

Figure 1: The FED quantitative easing and Indonesia capital flows



The figure shows capital flows in Indonesia before and after the implementation of the Federal Reserve System (FED) quantitative easing policy. The sample period is from 2000 to 2015.

Source: IMF, World Bank, CPB Netherland Bureau for Economic Policy Analysis, Bloomberg, BI Staff Calculation

International capital flows have consequences on the real and financial volatilities across countries, the distribution of global risk, and macroeconomic outcomes (Borio & Zhu, 2012).[4] This creates challenges for the monetary authority in its quest to ensure stability in domestic economy. Therefore, understanding the impact of capital flows on domestic risk-taking behavior is important–as it translates into macroeconomic and financial fluctuations.

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[2] Ibrahim (2019a), for instance, emphasize that the size of the financial system determines income distributions in eight Asian countries.

[3] Quantitative easing is an aggressive expansion of balance sheets by central banks (Curcuru, Kamin, Li and, Rodriguez, 2018; Park, Ramayand and Shin, 2016)

[4] Padhan and Prabheesh (2019) provide a comprehensive survey on studies developing early warning signals to detect such financial vulnerabilities.

Since capital flows are more likely to cause vulnerabilities in economies, where the financial sector is limited yet highly open (Lipschitz et al., 2011;), our empirical analysis focuses on a small emerging market with limited capital controls. Indonesia has all these attributes alongside a sizeable GDP, and hence fits our agenda (Fernandez et al., 2016). In addition, Indonesia is quite appealing because of its financial and macroeconomic history, which includes financial crises and exchange rate volatility (Juhro & Iyke, 2019). Indonesia's banking industry dominates its overall financial market (Indonesia Financial Services Authority, 2016). Moreover, stability of banking sector is important for sustainable economic growth (Rizvi et al., 2019). This narrows our focus to the banking industry. In particular, we examine whether international capital flows influence the risk-taking behavior of this industry.[5] We first examine a single-country industry-level data. Then, we extend the analysis to multi-country-level data using 11 emerging economies. This makes our analysis comprehensive and different from prior ones. We note that since our focus is on the financial sector, we discuss only the most liquid type of capital flows. Hence, foreign direct investment is excluded from our analysis. Our study is different from prior ones because it focuses on the impact of capital flows to risk-taking behavior, it relates them directly, whereas previous literatures mainly concentrate on explaining the determinants of capital flows (for instance, Ahmed & Slate, 2014) or on discussing the impact of regulation and other factors on bank behavior (Prasetyo & Sunaryo, 2015; Widiarti, Siregar, & Andati, 2015; Bougatef & Mgadmi, 2016; Mulyaningsih, Daly, & Miranti, 2016; Ibrahim, 2019b).

For the single-country bank-level analysis, we use the 15 banks that are listed on Indonesia Stock Exchange over the period of 2010Q1 to 2017Q3. The multi-country bank-level analysis involves 11 emerging market economies, namely Brazil, India, Indonesia, Korea, Malaysia, Mexico, Philippines, Russia, South Africa, Thailand, Vietnam, over the period of 2010Q1 to 2017Q3. The results indicate that capital inflows, in the form of portfolio investment, are an important determinant of bank risk-taking behavior. We show that large banks are less aggressive in their risk-taking behavior vis-à-vis smaller banks. We find these evidence in the multi-country level estimates. Finally, we observe that the effect of portfolio investment on risk-taking behavior is relatively persistent in both samples. Our findings survive robustness checks. In the single-country analysis, we use a dummy to distinguish large from small banks and find the results to hold true. The results hold true again in the multi-country analysis.

[5] See, Rokhim and Min (2020), investigate the effect of funding liquidity on bank risk-taking behavior, Hamid, Azmi and Ali (2020), examine the impact of financial development on bank risk-taking behavior and Li (2019) investigates how bank capital and competitive conditions affect bank risk-taking, using financial data of 7620 banks on 118 countries.

Our study is motivated by the limited empirical literature on the impact of capital flows on a domestic economy. Among others, Strieves & Dahl (1992) find positive correlation between changes in risk and capital. Du & Rousse (2018) show that capital flows drive risk structure of interest rates, corporate financing and investment, and aggregate economic activities. Mahdi & Abbes (2018) show a positive bidirectional association between capital and risk of Islamic banks. Pandolfi & Williams (2019) examine the impact of capital flows into the debt market on government bond prices, exchange rates, and liquidity. Based on their uninformative capital Flows Implied by Rebalancings (FIR), the show that capital flows are correlated with higher debt market depth and higher returns following the rebalancings. They further show that capital inflows are correlated with currency appreciations. Bourgain, Pieretti & Zanaj (2012) tests relationship between financial openness, disclosure, and bank risk-taking in several countries, and found interaction among them. In addition, Cubillas & González (2014) also found evidence of link between financial liberalization and bank risk-taking, and Bui & Bui (2019) suggest a nonlinear and heterogeneity of the impact. Our empirical assessment contributes to this broad literature by showing that capital flows are particularly an important determinant of risk-taking behavior of banks in emerging markets small open economies.

From a country-specific perspective, our study is motivated by prior studies examining the impact of international transmission of external shocks. Silalahi, Wibowo & Nurlian (2012) investigate the impact of external shocks on Indonesia's banking industry. They find that these shocks have significant direct and indirect impact on banks' behavior. Ariefianto & Soepomo (2013) compare the bank risk-taking behavior before and after the establishment of the Deposit Insurance Corporation (IDIC). They disaggregate the risk behaviors into three types of risk namely credit risk, market risk and operational risk. Abdullah, Bary, Astrayuda, & Sya'banni (2016) find that monetary policy affects risk-taking behavior in Indonesia. Harahap, Bary, Panjaitan & Satyanugroho (2016) examine the spillovers of shocks originated in the United States (US) and China, including US interest rates and broad money growth onto the Indonesian economy. The show that the main risk to Indonesia's real gross domestic product (GDP) is a shock to the China's real GDP. Hikes in the US interest rate poses the greatest risk to Indonesia's exchange rate in the form of depreciation in the short term, when compared with the US tapering off. Overall, Harahap et al (2016) observe that finance is the dominant transmission channel of US monetary tightening, reducing economic growth in small open economies. Harahap & Bary (2017a) show that global liquidity spills over to the Indonesian economy. They find such spillovers to influence economic indicators. Harahap, Rumondor, Kusuma, & Idham (2017), and Harahap and Bary (2017b) find that financial cycle (credit growth) in Indonesia is influenced by global financial cycles (capital inflows). However, none of these studies examine the impact of capital flows and banking risk-taking behavior in Indonesia—a research gap that our study fills.

This paper is organized as follows. Section 2 develops the conceptual framework. Section 3 outlines our methodology, which includes specifications and data. Section 4 presents the results. Section 5 concludes.

2. Conceptual Framework

The theoretical connection between capital flows and risk-taking stems from the very meaning of risk-taking. Borio & Zhu (2012) defines the term "risk-taking channel" of monetary policy as the impact of monetary policy on the willingness of market participants to take on risk exposures, thereby influencing financial conditions and ultimately influencing real economic decisions. Since it influences financial conditions and real economic decisions, risk-taking behavior should be a concern of the policy-maker, particularly during monetary policy formulation.

Traditionally, there are several channels through which capital flows may trigger risk-taking in a domestic financial market, particularly represented by an increase of bank lending. First, through the balance sheet channel, capital inflows decrease domestic interest rates, and hence raise bank lending (Angelopoulou & Gibson, 2009). Second, through the financial market channel, capital inflows, particularly in the form of portfolio investment, increase financial asset prices and asset volume (Kim & Yang, 2011). An increase in asset prices and volume raises collateral value and hence raises bank lending (European Central Bank, 2000). Third, through the real sector channel, capital flows may increase corporate debt, business activities, and consequently corporate revenues (Igan et al., 2016). This raises the net worth of corporations, and, in turn, bank lending to corporate sector (Villacorta, 2017). Fourth, through the market confidence channel, capital inflows are correlated with higher market expectations, which raise asset prices, corporate credit worthiness, and bank lending (Borio and Disyatat, 2010).

Shrives & Dahl (1992) develop the empirical framework connecting the response of banks to capital inflow dynamics. This framework has since become the standard tool for analyzing banking behavior. Closely related studies to ours are those of Bougatef & Mgadmi (2016) and Witowschi & Luca (2016), which analyze bank behavior in Middle East and North African Banks and European bank, respectively. Others, including Bruno & Shin (2015a, b), and Igan & Tan (2015), construct various forms of the framework, when studying bank risk-taking behavior, or the implications of capital inflows. Lane & McQuade (2015) show that domestic credit growth in European countries is strongly related to net debt inflows but not to net equity inflows.

Our specifications and estimations rest on these theoretical and empirical connections between capital inflows and bank risk-taking. We hypothesize that, all things equal, capital inflows determine bank risk-taking behavior in Indonesia. We outline, in the next section, the empirical specifications used to test this hypothesis.

3. Methodology

3.1. Specification

Our empirical specifications follow Bougatef & Mgadmi (2016). Unlike theirs, our focus is on bank risk-taking behavior. Therefore, we replace the capital regulation variable with capital flow variable. We make an assumption that the loan supply of a bank is log-linearly related to risk-taking behavior. In theory, risk-taking is often associated with lending standard, and the amount of bank lending.[6] Bank lending is riskier than other main asset alternative—central bank or government placement. Hence, this assumption is justified. Thus, loan supply is modelled as

$$C_S = \frac{E_R}{1 - \frac{1+r}{1+f}\varphi} \tag{1}$$

where the bank is assumed to be both a lender and a borrower (Bruno & Shin, 2015b). The bank is further assumed to borrow from a global bank, and lends to a local borrower (Bruno & Shin, 2015b).

We assume further that (i) risk-taking behavior is log-linearly related to loan supply,

$$R = {C_S}^{\mu} \tag{2}$$

where μ is parameter, and (ii) "own funds" is affected by size and liquidity of the banks,

$$E_R = Size^{\delta} Liquidity^{\gamma} \tag{3}$$

where δ and γ are parameters.

Next suppose, for simplicity, that

$$1 - \frac{1+r}{1+f}\varphi = \frac{1}{\theta Flow^{\rho}} \tag{4}$$

which justifies standard intuition about the relationship between interest rate differentials and capital flows. The parameters, θ and ρ are parameters, and *Flow* is capital flow. Substituting equation (2), (3) and (4) to (1) yields

$$R = Size^{\mu\delta} Liquidity^{\mu\gamma} \theta^{\mu} Flow^{\mu\rho} \tag{5}$$

[6] Lending standard refers to credit qualification threshold determined by the bank, which may vary across time period or with another bank.

Taking logarithms, adding time and cross-sectional dimensions, adding error terms, and separating the type of capital inflows, yields the following

$$R_{it} = \alpha_i + \beta_1 Size_{it} + \beta_2 Liquidity_{it} + \beta_3 OI_t + \beta_4 PI_t + u_{it} \quad (6)$$

where $\alpha_i = \mu \log \theta_i$, $\beta_1 = \mu\delta$ and $\beta_2 = \mu\gamma$. Note that we remove the logarithm operator on size and liquidity to keep the specification tidy. OI_t and PI_t are cross-sectional invariant variables and components of capital flows, which are other investments[7] and portfolio investment liabilities, respectively. u_{it} is an error term.

As mentioned earlier, we exclude fixed investment because it is not a "liquid" capital. In our estimations, we add return on assets (ROA) as a variable affecting "own funds". Besides, we sum OI_t and PI_t and include the result as one variable. Consistent with Bougatef & Mgadmi (2016), we use loan to deposit ratio as our measure of liquidity.

Our single-country bank-level analysis estimates equation (6) as a Seemingly Unrelated Regression (SUR) across cross-sectional units. This allows contemporaneous correlation between cross-sectional residuals. This is because risk-taking behaviors are likely to be correlated among competing banks, especially for banks that operate within a particular economy as a relevant market. We test this assumption empirically.

In addition, for the multi-country-level analysis, we use dynamic panel data estimators developed by Arellano & Bond (1991). Bank risk-taking behaviors are unlikely to be correlated across countries. Hence, the SUR weighting may not be required in this setting. The dynamic regression estimators allow us to overcome potential dynamic panel bias in multi-country specifications. Note that equation (6) is the general static version of the specification. A dynamic version is obtained by adding a lag dependent variable, and consequently estimating short-run, instead of long-run parameters.[8] The dynamic version is the one we estimated using the Arellano-Bond estimator.

A concern using the dynamic panel estimator is that the estimates are not efficient when the time period is considerable larger than the number of cross-sections. Hence, to ensure robustness, we report both fixed-effect and dynamic panel estimates for the multi-country specifications.

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[7] Other investments refer to International Monetary Fund (IMF's) Balance of Payment classification, which is a transaction/position that is not included in portfolio and fixed investment.

[8] Long-run parameters are obtained by adjusting short-run parameters with parameters of lag dependent variables.

3.2. Data

Our single-country bank-level sample covers 15 banks operating in Indonesia. These banks are listed on the Indonesia Stock Exchange over the period of 2010Q1 to 2017Q3. We retrieve the data from Bloomberg and Indonesia Financial Service Authority's (FSA's) website. The sample period is mainly due to data availability. We consider only these 15 banks because their data are publicly available. We obtained data on capital flows from the International Financial Statistics of the IMF.

The multi-country-level dataset is quarterly and covers the of 2010Q1 to 2017Q3. The sample covers Brazil, India, Indonesia, Korea, Malaysia, Mexico, Philippines, Russia, South Africa, Thailand, Vietnam. The countries are selected based on data availability. The data are sourced from the International Financial Statistics and the Financial Soundness Indicators of the IMF.

The measurement of risk is subject to debate. For example, Aggarwal and Jacques (2001) and Bougatef & Mgadmi (2016) use the ratio of loan loss provisions to total assets to measure risk. However, since our paper focuses on risk-taking behavior rather than the anticipation of credit risk, we use risk weighted assets to total asset as the measure of risk. This is in line with prior studies such as Shrieves & Dahl (1992), Das & Ghosh (2004), and Abdullah et al (2016).

Following Abdullah et al (2016), we compute bank risk-taking as representing the ratio of risk-weighted assets to total assets,

$$R_t = \sum_i^n \frac{a_{it}}{A_t} R_{it} \tag{7}$$

where bank risk is R_t, a_{it} is volume of asset type i (i = 1,2,...n) at time t, A_t is total asset at time t, such that $A_t = \sum_{i=0}^n a_{it}$, and R_{it} is risk of asset type i at time t. Thus, $\frac{a_{it}}{A_t}$ is the ratio of asset i type to total assets at time t. The equation can be rearranged as

$$R_t = \frac{1}{A_t} \sum_i^n a_{it} R_{it} \, . \tag{8}$$

Denoting $A_{R,t}$ as risk-weighted assets at time t, we have that $\sum_{i=0}^n a_{it} R_{it} = A_{R,t}$. Hence,

$$R_t = \frac{A_{R,t}}{A_t} \, . \tag{9}$$

In other words, the risk related to bank's decision-making in allocating assets can be represented by the ratio of risk-weighted assets to total assets.

A bank's size may impact on its behavior when managing its balance sheet. This is because bank size may influence a bank's ability to diversify its portfolio. Bank size may also relate to a bank's behavior through other channels (such as investment opportunities and access to capital), as discussed in Rime (2001). Following this rationale, we use total assets to represent bank size. We use return on asset (ROA) instead of return on equity (ROE) to measure bank performance (or profitability). The ROA is a better indicator of how efficient the management uses assets to generate earnings (Bougatef & Mgadmi, 2016). The ROA is computed as the ratio of net income to total assets. We avoid computing this variable by directly collecting the data from Bloomberg and FSA.

In addition, we collect data on loan to deposit ratio (LDR), which represents the ratio of banks loan to third party deposits. The higher values of LDR indicate lower liquidity, since banks aggressively lending to customers. The remaining variables are the components of capital flows, OI_t and PI_t , other investment and portfolio investment liabilities, respectively.

4. Analysis

4.1. Descriptive Statistics

Table 1 shows the summary statistics on the variables used in the study, particularly on Indonesia dataset. The distribution of the data are roughly normal as the mean is relatively similar to the median. The risk data are ranged between 0.11 – 1.61 with the mean of 0.61. The correlations among explanatory variables are weak, as we can see from Table 2. That is, the correlation coefficients are below 0.5. These values suggest the absence of multicollinearity among those variables. We also perform a number of tests and find no evidence of autocorrelation and heteroscedasticity.

Table 1. Descriptive Statistics

	Risk	Size	ROA	LDR	OI	PI
Mean	0.69	18.83	1.97	85.19	19.18	19.28
Median	0.69	18.76	1.84	87.02	19.18	19.28
Min.	0.11	17.24	0.13	52.39	18.96	18.89
Max.	1.61	20.63	4.19	114.63	19.37	19.55
Std. Dev.	0.16	0.83	0.90	12.25	0.11	0.16

The table shows summary statistics of the variables used in the study. ROA is return to asset, LDR is loan to deposit ratio, OI dan PI are other and portfolio investments, respectively. Min., Max., and Std. Dev. denote, respectively, the minimum, maximum, and standard deviation. The sample period is from 2010Q1 to 2017Q3.

Table 2. Correlation Matrix

	ASSET	LDR	ROA	PI	OI
ASSET	1				
LDR	0.015520	1			
ROA	0.411536	-0.161863	1		
PI	0.079031	0.080563	-0.032173	1	
OI	0.010600	-0.008006	-0.024367	-0.277981	1

The table shows correlation matrix between variables using full samples. ROA is return to asset, LDR is loan to deposit ratio, OI dan PI are other and portfolio investments, respectively.

4.2. Estimates for the Indonesian Banks

By estimating the specifications using the SUR methodology and applying the Breusch–Pagan Lagrange Multiplier (LM) and Pesaran cross-sectional dependence (CD) tests, we find no evidence of cross-sectional residuals (see Table 3 and 4). This shows that SUR-weighting scheme eliminates any cross-sectional residual correlations. Moreover, the fixed-effects are jointly significant in all specifications as indicated by redundant fixed effects statistics, suggesting that large variations among datasets can be explained by different intercepts across cross-sectional units (see Table 3 and 4). To illustrate this, we find that a pooled estimate yields an R2 of only 30%, whereas a fixed-effects estimate with SUR-weighted residuals yields an R2 above 50%. The inclusion of cross-sectional fixed-effects and then SUR-weighting also raises the significance of the explanatory variables, perhaps making the estimates more robust. Note that the estimates pass the multicollinearity, autocorrelation and heteroscedasticity tests (see Table 3 and 4).[9]

Looking at the results in Table 3, portfolio investment is positive and statistically significant, implying that high portfolio investment raises bank risk-taking. Other investment is not significant, when separated from portfolio investment. However, both of them is jointly significant to raise risk-taking behavior. The estimated signs of the parameters of the controls are generally in line with standard expectations. The bank size is negatively related to risk-taking behavior, suggesting that large banks can diversify and allocate their portfolio easily when compare to small banks. This implies that smaller banks (i.e. banks with lower assets) are more vigilant. Large banks are also expected to be more experienced in managing risks (Altunbas, Carbo, & Machrouh, 2007; Witowschi & Luca, 2016).

[9] Autocorrelation is indicated by DW statistics. For heteroscedasticity is not directly shown on table, however, sum squared residuals of weighted statistics are higher than sum squared residuals in unweighted statistics.

Table 3. Capital flows to bank's risks in Indonesian banks: SUR basic model

	(1)	(2)
C	0.516** (0.243)	-0.086 (0.250)
Size	-0.023*** (0.004)	-0.023*** (0.004)
Liquidity	0.005*** (0.000)	0.005*** (0.000)
ROA	0.011*** (0.002)	0.011*** (0.002)
Other investments	-0.016 (0.001)	
Portfolio Investments	0.023*** (0.007)	
Other investment + Portfolio investments		0.038*** (0.013)
Model Statistics		
Adj. R^2	0.699	0.700
S.E.R	1.007	1.022
DW	1.919	1.958
Redundant Fixed Effects	1584.163***	1535.888***
Cross section dependence (Pesaran CD)	0.030	0.092

The table shows estimation results on Indonesian banks dataset. This version is the basic version which does not include large banks dummy. *,**,***: significant in 90%, 95%, and 99% confidence level, respectively. Standard errors are in parentheses.

Liquidity is positively correlated to risk-taking behavior (Table 3), which is in line with Bougatef & Mgadmi (2016). This finding suggests that when banks lend excessively (i.e. as suggested by a high loan to deposit ratio), they become less liquid, thereby increasing their risk profiles. As expected, ROA, which represents profitability, has a positive sign. This indicates that banks increase risk-taking in order to increase profitability. In other words, a bank that tolerate risk tends to generate higher expected income, which is consistent with Das & Ghosh (2004).

4.3. Large Banks Characteristics

We examine whether the response of risk-taking to capital flows is dependent on large vs. small banks. We use common equity level to distinguish large from small banks. In Indonesian banking industry, banks are classified as follows. Banks with common equity larger than Rp30 trillion, between Rp5 trillion to Rp30 trillion, between Rp1 trillion to Rp5 trillion, and less than Rp1 trillion are categorized as Category 4, Category 3, Category 2 and Category 1 banks, respectively.[10] For simplicity, this study designates 'large banks' as Category 4 banks, while the rest are 'small banks'. Accordingly, a dummy variable, *LargeBanks*, is an indicator of large banks and takes a value of 1 if a bank belongs to Category 4 and 0 otherwise. The results are reported in Table 4.

Table 4. Capital flows to banks' risks in Indonesian banks: SUR with large bank differentials

	(1)	(2)
C	0.444* (0.255)	-0.152 (0.257)
Size	-0.025*** (0.004)	-0.024*** (0.004)
Liquidity	0.005*** (0.000)	0.005*** (0.000)
ROA	0.011*** (0.002)	0.011*** (0.002)
Other investments	-0.016 (0.010)	
Portfolio Investments	0.033*** (0.007)	
Other Investments + Portfolio Investments		0.050*** (0.016)
OI*LargeBanks	0.009 (0.019)	
PI* LargeBanks	-0.027** (0.013)	
(OI+PI)* LargeBanks		-0.032 (0.021)
Model Statistics		
Adj. R^2	0.699	0.699
S.E.R	1.005	1.023
DW	1.916	1.966
Redundant Fixed Effects	1299.453***	1260.455***
Cross section dependence (Pesaran CD)	-0.079	-0.003

The table shows estimation results on Indonesian banks dataset. This version is the version which includes large banks dummy. *,**,***: significant in 90%, 95%, and 99% confidence level, respectively. Standard errors are in parentheses.

[10] This categorization is called BUKU (Bank Umum Kegiatan Usaha) in Indonesia. This is based on the common equity level.

Table 4 shows that portfolio investment and other investments are statistically significant. That is, both investments increase risk-taking behavior in large and small banks. The impact of portfolio investment on risk-taking behavior is considerably different across large and small banks. Large banks are less likely to make a riskier asset allocation, when compare to small banks, during episodes of portfolio investment inflows. This finding may be driven by the fact that the large bank category (i.e. Category 4) is dominated by state-owned banks. Shleifer & Vishny (1997) and Cornett, Guo, Khaksari, & Tehranian (2010) point out that the performance of state-owned banks is inferior to privately-owned banks, which can be attributed to the lack of motivation by state-owned banks to maximized profit. Our finding is perhaps consistent with these studies.

Recall that we employ risk-weighted assets to total assets to measure bank risk-taking behavior rather than the anticipation of credit risk. The estimated coefficients of the other control variables are generally in line with standard expectations. The liquidity factor and the profitability ratio are positively associated with risk-taking behavior, while bank size is negatively related to risk-taking behavior. These estimates are qualitatively similar to the main estimates of the preceding section (see Table 3 and 4).

4.4. Multi-Country Estimations

We now turn to the multi-country analysis. The estimates are based on a different dataset and estimators (see details in Section 3). We employ 11 emerging market economies and a bank-level dataset spanning 2010Q1 to 2017Q3. We introduce a single period lag of risk-taking as an explanatory variable in order to account for the dynamic effect of bank risk-taking. Hence, we use a dynamic panel estimator to sidestep the dynamic panel bias, when estimating our dynamic specification.[11] Aside this, the dynamic panel estimator overcomes potential endogeneity in capital flows and controls. At the multi-country level, the data is less prone to cross-sectional correlations. Therefore, the SUR method may be irrelevant. For robustness, we present fixed-effect estimates alongside the dynamic panel estimates. The results are reported in twofold: estimates with portfolio investment and other investments; and estimates with sum of the two variables.

[11] The lag dependent variable is significant in all specifications.

Table 5. Panel multi-country fixed-effects results

	(1)	(2)
C	0.823*** (0.036)	0.823** (0.035)
Size	-0.100*** (0.038)	-0.100*** (0.038)
Liquidity	0.005*** (0.000)	0.005*** (0.000)
ROA	-0.039 (0.157)	-0.043 (0.153)
Other investments	0.030 (0.029)	
Portfolio Investments	0.052** (0.020)	
Other Investments + Portfolio Investments		0.042* (0.021)
Model Statistics		
Adj. R^2	0.404	0.457
S.E.R	0.236	0.235
Hausman test (prob)	0.01	0.01

The table shows estimation results on emerging markets dataset. This uses a least square based fixed effect regressor with cross-sectional effects. *,**,***: significant in 90%, 95%, and 99% confidence level, respectively. Standard errors are in parentheses.

The Hausman test result shows that the fixed-effect estimates are preferable (Table 5). The fixed-effect estimates, reported in Table 5, indicate that portfolio investment raises risk-taking behavior. In other words, global liquidity is an important contributor to the variation in risk-taking behavior within emerging market economies. Other investments are not statistically significant, and do not determine risk-taking behavior, based on the fixed-effects estimates. The combined capital flows (i.e. portfolio plus other investments) are a significant determinant of risk-taking behavior—again, signaling the importance of portfolio investment in this relationship.

The dynamic panel estimates suggest that the dynamic panel bias is eliminated. This is seen from the Arellano-Bond AR(2) statistic, which is insignificant in both specifications (Table 6). The Sargan test statistic indicates that instruments are statistically exogenous in both specifications. The instruments are, therefore, valid. The dynamic panel estimates are qualitatively similar to the fixed-effect estimates. Specifically, portfolio investment enhances risk-taking behavior. Other investments do not contribute to risk-taking.

Table 6. Panel multi country estimation results – dynamic panel

	(1)	(2)
C	-	-
Size	-0.010*** (0.004)	-0.010*** (0.004)
Liquidity	0.001*** (0.000)	0.001*** (0.000)
ROA	-0.003 (0.009)	-0.002 (0.008)
Other investments	0.006 (0.006)	
Portfolio Investments	0.012** (0.007)	
Other Investments + Portfolio Investments		0.009* (0.021)
Lag risk	0.979*** (0.007)	0.980*** (0.007)
Model Statistics		
Adj. R^2	0.461	0.433
S.E.R	0.558	0.570
Arrelano Bond AR(2) (prob)	0.962	0.977
Sargan test (prob)	0.833	0.865

The table shows estimation results on emerging markets dataset. This uses a Arellano-Bond dynamic panel regressor, with cross-sectional effects. *, **, ***: significant in 90%, 95%, and 99% confidence level, respectively. Standard errors are in parentheses. Instruments include lags of all independent variables, as well as second lag of dependent variable.

A closer look at the dynamic panel estimates show that they are much smaller than the fixed-effect estimates. This is due to the presence of the lag dependent variable, which imply that the estimated parameters in the dynamic panel model are short-term. By normalizing these short-term parameters with the estimated lag dependent variable parameter, we obtain the implied long-term parameters. Table 7 shows the long-term parameters implied by the dynamic panel model, which are very similar to the fixed-effect estimates. The statistical significances are similar as well.

Table 7. Selected fixed effect parameters and implied long term parameters of dynamic panel

	Fixed effect	Implied long term dynamic panel
Other investments	0.030 (0.029)	0.028
Portfolio investments	0.052** (0.020)	0.058**
Other Investments + Portfolio Investments	0.042* (0.021)	0.043*

The table shows comparison of fixed effect parameters and implied long term parameters from dynamic panel estimates. The implied long term parameters are calculated via lag dependent parameters.

5. Concluding Remarks

This paper investigates the response of bank risk-taking behavior to capital inflows. We consider two types of liquid capital inflows, namely portfolio investment and other investments, excluding fixed investment. Our specifications controls for characteristics including bank size, liquidity, and profitability. The analysis is carried out in two stages. The first analyses capital flows and risk-taking at a single-country bank-level, using 15 publicly listed Indonesian banks over the period of 2010Q1 to 2017Q3. Based on a SUR estimator, we find that portfolio investment is the component of capital inflows relevant to risk-taking. In particular, an increase in portfolio investment leads to an increase in risk-taking. Other investments are not relevant. We further find that the response of risk-taking to capital inflows varies across large and small banks. Following an increase in portfolio investment, large banks are less aggressive to shifting towards riskier asset allocations when compare to small banks. An explanation is that the majority of large banks in Indonesia are state-owned, and therefore tend to be more conservative.

Our second analysis uses multi-country industry-level quarterly dataset over the period of 2010Q1 to 2017Q3. Using dynamic panel estimators, we find the multi-country estimates to be consistent with the single-country ones. That is, portfolio investment is the only component of capital inflows determining bank risk-taking behavior. These estimates remain consistent using a fixed-effect estimator. Hence, our Indonesian estimates translate to other emerging market economies.

The findings imply that during periods of large capital inflows, policy-makers should put measures in place to safeguard the financial system from excessive risk-taking. Without precautionary measures in place during such times, the monetary authority may fail to realize its policy targets. Risk-taking behavior is associated with financial cycles, and consequently business cycles. Therefore, to some extent it may be necessary to shift the monetary policy stance in order to contain capital inflow surges. A relevant question is: how much risk-taking behavior should be allowed in the economy? The answer to this question is beyond the scope of this paper.

In the micro context, during periods of large capital inflows, bank supervisors should pay more attention to small banks in particular since their risk-taking behavior is more sensitive to capital inflows. Accordingly, a policy response via macroprudential policy, which is able to target a subset of banks with certain characteristics, is in order. One policy example is to relate bank size with high quality asset requirements, particularly during period of large capital inflows. This also suggests the need for macroprudential capital buffer.

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