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Foreign bank inflows: Implications for bank stability in sub-Saharan Africa

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Abstract

Foreign banks play progressively important roles in the banking sector in many developing countries. In sub-Saharan Africa (SSA), foreign ownership of banks is above 50% of the domestic banking sector and given the crucial role banks play in the domestic economy, the effect of their entry is questioned, especially in relation to domestic banking stability. We examine the impact of foreign bank inflows on the banking sector stability in SSA, using available data for the period 1995 to 2009. The study employed two econometric estimators: the multivariate logit and the two-step system generalised method of moment (GMM). The results from the two methods indicate that the presence of foreign banks in the domestic banking sector robustly reduces the probability of bank crisis. Finally, the study revealed that improvement in political institutions also reduces the probability of bank crisis.

Keywords: ECOWAS; SADC; Financial development; Multivariate logit; System-GMM.

1. Introduction

The debate on bank internationalisation and financial stability has rekindled, especially after the 2007-2009 financial crisis that affected the global banking system. Again, given the speed of global financial integration, the trends in foreign bank inflows have been dramatic for the past two decades (Süer *et al*., 2016). Prior economic literature focusing on the impact of foreign bank inflows on stabilisation of financial intermediation in host countries, pre-and post-crisis, appear to have a mix of conclusions. On the positive note, foreign banks' entry could improve the efficiency of credit delivery through modern banking technology that improves internal controls and risk management, stimulate competition and product innovation, generate increased availability of credit through capital injections and access to foreign capital, and reduce the economic impact of local bank crises (Crystal *et al*., 2002; Lardy, 2001; Claessens *et al*., 2001; Lensink & Hermes, 2004; De Haas, 2014). On the negative note, it could expose the domestic banking systems to international risks and shocks (De Haas, 2014). In addition, international banks' presence may cause domestic banks to engage in speculative actions to remain competitive (Süer *et al*., 2016). From the theoretical point of view, Kalemli-Ozcan, Papaioannou and Perri (2013) and Morgan, Rime and Strahan (2004) posit that foreign banks can cause domestic bank instability by moving capital from economies with limited investment opportunities across to other investment havens. To this end, domestic banking instability is closely related to the activities of foreign banks in the domestic economy through the volatility of credit supply and the potential for contagion.

The policy and academic discourse about the impact of foreign bank's entry on the banking stability of host economies have been advanced in developed markets of Europe and emerging markets of Eastern Europe and Asia (De Haas, 2014). Therefore, the objective of this paper is to examine the impact of international banking inflows on banking stability in sub-Saharan African (SSA) countries, which has rarely featured in the extant debates and literature. This has the potential to show whether or not foreign banking inflow stimulates capital build-up which better capitalizes domestic banks to absorb financial shocks and thus increase stability in the banking sector. Foreign banking inflow as a strategy to promote banking stability even became more important following the global financial crisis of 2007–2009, when most central banks proposed a higher capital adequacy as a requirement for building stability in the banking industry (Oduor *et al*, 2017).

Studies examining the effects of foreign banking inflows on the domestic banking sector crisis are uncommon for SSA, with the exception of Vogel and Winkler (2010) and Dwumfour (2017) and thus we make the following contributions. First, our study differs from Vogel and Winkler (2010) and Dwumfour (2017) as it used different specification as well as different measures of bank stability. For instance, we depart from Vogel and Winkler's (2010) seemingly unrelated regression in a cross-sectional framework which did not consider the endogeneity problems in the independent variables. Second, we use panel data for selected sub-Saharan African countries (SSAs), up to the crisis period, and applied standard econometric tools that account for endogeneity in our model specification. Bikker and Haaf (2002) explain that appropriate specification of an underlying model determines the validity of estimated parameters. The potential misspecifications, differences in econometric approach and the alternative definitions of bank stability present the potential for generating different results and findings (Roberts and Whited, 2013). Our analysis found that banking inflows reduce the probability of bank instability in SSAs, which supports the foreign banks influx-stability hypothesis.

The rest of this paper is structured as follows. Section 2 presents the background, section 3 the theoretical literature while section 4 discusses the empirical literature and hypothesis. Section 5 deals with the description of the methods, the model specification, and the data. In section 6, the results are discussed. The final section presents the concluding remarks and the policy implications.

2. Background

Even though there are other types of foreign capital inflows such as foreign direct investment and mergers which equally constitute thought-provoking research areas, we concentrate on foreign banking inflow in SSA for the following reasons. First, the financial systems of SSA are broadly bank-based with mostly underdeveloped and thinly-traded stock markets. Only South Africa possesses a well-advanced stock market comparable to markets in advanced economies.[1] The total assets value of the banking sector is estimated on average to be 90 percent of the total financial assets in the overall financial systems of SSAs (Quintyn and Taylor, 2007). For example, in countries, such as Gambia,

[1] According to SADC-Finance and Investment Sector Coordinating Unit (FISCU) 1998, the stock market of South Africa ranked 17th in the world based on stock market capitalization. Others with relative developed markets include Ghana, Kenya, Mauritius and Nigeria.

Madagascar and Mali, the banking sector contributes about 97%, 98% and 98.7% respectively to the total assets of the financial sector. These facts clearly mark the dominance of the banking sector in the financial system of SSA.

Second, the growth in cross-border bank (foreign banks) inflows largely attributed to the financial sector liberalisations motivates a study on foreign banking inflow in SSA. Liberalisation opens up domestic banking systems, thereby, improving the integration of financial systems in the sub-region to the rest of the global financial system. van Horen (2007) and Claessens and van Horen (2012) show evidence that net bank flows from developing economies into other developing economies and also from advanced industrialised countries to developing countries have increased in the form of foreign direct investments (FDIs) in the banking sector of SSA (World Bank, 2006). Also, international banks, currently, constitute close to 60% of the total banks in SSAs, with the number exceeding 80% in Burkina, Mali and Swaziland (See Figures 1 and 2 as well as Table 1 in the Appendix). According to Claessens and van Horen (2012), loans of foreign banks, deposits and profits, and current market shares averaged almost 50% in emerging markets and developing countries and 20% in Organization of Economic Co-operation and Development's countries.

In addition, the total number of foreign banks in SSA witnessed an increasing trend from 31% to 54% for the period 1995 to 2009 (Figure 1). This suggests the importance of financial sector foreign direct investment (FSFDI) in the banking industry of SSA. The above-described characteristics put into shape the reason SSA banking systems are of particular concern in the examination of the impact of foreign bank entry on the banking stability.

Figure 1: Regional Comparison of Percentage of Foreign Banks Ownership among Total Banks (Data from Claessens and van Horen, 2012)

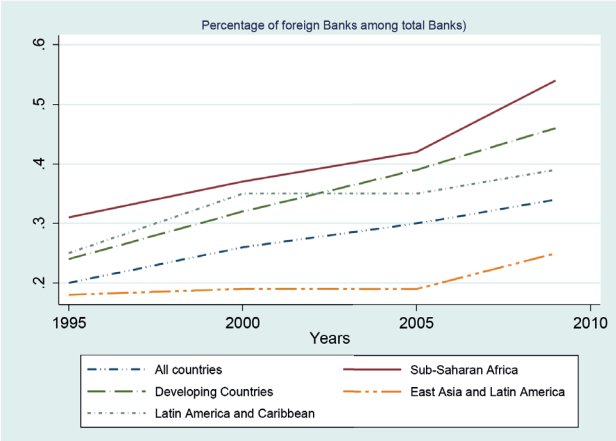
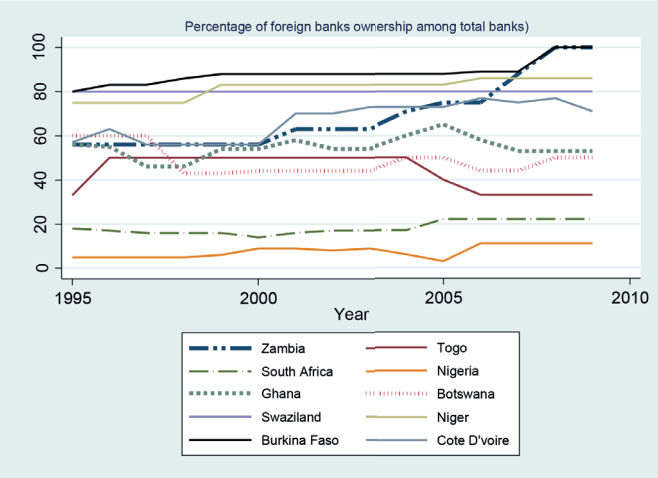


FIGURE 2: PERCENTAGE OF FOREIGN BANKS OWNERSHIP AMONG TOTAL BANKS (GLOBAL FINANACE DATABASE, 2014)



Against the background that the entry of foreign banks has potential repercussions on the hosts' banking systems, it is worthwhile to seek to investigate the implications of the phenomenon on the stability of the relatively underdeveloped and fragile banking sectors of SSAs. More importantly, given that the banking sector in the region accounts for almost 90% of financial sector assets, the stability of the sector is imperative and a major concern for banking supervision and regulation. Within the above context, we asked one key pertinent research question: has the entry of foreign banks contributed to greater domestic bank stability or crisis in SSAs?

3. Theoretical framework

This section addresses mechanisms through which foreign banks may affect the stability of the host country's banking system. Theoretical mechanisms explain the fact that subsidiaries of foreign banks are not completely independent institutions from the parent bank or a larger bank holding company. This implies that the parent bank will act as the lender of last resort during the period of financial turmoil. According to Stein (1997), such a parent bank has and manages an internal capital market and centralised treasury operations to allocate capital and liquidity over its subsidiaries. This implies that foreign banks are insulated against the adverse effects of a host country bank capital or liquidity shocks and will keep up their credit supply during domestic crises. This is known as foreign banking-stability view.

However, foreign banks can induce crises if they are more procyclical to changes in the host country's macroeconomic environment. When the economic activities of the host country decline, the activities of the foreign bank in this country may be scaled down in favour of other regions whose economies are upturned. Alternatively, foreign banks could also react to changes in the parent bank's home country. Worsening economic conditions in the home country can force parent banks to become capital-constrained, compelling the foreign banks to reduce their credit at the destination. This is described as wealth effect. Wealth effect could induce crises at the destination. This is foreign banking-fragility view.

On the other hand, it can be argued that when economic conditions in the home country worsen, parent banks will increase their efforts to expand their activities abroad, since investment opportunities in the home market are scarce. This is known as substitution effect. When home country conditions improve, the opportunity costs of limiting home country lending increases and banks may, therefore, allocate less capital to their foreign subsidiaries (Molyneux & Seth, 1998; Moshirian, 2001). This scenario indicates that there is a negative relationship between the home country business cycle and the foreign subsidiary's credit supply.

Other theories argue that entry of foreign banks into the domestic banking system ignites reactions in the following ways. First, in the short term, profit margins of the domestic banks are reduced drastically, triggering bank failures (Viverita *et al*., 2015). Second, in the long term, the overall banking sector is enhanced, which promotes competition (Viverita *et al*., 2015). Even though competition has the potential of promoting efficient allocation of credit, superior products and spurring innovation, it has become a contentious issue in the banking sector. To this end, two main views have arisen to explain the relationship between competition and stability among banks. The first view, competition-frugality, suggests a negative effect of competition on banks' stability (Kasman and Kasman, 2015; Mulyaningsih *et al*., 2015). This view contends that high level competition among banks reduces banks' influence in the market, which decreases profits. As a result, banks are compelled to take risks so as to stay competitive. The second view, competition-stability, suggests that competition drives bank stability (Kasman and Kasman, 2015; Mulyaningsih *et al*., 2015). This view stresses the fact that a competitive environment reduces interest rate and helps curtail asymmetry information associated with bank lending, which brings stability.

4. Literature review and hypothesis testing

A good number of studies have investigated the connection between financial liberalisation and banking crises (stability) in both developing and advanced economies. (For example,Demirgüç-Kunt and Detragiache, 1998b; Levine, 2001; De Haas and van Lelyveld, 2006, 2010). While some of the studies found financial liberalisation to increase the likelihood of bank crises (e.g. Hellmann *et al*., 2000; Mehrez and Kaufmann, 2000; Glick and Hutchison, 2000; Noy, 2004, 2005; Shehzad and De Haan, 2009; Angkinand *et al*., 2010), others found contrasting results (e.g. Demirgüç-Kunt and Detragiache, 1998b; Shehzad and De Haan, 2009). Some studies also found no relationship between liberalisation and bank crises (e.g. Bordo *et al*., 2001; Eichengreen and Arteta, 2002). However, Demirgüç-Kunt and Detragiache (1998b) on the determinants of banking crises for both developed and developing economies, argue that crises occur in countries with weak macroeconomic environment, such as high inflation, high interest rates, weak legal rules and institutions and lack of deposit insurance.

Other studies concentrated on the investigation of the impact of foreign bank inflows (due to financial liberalisation) on several variables, such as bank competition, efficiency, profitability, among others (Barth *et al*., 2004 and Mulyaningsih, Daly and Miranti, 2015). Other strands of the literature have also focused on the effects of variables, such as bank competition, capital requirements, bank concentration, institutions, bank access, among others, on bank stability (e.g. Dwumfour, 2017; Oduor, *et al*., 2017). Studies examining the impact of foreign bank inflows on the domestic banking sector stability are comparatively uncommon for SSA. This study focuses on the impact of foreign bank inflows on the domestic banking sector stability of SSAs. The next section reviews the extant literature on foreign bank entry and domestic banking stability and sets up the main hypothesis for the study.

4.1. Foreign bank entry and domestic banking stability

Empirical evidence on the effects of foreign bank's activities on the domestic banking sector stability and thus financial stability is mixed and limited. This follows the two main hypotheses in the existing literature: "foreign banks influx-stability hypothesis" and the "foreign bank influx-fragility hypothesis". The former argues for the position that foreign banks' inflow reduces the probability of banking crises and, therefore, brings stability to the financial sector of the host market. Selected studies that support the stability view include Demirgüç-Kunt *et al*. (1998), Detragiache and Gupta (2004), Arena *et al.* (2007), De Haas and van Lelyveld (2006, 2010). The foreign banks influx-fragility hypothesis,

on the other hand, argues that the presence of foreign banks heightens the probability of banking sector crises and makes the host sector fragile (De Haas, 2014; Dwumfour, 2017). Barth *et al*. (2004) found that barriers to foreign-bank entry and foreign ownership are positively associated with bank fragility. Beck *et al*. (2003) do not support any of the two hypotheses, indicating no evidence of direct relationship between foreign banking activities and the probability of banking crisis.

4.2. Foreign banks and banking stability in SSA

Despite considerable research on foreign bank inflows and domestic banking stability, little can be said about the African context, with the exception of Vogel and Winkler (2010) and Dwumfour (2017). The former examines whether increases in market share of foreign banks in many emerging markets since the mid-1990s contribute to financial stability in the respective host countries during the global financial crisis. The study suggests that the stabilising impact of foreign banks was limited to the cross-border component of financial globalisation and to two regions, Eastern Europe and SSA. Only in the SSA region was this translated into more stable credit growth. Thus, hopes that a stronger presence of foreign banks might help host countries in isolating domestic credit from international shocks did not materialise during the 2008 crisis. The work of Dwumfour (2017), which examined banking stability in SSA, posited that net interest margin is the main determinant of stability in the industry and that the presence of foreign banks in the domestic industry reduces stability, which corroborates the fragility view. However, a major concern of Dwumfour's (2017) study is the reported significant and high value coefficients, which is an indication of specification problems. The study also excluded theoretically important explanatory variables, such as deposit insurance, which is posited as important by Diamond and Dybvig (1983). Others include the ratio of money supply to foreign exchange reserves, which measures bank fragility. It tests whether banking instability occurs as a result of sudden capital outflows or vulnerability to a run on banks. Other relevant indicators include credit growth and financial liberalisation. The current study improves upon these omissions in the existing studies. Thus, this study contributes to the extant literature by focusing on the impact of foreign bank inflows on the banking stability of SSA by testing for either the "foreign banks influx-stability hypothesis" or the "foreign bank influx-fragility hypothesis". Therefore, our main hypothesis states that;

H1. Ceteris paribus, there is a statistically significant positive relationship between foreign banking activities on the domestic banking sector stability.

5. Research design/ model specification and data

In order to estimate the impact of foreign bank inflows on banking stability and test for the stated hypothesis, we modelled banking stability (crises) as a linear function of foreign bank inflows and other conditioning variables. We specify the following basic model:

$$y_{it} = \alpha_i + \beta_i x_{it} + \varepsilon_{it} \quad (1)$$

where i is the individual country at time t and $i = 1 \ldots \ldots \ldots N$; $t = 1 \ldots \ldots \ldots$ T. $\varepsilon_{i,t}$ is the error term and variable y_{it} refers to banking stability captured by two measures. The first measure is a binary variable (*bankcrisis*) showing 1 for banking crisis in country i for a particular year t and 0 for no crisis. The second measure is bank z-score, which measures the risk of default and is used to capture a bank's probability of insolvency. The x_{it} variable is a k-dimensional vector of regressors that is capable of explaining bank stability and includes foreign bank inflows (fbi_{it}). The banking crises (*bankcrisis*) variable can either be systemic or non-systemic. We consider the analysis of systemic crisis since most incidences of crisis experienced in SSA were largely due to credit directives and controls aimed at inducing economic growth.

We have eighteen bank crises episodes as shown in Table 2 in the Appendix resulting in seventy-two (72) observations. The countries that were hit are Nigeria, Swaziland, Zambia and Zimbabwe. However, to capture the effect of financial sector liberalisation, the study included countries without bank crises. In addition, we include non-crisis countries as controls and allow for the errors to be correlated within each country by clustering the errors.

The other variables captured by x_{it} include financial openness (*finop*), inflation, credit to the private sector (*Credit*), real GDP per capita (*rgdppc*), real GDP growth (*rgdppcgr*), exchange rate (*exrate*), governance indicator (*polity2*), deposit insurance (*depinss*) and M2 to foreign exchange reserves (*M2/res*).

Real GDP per capita (*rgdppc*) is used to control for economic development, which is expected to reduce the tendency of banking crises in the region. Real GDP growth rate (*rgdppcgr*) was used to control for cyclical output effects. Furthermore, to test whether banking crisis occurs as a result of sudden capital outflows or vulnerability to run on currency, we include the ratio of M2 to foreign exchange reserves (*M2/res*). Credit to the private sector as a ratio of GDP (*credit*) is expected to correlate positively with banking crisis. Political institution (*polity4*) is supposed to reduce the likelihood of banking crisis.

Financial openness (*finop*) is expected to reduce the risk of banking crises, as it creates the opportunity for banks to access funds abroad and strengthen their liquidity position and, thus, ensure stability. Explicit deposit insurance (*depinss*) is included to capture reduction in banking crisis after liberalisation by eliminating possibility of self-fulfilling panic analysed in the model (Diamond and Dybvig, 1983). Finally, inflation and exchange rate (*extrate*) are used to capture loss of monetary control and the impact of currency movements on bank fragility. We used annual data covering the period 1995-2009 for 22 SSA countries. This is because the main variable of interest does not extend beyond 2009. Data is only available for these 22 countries. Detail descriptions of the data used are found in Table 3 in the Appendix. We estimated equation (1), using Multivariate Logit and the dynamic System-GMM.

5.1 The multivariate logit method

Following Laeven and Valencia (2012), we applied a multivariate logit (and probit for robustness check) to estimate equation (1), given that dependent variable (*bankcrisis*) is binary. In this approach, the probability that a bank crisis will occur is assumed to be a function of a vector of the explanatory variables and estimates of the crisis probability are obtained by maximising the likelihood function. More formally, in each period, a country could be experiencing a crisis (y_{it}=1) or no crisis (y_{it}= 0). Thus, the outcome, y_{it}, is defined as:

$$y_{it} = \begin{cases} 1 & \text{with probability } P(i,t) \\ 0 & \text{with probability } 1 - P(i,t) \end{cases} \tag{2}$$

Equation (1) is estimated by parameterising P to depend on an index function $\beta' x$. The conditional probability in the binary outcome model is given by:

$$P(i,t) = (y_{it} = 1|x) = F(\beta' x(i,t)) \tag{3}$$

If $P(i,t)$ denotes banking crisis dummy variable, β is a vector of n unknown coefficients to be estimated and $F(\beta' x(i,t))$ indicates the cumulative probability distribution function evaluated at $\beta' x(i,t)$, then, the log likelihood function of the model from equation (1) is:

$$lnL = \sum_{t=1\ldots T} \sum_{i=1\ldots n} \{P(i,t) \ln[F(\beta' x(i,t))] + (1 - P(i,t)) \ln[1 - F(\beta' x(i,t))]\} \tag{4}$$

From equation (4), the probability distribution F(.) is assumed to be logistic and is given by:

$$F(.) = \frac{e^{\beta' x}}{1 + e^{\beta' x}} \tag{5}$$

The estimated coefficients reflect the effect of a change in the explanatory

variables on ln $P(i,t)/(1-P(i,t))$. An increase in the probability depends on the original probability and initial values of all independent variables and their coefficients. According to Beck *et al*. (2006), the estimated coefficients for each explanatory variable indicate whether an increase in the explanatory variable increases or reduces the probability of a bank crisis. Therefore, we present marginal effect estimates, which show the magnitudes of the relationship between the explanatory variables and bank crisis evaluated at the sample mean.

5.2. The system GMM

The alternative measure of banking stability variable is bank *z-score*. In using the *z-score*, the study applies System GMM technique to address the following problems: (i) potential endogeneity bias (ii) unobserved heterogeneity due to omitted variables. In addition, the dataset used in the study has a short-time dimension and a relatively large country dimension ($T<N$). This approach combines the first difference and level equations, which yields better estimates than the original GMM. However, since the lagged levels are poor instruments for first difference equations, the Arellano-Bond approach considers the autoregressive model, with additional regressors from equation (1), in the specification as follows:

$$y_{it} = \gamma y_{it-1} + \beta_0 x_{it} + u_{it} \tag{6}$$

where u_{it} is the error component term given by equation (7):

$$u_{it} = v_i + \varepsilon_{it} \tag{7}$$

where y_{it} measures bank *z-score* for country *i* at time *t* and u_{it}, which is the error component term, includes unobserved panel effect v_i and the error term ε_{it},with $E(\varepsilon_{it}) = E(v_i) = E(v_i \varepsilon_{it}) = 0$ for all *i* and *t*. One-period lagged of the dependent variable is represented by y_{it-1}, and x_{it} remains as defined in equation (1).

To remove the panel specific heterogeneity effect, the GMM uses first difference to transform equation (6) into equation (8):

$$\Delta y_{it} = \gamma \Delta y_{it-1} + \beta_0 \Delta x_{it} + \beta_1 \Delta fbi_{it} + \Delta u_{it} \tag{8}$$

By transforming the regressors through first differencing, the fixed country-specific effect is removed, since it does not vary with time as in equation (9), but the lagged dependent variable is still potentially endogenous.[2]

$$u_{it} - u_{it-1} = (v_i - v_i) + (\varepsilon_{it} - \varepsilon_{it-1}) = \varepsilon_{it} - \varepsilon_{it-1}\ \Delta u_{it} = \Delta \varepsilon_{it} \tag{9}$$

[2] This is because y_{it-1}term in $\Delta y_{it-1} = y_{it-1} - y_{it-2}$ is correlated with ε_{it-1} in $\Delta \varepsilon_{it-1} = \varepsilon_{it} - \varepsilon_{it-1}$and this applies to x_{it} variables too (Roodman, 2009)

Hence, the Arellano-Bond estimator is based upon the following orthogonality conditions:

$$E(y_{it-s}\Delta\varepsilon_{it}) = (x_{it-s}\Delta\varepsilon_{it}) = 0 \quad for\ t = 3, \ldots T \quad and\ \ 2 \leq s \leq T-1 \tag{10}$$

where y_{it-s} is suitable lags of the dependent variable which are used as instruments for the residuals of the differenced equation (8). To mitigate the problem of lagged levels as poor instruments, Arellano and Bover (1995) and Blundell and Bond (1998) developed the System GMM.

Furthermore, following Blundell and Bond (1998), we apply a two-step GMM estimator to address the problem of heteroscedascity. In the first stage, this procedure extracts residuals from the first-step estimation. In the second stage, the residuals are applied in estimating variance-covariance matrix. The associated Monte Carlo simulations show that this two-step estimator is asymptotically more efficient than the one-step method. We also follow Arellano and Bover (1995) and Blundell and Bond (1998) and include additional assumption that first differences of instrument variables are uncorrelated with the fixed effects, and this allows the introduction of more instruments that dramatically improve efficiency. In addition to the moment condition specified in equation (10), System GMM uses the following moment conditions:

$$E(\Delta y_{it-1}(u_{it})) = 0 \quad E(\Delta x_{it-1}(u_{it})) = 0 \ \ for\ t = 3, \ldots T \tag{11}$$

Equation (11) implies that lagged first-difference of the dependent variable is used to construct orthogonality conditions for the error term of equation (6) in levels. Additional moment condition arises from lagged explanatory variables in levels. However, the number of instruments tends to increase exponentially with the number of periods.

GMM consistency depends on the validity of the instruments used as well as the error term of autoregressive (AR) process: AR (1) indicates serial correlation whereas AR (2) does not. The study, thus, uses two tests proposed by Arellano and Bond (1991). The first test is Sargan-Hansen test for over-identifying restrictions, which is applied to obtain the validity of the instrument. The null hypothesis states that the instruments as a group are exogenous. Therefore, the higher the *p*-values of the Sargan-Hansen statistics, the better. The second test is to determine whether there exists first and second order serial correlations, and the Arellano-Bond test is used. Finally, Bond (2002) observed that asymptotic standard errors of the two-step system GMM estimators tend to be too small while t-ratios are too big, compared to equivalent tests for similar sample sizes based on one-step estimators. To eliminate this potential bias, we used the Windmeijer (2005) finite sample correction for the variance-covariance matrix.

6. Empirical findings and discussions

The sections that follow discuss the results of both the multivariate logit and the two-step system GMM estimates of foreign bank inflows on domestic banking stability. The descriptive statistics of the variables used are shown in Table 1.

Table 1: Descriptive Statistics

Variables	obs	Mean	std dev	Min	Max
z-score	299	13.7	9.0	-4.5	41.5
Fbi	330	57.3	24.2	3	100
Inflation	366	62.8	342.3	-9.6	4145.11
Rdgppc	374	1386.4	1663.95	188.2	6592.8
Polins	374	3.1	5.8	-9	10
Exrate	374	1792.9	25031.9	0.003	480097
rgdppcgr	374	2.0	3.9	-17.95	18.5
Finop	374	-0.7	1.1	-1.9	2.4
m2res	369	3.3	5.4	0.19	72.99
Credit	373	24.1	29.2	2.014	167.5
Depinss	374	0.14	0.34	0	1

Note: All variables are in levels. Fbi is percentage of foreign banks among domestic banks, credit is private credit, and finop is the financial openness index. The variable exrate is exchange rate, and *m2res* is the ratio of M2 to reserves. Finally, *rgdppc* is the real GDP per capita and *rgdppcgr* is the real GDP growth rate.

From Table 1, it is evident that, on average, the percentage of foreign bank presence in the domestic banking industry is about 57% for the period of the study. The mean values of the ratio of M2 to reserves and credit to the private sector indicate about 3% and 24% respectively. However, the maximum indicates about 73% for the ratio of M2 to reserves and 168% for credit to the private sector. The mean z-score is about 14, revealing relatively low stability in the banking system of the SSA region.

6.1. Impact of foreign bank inflows on banking stability, using bankcrisis

The results of the marginal effects from the multivariate logit model are presented in Table 2. The coefficient estimates are also shown in Table 4 in the Appendix. The pseudo R square ranges from 0.03 to 0.49. From Table 2, foreign bank presence in the region reveals a negative and significant marginal probability effect on banking crisis. It implies that increases in the presence of foreign banking in the region significantly reduce the probability of bank crisis,

as shown from columns 1 to 10. From columns 1 to 9, the coefficients remain robustly negative and statistically significant after each control variable is added to the model one after the other. The specifications indicate that, on average, increases in foreign banking inflows by one unit will reduce the probability of banking crisis by 0.1%.

The results provide evidence that supports the argument that foreign banks reduce incidence of bank crisis (e.g. Demirgüç-Kunt *et al*., 1998; De Haas and Van Lelyveld, 2006, 2010). This is supported by the evidence of the existence of some foreign banks in the continent for many decades (e.g. Barclays, Standard Chartered). Overall, these results indicate that the long-run benefits from the presence of foreign banks in the financial system are genuine and not explained by a sort of omitted variable bias. This is possible because foreign banks may introduce know-how and good banking practices that might lead to stability in the sector. Additionally, it implies that the presence of foreign banks in the domestic banking sector may have resulted in improvements in regulations and supervision, transparency and instigation of domestic reforms, which are all key to financial stability. Thus, the results support the "foreign banks influx-stability hypothesis".

Furthermore, political institutions (*polity IV*), real GDP per capita (*rgdppc*) and deposit insurance (*depinss*) all suggest inverse relationship with *bankcrisis*, as suggested by economic theory. The results indicate that these control variables have a robust effect in reducing bank crisis. Development in political institutions indicates statistical significance at 1% level from all the specifications. The results indicate that an improvement in democratic process and dispensation reduce the probability of bank crisis on average by 1%. The baseline model, which is column 10, indicates that democratic development decreases the likelihood of bank failure by about 1.2%. Intuitively, democratic development will include development in the rule of law and civil rights for protecting the banking industry from default, either from borrowers or the bank itself. In the same direction, Table 2 indicates that increases in real GDP per capita, which proxy for the level of development reduces the chances of bankcrisis. Intuitively, economic development, which is linked to development in the legal system, may reduce the level of loan default in the banking industry, which is usually blamed for bank crises. Studies, such as García-Herrero and Del Rio Lopez (2003), Komulainen and Lukkarila (2003), Beck *et al*. (2006) and Shehzad and De Haan (2009), also found such a relationship between real GDP per capita and bank crises.

The result of explicit deposit insurance is in line with the expectation of the Diamond and Dybvig (1983) model. It indicates a reverse relationship with banking crisis variable. This suggests that the likelihood of bank failure is reduced by 7% from the baseline estimates. This means the presence of explicit deposit insurance in the countries that introduced it into their banking system minimises the possibility of self-fulfilling panics. This finding is in contradiction to earlier studies by Demirgüç-Kunt and Detragiache (2005), Cull *et al*. (2005) and Beck *et al.* (2006).

Furthermore, from Table 2, credit to the private sector as well as financial openness variables indicate positive effects with bank crisis. Increases in credit induces bank crisis, as indicated in Table 2 from columns 5 to 10 at 1% statistically significant levels. From this perspective, uncontrolled increases in credit to the private sector have the power to induce bank crisis, which is in line with Kindleberger's (1978), Demirguc-Kunt and Detragiache's (2005), Klomp's (2010), Gwama's (2014) and Bara *et al*. (2017) studies, which argue that the expansion of credit in upturn in the economy results in accumulation of non-performing loans, which causes crisis. In most SSA countries there is always a high potential of accumulating non-performing loans, if credit risk measures are not keenly implemented by banks and regulators.

In addition, the financial openness indicator showed a positive coefficient, suggesting that it induces the chances of bank crisis and fragility. The variable indicates statistical significance at 5%, even though insignificance in model 5. On average, the results suggest that financial openness increases the probability of bank crisis. This introduces fragile domestic banks to intense competition, leading to weak banks failing, due to exposure to liquidity risk, credit risk and exchange rate risk. This could explain why UT Bank and Capital Bank are distressed and have to be taken over by Ghana Commercial Bank recently. In addition, the results could mean financial openness exposes developing countries to financial shocks through increased capital flows. The results lend support to the works of Demirgüç-Kunt and Detragiache (1998), Glick and Hutchison (2000) and Noy (2005). This corroborates "foreign banks influx-fragility hypothesis". However, inflation, which measures the level of control of monetary policy and real GDP per capita, is not statistically-significant, despite indicating the expected sign of reducing the likelihood of banking crisis.

Finally, the baseline estimates suggest that the vulnerability of capital outflows measured by the ratio of M2 to foreign exchange reserves is marginally-significant, but negative. This means an increase in M2 reduces bank crisis

as shown in Table 2. Adoption of flexible exchange rate suggests negative inducement on bank crisis, with probability almost zero.

To test if the results are sensitive to alternative specification and distributional properties, the multivariate probit model is used. The probit results, which are similar to the logit results in Table 2, are presented in Table 5 in the Appendix. It, generally, indicates that foreign bank inflows are negative and statistically-significant in all the specifications and point to the finding that the presence of foreign banks reduces the likelihood of banking crisis in the banking sector.

6.2 Impact of foreign bank inflows on banking stability, using z-score

This section discusses the extent to which bank *z*-score can be captured by the dynamics of both bank specific and macroeconomic variables. Deposit insurance was dropped because its inclusion may cause bias estimates, since it is a time-invariant regressor. Following Roodman (2009) and Heid, Langer and Larch (2012), the instruments are collapsed, and we used two lags for the System GMM. The standard errors are corrected using Windmeijer (2005) finite-sample correction.

From Table 3, the p-values of the Sargan and Hansen *J*-tests for over-identification restrictions results suggest that, in all the estimates, the instruments are valid. In addition, the test for the second order autocorrelation in the disturbance term reported by AR (2) suggests that there is no evidence for significant second order autocorrelation. This is in line with our expectations. Based on these tests, we can conclude that we have the right specification.

The results indicate that the coefficient of the lagged *z*-score is significant and positive, implying strong persistence in the risk of bank insolvency in the region. That is, previous bank probability of default is highly related to the current probability of default by banks in the region.

Over all, the variable of interest, foreign bank inflows, is statistically-significant and positively affects the *z*-score. This suggests that foreign banks' entry into the domestic banking sector reduces the risks of insolvency (increases distance-to-insolvency) of the domestic banking sector, thereby ensuring a stable banking sector in the SSA region. This supports the results from the banking crisis variable. Comparatively, the GMM results are relatively stronger than the results from multivariate logit (probit) regressions. The results for the five specifications in Table 3 suggest that foreign banks' presence in the region increases the domestic bank distance-to-insolvency.

TABLE 2: IMPACT OF FOREIGN BANK INFLOWS ON BANKING STABILITY USING *BANKCRISIS* (MARGINAL EFFECTS OF MULTIVARIATE LOGIT)

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Fbi	-0.001*	-0.0010**	-0.0013**	-0.0015**	-0.0014***	-0.0007**	-0.0007**	-0.0007**	-0.0012**	-0.0010*
	(0.0005)	(0.0005)	(0.0005)	(0.0006)	(0.0005)	(0.0003)	(0.0003)	(0.0003)	(0.0005)	(0.0006)
polins		-0.0092***	-0.0124***	-0.0124***	-0.0123***	-0.0127***	-0.0130***	-0.0130***	-0.0139***	-0.0117***
		(0.0029)	(0.0041)	(0.0039)	(0.0037)	(0.0037)	(0.0038)	(0.0038)	(0.0038)	(0.0035)
finop			0.0328**	0.0322**	0.0278	0.0364**	0.0373**	0.0379**	0.0380**	0.0239**
			(0.0154)	(0.0155)	(0.0193)	(0.0173)	(0.018)	(0.0172)	(0.0167)	(0.0119)
m2res				-0.004	-0.00611*	-0.0141*	-0.0145*	-0.0150**	-0.0172**	-0.0101*
				(0.0026)	(0.0034)	(0.0074)	(0.0078)	(0.0072)	(0.0077)	(0.0056)
credit					0.0017***	0.0040***	0.0041***	0.0042***	0.0049***	0.0049***
					(0.0006)	(0.0010)	(0.0011)	(0.0011)	(0.00117)	(0.0014)
rgdppc						-0.00004***	-0.00004***	-0.00004***	-0.00005***	-0.00006***
						(0.00001)	(0.00001)	(1.28e-05)	(1.52e-05)	(1.79e-05)
inflation							0.000002	2.95e-06	4.31e-06	-0.0003
							(0.00002)	(1.66e-05)	(1.36e-05)	(0.0003)
rgdppcgr								-0.00176	-0.0022	-7.54e-05
								(0.0040)	(0.00401)	(0.0050)
depinss									-0.0424	-0.0730*
									(0.0259)	(0.04)
exrate										-0.0002***
										(6.98e-05)
Prob>chi2	0.0756	0.0002	0.0076	0.0091	0.0057	0.0013	0.0019	0.0000	0.0000	0.0000
Pseudo R2	0.0330	0.2120	0.2677	0.2930	0.3378	0.4019	0.3979	0.3996	0.4058	0.4909
log likelihood	-51.75050	-42.17	-39.19	-37.743	-35.350	-31.93	-31.923	-31.83	-31.50	-26.99

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Fbi is % of foreign banks among domestic banks, credit is private credit,and finop is the financial openness. Exrate is exchange rate, and m2res is the ratio of M2 to reserves. Finally, rgdppc is the real GDP per capita, depinss is explicit deposit insurance and rgdppcgr is the real GDPper capita growth.

TABLE 3: RESULTS OF TWO-STEP SYSTEM GMM FOR BANK Z-SCORE

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
$zscore_{t-1}$	0.673***	0.702***	0.704***	0.668***	0.694***	0.663***	0.555***
	(0.113)	(0.125)	(0.127)	(0.080)	(0.121)	(0.110)	(0.094)
Fbi	0.0576**	0.0604*	0.0669*	0.102*	0.114**	0.105**	0.091**
	(0.029)	(0.031)	(0.037)	(0.057)	(0.054)	(0.051)	(0.0418)
Credit	0.0447*	0.0413*	0.0396*	0.0280	0.0271	0.0611	0.0854***
	(0.025)	(0.024)	(0.021)	(0.021)	(0.034)	(0.049)	(0.029)
Polins	0.174	0.198	0.244	0.732**	0.579	0.587**	0.505**
	(0.412)	(0.362)	(0.271)	(0.313)	(0.372)	(0.230)	(0.243)
finop		-0.0433	-0.0936	-0.0239	-0.223	0.729	2.470*
		(0.675)	(0.645)	(0.766)	(0.816)	(1.467)	(1.453)
exrate			-0.0007	-0.0014	-0.0022	-0.0038	-0.0047*
			(0.0017)	(0.0025)	(0.0025)	(0.0028)	(0.0025)
inflation				0.0210*	0.0133	0.0112	0.0065
				(0.012)	(0.0097)	(0.0071)	(0.0058)
m2res					-0.392	-0.419	-0.878**
					(0.277)	(0.291)	(0.353)
rgdppc						-0.0012	-0.0023*
						(0.0012)	(0.0012)
rgdppcgr							0.178
							(0.138)
Constant	-0.863	-1.333	-1.683	-5.491	-4.714*	-0.944	5.508
	(2.378)	(2.069)	(2.013)	(4.025)	(2.795)	(4.196)	(5.524)
AR(1)	-2.17	-2.09	-2.17	-2.25	-2.33	-2.46	-2.03
	(0.030)	(0.036)	(0.030)	(0.024)	(0.020)	(0.014)	(0.042)
AR(2)	-1.11	-1.13	-1.14	-0.91	-1.00	-0.99	-1.11
	(0.266)	(0.257)	(0.253)	(0.361)	(0.317)	(0.324)	(0.266)
Sargan test	1.05	1.04	1.05	1.39	6.75	5.84	4.34
	(903)	(0.959)	(0.984)	(0.986)	(0.563)	(0.755)	(0.931)
Hansen	0.44	0.85	0.86	1.97	4.95	4.15	1.73
J-test	(0.979)	(0.974)	(0.990)	(0.962)	(0.763)	(0.901)	(0.998)
Obs	213	213	213	211	211	211	211
N	20	20	20	20	20	20	20

Windmeijer-Corrected robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

The implication of these findings obtain from the two estimators is that the presence of foreign banks in the SSA region plays an integral role in decreasing the probability of bank crises or risks of bank insolvency, leading to financial sector stability and resilience. Our findings are in line with the "foreign banks influx-stability hypothesis".

Concerning the control variable, we find that development in political institutions positively affects bank distance-to-solvency at 5% level of significance, as shown by the full model. We can, thus, give credence to these findings that, in order to reduce the likelihood of bank crises in SSAs, improvement in political institutions must be sustained. The ratio of M2 to exchange rate reserves indicates that it reduces bank distance-to-insolvency at 5% significance level, considering the full model (7). This suggests that bank exposure to currency vulnerability induces banking instability in the region. An increase in bank exposure to currency vulnerability in the region by 10% will result in decreases in bank distance-to-insolvency by about 9%. This supports earlier findings of Demirguc-Kunt and Detragiache (2005) and Klomp (2010) but contrary to the findings of Komulainen and Lukkarila (2003). Financial sector openness, real GDP per capita and inflation are, generally, not statistically-significant in all specifications at the 5% level. Credit to the private sector shows positive relationship with *distance-to-insolvency* in all specifications, and it is highly significant at 1% in full specification (7), contrary to expectations.

7. Summary and conclusion

Foreign banks have progressively played an important role in the banking sector and, thus, the financial system development in many developing countries. Foreign banks hold relatively greater proportion of banking assets in SSA countries. To the extent that foreign banks dominate the banking industry of SSA economies, we examined the impact of foreign bank inflows on the banking sector stability in SSA.

We found that the presence of foreign banks in the domestic banking sector improves domestic banking stability in SSA, supporting the evidence from Latin America's emerging markets (Crystal, Dages & Goldberg, 2002). Therefore, policy should be targeted at improving the regulatory issues on cross-border bank flows into SSAs. Moreover, we found indications that domestic economic and political conditions matter for domestic banking stability. For instance, stability in inflation and political institutions increases the probability of banking stability. We recommend that SSAs should pursue a liberalisation policy towards attracting more foreign banks which have high capital and liquidity to help strengthen and stabilise their domestic banking industry. In addition, stability in the political institutions which will increase the influx of foreign banks can help reduce the likelihood of banking crisis.

In terms of limitations, this study could not capture the diversity of the sources of cross-border inflows of banking activities into SSAs. Therefore, future studies

could focus on the diversity of the sources of the foreign banks into SSAs. This is relevant in uncovering the magnitude and significant of the contribution of each source in moderating or activating crisis in the banking sector as well as the overall financial system development in SSAs. For instance, a regional analysis could enable us detect the sources of the mitigating impact of foreign banks inflow into SSAs. These sources are likely to differ in terms of magnitude and significance due to special features of the regions. In addition, we believe future research will be relevant in the area of foreign bank inflows and financial regulation in SSAs. This has the potential of identifying those aspects of financial regulations which inhibit the efficient inflows of foreign banks in some SSAs.

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Appendix

Table 1: Regional Comparison of Foreign Direct Inflows in the Banking Sector

Region	1995			2000			2005			2009		
	Domestic	Foreign	Total	Domestic	Foreign	Total	Domestic	Foreign	total	Domestic	Foreign	Total
All countries	3120	774	3894	2993	1058	4051	2805	1175	3980	2576	1334	3910
Fraction	0.8	0.2		0.74	0.26		0.7	0.3		0.66	0.37	
East Asia and Pacific	254	57	311	272	64	336	289	69	358	282	95	377
Fraction	0.82	0.18		0.81	0.19		0.81	0.19		0.75	0.25	
Latin America and Caribbean	596	198	794	479	256	735	395	217	612	367	232	599
Fraction	0.75	0.25		0.65	0.35		0.65	0.35		0.61	0.39	
SSA	213	94	307	229	135	364	209	152	361	152	181	333
Fraction	0.69	0.31		0.63	0.37		0.58	0.42		0.46	0.54	
Developing Economies		54%			50%			46.1%			47%	

Source: Own construction using Claessens and van Horen (2012). Foreign Banks: Trends, Impact and Financial Stability. IMF Working paper WP/12/10

TABLE 2: SHOWING PERIODS OF BANKING CRISES AND STABILITY FOR THE PERIOD 1995-2011

Sn	Country	Episode of bank crises from 1995-2011				
1	Benin	0				
2	Botswana	0				
3	Burkina Faso	0				
4	Burkina Faso	0				
5	DRC	1996	1997	1998		
6	Côte d'Ivoire	0				
7	Ghana	0				
8	Lesotho	0				
9	Madagascar	0				
10	Malawi	0				
11	Mali	0				
12	Mauritius	0				
13	Mozambique	0				
14	Namibia	0				
15	Niger	0				
16	Nigeria	1995	2009	2010	2011	
17	Senegal	0				
18	Togo	0				
19	Tanzania	0				
20	South Africa	0				
21	Zambia	1995	1996	1997	1998	
22	Zimbabwe	1995	1996	1997	1998	1999
23	Swaziland	1995	1996	1997	1998	1999
24	Bissau	1996	1997	1998		

TABLE 3: VARIABLES, SOURCES AND DESCRIPTION

Variable	Description	Source
Bank crisis	Dummy: 1 = Bank crisis, 0 = no crisis	Laeven and Valencia (2012), GFDD (2012), GFDD (2012)
Foreign banks	Percentage of the number of foreign-owned banks to the number of total banks in an economy. Foreign bank is bank where 50% or more of its shares are owned by foreigners	Neeltje van Horen (2012), GFDD (2012)
Z-score	Captures the probability of default of the banking system	Bankscope, Bereau van Dijk (2012), GFDD (2012)
Polity2	Measures political institution with -10 extreme autocratic and +10 total democracy	PolityIV
Credit to the private	Domestic credit provided by financial sector (% of GDP)	WDI (2014)
sector	Enterprises and nonfinancial public entities	
m2 to reserves	Broad money to total reserves ratio	WDI (2014)
Inflation	Inflation, consumer prices (annual %)	WDI (2014)
Real GDP per capita	GDP at constant US (2005)	WDI (2014)
Exchange rate	Official exchange rate (LCU per US$, period average)	WDI (2014)
Deposit insurance	Dummy: 1 =a country has explicit deposit insurance, 0 = otherwise	Demirguc-Kunt, *et.al*. (2012),
Financial liberalisation		Chinn-Ito (2012)
Real GDP per capita growth	GDP per capita growth (annual %)	WDI (2014)

Table 4: Impact of Foreign Bank Inflows on Banking Crisis (multivariate logit model)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Fbi	-0.0221*	-0.0247**	-0.0363**	-0.0417***	-0.0416**	-0.0243***	-0.0242***	-0.0237***	-0.0402***	-0.0415*
	(0.0124)	(0.0113)	(0.0149)	(0.0161)	(0.0164)	(0.0084)	(0.0084)	(0.0087)	(0.0142)	(0.0227)
Polins		-0.248***	-0.347***	-0.356***	-0.375***	-0.434***	-0.433***	-0.433***	-0.464***	-0.450***
		(0.0702)	(0.123)	(0.122)	(0.133)	(0.160)	(0.162)	(0.160)	(0.154)	(0.174)
Finop			0.919**	0.926*	0.851	1.246*	1.243*	1.261*	1.268**	0.915*
			(0.459)	(0.485)	(0.623)	(0.701)	(0.711)	(0.668)	(0.645)	(0.555)
m2res				-0.115*	-0.187*	-0.482	-0.481	-0.499*	-0.575*	-0.388
				(0.0691)	(0.101)	(0.303)	(0.311)	(0.277)	(0.297)	(0.236)
Credit					0.0523**	0.135**	0.135**	0.138**	0.163***	0.188**
					(0.0230)	(0.0584)	(0.0594)	(0.0548)	(0.0577)	(0.0734)
Rgdppc						-0.0014**	-0.0014**	-0.0014**	-0.0017**	-0.0024***
						(0.0007)	(0.0007)	(0.0006)	(0.0007)	(0.0009)
Inflation							5.21e-05	9.82e-05	0.0002	-0.0120
							(0.0005)	(0.0007)	(0.0005)	(0.0130)
Rgdppcgr								-0.0586	-0.0724	-0.0029
								(0.123)	(0.120)	(0.189)
Depinss									-1.416*	-2.798*
									(0.769)	(1.617)
Exrate										-0.0084***
										(0.0015)
Constant	-1.895***	-1.813***	-0.719	-0.0625	-0.948	-0.841	-0.846	-0.744	0.604	1.828
	(0.667)	(0.701)	(0.821)	(0.950)	(0.972)	(0.973)	(0.973)	(0.944)	(1.443)	(1.871)
Obs	300	300	300	297	297	297	289	289	289	289
Prob>chi2	0.0756	0.0002	0.0076	0.0091	0.0057	0.0013	0.0019	0.0000	0.0000	0.0000
Pseudo R2	0.0330	0.2120	0.2677	0.2930	0.3378	0.4019	0.3979	0.3996	0.4058	0.4909
log likelihood	-51.750503	-42.17	-39.19	-37.743	-35.350	-31.93	-31.923	-31.83	-31.50	-26.99

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Fbi is % of foreign banks among domestic banks, credit is private credit, and finop is the financial liberalisation. The variable exrate is exchange rate, and m2res is the ratio of M2 to reserves. Finally, rgdppc is the real GDP per capita, depinss is explicit deposit insurance, and rgdppcgr is the real GDPper capita growth.

TABLE 5: RESULTS OF MARGINAL EFFECTS OF MULTIVARIATE PROBIT

Variables	1	2	3	4	5	6	7	8	9	10
fbi	-0.00089*	-0.000967**	-0.00119**	-0.00135**	-0.00123***	-0.000784***	-0.000810***	-0.000787***	-0.00124***	-0.000951*
	(0.00053)	(0.000471)	(0.000535)	(0.000537)	(0.000470)	(0.000286)	(0.000296)	(0.000303)	(0.000435)	(0.000490)
pol		-0.00848***	-0.0103***	-0.0105***	-0.0106***	-0.0111***	-0.0114***	-0.0116***	-0.0126***	-0.0108***
		(0.00252)	(0.00345)	(0.00335)	(0.00320)	(0.00309)	(0.00322)	(0.00315)	(0.00329)	(0.00291)
finop			0.0244*	0.0232	0.0191	0.0266	0.0271	0.0304*	0.0309**	0.0188*
			(0.0144)	(0.0146)	(0.0163)	(0.0168)	(0.0177)	(0.0157)	(0.0156)	(0.0105)
m2res				-0.00423*	-0.00599**	-0.0103*	-0.0104*	-0.0129***	-0.0144**	-0.00839**
				(0.00235)	(0.00291)	(0.00570)	(0.00606)	(0.00497)	(0.00581)	(0.00410)
creddit					0.00151**	0.00338***	0.00345***	0.00371***	0.00438***	0.00463***
					(0.000650)	(0.00102)	(0.00108)	(0.00107)	(0.00115)	(0.00124)
rgdppc						-3.33E-05***	-3.38E-05**	-3.64E-05***	-4.41E-05***	-5.95E-05***
						(1.27E-05)	(1.36E-05)	(1.35E-05)	(1.51E-05)	(1.61E-05)
inflation							-5.74E-06	-2.07E-06	2.17E-07	-0.000314
							(1.54E-05)	(2.75E-05)	(1.78E-05)	(0.000240)
rgdppcgr								-0.00455	-0.00479	-0.00259
								(0.00385)	(0.00396)	(0.00447)
depinss									-0.0405*	-0.0637
									(0.0215)	(0.0391)
exrate										-0.000230***
										(7.00E-05)
Prob>chi2	0.0799	0.0001	0.0048	0.0071	0.0026	0.0009	0.0007	0.0000	0.0000	0.0000
Pseudo R2	0.032	0.212	0.251	0.279	0.311	0.359	0.355	0.368	0.375	0.480
Log likelihood	-51.79	-42.15	-40.08	-38.52	-36.77	-34.21	-34.2	-33.50	-33.13	-27.56

Robust errors in parentheses*** p<0.01, ** p<0.05,* p<0.1