FDI and Economic Growth: New Evidence on the Role of the Financial Sector

Michael Osei
Department of Economics
Oklahoma State University
Stillwater, OK 74078
michael.osei@okstate.edu

Jaebeom Kim*
Department of Economics
Oklahoma State University
Stillwater, OK 74078
jb.kim@okstate.edu

Abstract

*Corresponding author. Tel. 405.744.7359.

FDI and Economic Growth:
New Evidence on the Role of the Financial Sector
(This version: March 2018)

Abstract

This study investigates whether an increase in financial market development leads to an increase in the positive impact of foreign direct investment (FDI) on economic growth using a dynamic panel threshold model. Utilizing the sample of 62 developed and developing countries spanning the period of 1987-2016, we find significant evidence that the relationship between FDI and economic growth is not monotonic with the level of financial development and this finding is robust to different econometric methods, various sub-samples and interaction analysis, and distinct financial development indicators. Consistent with the "vanishing effect" of financial development, our new empirical evidence shows that there is a potential maximum financial development threshold beyond which the positive effect of FDI on economic growth becomes negligible, suggesting that more finance is not necessarily better.

Keywords: Foreign direct investment, Financial development, Economic growth, GMM, Dynamic panel threshold model

JEL Classification: C33, F23, F36, F43, G21, O16

1 Introduction

Is more finance better for the foreign direct investment (FDI) and economic growth relationship? This study investigates whether an increase in financial market development leads to an increase in the positive impact of FDI on economic growth regardless of the size and growth of the financial sector. FDI has come to be seen as an essential part of economic growth and financial development due to the belief that FDI inflows can bring not only the much-needed additional foreign capital but also new technology and know-how, new and improved managerial and marketing skills, and horizontal and vertical knowledge spillovers via backward or forward linkage with local firms. Policymakers especially in the developing and emerging economies, thus, have adopted effective strategies with a variety of preferential incentives to attract more FDI and the share of FDI in total capital flows has increased dramatically over the past two decades.

Given the potential benefits of FDI inflows, a number of empirical studies has focused on the effects of FDI on economic growth in the host economies. At the micro level, spillovers from FDI may affect the productivity of domestic firms through the horizontal (intra-industry) spillover channel or through the vertical (inter-industry) spillover channel via the backward[1] or forward[2] linkages between local and foreign firms. Empirical micro studies find both positive and negative productivity spillovers that are more vertical rather than horizontal in nature.[3] While empirical studies at the macro level have also found mixed evidence,[4] the evidence from the literature shows that the positive growth effect of FDI are conditional on host country policies and environments, including financial sector

[1] The interaction between downstream firms and upstream firms is called the backward linkage channel. That is, interaction between the upstream domestic suppliers of intermediate inputs and their multinational clients. Domestic firms through backward linkage channel may obtain free knowledge transfer by being a supplier of intermediate input to multinational firms.

[2] By having a foreign upstream firms and gaining access to less costly intermediate inputs from foreign suppliers, domestic firms may become more productive - forward linkage channel.

[3] See Javorcik (2004) and Blalock and Gertler (2008) for positive productivity spillovers from foreign firms to their local upstream suppliers: Xu and Sheng (2012) for a positive effect on manufacturing downstream firms: Javorcik and Spatareanu (2008) for projects with joint domestic and foreign ownership benefits from vertical spillovers: Aitken and Harrison (1999) and Kathuria (2000) for negative spillover effects.

[4] See Lipsey (2002) for positive rather than negative effect and Bruno and Campos's (2013) for details.

development (Bilir et al. 2014; Hermes and Lensink, 2003; Alfaro et al., 2004, 2010; Azman-Saini et al., 2010), human capital (Borensztein et al., 1998; Ford et al., 2008), trade openness (Balasubramanyam et al., 1996; Nair-Reichert and Weinhold, 2001), and level of economic development (Blomstrom et al.,1992). This suggests that FDI and host country characteristics are complementary in the technological spillover process and such complementarities may help explain the mixed empirical evidence on the growth effect of FDI.

By and large, the empirical evidence on the FDI and growth nexus has demonstrated that the benefits of FDI vary across countries and sectors, and its impact on economic growth depends on financial development of the host economies, implying that a well-functioning financial sector is an important precondition for a positive growth effect of FDI.[5] Furthermore, evidence from recent studies suggests that once a host country achieves the minimum financial development threshold, the impact of FDI on economic growth comes into effect and the relationship between FDI and economic growth increases with financial development.[6] A number of literatures on the finance-growth nexus, however, have found that financial development promotes economic growth up to a certain threshold, beyond which the effect of more finance vanishes or becomes negligible.[7] The financial sector is beneficial for economic growth, but this consensus is not always true regardless of sizes and levels of financial development. If financial development is good only up to a certain maximum point of "more finance, more growth", it might be a role financial markets play in arbitrating the effects of FDI on economic growth. However, despite the theoretical and empirical importance of the role of FDI in economic growth, empirical evidence on this issue remains elusive.

Based on the complementarities between FDI and host country financial development, the main question in this study is whether more financial development leads to more impact of foreign direct investment on economic growth. If the impact of FDI on economic growth

[5] See Alfaro et al. (2004, 2010), Azman-Saini et al. (2010), Ford et al. (2008), and Bilir et al. (2014).
[6] See Alfaro et al. (2010) and Azman-Saini et al. (2010).
[7] See Beck et al. (2014), Law and Singh (2014), and Arcand et al. (2015) for details.

becomes effective only after financial development exceeds a minimum threshold level, the question is whether the relationship between FDI and economic growth is monotonic with the level of financial development. Is there any certain maximum financial development threshold beyond which the growth benefit of FDI becomes negligible, less pronounced or negative? Answers to these questions can provide insights into how changes in financial conditions in the host economies will affect the growth benefit of FDI, as well as inform policy responses toward attracting more FDI. For this purpose, we consider a dynamic panel threshold method by Kremer et al. (2013) that extends the original static model by Hansen (1999) and Caner and Hansen (2004) to allow for endogenous regressors in a panel setup and has not been used to examine the nonlinear relationship between FDI, financial development, and economic growth. While Azman-Saini et al. (2010) employ a cross-section-based static threshold approach by Hansen (2000) to identify minimum threshold effects in the FDI-growth relationship, we investigate the "too much" finance hypothesis and thus test for the existence of a possible maximum financial development threshold effect in the FDI and growth nexus. In particular, we explore whether the growth benefit of FDI differs in systematic ways depending on the level of financial development of a country.

Comparisons are made between linear dynamic panel system GMM and non-linear dynamic panel GMM methods, financial development sub-groups and different income groups, as well as split sample regressions and interaction analysis, together with various financial development indicators. Consistent with the "vanishing effect" of financial development, we find significant and robust evidence that the relationship between FDI and economic growth does not monotonically increase with the level of financial development. There is a possible maximum financial development threshold beyond which the positive effect of FDI on economic growth becomes negligible. That is, the growth effect of FDI tends to become negligible as a country becomes more financially developed, suggesting that more finance is not always better.

2 Data and Preliminary Analysis

We employ a panel of 62 middle and high income countries over the period 1987-2016. This study focuses on the inflows of FDI to the host economy, therefore, we use net FDI inflow as a percentage of GDP as a measure of FDI. Net FDI inflows measure the net inflows of investment to acquire a lasting interest in an enterprise operating in an economy outside of the investor's. It is the sum of short-term and equity capital, reinvestment of earnings, and other long-term capital. Bank-based financial development measures are used as the measure of financial development[8]. In the finance-growth literature, private credit is the preferred measure of financial development.[9] Thus, private credit by deposit money banks and other financial institutions to GDP is used as the primary measure of financial development. To provide a more nuanced view of the FDI-finance-growth relationship, we use three other measures: domestic credit to private sector, liquid liability (LLY) and a new broad-based indices of financial development developed by the IMF namely, financial institution index.[10] Private credit and domestic credit are obtained from the World Bank's Financial Structure and Development Database. The growth of real GDP per capita in constant 2010 dollars is used as a measure of growth rate of output. The control variables are: the initial level of real GDP per capita to control for the convergence effect in the standard growth theory; average years of education completed among people over age 25 to control for the level of human capital in the country; the government size (government consumption/GDP), the CPI-based average inflation rate, and openness to trade ((exports+import)/GDP) as controls for policy in the country. Large government size and high inflation rate are presumed to negatively affect growth, while trade openness affects growth positively. Domestic investment is also included for further robustness check. All the control variables, FDI inflows and domestic investment are from the World Bank's World Development Indicators. The average years of schooling data is from Barro

[8] Stock-market-based measures reduce the sample substantially.
[9] See Levine et al. (2000), Rioja and Valev (2004), Aghion et al. (2009).
[10] See Sahay et al. (2015).

and Lee (2013) series.

In order to filter out cyclical fluctuations and to focus on long-run growth, the data are averaged over 3-year non-overlapping periods. Table 1 presents the descriptive statistics for all the variables. In the preliminary discussion, we focus on the main variables of interest: private credit, and FDI and growth. As shown in Table 1, there is substantial variation in private credit to GDP across countries, ranging from 2.3% in Sudan to 268.3% in Iceland; economic growth ranges from -7.4% in Cameroon to 10.8% in Botswana. FDI as a share of GDP also ranges extensively, from -5.8% in Panama to 56.7% in Netherlands. Based on the cross-country correlation among the main variables for the full, top half and bottom half samples, overall, there is a positive correlation between FDI and private credit. However, the correlation is stronger and statistically significant at the 5% level in the bottom half subsample but relatively weaker and statistically insignificant in the top half subsample. According to the preliminary evidence, the interaction between FDI and financial development displays heterogeneity. The evidence seems to be consistent with the "too much" finance hypothesis, implying that if financial development plays a role in arbitraiting the potential growth benefit of FDI, then one can expect countries with the same levels of FDI to experience different growth effect; the growth effect of FDI will vary with the level of financial development.

3 Econometric methodology

This study employs a dynamic panel threshold model by Kremer et al. (2013) to test for the existence of threshold level of financial development in the FDI-growth relationship.[11] This method extends the original model by Hansen (1999) and Caner and Hansen (2004) to allow for endogenous regressors in a panel framework. If financial development plays a role in mediating the growth effect of FDI, regression functions will differ across countries. With no prior knowledge of the cut-off values, rather than arbitrarily assuming cut-off

[11] We do not use quadratic specification since it places a specific functional form on the nonlinearity regardless of the patterns in the data. Unlike other nonlinear models such as spline and quadratic regressions, the threshold model does not impose any specific functional form on the nonlinearity aspect of the model.

values, appropriate threshold level of financial development is estimated using the dynamic panel threshold method. The dynamic panel threshold model of the FDI-finance-growth nexus takes the following form:

$$\begin{aligned}\Delta y_{i,t} &= \mu_i + \beta_1 FDI_{i,t} I(FIN_{i,t} \leq \gamma) + \delta_1 I(FIN_{i,t} \leq \gamma) + \beta_2 FDI_{i,t} I(FIN_{i,t} > \gamma) \\ &\quad + \psi' X_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{1}$$

where $\Delta y_{i,t}$ is the growth rate of real per capita GDP in country i at time t, μ_i is the country-specific fixed effect, γ is the threshold level, and the error term is $\varepsilon_{i,t} \overset{i.i.d}{\sim} (0, \sigma^2)$. $I(\cdot)$ is an indicator function taking a value of 1 if the argument in the indicator function holds, and 0 otherwise. The threshold variable, $FIN_{i,t}$, divides the sample into regimes with differing regression slope parameters β_1 and β_2. The level of financial development measured by either private credit, domestic credit, financial institution index, or financial development index is used as the threshold variable. $X_{i,t}$ is a vector of explanatory variables which can be partitioned into a subset of exogenous variables ($X_{1i,t} = schooling$, $government\ expenditure$, $inflation\ rate$, $trade\ openness$) uncorrelated with $\varepsilon_{i,t}$, and a subset of endogenous variable ($X_{2i,t} = real\ per\ capita\ GDP\ from\ previous\ period$) correlated with $\varepsilon_{i,t}$. Allowing for differences in the regime intercept helps minimize any potential bias in both the threshold and the corresponding marginal effect estimates. Following Bick (2010), we include a threshold intercept, δ_1. All variables, with the exception of inflation and growth, are transformed into logarithms.

Since the threshold level, γ, is not known a priori, it must be estimated. The estimation procedure involves eliminating the country-specific fixed effects μ_i using a fixed-effect transformation method. In a dynamic panel threshold model, however, the traditional within-transformation and first differencing methods of removing individual effects leads to inconsistent estimates as it violates the distributional assumptions underlying the threshold model by Hansen (1999). Thus, the forward orthogonal deviations transformation method by Arellano and Bover (1995) is used to eliminate the country-specific fixed effects.[12] The

[12] It ensures the error terms are not correlated. See Kremer et al.(2013).

estimation procedure by Caner and Hansen (2004) can now be applied to Equation (1).

Following Caner and Hansen (2004), the parameters are estimated sequentially. First, run a reduced-form regression of the endogenous variable $X_{2,it}$ on a set of instruments $Z_{1,it}$, including all exogenous regressors $X_{1i,t}$. Obtain the predicted values $\hat{X}_{2,it}$. Second, in Equation (1), replace $X_{2,it}$ with $\hat{X}_{2,it}$ and obtain the least square estimates for a fixed threshold γ. Let $S(\gamma)$ denote the resulting sum of squared residuals. For a strict subset of the support of $FIN_{i,t}$, repeat this second step. Observe that, since the slope parameters depend on the threshold value, the sum of squared errors (SSE) for Equation (1) which is also a function of the threshold value is a step function, with the steps occurring at some well-defined values of the threshold variable $FIN_{i,t}$. Conditioning on a threshold value, however, SSE is linear in the parameters and minimization will yield the conditional OLS estimates for β_1 and β_2. Finally, the estimator of the threshold corresponds to the value of γ that produces the smallest sum of squared residuals. That is, the minimizer of the sum of squared residuals: $\hat{\gamma} = \arg\min_{\gamma} S_n(\gamma)$.[13]

Let $C(\alpha)$ be the 95 percentile of the asymptotic distribution of the likelihood ratio statistic $LR(\gamma)$, then the critical values for determining the 95% confidence interval of the threshold value are given by $\Gamma = \{\gamma : LR(\gamma) \leq C(\alpha)\}$.[14] Once the sample-splitting threshold estimate $\hat{\gamma}$ is obtained, the sample can be divided into subsamples and, on each subsample, the slope parameters β_1 and β_2 can be estimated by GMM. Lags of the dependent variable are used as instruments. Given the bias-efficiency trade-off in finite sample, empirical results based on GMM may depend on the number of instruments. Therefore, in estimation, we use different lag lengths. To avoid potential overfitting, we use a lag length of one, and to increase efficiency, we use all available lags as instruments. However, the choice of instruments did not have any significant effect on the main results.

[13] This minimization problem can be reduced to searching over values of γ up to nT distinct values of $FIN_{i,t}$ in the sample.

[14] See Hansen (1999) and Caner and Hansen (2004).

4 Empirical results

4.1 Split-sample and the interaction analysis

As a starting point, countries are ranked according to their average level of financial development measured by private credit to GDP over the sample period and then we split the sample into two equal subgroups, high (HFD) and low level of financial development (LFD).[15] To provide a more complete picture of the financial development, three financial development sub-groups are also considered.[16] Then we estimate sub-sample regressions to compare the coefficient sizes across the sub-groups as well as MIC and HIC based on the World Bank Income Classifications. As an alternative, we also employ linear interaction analysis to test whether the coefficient of FDI depends on the level of financial development of a country.[17] In order to filter out cyclical fluctuations and to focus on long-run growth, the data are averaged over 3-year non-overlapping periods. In this paper, the sample consist of only middle and high income countries and most countries have an average level of private credit to GDP exceeding 14%, so we would expect FDI to have a direct effect on growth in the countries where the financial markets are well-developed.[18]

Figure 1 shows that there is clearly a positive relationship between the average private credit and the average FDI as a share of GDP for the full sample and LFD group, whereas there appears to be no relationship between the two variables for the HFD group. If financial development plays a role in mediating the potential growth benefit of FDI, then one can expect that the growth effect of FDI will vary with the level of financial development. As shown in Table 1 for full sample, the estimated coefficient of FDI is positive and statistically significant at the 5% level, suggesting that FDI has a direct effect on growth.

[15] The HFD includes the 31 countries with average level of private credit to GDP exceeding 50%.

[16] For the three groups, we split it into three equal sub-groups. For HFD (20), average level of private credit to GDP exceeds 87%, for LFD (21), it is below 33%, and for MFD (21), it lies in between the two.

[17] See appendix for details.

[18] In a pure cross-sectional analysis, while there is no significant direct effect of FDI on growth, when the interaction of FDI with financial development measures is added, it turns out to be positive and significant. Rioja and Valev (2004a) also find that, finance has positive effect on growth when private credit to GDP is greater than 14%.

The estimated coefficients of FDI for both HFD and LFD groups in two-way split are significantly positive. However, the coefficient of FDI for the HFD group is substantially smaller than the LFD group. Further, relative to the full sample, the growth effect of FDI in the LFD group is larger in magnitude than the HFD group. The results using three-way split are similar to the two-way split results and are interesting. While the coefficient of FDI decreases as we move up from the LFD toward the HFD, the coefficient of FDI in the HFD is not significantly different from zero. The coefficient for the LFD, however, is significantly positive and larger in magnitude than in the MFD. The same is true for the MICs and HICs and the results are consistent with the previous cases, implying that the estimated coefficient for the MICs is larger than that for the HICs. Turning to the interaction analysis, regardless of different measures of financial indicators, the interaction term turns out to be negative and statistically significant at the 5% level, leading to the conclusion that the growth effect of FDI declines with increased financial development. As indicated by the F-statistic for FDI, the coefficient of FDI and the interaction term are jointly significant at the 5% level. All the other explanatory variables have the expected signs whenever significant. In addition, the Arellano-Bond serial correlation test shows that there is no second-order serial correlation while the Hansen instrument validity test shows that the instruments are not correlated with the error term.

In summary, the results based on the split-sample regressions and the interaction analysis bear out the nonlinearity in the FDI-finance-growth relationship. The interaction between FDI and financial development displays heterogeneity. The implication is that the more financially developed a country is, the smaller the effect of FDI on growth. These findings are consistent with the declining growth effect of financial development reported in the literature.[19]

[19] For details, see Rioja and Valev (2004 a,b), Aghion et al. (2005), Shen and Lee (2006), Rousseau and Wachtel (2011), Arcand et al. (2015).

4.2 Dynamic panel threshold model

Although the split-sample regressions and the interaction analysis appear informative, each has shortcomings. In the split-sample regressions, the sample is divided in a rather ad hoc fashion and hence standard asymptotic confidence intervals as well as the chi-square approximation may be inaccurate.[20] The linear interaction model places a priori restriction that the growth effect of FDI monotonically decreases with financial development. For these reasons, we test for the existence of threshold level of financial development in the FDI-growth relationship using the dynamic panel threshold model.

Table 3 presents the estimates from the dynamic panel threshold model in Equation (1), where the financial development measure, private credit, is used as the threshold variable. The first row displays the estimated financial development threshold values and the corresponding 95% confidence intervals. The slope parameter estimates, $\hat{\beta}_1$ and $\hat{\beta}_2$, denote the regime-dependent marginal effects of FDI on growth. First column in Table 3 shows the benchmark results. The point estimate of the threshold value is 92.582 which is equivalent to 92.58% of GDP. Approximately, 18% of the observations in the sample are above this threshold value. The 95% confidence interval, [83.748, 97.492], for the threshold is reasonably tight. However, the threshold value of 104% is close to threshold estimate by Arcand et al. (2015), who find that finance tends to have negative effect on growth when private credit reaches 100% of GDP. With respect to the regime-dependent marginal effects, FDI has significantly positive effect on economic growth if private credit is less than the threshold. Above the threshold, however, the effect of FDI is not significant. All the policy covariates are plausibly signed and mostly significant.

To examine the robustness of the benchmark results, we conduct different sensitivity analyses. First, it may be that FDI has significantly positive effect on growth only because domestic investment was not controlled for. In column (2) of Table 2, we include domestic investment as a regressor. The results remain robust. In particular, the threshold value

[20] See Hansen (2000).

remains unchanged albeit the marginal effects are relatively smaller. Second, following the finance-growth literature including Levine et al. (2000) and Beck et al. (2000), we re-estimate the model using a simple conditioning set that includes the logarithm of initial income and educational attainment, and the results are reported in column (3). In column (4), we include domestic investment to the "simple" conditioning set as an additional variable. Again, the point estimate of the threshold value remains unchanged; FDI positively affects growth if private credit is less than the threshold but has no significant effect above the threshold. Alternative measures of financial development such as bank credit, LLY, and financial institution index are also considered and the results presented in Table 4 are qualitatively similar with the exception of LLY and financial institution index, whose results provide that these exists a minimum financial development threshold. In summary, the empirical findings are robust to alternative conditioning sets and different measures of financial development.

In general, the interesting picture that emerges from the empirical findings is that there might be another financial development threshold effects in the FDI and economic growth relationship; the growth effect of FDI tends to become negligible as a country becomes more financially developed. These findings are robust to alternative conditioning sets, estimation procedures, and measures of financial development. They are also consistent with the "vanishing effect" of financial development.[21] The empirical evidence strongly suggests that there might be another threshold beyond which the positive effect of FDI on economic growth becomes negligible, suggesting that more finance is not always better.

5 Conclusion

Empirical studies on the FDI and economic growth relationship have found that once a country achieves a minimum level of financial development threshold, FDI has a positive effect on economic growth. If the impact of FDI on economic growth comes into effect

[21] For details, see Rioja and Valev (2004 a,b), Aghion et al. (2005), Shen and Lee (2006), Rousseau and Wachtel (2011), Beck et al., (2014), Herwartz and Walle (2014), Law and Singh (2014), and Arcand et al. (2015).

only after financial development exceeds a minimum threshold level, the main question in this study is whether the relationship between FDI and economic growth is monotonic with the level of financial development? Is there any certain maximum financial development threshold beyond which the growth benefit of FDI becomes negligible, less pronounced or negative? To answer the questions, dynamic panel threshold model is considered to test for the existence of threshold levels of financial development in the FDI-finance-growth relationship. For the direct comparisons, the linear dynamic growth model is also employed for split-sample regressions and an interaction analysis, as well as for financial development sub-groups and different income groups, together with various financial development indicators.

Overall, consistent with the "vanishing effect" of financial development, we find significant and robust evidence that the positive relationship between FDI and economic growth does not monotonically increase with the level of financial development. There exists a threshold beyond which the positive effect of FDI on economic growth becomes negligible. Using private credit as a measure of financial development, our results show that the effect of FDI on economic growth becomes statistically insignificant when private sector credit to GDP reaches 93%. Our empirical findings suggest that at low levels of financial development, improving domestic financial market conditions have the effect of enabling host economies maximized the growth benefits of FDI. However, the growth effect of FDI tends to become negligible as a country becomes more financially developed, suggesting that more finance is not necessarily better. Thus, while sound macroeconomic policies may spur both financial development and economic growth, our empirical results show that there might be a financial development threshold beyond which the benefits of FDI become negligible, suggesting that government might focus on efficient channeling of economic resources to optimize financial development for FDI to exert a significant effect on economic growth.

6 APPENDIX

6.1 Dynamic Panel GMM

We consider the following cross-country growth equation:

$$y_{i,t} - y_{i,t-1} = (\alpha - 1)y_{i,t-1} + \beta' X_{i,t} + \mu_i + \varepsilon_{i,t}. \tag{A1}$$

where $y_{i,t}$ is the logarithm of real per capita GDP in country i at time t, $X_{i,t}$ is a set of explanatory variables, including FDI, average years of schooling, government consumption expenditure, inflation rate, and trade openness, μ_i represents time invariant country-specific effect, and $\varepsilon_{i,t}$ denotes the idiosyncratic shocks.[22] To obtain efficient, unbiased, and consistent estimates of the effect of FDI on growth, we use a system dynamic panel GMM estimator by Blundell and Bond (1998). This dynamic panel estimator has a number of advantages over cross-sectional estimators. First, it addresses the potential endogeneity of all explanatory variables. Second, it accounts for the biases induced by including lagged or initial income in the growth equation. Third, unlike pure cross-sectional instrumental variable estimators, the system dynamic panel GMM estimator exploits the time series variation and controls for unobserved country-specific effect. To eliminate the unobserved country-specific effects, Equation (1) can be rewritten as:

$$y_{i,t} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + \beta'(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}). \tag{A2}$$

Empirical research pertaining to economic growth generally deals with the endogeneity issue by implementing GMM estimators that use instruments to control for unobserved heterogeneity and simultaneity. However, Blundell and Bond demonstrated that when explanatory variables are persistent over time, the untransformed lagged levels of these variables are weak instruments for transformed variables, and this adversely affects the small sample and asymptotic properties of difference GMM. To increase efficiency, Blundell and Bond developed a system GMM that augments the difference estimator by estimating simultaneously in differences and levels, with the two equations being distinctly

[22] We use cross-sectionally demeaned data for all variables to control for time-specific effect and any potential cross-sectional dependence.

instrumented. In a dynamic panel GMM, we replace the moment conditions of the standard difference GMM with the new moment conditions and make the same orthogonality assumption between the lagged levels and the differenced error term so as to minimize the magnitude of the empirical moments rather than separate moments for each cross-sectional unit and time. This method, known as the Windmeijer (2005) correction, significantly minimizes the potential biases and boosts the efficiency of our estimates without losing information as no lags are actually dropped.

6.1.1 Interaction analysis

As an alternative to the split-sample regressions, we form a linear interaction term between FDI and financial development to test whether the coefficient on FDI depends on the level of financial development of a country. Separate FDI from the set of explanatory variables and rewrite Equation (A1) as follows:

$$y_{i,t} - y_{i,t-1} = (\alpha - 1)y_{i,t-1} + \delta FDI_{i,t} + \beta' X_{i,t} + \tau_t + \mu_i + \varepsilon_{i,t}. \tag{A3}$$

Let the coefficient on FDI depends on the level of financial development of a country so that

$$\delta = \gamma_1 + \gamma_2 FD_{i,t} \tag{A4}$$

where $FD_{i,t}$ is a measure of financial development. Substitute Equation (A4) into Equation (A3) to get

$$y_{i,t} - y_{i,t-1} = (\alpha - 1)y_{i,t-1} + \gamma_1 FDI_{i,t} + \gamma_2 FDI_{i,t} \times FD_{i,t} + \beta' X_{i,t} + \tau_t + \mu_i + \varepsilon_{i,t}. \tag{A5}$$

Equation (A5) is a standard growth regression augmented with the interaction term, $FDI_{i,t} * FD_{i,t}$ and is also estimated using a system dynamic panel GMM estimator. The hypothesis is that $\gamma_1 > 0$ and $\gamma_2 < 0$ so that the growth effect of FDI, $\gamma_1 + \gamma_2 * FD_{i,t}$, is lower at high levels of financial development.

References

[1] Aghion, P., Bacchetta, P., Rancire, R., Rogoff, K., 2009. Exchange rate volatility and productivity growth: The role of financial development. Journal of Monetary Economics 56 (4), 494-513.

[2] Aitken, B. J., Harrison, A. E., 1999. Do domestic firms benefit from direct foreign investment? Evidence from venezuela. American Economic Review 89 (3), 605-618.

[3] Alfaro, L., 2017. Gains from foreign direct investment: Macro and micro approaches. The World Bank Economic Review 30 (Supplement 1), S2-S15.

[4] Alfaro, L., Chanda, A., Kalemli-Ozcan, S., Sayek, S., 2004. FDI and economic growth: the role of local financial markets. Journal of International Economics 64 (1), 89-112.

[5] Alfaro, L., Chanda, A., Kalemli-Ozcan, S., Sayek, S., 2010. Does foreign direct investment promote growth? exploring the role of financial markets on linkages. Journal of Development Economics 91 (2), 242-256.

[6] Alonso-Borrego, C., Arellano, M., 1999. Symmetrically normalized instrumental-variable estimation using panel data. Journal of Business & Economic Statistics 17 (1), 36-49.

[7] Arcand, J. L., Berkes, E., Panizza, U., 2015. Too much finance? Journal of Economic Growth 20 (2), 105-148.

[8] Arellano, M., Bond, S., 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. The Review of Economic Studies 58 (2), 277-297.

[9] Arellano, M., Bover, O., 1995. Another look at the instrumental variable estimation of error-components models. Journal of Econometrics 68 (1), 29-51.

[10] Azman-Saini, W. N. W., Law, S. H., Ahmad, A. H., 2010. FDI and economic growth: New evidence on the role of financial markets. Economics Letters 107 (2), 211-213.

[11] Balasubramanyam, V. N., Salisu, M., Sapsford, D., 1996. Foreign direct investment and growth in EP and IS countries. The Economic Journal 106 (434), 92-105.

[12] Barro, R. J., Lee, J. W., 2013. A new data set of educational attainment in the world, 19502010. Journal of Development Economics 104 (Supplement C), 184-198.

[13] Beck, R., Georgiadis, G., Straub, R., 2014. The finance and growth nexus revisited. Economics Letters 124 (3), 382-385.

[14] Beck, T., Levine, R., Loayza, N., 2000. Finance and the sources of growth. Journal of Financial Economics 58 (1), 261-300.

[15] Bick, A., 2010. Threshold effects of inflation on economic growth in developing countries. Economics Letters 108 (2), 126-129.

[16] Bilir, K., Chor, D., Manova, K., 2014. Host-country financial development and multinational activity. National Bureau of Economic Research Working Paper Series No. 20046.

[17] Blalock, G., Gertler, P. J., 2008. Welfare gains from foreign direct investment through technology transfer to local suppliers. Journal of International Economics 74 (2), 402-421.

[18] Blomstrom, M., Lipsey, R. E., Zejan, M., 1992. What explains developing country growth? National Bureau of Economic Research Working Paper Series No. 4132.

[19] Bluedorn, J., Duttagupta, R., Guajardo, J., Topalova, P., 2013. Capital Flows are Fickle: Anytime, Anywhere. International Monetary Fund, Research Department.

[20] Blundell, R., Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics 87 (1), 115-143.

[21] Borensztein, E., De Gregorio, J., Lee, J. W., 1998. How does foreign direct investment affect economic growth? Journal of International Economics 45 (1), 115-135.

[22] Boubakri, N., Cosset, J.-C., Debab, N., Valry, P., 2013. Privatization and globalization: An empirical analysis. Journal of Banking & Finance 37 (6), 1898-1914.

[23] Bruno, R., Campos, N., 2013. Reexamining the conditional effect of foreign direct investment. Report, Institute for the Study of Labor (IZA).

[24] Calvo, G. A., Leiderman, L., Reinhart, C. M., 1996. Inflows of capital to developing countries in the 1990s. Journal of Economic Perspectives 10 (2), 123-139.

[25] Caner, M., Hansen, B. E., 2004. Instrumental variable estimation of a threshold model. Econometric Theory 20 (5), 813-843.

[26] Desbordes, R., Wei, S.-J., 2017. The effects of financial development on foreign direct investment. Journal of Development Economics 127 (Supplement C), 153-168.

[27] Ford, T. C., Rork, J. C., Elmslie, B. T., 2008. Foreign direct investment, economic growth, and the human capital threshold: Evidence from us states. Review of International Economics 16 (1), 96-113.

[28] Hansen, B. E., 1999. Threshold effects in non-dynamic panels: Estimation, testing, and inference. Journal of Econometrics 93 (2), 345-368.

[29] Hansen, B. E., 2000. Sample splitting and threshold estimation. Econometrica 68 (3), 575-603.

[30] Hermes, N., Lensink, R., 2003. Foreign direct investment, financial development and economic growth. The Journal of Development Studies 40 (1), 142-163.

[31] Herwartz, H., Walle, Y. M., 2014. Openness and the finance-growth nexus. Journal of Banking & Finance 48 (Supplement C), 235-247.

[32] Holtz-Eakin, D., Newey, W., Rosen, H. S., 1988. Estimating vector autoregressions with panel data. Econometrica 56 (6), 1371-1395.

[33] Javorcik, B. S., 2004. Does foreign direct investment increase the productivity of domestic firms? in search of spillovers through backward linkages. American Economic Review 94 (3), 605-627.

[34] Javorcik, B. S., Spatareanu, M., 2008. To share or not to share: Does local participation matter for spillovers from foreign direct investment? Journal of Development Economics 85 (12), 194-217.

[35] Kathuria, V., 2000. Productivity spillovers from technology transfer to Indian manufacturing firms. Journal of International Development 12 (3), 343-369.

[36] Kose, M. A., Prasad, E., Rogoff, K., Wei, S.-J., 2009. Financial globalization: A reappraisal. IMF Staff Papers 56 (1), 8-62.

[37] Kremer, S., Bick, A., Nautz, D., Apr 2013. Inflation and growth: new evidence from a dynamic panel threshold analysis. Empirical Economics 44 (2), 861-878.

[38] Law, S. H., Singh, N., 2014. Does too much finance harm economic growth? Journal of Banking & Finance 41 (Supplement C), 36-44.

[39] Levine, R., Loayza, N., Beck, T., 2000. Financial intermediation and growth: Causality and causes. Journal of Monetary Economics 46 (1), 31-77.

[40] Lipsey, R. E., 2002. Home and host country effects of FDI. National Bureau of Economic Research Working Paper Series No. 9293.

[41] Nair-Reichert, U., Weinhold, D., 2001. Causality tests for cross-country panels: a new look at FDI and economic growth in developing countries. Oxford Bulletin of Economics and Statistics 63 (2), 153-171.

[42] Rioja, F., Valev, N., 2004a. Does one size fit all?: a reexamination of the finance and growth relationship. Journal of Development Economics 74 (2), 429-447.

[43] Rousseau, P. L., Wachtel, P., 2011. What is happening to the impact of financial deepening on economic growth? Economic Inquiry 49 (1), 276-288.

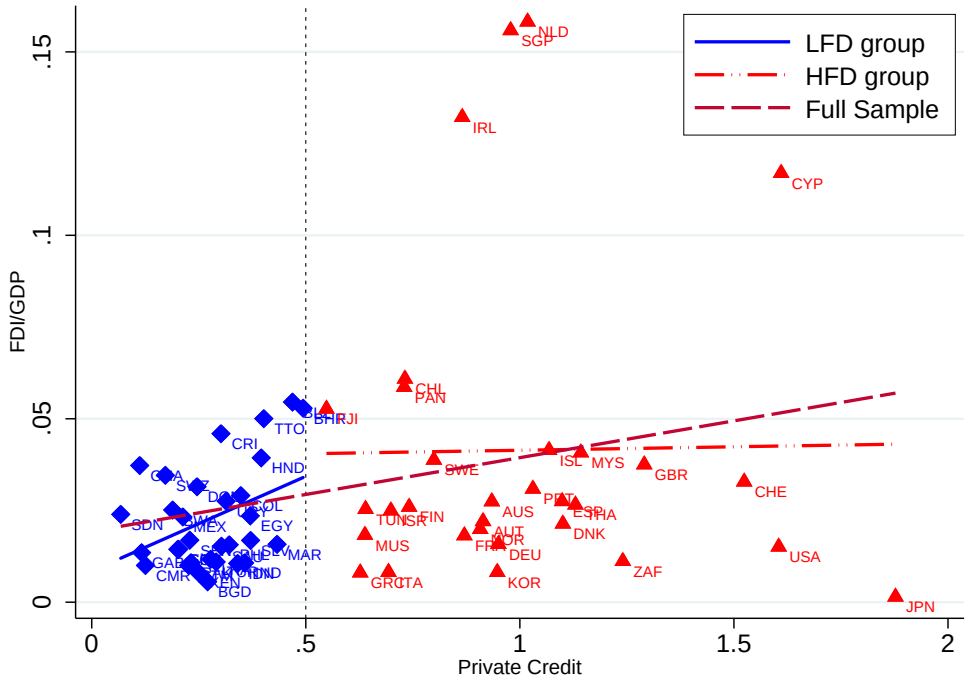
[44] Sahay, R., Cihak, M., N'Diaye, P. M., Barajas, A., Ayala Pena, D. B., Bi, R., Gao, Y., Kyobe, A. J., Nguyen, L., Saborowski, C., Svirydzenka, K., Yousefi, R., 2015. Rethinking financial deepening; stability and growth in emerging markets. IMF Staff Discussion Notes 15/08, International Monetary Fund.

[45] Shen, C.-H., Lee, C.-C., 2006. Same financial development yet different economic growth: Why? Journal of Money, Credit and Banking 38 (7), 1907-1944.

[46] Windmeijer, F., 2005. A finite sample correction for the variance of linear efficient two-step gmm estimators. Journal of Econometrics 126 (1), 25-51.

[47] Xu, X., Sheng, Y., 2012. Productivity spillovers from foreign direct investment: Firm-level evidence from china. World Development 40 (1), 62-74.

Figure 1. FDI and Financial Development, 1987-2016



Notes: Total 62 countries are ranked according to their average level of financial development measured by private credit to GDP over the sample period and then split into bottom half (31) and top half (31) sub-samples. The top half sample includes the 31 most financially developed countries with average level of private credit to GDP over the sample period exceeding 50 percent. The average level of private credit to GDP for the bottom half is 50 percent or less.

Table 1. Descriptive statistics, 1987-2016

	N	Mean	SD	Min	Max
Real GDP per capita growth	620	0.021	0.024	-0.074	0.108
Log Real GDP per capita	620	8.996	1.393	5.959	11.410
Foreign direct investment	620	0.032	0.050	-0.058	0.567
Domestic Investment	620	0.221	0.052	0.085	0.433
Private credit	620	0.639	0.487	0.023	2.683
Bank Credit	620	0.590	0.440	0.023	2.683
Liquid liabilities	620	0.636	0.383	0.093	2.390
Financial development index	620	0.405	0.248	0.038	0.997
Financial institutions index	620	0.480	0.241	0.076	0.999
Financial markets index	620	0.325	0.280	0.000	0.998
Government consumption	620	0.155	0.051	0.038	0.333
Openness	620	0.785	0.507	0.136	4.173
Inflation	620	0.074	0.123	-0.045	1.021
Average years of schooling	620	7.448	2.852	1.090	13.420

Correlation

	Full Sample		Bottom Half (LFD)		Top Half (HFD)	
	Growth	FDI	Growth	FDI	Growth	FDI
FDI	0.179**	1	0.230**	1	0.185**	1
Private Credit	-0.092**	0.259**	0.083	0.380**	-0.239**	0.159**

Note: Top half sample includes the 31 most financially developed countries with average level of private credit to GDP over the sample period exceeding 50 percent. The average level of private credit to GDP for the bottom half is 60 percent or less. ** $p < 0.05$ statistically significant at 5% level.

Table 2. A System Dynamic Panel GMM

Variable	Two-way Split			Three-way Split			Income Group		Interaction		
	Full Sample	LFD Group	HFD Group	LFD Group	MFD Group	HFD Group	Middle Income	High Income	Private Credit	Bank Credit	LLY
Initial Income	-0.061**	-0.051**	-0.129**	-0.009	-0.118**	-0.100**	-0.047**	-0.098**	-0.059**	-0.059**	-0.062**
	(0.014)	(0.021)	(0.023)	(0.018)	(0.020)	(0.034)	(0.023)	(0.029)	(0.011)	(0.011)	(0.011)
FDI	0.163**	0.234*	0.078**	0.321**	0.231**	0.194	0.246**	0.084*	0.262**	0.271**	0.408**
	(0.058)	(0.117)	(0.021)	(0.105)	(0.053)	(0.197)	(0.110)	(0.044)	(0.070)	(0.075)	(0.128)
Gov'tSize	-0.305**	-0.075	-0.689**	-0.076	-0.592**	-0.428*	-0.174**	-0.396*	-0.270**	-0.266**	-0.235**
	(0.101)	(0.099)	(0.190)	(0.099)	(0.166)	(0.235)	(0.079)	(0.206)	(0.100)	(0.101)	(0.103)
Openness	0.063**	0.057*	0.079**	0.037	0.076	0.100**	0.021	0.156**	0.026	0.025	0.008
	(0.022)	(0.032)	(0.034)	(0.030)	(0.045)	(0.046)	(0.023)	(0.018)	(0.025)	(0.025)	(0.024)
Inflation	-0.053**	-0.040**	-0.267**	-0.025*	-0.135**	-0.296**	-0.055**	-0.052*	-0.050**	-0.049**	-0.046**
	(0.015)	(0.017)	(0.067)	(0.013)	(0.058)	(0.066)	(0.016)	(0.027)	(0.015)	(0.015)	(0.015)
Schooling	0.027*	0.036	0.097**	0.016	0.101**	0.002	0.028	0.020	0.028**	0.029**	0.029**
	(0.015)	(0.021)	(0.038)	(0.019)	(0.027)	(0.037)	(0.026)	(0.041)	(0.013)	(0.013)	(0.014)
FDI*PrvtCrdt									-0.614*		
									(0.342)		
FDI*BnkCrdt										-0.671*	
										(0.351)	
FDI*LLY											-1.210**
											(0.552)
F-stats for FDI									7.60**	7.55**	5.77**
Obs.	620	310	310	210	210	200	340	280	620	620	620
Countries	62	31	31	21	21	20	34	28	62	62	62
Hansen J test[b]	0.729	0.243	0.614	0.755	0.575	0.382	0.688	0.685	0.202	0.212	0.272
AR(2) test[a]	0.122	0.388	0.462	0.681	0.144	0.386	0.125	0.349	0.211	0.209	0.464

Note: All variables are cross-sectionally demeaned log values; * and ** indicate significance at the 10% and 5% level, respectively; (a) The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation; (b) The null hypothesis is that the instruments used are not correlated with the residuals.

Table 3. A Dynamic Panel Threshold Estimation

	Private Credit	Private Credit	Private Credit	Private Credit
Threshold ($\hat{\gamma}$)	92.582	83.771	92.582	83.771
	[83.748,97.492]	[83.748,95.970]	[83.748,96.511]	[83.748,96.511]
Impact of FDI				
$\widehat{\beta_2}$ $(FD > \gamma)$	0.033	0.030	0.040	0.038
	(0.031)	(0.027)	(0.032)	(0.027)
$\widehat{\beta_1}$ $(FD \leq \gamma)$	0.235**	0.189**	0.279**	0.216**
	(0.046)	(0.046)	(0.049)	(0.047)
Covariates				
Initial Income	-0.025**	-0.017	-0.024**	-0.016
	(0.012)	(0.013)	(0.012)	(0.012)
Gov'tSize	-0.217**	-0.193**		
	(0.069)	(0.067)		
Openness	0.032**	0.030**		
	(0.015)	(0.015)		
Inflation	-0.035**	-0.026**		
	(0.011)	(0.010)		
Schooling	0.012	0.004	0.021	0.012
	(0.017)	(0.015)	(0.014)	(0.015)
Investment		0.178**		0.204**
		(0.035)		(0.036)
$\hat{\alpha}$	0.012**	0.013**	0.012**	0.013**
	(0.004)	(0.004)	(0.004)	(0.004)
Obs.	620	620	620	620
Countries	62	62	62	62

Notes: Each column shows the coefficient from a separate regression and standard errors are in parentheses. *, and ** indicates statistical significance at the 10%, and 5% level.

Table 4. A Dynamic Panel Threshold Estimation for Other Measures

	Bank Credit	Bank Credit	LLY	LLY	Fin. Inst. Index	Fin. Inst. Index
Threshold ($\hat{\gamma}$)	83.773	83.773	91.203	91.203	0.607	0.615
	[83.012,97.148]	[83.370,94.137]	[83.020,92.418]	[83.185,95.255]	[0.569, 0.641]	[0.569, 0.641]
Impact of FDI						
$\widehat{\beta_2}$ $(FD > \gamma)$	0.025	0.033	0.086**	0.109**	0.045	0.062*
	(0.029)	(0.030)	(0.034)	(0.038)	(0.030)	(0.032)
$\widehat{\beta_1}$ $(FD \leq \gamma)$	0.234**	0.278**	0.209**	0.248**	0.282**	0.330**
	(0.048)	(0.050)	(0.043)	(0.048)	(0.070)	(0.074)
Covariates						
Initial Income	-0.026**	-0.025**	-0.026**	-0.024**	-0.029**	-0.028**
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Gov'tSize	-0.218**		-0.228**		-0.261**	
	(0.069)		(0.070)		(0.072)	
Openness	0.033**		0.042**		0.036**	
	(0.015)		(0.015)		(0.015)	
Inflation	-0.035**		-0.036**		-0.038**	
	(0.011)		(0.011)		(0.011)	
Schooling	0.011	0.021	0.011	0.023	0.010	0.021
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
$\hat{\alpha}$	0.013**	0.014**	0.020**	0.021**	0.010**	0.010**
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Obs.	620	620	620	620	620	620
Countries	62	62	62	62	62	62

Notes: Each column shows the coefficient from a separate regression and standard errors are in parentheses. *, and ** indicates statistical significance at the 10%, and 5% level.