
GMM ESTIMATION AND SHAPIRO-FRANCIA NORMALITY TEST: A CASE STUDY OF DEVELOPING COUNTRIES

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Abstract:

The study of relationships between economic and financial system indicators in developing countries became contemporary issue taking into account the influence of the last crisis. This paper aims to analyze the correlation of number of explanatory variables with portfolio investments in 38 emerging markets in the period from 2005 to 2009. As a empirical methodology of this research serves Arellano-Bond and Arellano/Bover-Blundell/Bond estimations and Shapiro-Francia normality test. We identify that the capital market indicators, in particular, the stock market capitalization, stock market total value traded to GDP are considered the main positive and statistically significant variables. Since the outbreak of the crisis, investors start to pay their attention to almost every indicator affecting the flows of portfolio investments. Almost all banking and economic indicators (except some business environment indicators, bank non-performing loans to gross loans (%), lending interest rate (%), banks Z-score and official exchange rate) are highly associated with portfolio investments.

Key words: *developing markets, inflation, stock market capitalization, lending interest rate*

1. Introduction

The ongoing globalization processes and financial market integration enhances capital market participants' interactions, credit flows and investment projects' financing. In this regard, the role of developing countries in global markets become more apparent regarding increased competition, new management skills and production technologies. The continuous rise of cross-border financial holdings and banking operations bring more financially integrated world. However, the last financial crisis hit seriously financial systems of developing countries because of large share of toxic foreign assets in domestic markets. On the other hand, declining world commodity prices, turbulences of capital flows and exchange rate policies jeopardize market positions of developing countries.

Taking into account the fast growth of developing economies in the last 10 years, the onset of financial crisis and strengthening financial integration process this paper aims to identify the main factors affecting foreign investments of emerging

countries. We find that foreign capital flows, particularly foreign portfolio investments are considered a crucial indicator reflecting the stage of development of business environment, healthy financial market conditions and regulatory framework. The next section of this paper covers related literature review indicating the main approaches of study of relations between financial market indicators. Then, we present the model of our study including the outline of features of GMM estimation and Shapiro-Francia normality test. The third part includes the international data of the study. The fourth part involves the empirical results of the research. Finally, the last section summarizes the main outcomes of our paper.

2. Literature review

There is a large bulk of studies concerning the relations of different financial indicators. There are various possible determinants of portfolio investments discussed in the literature can be classified as follows (Wildmann, 2010):

- Indicators of the financial market development
- Determinants based on the portfolio calculus of international investors
- Individual characteristics of the investor, such as bank-specific characteristics concerning risk exposure and the business model of the bank, as well as
- The global and national macroeconomic environment

The direct linkage between economic growth and capital flows allocation channels of country was approved by King and Levine (1993). For example, the link between exchange rate and investments was analyzed by many authors. The work conducted by Phillips and Freedom (2008) shows the different connections between FDI and exchange rate risk. In this context, Foad (2005), Carrieri and Majerbi (2006) and Eun and Resnick (1988) reports the influence of exchange rate policy on foreign direct and portfolio investment flows to countries. The similar study has been undertaken by Zis (1989) showing the rise of investment uncertainty in conditions of turbulences of exchange rate. The affect of uncertain exchange rate on investment flows was also investigated by Dixit and Pindyck (1994). Landon and Smith (2009) point out the negative effect of risen exchange rate risk on investment environment. The effect of exchange rate risk volatility on foreign portfolio investments was highlighted by Muller and Verschoor (2009).

Keynes identified some main macroeconomics variables that study the FPI of the economy as a whole: gross domestic product, exchange rate, interest rate, inflation and money supply. GDP is a measure of the annual improvement in the standard of living of the average citizen/resident of a country and it takes into account all the production inside a country, independent of whose domestic or foreign own production site (Onworah, 2013). Jenkins and Thomas (2002) study the relationships between FPI and several variables and find out that inflation is among four determinants which exhibit statistical significance.

The bank performance is considered one of the important factors affecting investors' decisions. In particular, the variations of profitability of large financial

intermediaries influence the flows of investment flows (Abdus and Kabir, 2000). Here the authors highlight the ROE and ROA of banking performance.

Pavabutr and Yan (2003) note that a good understanding of the effect of foreign portfolio flows on stock market performance is therefore imported in assessing the role that foreign portfolio plays on the stock market given the concern that such flows may destabilize the fragile markets especially at times of crisis. Sharpe et al., (2003) indicate that the investment return is mostly conditioned by variations of exchange rate and stock price. Dittbacher et al., (2005) consider the regulatory framework one of the main determinants of foreign portfolio investments.

3. The model

In simple dynamic panel models, it is well known that the usual fixed effects estimator is inconsistent when the time span is small (Nickell, 1981), as is the ordinary least squares (OLS) estimator based on first differences. In such cases, the instrumental variable estimator (Anderson and Hsiao, 1981) and generalized method of moments (GMM) estimator (Arellano and Bond, 1991) are both widely used (Han and Phillips, 2010). On the other hand, as Blundell and Bond (1998) suppose that GMM estimator suffer from a weak instrument problem when the dynamic panel autoregressive coefficient (ρ) approaches unity. When $\rho=1$, the moment conditions are completely irrelevant for the true parameter ρ , and the nature of the behavior of the estimator depends on T . When T is small, the estimators are asymptotically random, and when T is large the unweighted GMM estimator may be inconsistent and the efficient two-step estimator (including the two-stage least squares estimator) may behave in a nonstandard manner (Han and Phillips, 2010).

Rigorous surveys of these estimators can be found in, for example, Arellano and Honore (2001) or Blundell, Bond and Windmeijer (2000). The emphasis here will be on a intuitive review of these methods, intended to give the applied researcher an appreciation for when it may be reasonable to use particular GMM estimators, and how this can be evaluated in practice. (Bond, 2002).

Arellano (1989) showed that an estimator that uses the levels for instruments has no singularities and displays much smaller variances than does the analogous estimator that uses differences as estimators (Weinhold, 1999). The Arellano-Bond estimator sets up a generalized method of moments (GMM) problem in which the model is specified as a system of equations, one per time period, where the instruments applicable to each equation differ (for instance, in later time periods, additional lagged values of the instruments are available) (Baum, 2013). Arellano and Bond argue that the Anderson-Hsiao estimator, while consistent, fails to take all of the potential orthogonality, conditions into account. A key aspect of the AB strategy, echoing that of AH, is the assumption that the necessary instruments are "internal": that is, based on lagged values of the instrumented variable (s). The estimators allow the inclusion of external instruments as well.

Consider the following model:

$$\begin{aligned} Y_{it} &= X_{it}\beta_1 + W_{it}\beta_2 + v_{it} \\ V_{it} &= u_i + \varepsilon_{it} \end{aligned} \quad (1)$$

where X_{it} includes strictly exogenous regressors, W_{it} are predetermined regressors (which may include lags of y) and endogenous regressors, all of which may be correlated with u_i , the unobserved individual effect. First-differencing the equation removes the u_i and its associated omitted-variable bias (Baum, 2013).

Dynamic panel data (DPD) models estimated using the Generalized Method of Moments (GMM) have become an important tool in the empirical analysis of microeconomic panels with a large number of individual units and relatively short time series. An important baseline case is the first order autoregressive (AR(1)) model with unobserved individual-specific effects considered by Arellano and Bond (1991). It is the following model

$$y_{it} = \alpha y_{i,t-1} + \eta_i + v_{it} \quad (2)$$

where $i=1, \dots, N$ and $t=2, \dots, T$; $T \geq 3$ and $|\alpha| < 1$

Adopting what are now standard assumptions concerning the error components and initial conditions process (notably that the error terms v_{it} are not autocorrelated for a convenient summary (Blundell and Bond, 1998), Arellano and Bond (1991) noted that validity of the following set of moment conditions

$$E[y_{i,t-s} (\Delta y_{it} - \alpha \Delta y_{i,t-1})] = 0 \quad (3)$$

for $t = 3, \dots, T$ and $s = 2, \dots, (t-1)$

where Δ is the first difference operator. Since these involve the use of lagged levels of y_{it} as instruments for the first differenced equations it is added DIF moment conditions of Blundell and Bond (1998). They constitute all of the second-order linear moment conditions that are available under the maintained assumptions of Arellano and Bond (1991). Under the additional assumption that the deviation of the initial conditions from $\eta_i/(1-\alpha)$ be uncorrelated with the level of $\eta_i/(1-\alpha)$ itself, Blundell and Bond (1998) establish that

$$E[y_{it} - \alpha y_{i,t-1}] \Delta y_{i,t-1} = 0 \quad (4)$$

for $t=3, 4, \dots, T$

Simulation results reported in Blundell and Bond (1998) show that the first-differenced GMM estimator may be subject to a large downward finite-sample bias in

these cases, particularly when the number of time periods available is small (Bond et al., 2001). The lagged levels are rather poor instruments for first differenced variables, especially if the variables are close to a random walk. Their modification of the estimator includes lagged levels as well as lagged differences (Baum, 2013). The inclusion of current or lagged values of these regressors in the instrument set, will improve the behavior the first-differenced GMM estimator in particular applications (Bond et al., 2001). So the Arellano-Bover/Blundell-Bond estimation augments Arellano-Bond by making an additional assumption, that first differences of instrument variables are uncorrelated with the fixed effects. This allows the introduction of more instruments, and can dramatically improve efficiency. It builds a system of two equations-the original equation as well as the transformed one-and is known as System GMM (Roodman, 2009).

The Arellano-Bond (1991) and Arellano-Bover (1995)/Blundell-Bond (1998) dynamic panel estimators are increasingly popular are general estimators designed for situations with 1) "small T, large N" panels, meaning few time periods and many individuals; 2) a linear functional relationship; 3) a single left-hand-side variable that is dynamic, depending on its own past realizations; 4) independent variables that are not strictly exogenous, meaning correlated with past and possibly current realizations of the error; 5) fixed individual effects, and 6) heteroskedasticity and autocorrelation within individuals but not across them (Roodman, 2009).

The important diagnostic in DPD estimation is the AR test for autocorrelation of the residuals. By construction, the residuals of the differenced equation should possess serial correlation, but if the assumption of serial independence in the original errors is warranted, the differenced residuals should exhibit significant AR(2) behavior. If a significant AR(2) statistic is encountered the second lags of endogenous variables will not be appropriate instruments for their current values (Baum, 2013).

Arellano and Bond develop a test for a phenomenon that would render some lags invalid as instruments, namely, autocorrelation in the idiosyncratic disturbance term, v_{it} . Of course, the full disturbance, ε_{it} , is presumed autocorrelated because it contains fixed effects, and the estimators are designed to eliminate this source of trouble. But if the v_{it} are themselves serially correlated of order 1 then, for instance, $y_{i,t-2}$ is endogenous to the $v_{i,t-1}$ in the error term in differences, $\Delta\varepsilon_{it}=v_{it} - v_{i,t-1}$, making it a potentially invalid instrument after all. Arellano-Bond test for autocorrelation is actually valid for any GMM regression on panel data, including OLS and 2SLS, as long as none of the regressors is "post-determined", depending on future disturbances (Roodman, 2009).

The Difference and System GMM estimators are designed for panel analysis, and embody the following assumptions about the data-generating process (Roodman, 2009):

- The process may be dynamic, with current realizations of the dependent variable influenced by past ones.
- There may be arbitrarily distributed fixed individual effects. This argues against cross-section regressions, which must essentially assume fixed effects away,

and in favor of a panel set-up, where variation over time can be used to identify parameters.

- Some regressors may be endogenous
- The idiosyncratic disturbances (those apart from the fixed effects) may have individual-specific patterns of heteroskedasticity and social correlation
- The idiosyncratic disturbances are uncorrelated across individuals
- Some regressors may be predetermined but not strictly exogenous: independent of current disturbances, they may be influenced by past ones. The lagged dependent variable is an example
- The number of time periods of available data, T, may be small
- Finally, since the estimators are designed for general use, they do not assume that good instruments are available outside the immediate data set.

The numerical methods of normality include the Kolmogorov-Smirnov (K-S) test, Lilliefors test, Shapiro-Wilk test, Anderson-Darling test, and Cramer-von Misestest (SAS Institute 1995). Shapiro-Wilk test is the most powerful test for all types of distribution and sample sizes whereas Kolmogorov-Smirnov test is the least powerful test (Razali and Wah, 2011). The K-S test and Shapiro-Wilk W' test are commonly used. The K-S, Anderson-Darling, and Cramer-von Misers tests are based on the empirical distribution function (EDF) which is defined as a set of N independent observations x_1, x_2, \dots, x_n with a common distribution function F(x) (SAS 2004) (Myoung, 2008).

The Shapiro-Wilk W' is the ratio of the best estimator of the variance to the usual corrected sum of squares estimator of the variance (Shapiro and Wilk, 1965). The statistic is positive and less than or equal to one. Being close to one indicates normality. The W statistic requires that the sample size is greater than or equal to 7 less than or equal to 2000 (Shapiro and Wilk, 1965).

$$W = \frac{\left(\sum_{i=1}^n a_i x_{(i)}\right)^2}{\sum_{i=1}^n (x_i - \bar{x})^2} \quad (5)$$

where $a_i = (a_1, a_2, \dots, a_n) = m'V^{-1}[m^1V^{-1}V^{-1}m]^{-1/2}$, $m = (m_1, m_2, \dots, m_n)$ is the vector expected values of standard normal order statistics, V is the n by n covariance matrix, $x = (x_1, x_2, \dots, x_n)$ is a random sample and $x_{(1)} < x_{(2)} < \dots < x_{(n)}$ (Myoung, 2008).

The Shapiro-Wilk test has the highest power among all tests for normality. Overall, generally for symmetric non-normal distributions, Shapiro-Wilk is the best test among other normality tests (Razali and Wah, 2011). Unlike some other normality tests, Shapiro-Wilk test does not require specifying the mean and variance in advance and it is very powerful to detect the small departure from normality. But it will not indicate the source of abnormality (Peng, 2004).

The Shapiro-Francia W' test is an approximate test that modifies the Shapiro-Wilk W' . The S-F statistic uses $b' = (b_1, b_2, \dots, b_n) = m'(m'm)^{-1/2}$ instead of a_i . The statistic was developed by Shapiro and Francia (1972) and Royston (1983). (Myoung, 2008). Portfolio equity flows into developing markets are modeled according to the following model:

$$Y_t = h(x_{t-1}) + \varepsilon_t \quad (6)$$

where Y_t is the net equity portfolio inflows in emerging markets, x_{t-1} a set of explanatory variables. We involve polynomial fitting in order to capture the non-linear effects induced by explanatory variables on portfolio investment. To build our model with parameters we add utility functions of domestic and foreign investors which are U_t and U_t^f correspondingly, where:

$$U_t = \alpha_0 + \alpha_1 x_t^3 + \alpha_2 x_t^2 + \alpha_3 x_t + \alpha_4 (x_t^f)^3 + \alpha_5 (x_t^f)^2 + \alpha_6 (x_t^f) + \varepsilon_t^1 \quad (7)$$

$$U_t^f = \beta_0 + \beta_1 x_t^3 + \beta_2 x_t^2 + \beta_3 x_t + \beta_4 (x_t^f)^3 + \beta_5 (x_t^f)^2 + \beta_6 (x_t^f) + \varepsilon_t^2 \quad (8)$$

where x_t – domestic determinants of foreign portfolio investments (FPI), x_t^f – foreign determinants of FPI, $\alpha_0, \alpha_1, \dots, \alpha_6$ and $\beta_0, \beta_1, \dots, \beta_6$ are given parameters.

$$\nu U / \nu x = 0; \nu U_f / \nu x^f = 0; \nu U^f / \nu x = 0; \nu U^f / \nu x^f = 0$$

We have the following equations after the changes in models above:

$$3\alpha_1 x_t^2 + 2\alpha_2 x_t + \alpha_3 = 0 \quad (9)$$

$$3\alpha_4 (x_t^f)^2 + 2\alpha_5 x_t^f + \alpha_1 x_t^f + \alpha_6 = 0 \quad (10)$$

$$3\beta_1 x_t^2 + 2\beta_2 x_t + \beta_3 = 0 \quad (11)$$

$$3\beta_4 (x_t^f)^2 + 2\beta_5 x_t^f + \beta_6 = 0 \quad (12)$$

From those models we obtain:

$$\alpha = 3(\alpha_1 + \beta_1) \quad (13)$$

$$\beta = 2(\alpha_2 + \beta_2) \quad (14)$$

$$\delta = 3(\alpha_4 + \beta_4)(x_t^f)^2 + 2(\alpha_5 + \beta_5)(x_t^f) + \alpha_3 + \alpha_6 + \beta_3 + \beta_6 \quad (15)$$

The influence of α , β and δ parameters on a is shown in the following quadratic equation:

$$\alpha a^2 + \beta a = \delta \quad (16)$$

$$\alpha a^2 + \beta a - \delta = 0 \quad (17)$$

where \mathbf{a} is a vector of the explanatory variables. We find easily the value of \mathbf{a} . In particular, taking into account the formula of quadratic equation $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ and given values of α , β and δ , one might obtain the following solution for the equation (17):

$$\mathbf{a} = \frac{-2\alpha_2 - 2\beta_2 \pm \sqrt{4(\alpha_2^2 + \beta_2^2 + 2\alpha_2\beta_2) - (12\alpha_1 - 12\beta_1)(3\alpha_4(x^1)^2 + 3\beta_4(x^1)^2 + 2\alpha_5(x^1) + 2\beta_5(x^1) + \alpha_3 + \alpha_6 + \beta_3 + \beta_6)}{6\alpha_1 + 6\beta_1}$$

According to relation the optimal level of the domestic determinants of FPI is conditioned by the foreign determinants of FPI. In such case the public policies aiming to attract higher level of FPI should insure the internal market conditions and overall macroeconomic stability.

4. Empirical results

We collected panel data of 37 countries (from 2005-2009) using the World Bank and IMF databases regarding portfolio equity, net inflows (BoP, current US\$), bank Z-score, bank non-performing loans to gross loans (%), GDP per capita (current US\$), inflation, consumer prices (%), financial system deposits to GDP (%), percentage of foreign capital to risk-weighted assets (%), percentage of foreign banks to total banks (%), return on equity (%), stock market capitalization to GDP (%), stock market total value traded to GDP (%), foreign direct investments (net inflows, % of GDP), lending interest rate (%), official exchange rate, LCU per USD, period average, stock market turnover ratio (value traded/capitalization) (%), and business environment indicators like cost (of income per capita), time (days) and procedures (number).

The regression results of two-step Arellano-Bond dynamic panel-data estimation from the table 1 and 2 show the relationship of portfolio investments with all independent variables. According to those outcomes we can notice that the percentage of foreign banks to total banks is only variable which is negative and significant at 5% level. Stock market total value traded to GDP (%) and stock market capitalization to GDP (%) are positively correlated with portfolio investment and show significance at 1% level. Other explanatory variables are either in negative or positive relationship with the dependent variable. On the other hand, Arellano-Bond test for zero autocorrelation reveals

The regression results including crisis dummy (table 1 and 2) indicate the statistical significance of all variables except bank non-performing loans to gross loans, lending interest rate (%), cost (income per capita), and time (days). Moreover, the number of positively correlated and statistically significant variables fully exceeds negative effects of the rest of indicators. Only cost (of income per capita) and procedures (number) exhibit negative effects and only the latter is significant at 1% level.

From the system dynamic panel-data estimation (table 3 and 4) only percentage of foreign banks to total banks (%) and percentage of foreign capital to risk-weighted assets (%) are statistically significant and negatively associated with foreign portfolio investments. The range of positive and statistically significant variables includes return on equity (%), lending interest rate (%), stock market capitalization and stock market total value to GDP. All variables except lending interest rate (%) indicate significance at 1% level. On the other hand, coefficients with crisis dummy (table 3 and 4) exhibit a large range of positive and statistically significant variables except cost (of income per capita).

The regression with variable squares brought somewhat different pattern of results. In particular, the Arellano-Bond dynamic panel-data estimation (table 5 and 6) shows that banks Z-score, bank non-performing loans to gross loans (%), percentage of foreign banks to total banks and official exchange rate are in negative relationship with dependent variable and significant at different levels. On the other hand, return on equity, stock market total value traded to GDP, procedures (number) and stock market turnover ratio (%) are positively connected with the dependent variable. The significance at 1% level is observed for return on equity and stock market total value traded to GDP, and 5% significance is viewed for procedures (number) and stock market turnover ratio (%).

The outcomes of system dynamic panel-data estimation (table 7 and 8) show the negative effects of bank non-performing loans to gross loans (%), percentage of foreign banks to total banks (%), official exchange rate, FDI, lending interest rate, cost (of income per capita) and time (days) indicate negative correlation with portfolio investments. However, only percentage of foreign banks to total banks (%) and official exchange rate are significant at 10% and 5% confidence level.

Taking into account the estimation results viewed in the tables we can notice that the important role of stock market variables as determinants of foreign portfolio investments is evident in our tests. So, domestic securities market shows more powerful impact on portfolio investments than macroeconomic or business environment variables.

The results of autocorrelation tests reveal the fact of no autocorrelation in our dataset. As it concerns the Shapiro-Francia normality test for normality it reveals that W' values are greater than 5% for all independent variables. So, we assert that the data comes from the normal distribution. The Shapiro-Francia test for normality has an impact on robustness of our tests and the null hypothesis of normal distribution of our data is confirmed.

5. Conclusions

The empirical part of the paper studies the determinants of portfolio equity flows to developing market over the 2005-2009. Policy implications of our findings may be resumed as follows:

- Arellano-Bond dynamic panel-data estimation reveals that most of the independent variables are not significant. The main explanation of that is the more attention of investors paid on stock market developments. In conditions of ample investment sources, developing trade relations between emerging and developed countries, the entry of foreign banks to domestic markets and continuous stimulus of a government foster the fast development of securities markets and banking sector. This is a reason for statistical significance of only stock market capitalization to GDP (%), percentage of foreign banks to total banks (%) and stock market total value traded to GDP (%). The statistical significant influence of the stock market capitalization was confirmed also by Pavabutr and Yan (2003). However, in contrast to the findings of Abdus and Kabir (2000) we reject the statistical importance of return on equity.
- The estimation with dummy variables shows that in the period of crisis investors pay more attention to macro/financial conditions in recipient countries. The general loss of confidence, growing public debt and budget deficit of developing markets enhanced the influence of large number of explanatory variables on investment environment. In particular, financial sector determinants (except bank non-performing loans to gross loans and lending interest rate (%)), all macroeconomic variables and procedures (number) indicate a statistical significance. The similar results were obtained by Zis (1989) who shows the negative influence of exchange rate fluctuations on investment flows. Besides, Gourinchas and Rey (2005) indicate the adverse effect of currency depreciations and appreciations on US investment environment.
- Arellano-Bond dynamic panel-data estimation with square variables indicates different correlation patterns. Particularly, the banks Z-score, bank non-performing loans to gross loans (%), return on equity (%), stock market total value traded to GDP (%) are significant at 10% level. Moreover, first two are negative and the others are positive. This may be explained by worsening economic situation in recipient markets, banking system failures in foreign countries, particularly, in the USA and euro area countries. On the other hand, less significance at 1% and 5% level viewed among percentage of foreign banks to total banks (%), official exchange rate, procedures (number) and stock market turnover ratio (%) is associated with the investors' caution to "bad" assets of foreign banks in domestic market, bureaucratic barriers to start a business and stock prices variations due to growing unemployment and low profitability of large companies. Conversely, other variables like GDP per capita, inflation, consumer prices (%), financial system deposits to GDP (%), percentage of foreign capital to risk weighted assets (%), foreign direct investment (net inflows % of GDP), lending interest rate (%), cost (of income per capita), and times (days) exhibit no statistical significance because investors pay more attention to companies and banks' performance and their activity on stock market. Dixit and Pindyck (1994) document similar results regarding the negative and statistical significant effect of exchange rate variations on portfolio investments. The same outcomes were obtained by Landon and Smith

(2009) who point out the negative effect of risen exchange rate risk on investment environment.

- System dynamic panel-data estimation identifies the statistical significance of percentage of foreign banks to total banks (%), return on equity (%), percentage of foreign capital to risk weighted assets (%), lending interest rate (%), stock market capitalization to GDP (%) and stock market total value traded to GDP. Major changes in the importance of the drivers of portfolio flows coincide with important banking sector and stock market changes like capital adequacy requirements, share of foreign capital and stock prices development. From financial sector variables only bank Z-score, bank non-performing loans to gross loans (%), and financial system deposits to GDP (%) are not statistically important as investors highlight the financial development, companies' activity in a securities market and openness of domestic financial system. Macroeconomic determinants (GDP per capita, inflation, consumer prices and official exchange rate) are also not statistically important due to the enlargement of banking sector and capital market in recipient countries. The same factors determine the insignificance of business environment variables. Our results are similar to the outcomes of study of Abdus and Kabir (2000) who show the positive importance of return on equity.
- System dynamic panel-data estimation with dummy variables underlines the statistical importance of all explanatory variables except the banks Z-score, official exchange rate, cost (of income per capita) and procedures (number). Therefore, we conclude that growing market tensions, changes in uncertainty and risk aversion drive portfolio flows. Our results are confirmed also by Dittbacher et al., (2005) who indicate the important role of regulatory framework in foreign portfolio flows.
- Keynes identified some main macroeconomics variables that study the FPI of the economy as a whole: gross domestic product, exchange rate, interest rate, inflation and money supply (Onworah, 2013). According to Arellano/Bover-Blundell-Bond estimation with square variables we identify the statistical significance of the percentage of foreign banks to total banks (%), return on equity (%), official exchange rate, stock market capitalization to GDP (%), stock market total value traded to GDP (%), procedures (number) and stock market turnover ratio (%). In this case we note that investors were engaged in a close scrutiny of evaluation of macro-financial conditions. Other explanatory variables like banks Z-score, bank non-performing loans, GDP per capita, inflation, consumer prices, financial system deposits to GDP (%), percentage of foreign capital to risk weighted assets (%), FDI, lending interest rate (%), cost (of income per capita) and time (days) are statistically insignificant. It shows the willingness of investors to observe stock market development and foreign banks' performance. The negative influence of exchange rate variations on foreign capital flows was reported by also Foad (2005), Carrieri and Majerbi (2006) and Eun and Resnick (1988).

There are some reasons for choosing normality test to check the robustness of our findings. First of all, econometricians are more familiar with testing normality.

Second, any continuous distribution may be transformed on a normal one (Bontemps and Meddahi, 2005). Thus, the robustness of our results was checked by the Shapiro-Francia normality test. The fact of normal distribution of the data is confirmed by p-values of this test. Therefore, we accept the null hypothesis of our dataset.

6. References

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Table 1. GMM estimation and Shapiro-Francia normality test

Dependent variable	Independent variables	Variable coefficient	Std. Err.	z	P> z	Arellano-Bond test for zero autocorrelation	Sargan	S-F	S-F Prob>z	Number of observations	Variable coefficient (dummy)
Portfolio equity, net inflows (BoP, current US\$) 2005-2009	banks Z-score	0.37	0.14	0.28	0.78	0.90	1.00	0.89	0.00	180.00	0.4815232***
	bank non-performing loans to gross loans (%)	-0.05	0.08	-0.66	0.51	0.76	1.00	0.81	0.00	180.00	0.22
	GDP per capita (in US\$)	-0.12	0.21	-0.56	0.57	0.55	1.00	0.79	0.00	180.00	0.3567005*
	inflation, consumer prices (%)	-0.04	0.07	-0.59	0.56	0.31	1.00	0.92	0.00	180.00	0.7784671***
	financial system deposits to GDP (%)	0.14	0.22	0.63	0.53	0.68	1.00	0.62	0.00	180.00	0.6195122***
	percentage of foreign banks to total banks (%)	-0.241849**	0.10	-2.38	0.02	0.25	1.00	0.97	0.00	180.00	0.4696937***
	percentage of foreign capital to risk-weighted assets (%)	-0.15	0.11	-1.39	0.16	-0.51	1.00	0.85	0.00	180.00	0.404575**

Notes: ***, **, * indicates statistical significance at the 1%, 5% and 10% confidence level respectively. Dummy variable – variable multiply crisis dummy for 2008 and 2009

Table 2. GMM estimation and Shapiro-Francia normality test

Dependent variable	Independent variables	Variable coefficient	Std. Err.	z	P> z	Arellano-Bond test for zero autocorrelation	Sargan	S-F	S-F Prob>z	Number of observations	Variable coefficient (dummy)
Portfolio equity, net inflows (BoP, current US\$) 2005-2009	return on equity (%)	0.94	0.98	0.95	0.34	0.92	1.00	0.97	0.00	180.00	0.6160301***
	official exchange rate, LCU per USD, period average	-0.04	0.07	-1.47	0.14	0.63	1.00	0.22	0.00	180.00	0.4348289*
	foreign direct investments (net inflows, % of GDP)	0.05	0.03	1.44	0.15	0.68	1.00	0.72	0.00	180.00	0.5577678***
	lending interest rate (%)	0.11	0.06	1.76	0.08	0.30	1.00	0.68	0.00	180.00	0.60
	stock market capitalization to GDP (%)	0.3695308***	0.07	4.93	0.00	0.67	1.00	0.63	0.00	180.00	0.49647*
	stock market total value traded to GDP (%)	0.4402633***	0.10	4.43	0.00	0.80	1.00	0.65	0.00	180.00	0.5413588**
	cost (of income per capita)	-0.06	0.26	-0.24	0.81	0.90	1.00	0.63	0.00	180.00	-0.07
	time (days)	-0.46	0.54	-0.85	0.40	0.60	1.00	0.69	0.00	180.00	0.62
	procedures (number)	-0.02	0.11	-0.22	0.82	0.23	1.00	0.97	0.00	180.00	-0.0811223***
	stock market turnover ratio (%)	0.14	0.13	1.13	0.26	0.18	1.00	0.78	0.00	180.00	0.3980065**

Notes: ***, **, * indicates statistical significance at the 1%, 5% and 10% confidence level respectively. Dummy variable – variable multiply crisis dummy for 2008 and 2009

Table 3. GMM estimation and Shapiro-Francia normality test

Dependent variable	Independent variables	Variable coefficient	Std. Err.	z	P> z	Arellano-Bover/Blundell-Bond test	Sargan	S-F	S-F Prob>z	Number of observations	Variable coefficient (dummy)
Portfolio equity, net inflows (BoP, current US\$) 2005-2009	banks Z-score	0.33	0.14	0.25	0.81	0.90	1.00	0.89	0.00	185.00	0.26
	bank non-performing loans to gross loans (%)	-0.04	0.76	-0.52	0.60	0.77	1.00	0.81	0.00	185.00	0.3355029**
	GDP per capita (in US\$)	-0.14	0.20	-0.67	0.50	0.55	1.00	0.80	0.00	185.00	0.2830462*
	inflation, consumer prices (%)	-0.12	0.23	-0.53	0.60	0.76	1.00	0.92	0.00	185.00	0.7357424*
	financial system deposits to GDP (%)	0.12	0.22	0.52	0.60	0.69	1.00	0.62	0.00	185.00	0.3442714*
	percentage of foreign banks to total banks (%)	-0.2466968**	0.10	-2.47	0.01	0.26	1.00	0.97	0.00	185.00	0.3860394**
	percentage of foreign capital to risk-weighted assets (%)	-0.1914161*	0.12	-1.66	0.10	0.52	1.00	0.85	0.00	185.00	0.326297*
	return on equity (%)	0.272512***	0.02	11.20	0.00	0.72	1.00	0.97	0.00	185.00	0.6086822***

Notes: ***, **, * indicates statistical significance at the 1%, 5% and 10% confidence level respectively. Dummy variable – variable multiply crisis dummy for 2008 and 2009

Table 4. GMM estimation and Shapiro-Francia normality test

Dependent variable	Independent variables	Variable coefficient	Std. Err.	z	P> z	Arellano-Bover/Blundell-Bond test	Sargan	S-F	S-F Prob>z	Number of observations	Variable coefficient (dummy)
Portfolio equity, net inflows (BoP, current US\$) 2005 -2009	official exchange rate, LCU per USD, period average	0.12	0.26	0.45	0.65	0.62	1.00	0.22	0.00	185.00	0.36
	foreign direct investments (net inflows, % of GDP)	0.04	0.03	1.25	0.21	0.68	1.00	0.72	0.00	185.00	0.4964435***
	lending interest rate (%)	0.1050715*	0.06	1.75	0.08	0.30	1.00	0.68	0.00	185.00	0.4974448***
	stock market capitalization to GDP (%)	0.0364342***	0.08	4.79	0.00	0.69	1.00	0.63	0.00	185.00	0.5997727***
	stock market total value traded to GDP (%)	0.4365389***	0.11	4.12	0.00	0.80	1.00	0.65	0.00	185.00	1.115375***
	cost (of income per capita)	-0.06	0.26	-0.25	0.81	0.90	1.00	0.63	0.00	185.00	-0.10
	time (days)	-0.45	0.54	-0.83	0.41	0.60	1.00	0.69	0.00	185.00	0.5605184***
	procedures (number)	-0.02	0.11	-0.19	0.85	0.23	1.00	0.97	0.00	185.00	0.08
	stock market turnover ratio (%)	0.14	0.13	1.06	0.29	0.19	1.00	0.78	0.00	185.00	0.3911306**

Notes: ***, **, * indicates statistical significance at the 1%, 5% and 10% confidence level respectively. Dummy variable – variable multiply crisis dummy for 2008 and 2009

Table 5. GMM estimation and Shapiro-Francia normality test

Dependent variable	Independent variables	Variable coefficient	Std. Err.	z	P> z	Arellano-Bond test for zero autocorrelation	Sargan	S-F	S-F Prob>z	Number of observations
Portfolio equity, net inflows (BoP, current US\$) 2005 -2009	banks Z-score squares	-0.1212532*	0.08	-1.60	0.06	0.77	1.00	0.72	0.00	180.00
	bank non-performing loans to gross loans (%) squares	-0.07258856*	0.04	1.90	0.06	0.79	1.00	0.50	0.00	180.00
	GDP per capita (in US\$) squares	0.10	0.15	0.62	0.53	0.75	1.00	0.50	0.00	180.00
	inflation, consumer prices (%) squares	-0.15	0.13	-1.22	0.22	0.95	1.00	0.72	0.00	180.00
	financial system deposits to GDP (%)squares	0.18	0.13	1.40	1.16	0.43	1.00	0.32	0.00	180.00
	percentage of foreign banks to total banks (%) squares	-0.2169057***	0.07	-3.15	0.00	0.58	1.00	0.90	0.00	180.00
	percentage of foreign capital to risk-weighted assets (%) squares	0.21	0.25	0.82	0.41	0.52	1.00	0.70	0.00	180.00
	return on equity (%) squares	0.0500572*	0.03	1.90	0.06	0.87	1.00	0.86	0.00	180.00
	official exchange rate, LCU per USD, period average squares	-0.0597154**	0.03	-2.36	0.02	0.72	1.00	0.16	0.00	180.00

Notes: ***, **, * indicates statistical significance at the 1%, 5% and 10% confidence level respectively. Dummy variable – variable multiply crisis dummy for 2008 and 2009

Table 6. GMM estimation and Shapiro-Francia normality test

Dependent variable	Independent variables	Variable coefficient	Std. Err.	z	P> z	Arellano-Bond test for zero autocorrelation	Sargan	S-F	S-F Prob>z	Number of observations
Portfolio equity, net inflows (BoP, current US\$) 2005 -2009	foreign direct investments (net inflows, % of GDP) squares	-0.04	0.06	-0.74	0.46	0.89	1.00	0.45	0.00	180.00
	lending interest rate (%) squares	-0.37	0.77	-0.48	0.63	0.65	1.00	0.38	0.00	180.00
	stock market capitalization to GDP (%) squares	0.18	0.15	1.23	0.22	0.94	1.00	0.35	0.00	180.00
	stock market total value traded to GDP (%) squares	0.3613946*	0.20	1.85	0.06	0.33	1.00	0.42	0.00	180.00
	cost (of income per capita) squares	-0.19	0.30	-0.65	0.51	0.48	1.00	0.41	0.00	180.00
	time (days) squares	-0.12	0.28	-0.43	0.67	0.46	1.00	0.42	0.00	180.00
	procedures (number) squares	0.2182585**	0.09	2.44	0.02	0.55	1.00	0.89	0.00	180.00
	stock market turnover ratio (%) squares	0.3016383**	0.13	2.38	0.02	0.27	1.00	0.48	0.00	180.00

Notes: ***, **, * indicates statistical significance at the 1%, 5% and 10% confidence level respectively. Dummy variable – variable multiply crisis dummy for 2008 and 2009

Table 7. GMM estimation and Shapiro-Francia normality test

Dependent variable	Independent variables	Variable coefficient	Std. Err.	z	P> z	Arellano/Bover-Blundell/Bond test	Sargan	S-F	S-F Prob>z	Number of observations
Portfolio equity, net inflows (BoP, current US\$) 2005-2009	banks Z-score squares	0.04	0.22	0.16	0.87	0.66	1.00	0.72	0.00	185.00
	bank non-performing loans to gross loans (%) squares	-0.05	0.07	-0.64	0.52	0.72	1.00	0.50	0.00	185.00
	GDP per capita (in US\$) squares	0.11	0.15	0.73	0.47	0.74	1.00	0.50	0.00	185.00
	inflation, consumer prices (%) squares	0.01	0.17	0.00	0.98	0.95	1.00	0.72	0.00	185.00
	financial system deposits to GDP (%) squares	0.16	0.13	1.27	0.20	0.44	1.00	0.32	0.00	185.00
	percentage of foreign banks to total banks (%) squares	-0.4183409*	0.25	-1.68	0.09	0.98	1.00	0.90	0.00	185.00
	percentage of foreign capital to risk-weighted assets (%) squares	0.27	0.23	1.19	0.24	0.61	1.00	0.70	0.00	185.00
	return on equity (%) squares	0.0636892**	0.03	2.20	0.03	0.61	1.00	0.86	0.00	185.00

Notes: ***, **, * indicates statistical significance at the 1%, 5% and 10% confidence level respectively. Dummy variable – variable multiply crisis dummy for 2008 and 2009

Table 8. GMM estimation and Shapiro-Francia normality test

Dependent variable	Independent variables	Variable coefficient	Std. Err.	z	P> z	Arellano/Bover-Blundell/Bond test	Sargan	S-F	S-F Prob>z	Number of observations
Portfolio equity, net inflows (BoP, current US\$) 2005-2009	official exchange rate, LCU per USD, period average squares	-0.0595218**	0.03	-2.36	0.02	0.72	1.00	0.16	0.00	185.00
	foreign direct investments (net inflows, % of GDP)	-0.03	0.15	-0.21	0.84	0.96	1.00	0.45	0.00	185.00
	lending interest rate (%)	-0.37	0.77	-0.49	0.63	0.65	1.00	0.38	0.00	185.00
	stock market capitalization to GDP (%)	0.2284327*	0.13	1.74	0.08	0.57	1.00	0.35	0.00	185.00
	stock market total value traded to GDP (%)	0.4526733**	0.18	2.47	0.01	0.20	1.00	0.42	0.00	185.00
	cost (of income per capita)	-0.25	0.31	-0.81	0.42	0.47	1.00	0.41	0.00	185.00
	time (days)	-0.13	0.27	-0.47	0.64	0.46	1.00	0.42	0.00	185.00
	procedures (number)	0.2311266***	0.09	2.58	0.01	0.55	1.00	0.89	0.00	185.00
stock market turnover ratio (%)	0.3009814**	0.13	2.38	0.02	0.27	1.00	0.48	0.00	185.00	

Notes: ***, **, * indicates statistical significance at the 1%, 5% and 10% confidence level respectively. Dummy variable – variable multiply crisis dummy for 2008 and 2009