GROWTH EFFECT OF FOREIGN DIRECT INVESTMENT AND FINANCIAL DEVELOPMENT: NEW INSIGHTS FROM THRESHOLD APPROACH

Thu-Ha T. An and **Kuo-Chun Yeh**
Graduate Institute of National Development
National Taiwan University

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Highlights

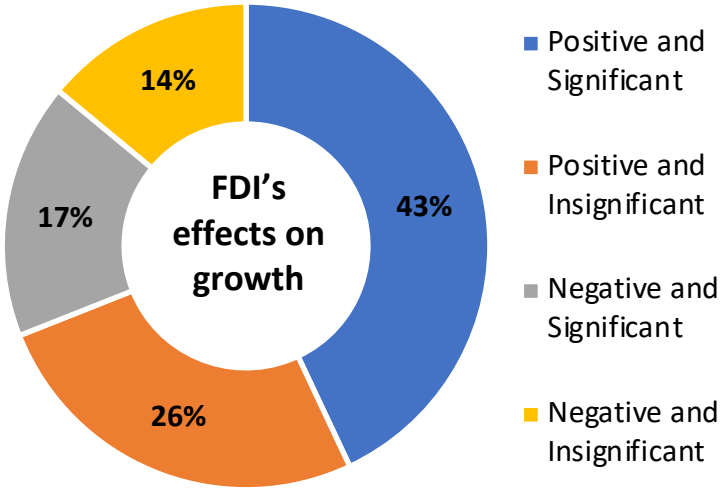
- Study the effect of FDI on economic growth depending on the development level of the local financial system in 18 emerging and developing Asian countries in 1996-2017.
- Estimate two distinct thresholds of financial development in the FDI-growth link.
- Illustrate the growth-enhancing effect of FDI that is nonlinear contingent on financial development.
- Apply the Panel smooth transition regression (PSTR) model.

Research questions

- The wish to attract foreign investment is as great as ever for developing countries. FDI is generally believed not only to contribute capital accumulation but also generate transmissions of knowledge and advanced technology, which potentially accelerate the long-run growth rate in developing world. But is it really?

- Emerging and developing Asia is noted as the largest FDI recipient recently, occupying 39.4% of global inflows in 2018. The real GDP growth rate of the region is the highest worldwide, at roughly 6.8% in the last 5 years. Is there evidence of FDI's positive effects on economic growth in these countries?

Literature review



Source: Iamsiraroj and Ulubaşoğlu (2015), doing a thorough review of 108 empirical studies using data from around the globe.

- The growth effect of FDI is much dependent on local conditions that are called factors of absorptive capacity.
- FDI will boost economic growth only when the factors of absorptive capacity exceed certain thresholds.

Literature review

The development of domestic financial system is a pivotal factor to enable the potential advantages of FDI (Levine, 2004; Hermes and Lensink, 2003; Alfaro *et al.,* 2004, 2010)

- Capital accumulation: easing information about possible investments, allocating capital, monitoring investment…
- Facilitate the trading, diversification and management of risk…
- Facilitate the process of technological diffusion, reduce risks to adopt new technologies, lower set-up costs for technology adaptation…
- Create new firms through mergers and acquisitions, allow positive spillovers to domestic firms and the host countries…

Literature review

The previous empirics on growth effects of FDI are inconclusive

- An inverted-U-shaped effect, implying an increasing effect of FDI on growth at higher levels of FD but fading at very high levels of the condition (Iamsiraroj and Ulubaşoğlu, 2015)
- A U-shaped curve for the nonlinear relationship between FD and growth considering the interaction terms between FD and FDI in growth model (Abdul Bahri *et al.,* 2019)
- There are thresholds of FD that unlock the effects of FDI on growth (Azman-Saini *et al.,* 2010; Chen and Quang, 2014; Baharumshah *et al.,* 2017;…)

Literature review

Limitations:

- FDI is treated as an independent variable or considered in interaction terms with absorptive capacity factors. This implies the linear effect of FDI on growth, which blocks the heterogeneity of the growth effect of FDI.
- Although nonlinear effect of FDI on economic growth is detected in several studies, the results are limited in providing benchmarks of financial development for follow-up policies.
- The studies adopting threshold approach similarly attain one threshold in a two-regime pattern only. Yet, there might exist more thresholds in some specific conditions
- No empirical study so far for emerging and developing Asia

Our aims

This study aims to

- Provide the first empirical study on growth effect of FDI and financial development particularly in emerging and developing Asia.
- Examine the role of financial development in the FDI-growth nexus
- Suggest benchmarks of development level of financial system for FDI to benefit economic growth in emerging and developing Asia .

Panel smooth transition regression (PSTR) framework

- Growth model

$$GROWTH_{it} = \mu_i + \alpha' \boldsymbol{X}_{it} + \beta' FDI_{it} + \varepsilon_{it} \qquad (1)$$

where i ($i = 1, 2, \ldots, N$) and t ($t = 1, 2, \ldots, T$) represent countries and years

$GROWTH_{it}$ stands for economic growth

FDI_{it}: net inflow of foreign direct investment.

$\boldsymbol{X}_{it}$: a vector of time-varying explanatory variables

μ_i: country fixed effect, ε_{it}: *i.i.d.* errors.

- PSTR framework (Gonzalez *et al.,* 2005, 2017)

$$GROWTH_{it} = \mu_i + \alpha_0' \boldsymbol{X}_{it} + \beta_0' FDI_{it} + (\alpha_1' \boldsymbol{X}_{it} + \beta_1' FDI_{it})\, g(q_{it}; \gamma, c) + \varepsilon_{it} \qquad (2)$$

where $g(q_{it}; \gamma, c)$ is transition function, continuous and bounded between 0 and 1

q_{it}: threshold variable

Panel smooth transition regression (PSTR) framework

- Transition function

Follow Colletaz and Hurlin (2012), Gonzalez *et al.* (2005, 2017), we use logistic form

$$(q_{it};\gamma,c) = \frac{1}{1+\ \exp(-\gamma\,(q_{it}-c))}$$

where $\gamma > 0$: the slope of the transition function

c : location parameter, presenting the threshold value

- When $\gamma \to \infty$, $g(q_{it};\gamma,c)$ becomes indicator function I $[q_{it} > c]$
  where I [.] = 1 when q_{it} exceed the threshold value, 0 otherwise.
  PSTR becomes two-regime panel threshold regression model (PTR) Hansen (1999)

- When $\gamma \to 0$, $g(q_{it};\gamma,c)$ is constant
  PSTR becomes a linear panel model with fixed effects.

Panel smooth transition regression (PSTR) framework

- Marginal effect of FDI on growth conditional on the threshold variable

$$e_{it} = \frac{\partial GROWTH_{it}}{\partial FDI_{it}} = \beta_0 + \beta_1 \, g(q_{it}; \gamma, c) \qquad (4)$$

This illustrates the nonlinear effect of FDI evolving as a continuum from β_0 (corresponding to low regime) to $\beta_0 + \beta_1$ (corresponding to high regime), driven by a monotonic transition at the slope γ and centered around the threshold value c.

- The PSTR model expanded for $(r + 1)$ extreme regimes

$$GROWTH_{it} = \mu_i + \alpha_0^{'} \boldsymbol{X}_{it} + \beta_0^{'} FDI_{it} + \sum_{j=1}^{r} (\alpha_j' \boldsymbol{X}_{it} + \beta_j^{'} FDI_{it}) \, g_j(q_{it}; \gamma_j, c_j) + \varepsilon_{it} \qquad (5)$$

Estimation procedure

(1) Linearity test

- As the PSTR model is not identified in a homogeneous data generating process, we first need to test the specification in *Eq.* (2):

H_o: $\gamma = 0$ or $H_0^{'}$: $\beta_1 = 0$ (linear model, or homogeneous coefficients)

H_1: nonlinear model (PSTR)

- First-order Taylor expansion around $\gamma = 0$ and the auxiliary regression given as:

$$GROWTH_{it} = \mu_i + \theta_0^{'*}\boldsymbol{Z}_{it} + \theta_1^{'*}\boldsymbol{Z}_{it}q_{it} + \varepsilon_{it}^{*} \qquad (5)$$

Testing H_o: $\gamma = 0$ in *Eq.* (2) is equivalent to testing H_0^{*}: $\theta_1^{*} = 0$ in *Eq.* (5) without affecting the asymptotic inference

Wald LM test: $LM_W = \frac{NT(SSR_0 - SSR_1)}{SSR_0} \sim \chi^2(K)$

Likelihood ratio test: $LR = -2[\log(SSR_1) - \log(SSR_0)] \sim \chi^2(K)$

Fisher LM test: $LM_F = \frac{(SSR_0 - SSR_1)}{SSR_1} \times \frac{NT - N - K}{K} \sim F(K, NT - N - K)$

Estimation procedure

(2) PSTR estimation

The parameters are estimated by nonlinear least squares (NLS).

We do a grid search for values of γ and c such that $\gamma > 0$, $c_{j,min} > min_{i,t}\{q_{it}\}$, $c_{j,max} < max_{i,t}\{q_{it}\}$ and those minimize the concentrated sum of squared errors are the starting values of the nonlinear optimization algorithm.

(3) No remaining nonlinearity

H_o: PSTR model of one transition ($r = 1$)

H_1: PSTR model of two transition ($r = 2$)

→ test H_o: $\gamma_2 = 0$ in *Eq.* (5) with $r = 2$, given the parameter (γ_1, c_1) estimated in the initial PSTR model → use first-order of Taylor expansion for *Eq.* (5)

→ repeat until H_o is not rejected

→ get the optimal number of transition

Empirical models

- Threshold variables of financial development
  - i. Domestic credit to private sector (*CREPRI*): credit to the private sector from deposit money banks and other financial institutions
  - ii. Credit by financial sector (CREFIN): domestic credit provided by the financial sector, including all credits to various sectors on a gross basis
  - iii. Liquid liability (LIQUID): liquid liabilities, also known as broad money

- Alternative models

$$GROWTH_{it} = \mu_i + \alpha_0^{'} \boldsymbol{X}_{it} + \beta_0^{'} FDI_{it} + \sum_{j=1}^{r} (\alpha_j^{'} \boldsymbol{X}_{it} + \beta_j^{'} FDI_{it})\, g_j(CREPRI_{it}; \gamma_j, c_j) + \varepsilon_{it} \quad (6)$$

$$GROWTH_{it} = \mu_i + \alpha_0^{'} \boldsymbol{X}_{it} + \beta_0^{'} FDI_{it} + \sum_{j=1}^{r} (\alpha_j^{'} \boldsymbol{X}_{it} + \beta_j^{'} FDI_{it})\, g_j(CREFIN_{it}; \gamma_j, c_j) + \varepsilon_{it} \quad (7)$$

$$GROWTH_{it} = \mu_i + \alpha_0^{'} \boldsymbol{X}_{it} + \beta_0^{'} FDI_{it} + \sum_{j=1}^{r} (\alpha_j^{'} \boldsymbol{X}_{it} + \beta_j^{'} FDI_{it})\, g_j(LIQUID_{it}; \gamma_j, c_j) + \varepsilon_{it} \quad (8)$$

Data

Table A1.
Variable measurement and data sources

Variable	Definition	Measurement	Source of data
GROWTH	Economic growth	Real GDP per capita in 2011 international dollar purchasing power parity-PPP (log difference) (%)	WDI
FDI	Foreign direct investment	Net inflows of foreign direct investment (% of GDP)	WDI
CREPRI	Credit to private sector	Domestic credit to private sector (% of GDP)	FSD
CREFIN	Credit by financial sector	Domestic credit by financial sector (% of GDP)	WDI
LIQUID	Liquid liability	Liquid liability or broad money (M3) (% of GDP)	FSD
GC	Government consumption	General government final consumption expenditure (% of GDP)	WDI
DI	Domestic investment	Difference between gross fixed capital formation and foreign direct investment (% of GDP)	WDI
OPEN	Trade openness	Sum of exports and imports of goods and services (% of GDP)	WDI
INC	Initial income	Real GDP per capita in 2011 international dollar PPP in previous period (natural logarithm)	WDI
POP	Population growth	Country population growth rate (annual %)	WDI
LABOR	Labor force	Proportion of the population that is economically active (%)	WDI
INF	Inflation	Inflation, GDP deflator (annual %)	WDI
INS	Institutional quality	Composite index by simple average of six index components (control of corruption, government efficiency, political stability, regulation quality and rule of law)	WGI

Note(s): WDI: World Development Indicators, the World Bank. WGI: Worldwide Governance Indicators, the World Bank. FSD: Financial Structure Database, the World Bank.
Source(s): Author's compilation.

Data

Table A2.
Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
GROWTH	396	1.544	1.504	– 6.728	6.830
FDI	396	2.757	4.568	– 37.155	43.912
CREPRI	396	49.070	35.794	3.933	163.211
CREFIN	396	65.390	43.489	2.599	216.908
LIQUID	396	61.266	36.012	8.442	197.997
GC	396	12.469	5.383	3.460	29.867
DI	396	24.415	10.060	3.216	68.234
OPEN	396	83.028	42.193	21.929	220.407
INC	396	3.873	0.467	3.041	4.937
POP	396	1.475	0.931	– 0.267	7.350
LABOR	396	67.551	10.287	48.491	88.533
INF	396	7.522	12.132	– 25.128	143.693
INS	342	– 0.231	0.505	– 1.178	0.840

Note(s): Values reported are the statistics of the variables used in the models, as defined and measured in *Table A1*. Data for institutional quality stem from WGI, getting the values by definition from –2.5 to 2.5. The WGI data are not available for three years 1997, 1999 and 2001.
Source(s): Author's calculations.

Empirical results – Linearity tests

Table 1.
Test of linearity

Threshold variable	Wald (LM) test		Fisher (LMF) test		Likelihood-ratio (LR) test	
	statistic	*p*-value	statistic	*p*-value	statistic	*p*-value
CREPRI	21.600	0.017	2.117	0.023	22.312	0.014
CREFIN	32.493	0.000	3.296	0.000	34.141	0.000
LIQUID	37.108	0.011	1.850	0.016	39.280	0.006

Note(s): This table reports the results of the tests of linearity for the models defined in *Eq*. (6)–(8).
H_0: linear model, H_1: nonlinear model (PSTR model with at least one transition function ($r = 1$).
Source(s): Author's computations.

Empirical results – No remaining nonlinearity tests

Table 2.
Test of no remaining nonlinearity

Threshold variable	r* = 1		r* = 2		Optimal number of transition function (r)
	LMF stat.	p-value	LMF stat.	p-value	
CREPRI	3.786	0.000	1.634	0.097	$r = 2$
CREFIN	4.191	0.000	2.228	0.016	$r = 2$
LIQUID	2.539	0.006	1.798	0.061	$r = 2$

Note(s): This table reports the results of the tests of no remaining nonlinearity for the models defined in *Eq.* (6)–(8). H_0: PSTR model with r = r*, H_1: PSTR model with r = r*+1. At each step of the sequential testing procedure for the optimal r, the critical p-value is reduced by a constant factor (*tau*=0.5) to avoid excessively large models.
Source(s): Author's computations.

Empirical results – Financial development thresholds

Table 3.
PSTR estimates of financial development thresholds and regimes

Threshold variable	Regime	Threshold value (c)	Slope parameter (γ)	AIC	SBC
CREPRI	$j = 1$	33.025	235.908	0.048	0.390
	$j = 2$	99.401	0.840		
CREFIN	$j = 1$	48.238	2976.2	– 0.007	0.334
	$j = 2$	63.427	3.996		
LIQUID	$j = 1$	35.519	96.824	0.109	0.451
	$j = 2$	102.099	0.182		

Note(s): This table reports the PSTR estimation of transition functions in the models defined in *Eq*. (6)–(8). There are two transition locations ($r = 2$) for each model. $j = [1, r]$ is the order of the transition locations. AIC and SBC are the Akaike Information Criterion and the Schwarz Bayesian Criterion, respectively.

Source(s): Author's computations.

Empirical results – Growth effect of FDI

Table 4.
Growth effect of FDI conditional on financial development

Dep. var. *GROWTH*	*CREPRI* *Eq.* (6)		*CREFIN* *Eq.* (7)		*LIQUID* *Eq.* (8)	
Low regime						
FDI	– 0.112*	(0.063)	0.059**	(0.024)	– 0.119	(0.095)
Mid-regime (first transition function)						
$FDI \times g_1(q_{it}; \gamma_1, c_1)$	0.175***	(0.062)	0.068**	(0.032)	0.175*	(0.096)
High regime (second transition function)						
$FDI \times g_2(q_{it}; \gamma_2, c_2)$	– 0.255***	(0.088)	– 0.121***	(0.029)	– 0.334*	(0.172)
Number of obs.	342		342		342	

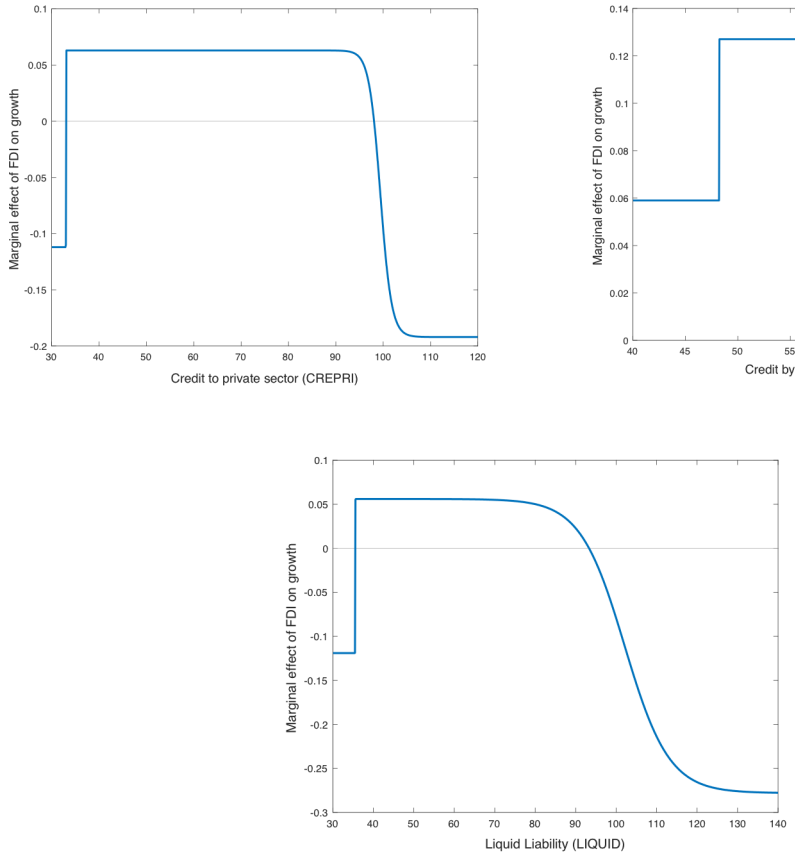
Note(s): This table reports the effect of FDI on economic growth in different regimes of financial development in the models defined in *Eq.* (6)–(8). Standard errors corrected for heteroskedasticity in parentheses. *, **, *** denote significance at the 10%, 5% and 1% level, respectively.

Source(s): Author's computations.

Empirical results – Growth effect of FDI

Figure 1.

Marginal effect of FDI on economic growth conditional on financial development



Source(s): Author's computations.

Empirical results – direct growth effect of financial development

Table 5.
PSTR estimates of explanatory variables

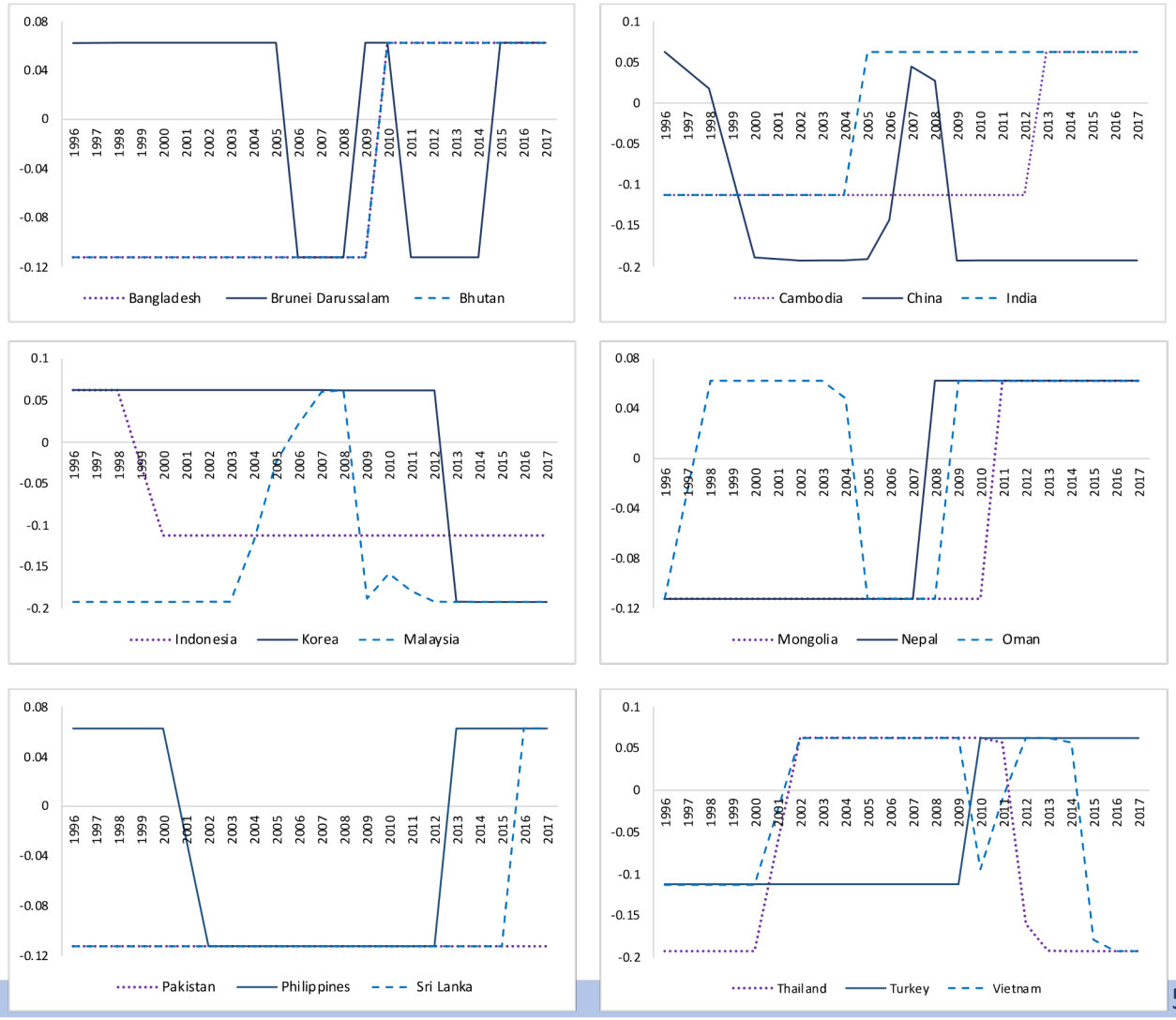
Dep. var. *GROWTH*	*CREPRI* *Eq.* (6)		*CREFIN* *Eq.* (7)		*LIQUID* *Eq.* (8)	
Low regime						
FD	– 0.025	(0.020)	0.002**	(0.011)	– 0.009	(0.039)
...						
Mid-regime (first transition function)						
FD	– 0.003	(0.023)	– 0.057*	(0.033)	0.023	(0.039)
...						
High regime (second transition function)						
FD	– 0.058***	(0.020)	0.029	(0.033)	– 0.019	(0.012)
...						
Number of obs.	342		342		342	

Note(s): Standard errors corrected for heteroskedasticity in parentheses. *, **, *** denote significance at the 10%, 5% and 1% level, respectively.
Source(s): Author's computations.

Empirical results – Individual marginal growth effect of FDI

Figure 2.

Individual marginal growth effect of FDI conditional on credit to private sector



Conclusions

- FDI has nonlinear effects on growth conditional on the level of financial development in a three-regime scheme of the evolving movement.
- The finding of the second threshold value reveals “too much finance” does not necessarily induce beneficial impact of FDI on growth in emerging and developing Asia
- The empirical results make a remark for emerging and developing Asia to position themselves at particular levels of financial development and hence explain the current earning capability from FDI.
- FDI promotion policies should be shadowed by strategies of improving the absorptive capacity, namely effective reforms in financial system.
- The vanishing effect of “too much finance” sheds light on coherent and effective policies for fostering growth effect of FDI in emerging and developing Asia.
- Comprehensive policies to improve economic environment towards enhancing the advantages of FDI should be pursued in the long-run.

Thank you!

Growth Effect of Foreign Direct Investment and Financial Development:

New Insights from Threshold Approach

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