



Behavioral and Empirical Perspectives on FDI: International Capital Allocation Across Asia

Douglas H. Brooks, Asian Development Bank Institute

David Roland-Holst, UC Berkeley

Fan Zhai, Asian Development Bank

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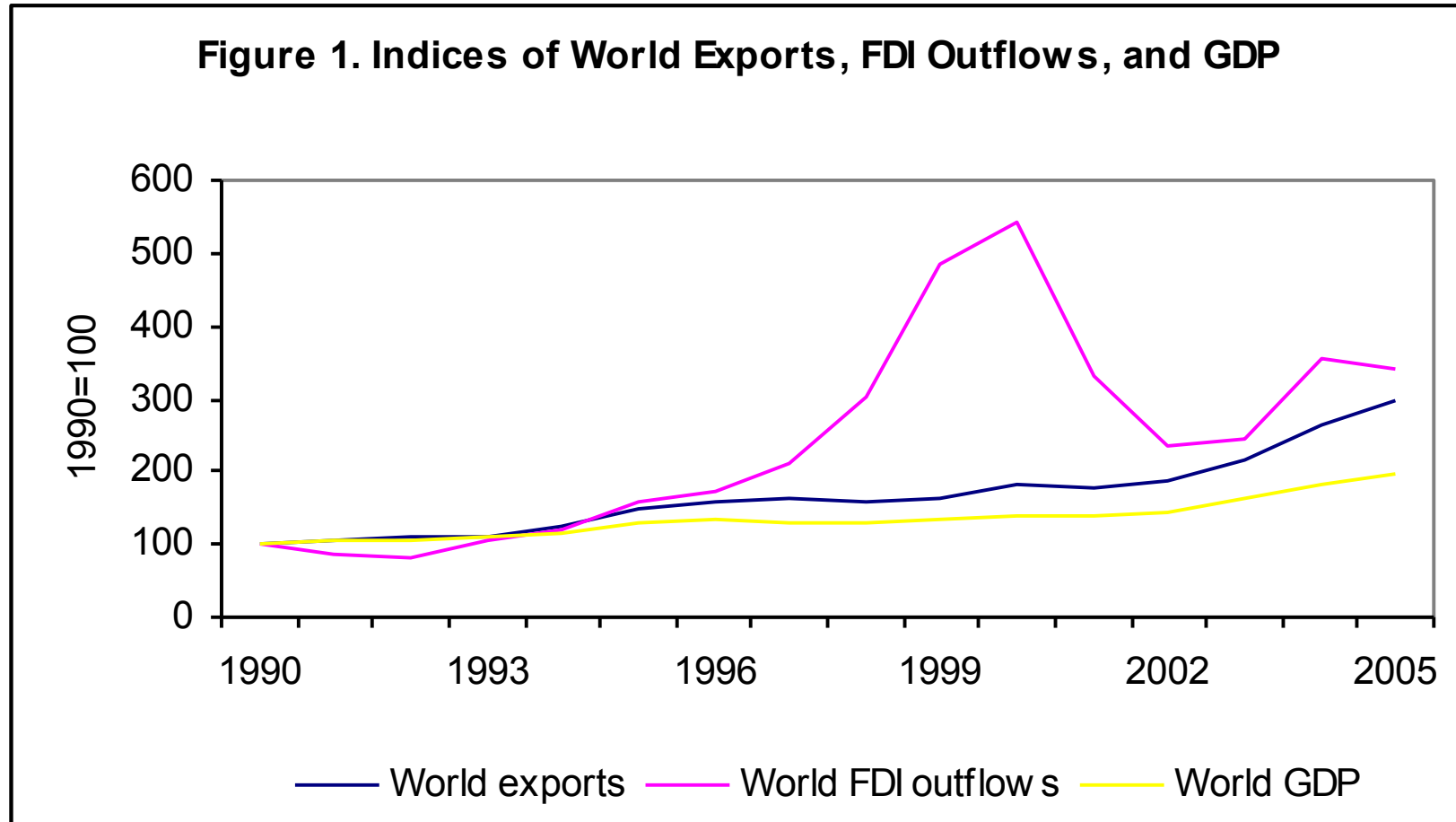
1. Introduction and Overview

- International capital allocation has been a primary driver of modern growth dynamics, particularly for emerging economies, and this relationship has nowhere been more fortuitous than in Asia.
- Together with disciplined commitments to domestic and external economic reform, the region's economies have leveraged foreign savings to achieve growth and modernization beyond the imagining of prior generations.
- Despite the pervasive influence FDI has had on Asia's growth experience, the precise benefits of foreign investment remain challenging to quantify and the process of international capital allocation very difficult to predict.



- Given the nearly universal appeal of FDI as a growth catalyst, however, it would clearly be desirable for policy makers to better understand its fundamental determinants.
- As Asia transits from a loose federation of emerging economies to a more fully integrated and mature economic region, the need to understand multilateral investment dynamics will only increase.

Trends in Global Agregates

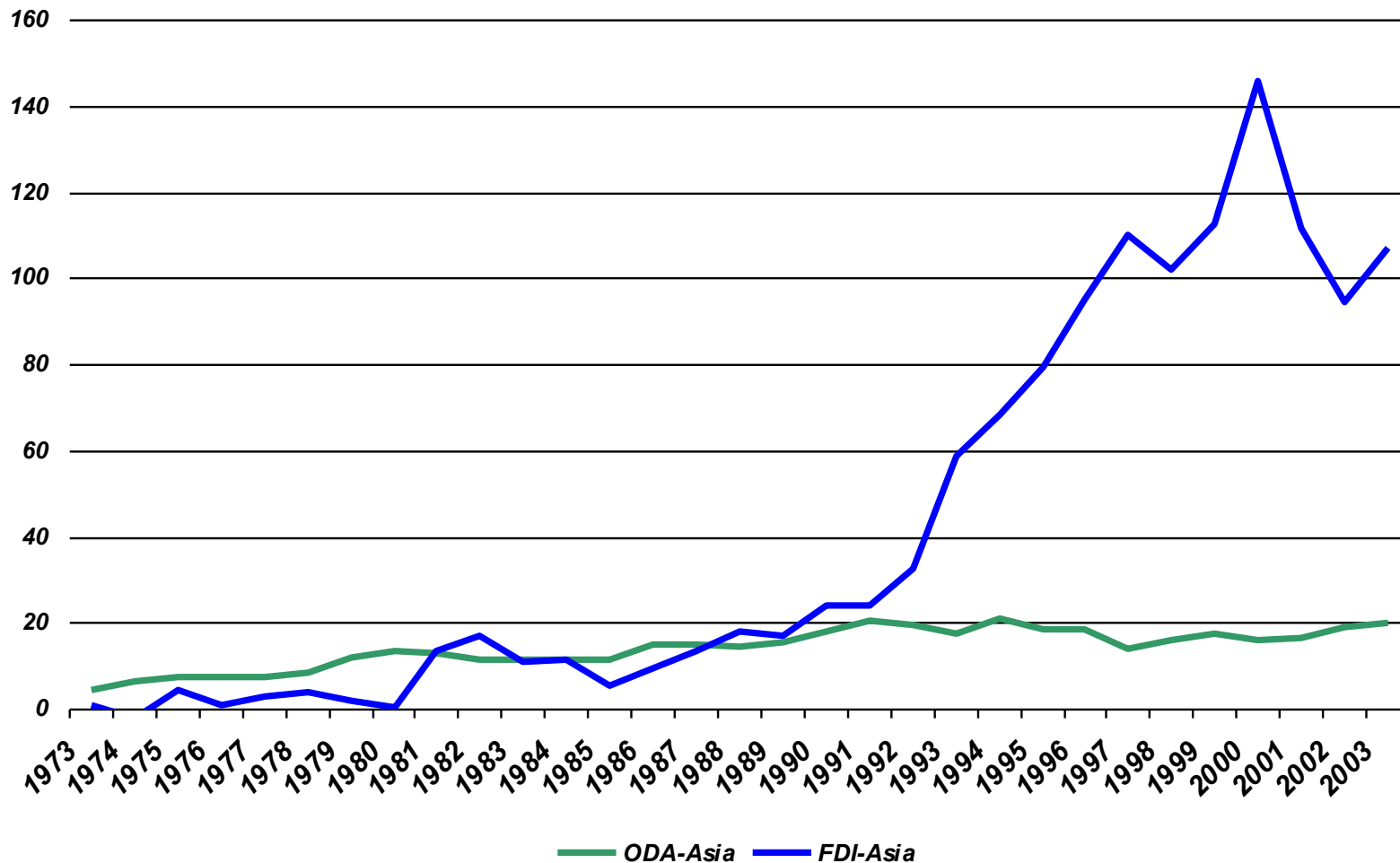


Sources: Exports and GDP - IMF WEO September 2006 database; FDI Outflows - UNCTAD FDI September 2006 database.

Asian Public and Private Inflows

(Asian inbound Aid and FDI, USD Billions)

Clearly, we have entered an Age of Complementarity.



FDI Inflows in Selected Developing Asian Economies, 2001-05

Economy	% of Total FDI in Developing Asia	Ratio to GDP
PRC	46.1	3.4
Hong Kong, China	18.9	13.9
Singapore	11	13.8
India	4.5	0.9
Korea, Rep. of	4.1	0.8
Malaysia	2.4	2.7
Kazakhstan	2.2	8.5
Thailand	1.9	1.7
Azerbaijan	1.6	25.2
Taipei, China	1.5	0.6

Sources: UNCTAD FDI September 2006 database; World Bank World Development Indicators online database; IMF WEO September 2006 database.

Annual FDI Inflows (US\$ million)

Rank	Host Economy	1991-95	Rank	Host Economy	2001-05
1	PRC	22,835	1	PRC	57,232
2	Singapore	6,373	2	Hong Kong, China	23,402
3	Hong Kong, China	5,176	3	Singapore	13,653
4	Malaysia	5,064	4	India	5,551
5	Indonesia	2,342	5	Korea, Rep. of	5,145
6	Thailand	1,889	6	Malaysia	2,964
7	Taipei,China	1,200	7	Kazakhstan	2,674
8	Philippines	1,124	8	Thailand	2,377
9	Viet Nam	1,100	9	Azerbaijan	2,028
10	Korea, Rep. of	857	10	Taipei,China	1,906

FDI Inflows (as % of Gross Fixed Capital Formation)

Rank Host Economy		1991-95	Rank Host Economy	2001-05	
1	Vanuatu	62	1	Hong Kong, China	63
2	Viet Nam	42	2	Azerbaijan	61
3	Singapore	29	3	Singapore	55
4	Papua New Guinea	24	4	Kazakhstan	36
5	Azerbaijan	24	5	Tajikistan	32
6	Cambodia	23	6	Armenia	23
7	Fiji Islands	21	7	Mongolia	23
8	Malaysia	20	8	Kyrgyz Republic	21
9	Kyrgyz Republic	17	9	Fiji Islands	19
10	Hong Kong, China	15	10	Cambodia	15

FDI Inflows Per Capita (US\$)

Rank	Host Economy	1991-95	Rank	Host Economy	2001-05
1	Singapore	1,885	1	Hong Kong, China	3,416
2	Hong Kong, China	866	2	Singapore	3,227
3	Brunei Darussalam	415	3	Brunei Darussalam	3,052
4	Malaysia	262	4	Marshall Islands	2,019
5	Vanuatu	170	5	Azerbaijan	245
6	Fiji Islands	62	6	Kazakhstan	179
7	Taipei,China	57	7	Kiribati	170
8	Papua New Guinea	49	8	Malaysia	120
9	Thailand	33	9	Korea, Rep. of	107
10	Solomon Islands	33	10	Taipei,China	85



2. Methodological Issues

- Financial flows generally, and foreign capital flows in particular, have been one of the most challenging areas of empirical trade research.
- These flows offer important growth leverage to regional economies, particularly developing ones.
- Despite general agreement about what kind of phenomena deserve primary study, researchers have failed to develop empirically robust specifications.



Methodology

In this study, we approach the problem from three perspectives.

1. Macroeconomic determinants – FDI is a component of macro adjustment
2. Market Expansion – FDI is driven by supply chains
3. Productivity – FDI is a portfolio decision

$$Z = \alpha P^{\varepsilon_P} R^{\varepsilon_R} G^{\varepsilon_G}$$

3. Aggregate Determinants of Inbound FDI

A parsimonious representation of the basic macro-driver model would be

$$Z = \alpha P^{\varepsilon_P} R^{\varepsilon_R} G^{\varepsilon_G}$$

where

Z denotes a monotone index of the level of inbound FDI

P is an index for capital cost or a forward price of savings

R is an index of local relative to global real interest rates

G is an index of local real GDP growth

This can be conveniently represented in elasticity form as

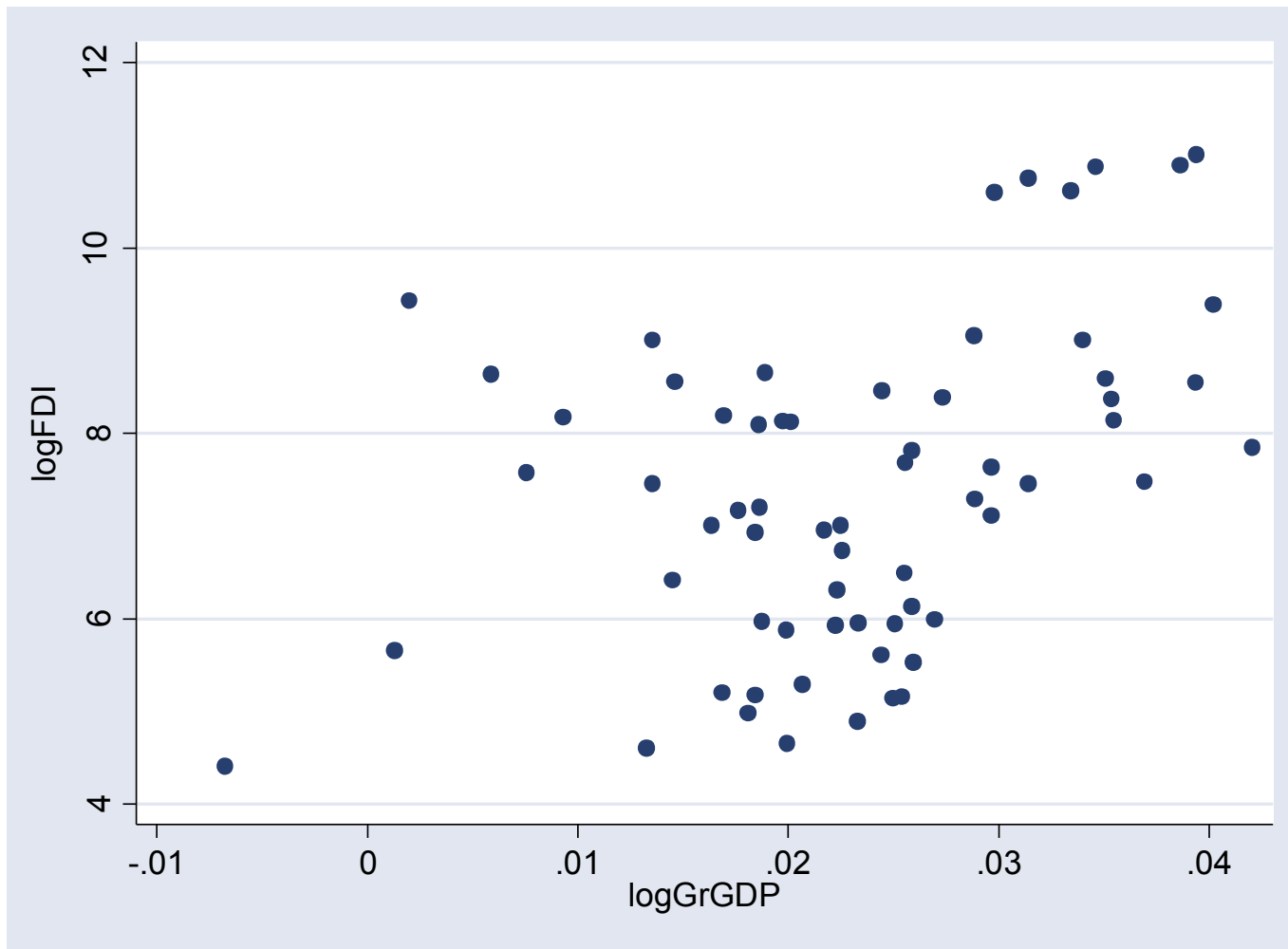
$$\log Z = \log \alpha + \varepsilon_P \log P + \varepsilon_R \log R + \varepsilon_G \log G$$



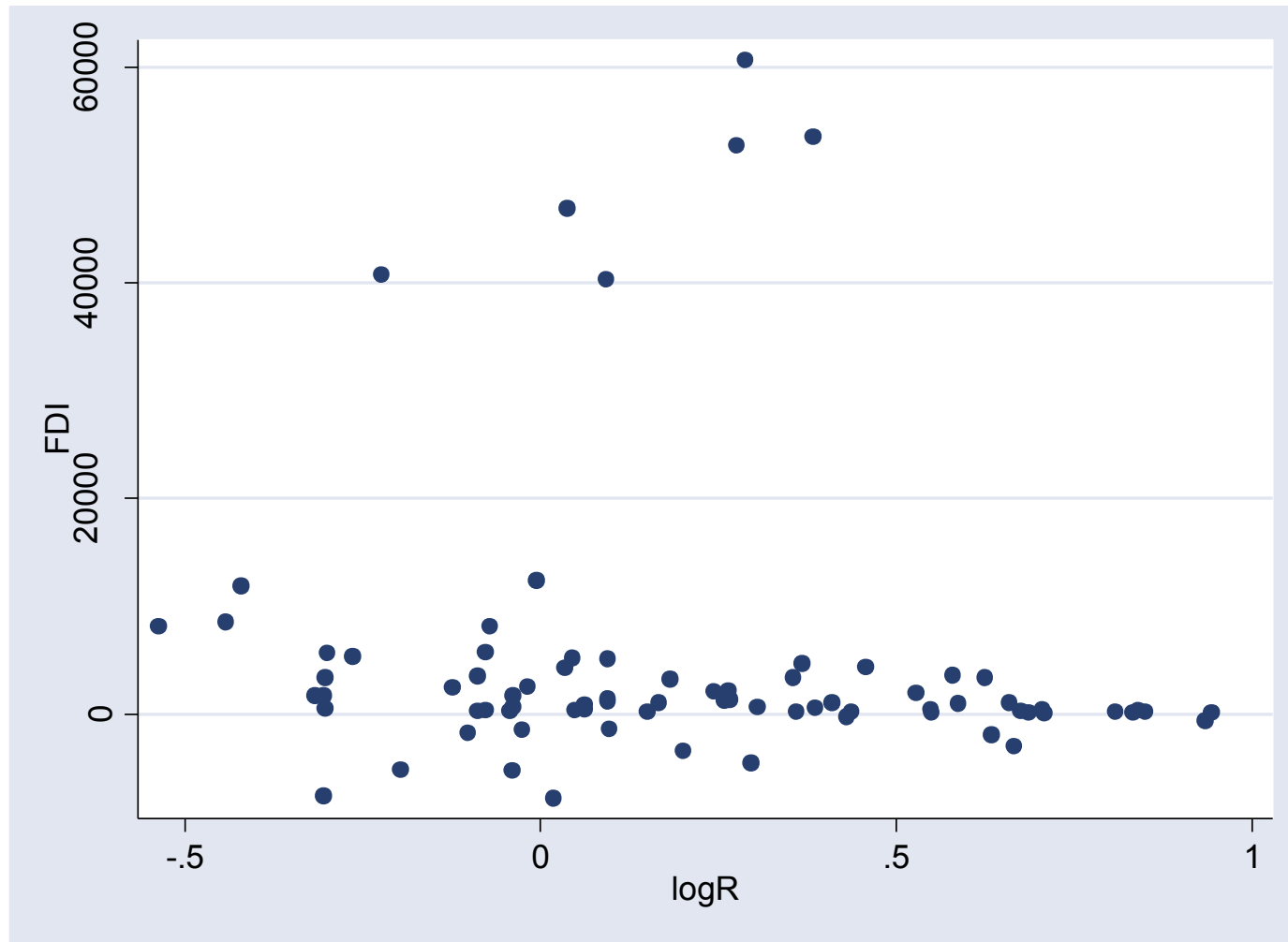
Econometric Estimates

- Using annual data for twelve Asian countries, we experimented with a variety of proxies for P and R.
- We were unsuccessful in identifying variables to represent P, but for R the most useful proxy was the ratio of average domestic interbank rates to LIBOR.
- As in much of the literature on this subject, our estimates did not indicate conclusive macroeconomic interactions between FDI, growth, or rates of return.
- Instead, we find that flows are most dependent on initial conditions (national fixed effect coefficients), with high degrees of statistical significance and a very high R-square for pooled data.

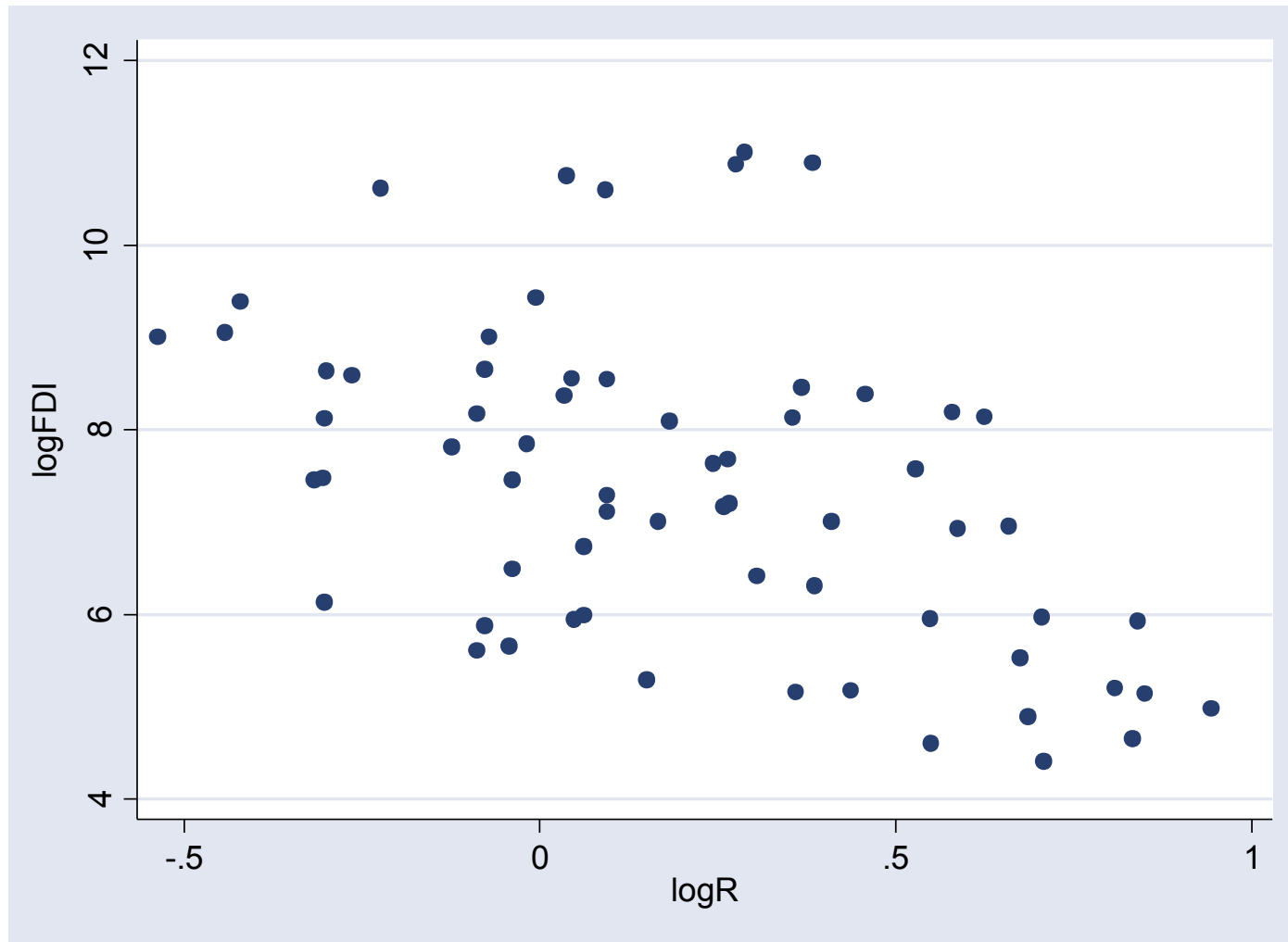
Log(FDI) and Log(GDP growth)



FDI and $\text{Log}(R/RW)$



Log(FDI) and Log(R/RW)



FDI Flow Regression 1

Equation: reg fdi logR logGrGDP kor twn hkg idn mys phl sgp tha vnm bgd ind lka

Source	SS	df	MS	Number of obs = 78	
Model	1.3054e+10	14	932411577	F(14, 63) =	73.23
Residual	802123492	63	12732118.9	Prob > F =	0.0000
				R-squared =	0.9421
				Adj R-squared =	0.9292
Total	1.3856e+10	77	179946566	Root MSE =	3568.2

FDI	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
logR	1816.127	2176.382	0.83	0.407	-2533.026	6165.279
logGrGDP	107507.1	43425.21	2.48	0.016	20728.77	194285.5
kor	-46095.11	2108.189	-21.86	0.000	-50307.99	-41882.23
twm	-49871.46	2264.367	-22.02	0.000	-54396.43	-45346.48
hkg	-42254.03	2249.505	-18.78	0.000	-46749.31	-37758.75
idn	-49690.7	2446.088	-20.31	0.000	-54578.82	-44802.58
mys	-46187.1	2138.156	-21.60	0.000	-50459.86	-41914.33
phl	-47120.48	2309.259	-20.41	0.000	-51735.17	-42505.8
sgp	-42336.87	2448.275	-17.29	0.000	-47229.35	-37444.38
tha	-44690.94	2204.846	-20.27	0.000	-49096.98	-40284.91
vnm	-47143.44	2146.111	-21.97	0.000	-51432.1	-42854.78
bgd	-47957.01	2207.56	-21.72	0.000	-52368.46	-43545.55
ind	-44963.4	2167.88	-20.74	0.000	-49295.57	-40631.24
lka	-47996.92	2401.47	-19.99	0.000	-52795.88	-43197.97
_cons	45154.94	2145.056	21.05	0.000	40868.38	49441.49

FDI Flow Regression 2

Equation: reg fdi logGrGDP kor twn hkg idn mys phl sgp tha vnm bgd ind lka

Source	SS	df	MS	Number of obs =	78
Model	1.3045e+10	13	1.0035e+09	F(13, 64) =	79.19
Residual	810989389	64	12671709.2	Prob > F =	0.0000
Total	1.3856e+10	77	179946566	R-squared =	0.9415
				Adj R-squared =	0.9296
				Root MSE =	3559.7

FDI	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
logGrGDP	102336.3	42878.74	2.39	0.020	16676.15 187996.4
kor	-45906.83	2091.102	-21.95	0.000	-50084.29 -41729.37
twn	-50249.13	2213.405	-22.70	0.000	-54670.91 -45827.35
hkg	-42764.75	2159.507	-19.80	0.000	-47078.86 -38450.64
idn	-48789.94	2189.814	-22.28	0.000	-53164.59 -44415.28
mys	-46375.94	2121.096	-21.86	0.000	-50613.32 -42138.56
phl	-46500.71	2181.366	-21.32	0.000	-50858.49 -42142.93
sgp	-43294.78	2157.339	-20.07	0.000	-47604.56 -38985
tha	-45126.55	2137.072	-21.12	0.000	-49395.84 -40857.26
vnm	-47550.69	2084.919	-22.81	0.000	-51715.79 -43385.58
bgd	-47469.45	2123.78	-22.35	0.000	-51712.18 -43226.71
ind	-44524.07	2097.984	-21.22	0.000	-48715.27 -40332.86
lka	-47181.18	2188.289	-21.56	0.000	-51552.79 -42809.57
_cons	45592.05	2075.174	21.97	0.000	41446.41 49737.68

FDI Elasticity Regression 1

Equation: logFDI logR logGrGDP kor twn hkg idn mys phl sgp tha vnm bgd ind lka

Source	SS	df	MS	Number of obs =	65
Model	158.649624	13	12.2038172	F(13, 51) =	20.93
Residual	29.7340597	51	.583020778	Prob > F =	0.0000
Total	188.383684	64	2.94349506	R-squared =	0.8422
				Adj R-squared =	0.8019
				Root MSE =	.76356

logFDI	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
logR	-.9106291	.5019144	-1.81	0.076	-1.918264	.097006
logGrGDP	16.88279	11.14914	1.51	0.136	-5.500035	39.26562
kor	-3.207413	.4760129	-6.74	0.000	-4.163049	-2.251777
tw	(dropped)					
hkg	-2.034895	.5077449	-4.01	0.000	-3.054235	-1.015555
idn	-3.979752	.7145343	-5.57	0.000	-5.41424	-2.545265
mys	-3.521003	.4640808	-7.59	0.000	-4.452684	-2.589322
phl	-3.763287	.5090549	-7.39	0.000	-4.785258	-2.741317
sgp	-2.448458	.5418926	-4.52	0.000	-3.536353	-1.360563
tha	-3.166567	.4813388	-6.58	0.000	-4.132895	-2.200239
vnm	-4.474914	.4639033	-9.65	0.000	-5.406239	-3.543589
bgd	-4.403957	.4811483	-9.15	0.000	-5.369902	-3.438011
ind	-2.220983	.4699593	-4.73	0.000	-3.164466	-1.2775
lka	-5.046396	.5316096	-9.49	0.000	-6.113646	-3.979145
_cons	10.33753	.5076863	20.36	0.000	9.318304	11.35675

FDI Elasticity Regression 2

Equation: logFDI logGrGDP kor twn hkg idn mys phl sgp tha vnm bgd ind lka

Source	SS	df	MS	Number of obs =	65
Model	156.730479	12	13.0608732	F(12, 52) =	21.46
Residual	31.6532047	52	.608715476	Prob > F =	0.0000
Total	188.383684	64	2.94349506	R-squared =	0.8320
				Adj R-squared =	0.7932
				Root MSE =	.7802

logFDI	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
logGrGDP	19.49777	11.29658	1.73	0.090	-3.17047	42.16601
kor	-3.270825	.4850763	-6.74	0.000	-4.244202	-2.297448
twm	(dropped)					
hkg	-1.76354	.495794	-3.56	0.001	-2.758424	-.7686568
idn	-4.540919	.6581624	-6.90	0.000	-5.861618	-3.22022
mys	-3.426042	.4711715	-7.27	0.000	-4.371517	-2.480568
phl	-4.073672	.4898987	-8.32	0.000	-5.056726	-3.090619
sgp	-1.975308	.4853677	-4.07	0.000	-2.94927	-1.001347
tha	-2.947845	.4761556	-6.19	0.000	-3.903321	-1.992369
vnm	-4.270531	.4598275	-9.29	0.000	-5.193242	-3.347819
bgd	-4.648148	.4720098	-9.85	0.000	-5.595305	-3.700991
ind	-2.441053	.4639334	-5.26	0.000	-3.372003	-1.510102
lka	-5.45503	.4920369	-11.09	0.000	-6.442374	-4.467686
_cons	10.11758	.5037472	20.08	0.000	9.106742	11.12843



FDI From a Simulation Perspective

- In the absence of definitive econometric evidence regarding FDI behavior, a simulation framework may be able to elucidate the primary interactions between initial conditions and outcomes using a variety of alternative behavioral specifications.
- We used a global CGE model to examine how the ultimate effects of trade policy would vary under different hypothetical patterns of FDI behavior.
- Given the importance of private capital flows to the modern process of globalization, it is hardly surprising that trans-boundary investment behavior can strongly influence the effects of trade liberalization.
- Indeed, it is apparent even in this preliminary analysis that shifting FDI patterns can make the difference between success and failure for countries joining regional FTAs and larger trade reform initiatives.
- The model we use is a multi-country, dynamic CGE calibrated to the GTAP VI database. The present version includes an option for endogenous determination of FDI flows, based on the same logic as the estimating equation of the previous section.



Simulation Experiments

We conducted four experiments based on a scenario of global trade liberalization (GBL), assuming all tariffs and export subsidies are removed over the period 2005-2010. This scenario has the predictable results for global efficiency gains and growth, and then forms a policy reference for four FDI scenarios based on the following elaboration of the last equation

$$\frac{Z_r}{GDP_r} = \lambda_r \left[\alpha_r \left(\frac{P^w}{P} \right)^{\varepsilon_P} \left(\frac{TR_r}{WRR} \right)^{\varepsilon_P} (1 + \gamma_r)^{\varepsilon_G} \right] + (1 - \lambda_r) Z_{r,t-1}$$

where for country r , Z denotes total investment, P^w/P denotes the relative price of future consumption, TR/WRR is a the ratio of domestic and global rental rates, and γ is the growth rate of real GDP. This specification explains domestic aggregate investment shares as a product of three components: a forward discount rate, an inter-country relative rate of return, and an accelerator mechanism (including a lagged investment term)



Scenarios

Scenario		Forward Discount Rate	Elasticity Relative Rental Rate	Growth Rate of GDP
FDIGBL	Endogenous FDI under GBL	10.00	.50	10.00
FDR	Forward Discount Rate	10.00	.01	.10
RRW	Domestic Relative Rate of Return	.10	.50	.10
GGDP	Growth Rate of GDP	.10	.01	10.00

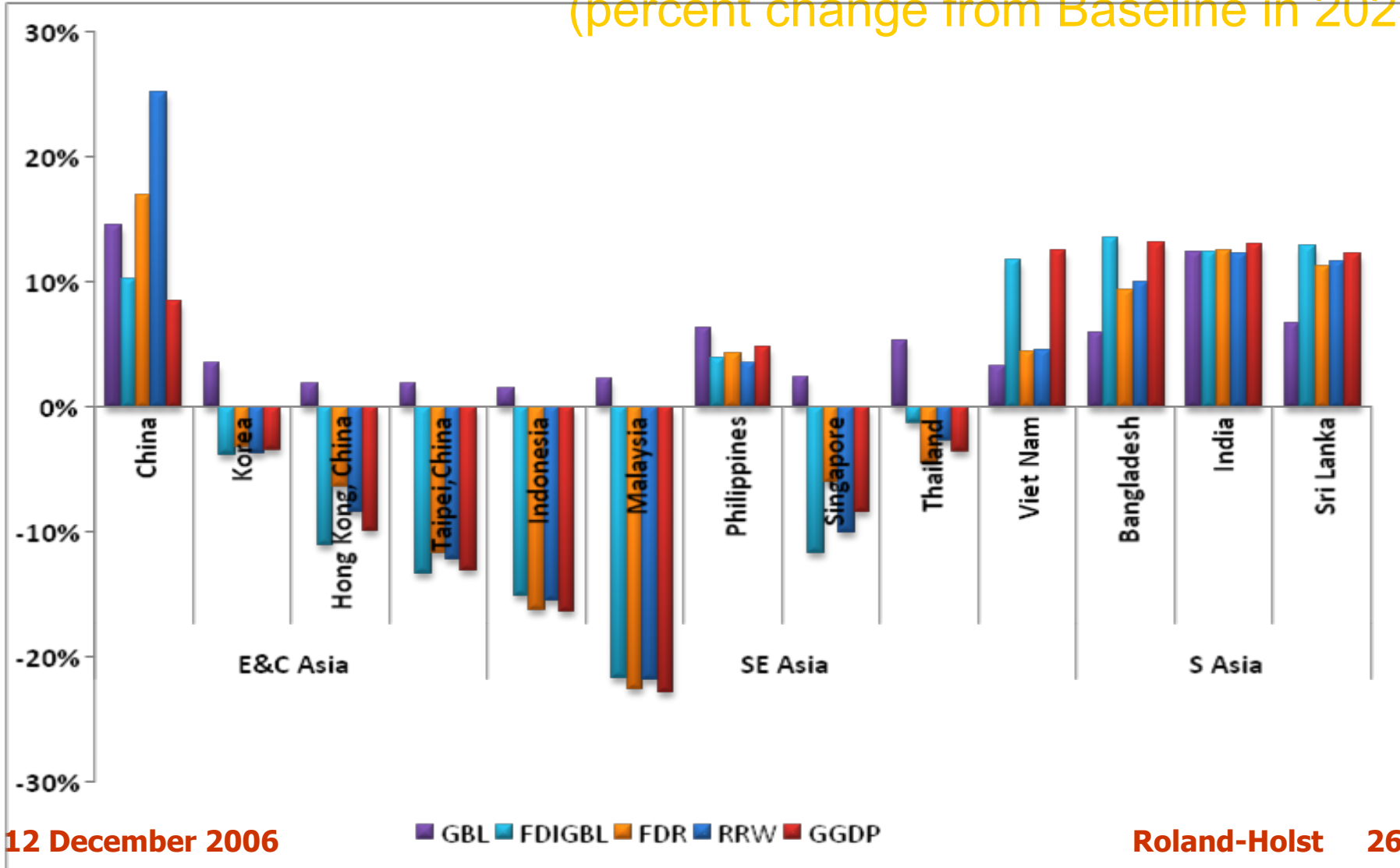
Equivalent Variation Aggregate Income

(percent change from Baseline in 2025)

Region	Country	GBL	FDIGBL	FDR	RRW	GGDP
E&C Asia	PRC	22.38%	17.24%	24.70%	28.80%	13.13%
	Korea	8.78%	1.11%	2.34%	2.32%	1.13%
	Hong Kong, China	6.18%	-3.77%	0.25%	-0.68%	-3.46%
	Taipei, China	2.03%	-12.17%	-10.37%	-10.90%	-12.00%
SE Asia	Indonesia	2.06%	-21.78%	-23.54%	-22.20%	-23.78%
	Malaysia	8.65%	-18.35%	-19.18%	-17.71%	-20.05%
	Philippines	3.37%	27.06%	9.35%	14.28%	19.52%
	Singapore	4.44%	-5.80%	-2.38%	-4.52%	-4.08%
	Thailand	8.01%	-4.84%	-11.74%	-7.88%	-9.95%
	Viet Nam	5.15%	15.35%	6.50%	6.55%	16.59%
S Asia	Bangladesh	2.38%	18.38%	11.67%	12.48%	18.14%
	India	8.59%	11.44%	7.35%	7.06%	12.55%
	Sri Lanka	6.45%	26.59%	21.02%	22.62%	24.53%
	Mean	6.81%	3.88%	1.23%	2.32%	2.48%
	Standard Deviation	5.33%	16.53%	14.52%	15.10%	16.01%

Equivalent Variation Aggregate Income

(percent change from Baseline in 2025)





4. FDI and Market Expansion

- FDI enables propagation of production linkages by establishing new upstream or downstream capacity for existing enterprises
- In this way FDI can accelerate market growth and intra-industry trade for recipient countries.
- Here we present to indicate how these growth externalities could influence Asian FDI recipients.
- To get a sense of the potential significance of this network effect, we consider only trade stimulus, since much FDI is targeted at import substitution and export promotion.



Trade Cost and Capital Flows

Enterprise level modeling is beyond the scope of the present work and in any case lacks definitive theoretical or empirical precedence. Instead, we proxy market expansion with trade cost and use a relationship of the form

$$\hat{T}_{ij} = -\varepsilon_{ij} \hat{K}^F$$

where T_{ij} denotes trade costs from country i to j , K^F denotes the domestic stock of foreign capital, and the caret denotes percent changes, i.e.

$$\hat{T}_{ij} = \frac{\Delta(T_{ij} + T_{ji})}{T_{ij} + T_{ji}} \quad \text{and} \quad \hat{K}_F = \frac{FDI_{ij}}{K^F}$$

Lacking information on FDI by origin, in the following experiments we consider only the aggregate relationship

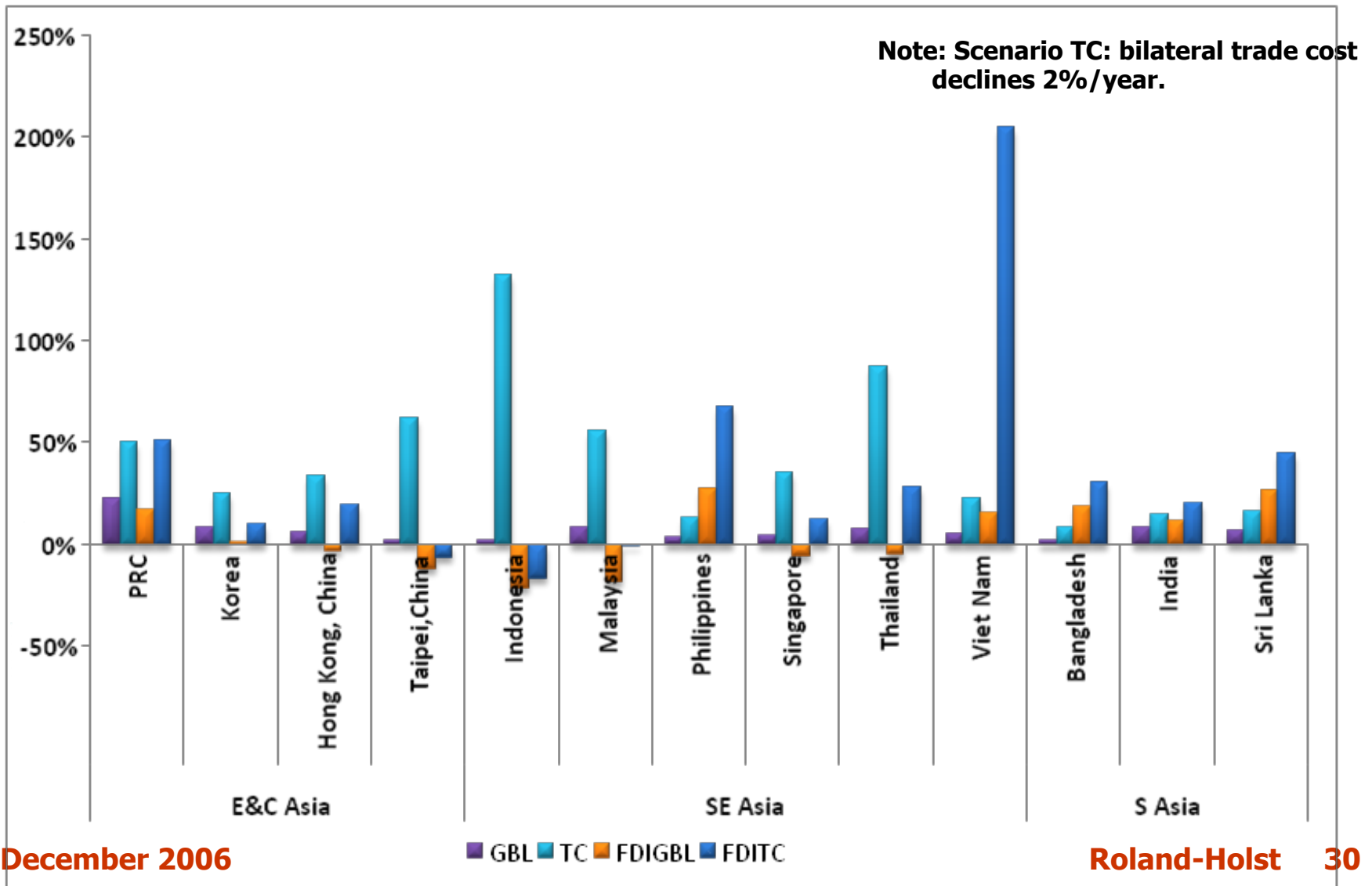
$$\hat{T}_i = -\varepsilon_i \hat{K}^F$$

Equivalent Variation Aggregate Income (percent change from Baseline in 2025)

Region	Country	Scenario			
		1	2	3	4
		GBL	TC	FDIGBL	FDITC
E&C Asia	PRC	22.38%	50.12%	17.24%	51.02%
	Korea	8.78%	25.07%	1.11%	9.87%
	Hong Kong, China	6.18%	33.86%	-3.77%	19.86%
	Taipei, China	2.03%	62.17%	-12.17%	-6.91%
SE Asia	Indonesia	2.06%	132.57%	-21.78%	-16.57%
	Malaysia	8.65%	56.07%	-18.35%	-1.42%
	Philippines	3.37%	13.51%	27.06%	68.00%
	Singapore	4.44%	35.59%	-5.80%	12.55%
	Thailand	8.01%	87.61%	-4.84%	28.37%
	Viet Nam	5.15%	22.77%	15.35%	204.89%
S Asia	Bangladesh	2.38%	8.17%	18.38%	30.56%
	India	8.59%	14.49%	11.44%	20.55%
	Sri Lanka	6.45%	16.43%	26.59%	44.80%
	Mean	6.81%	42.96%	3.88%	35.81%
	Standard Deviation	5.33%	35.44%	16.53%	56.03%

Note: Scenario TC: bilateral trade cost declines 2%/year.

Equivalent Variation Aggregate Income (percent change from Baseline in 2025)

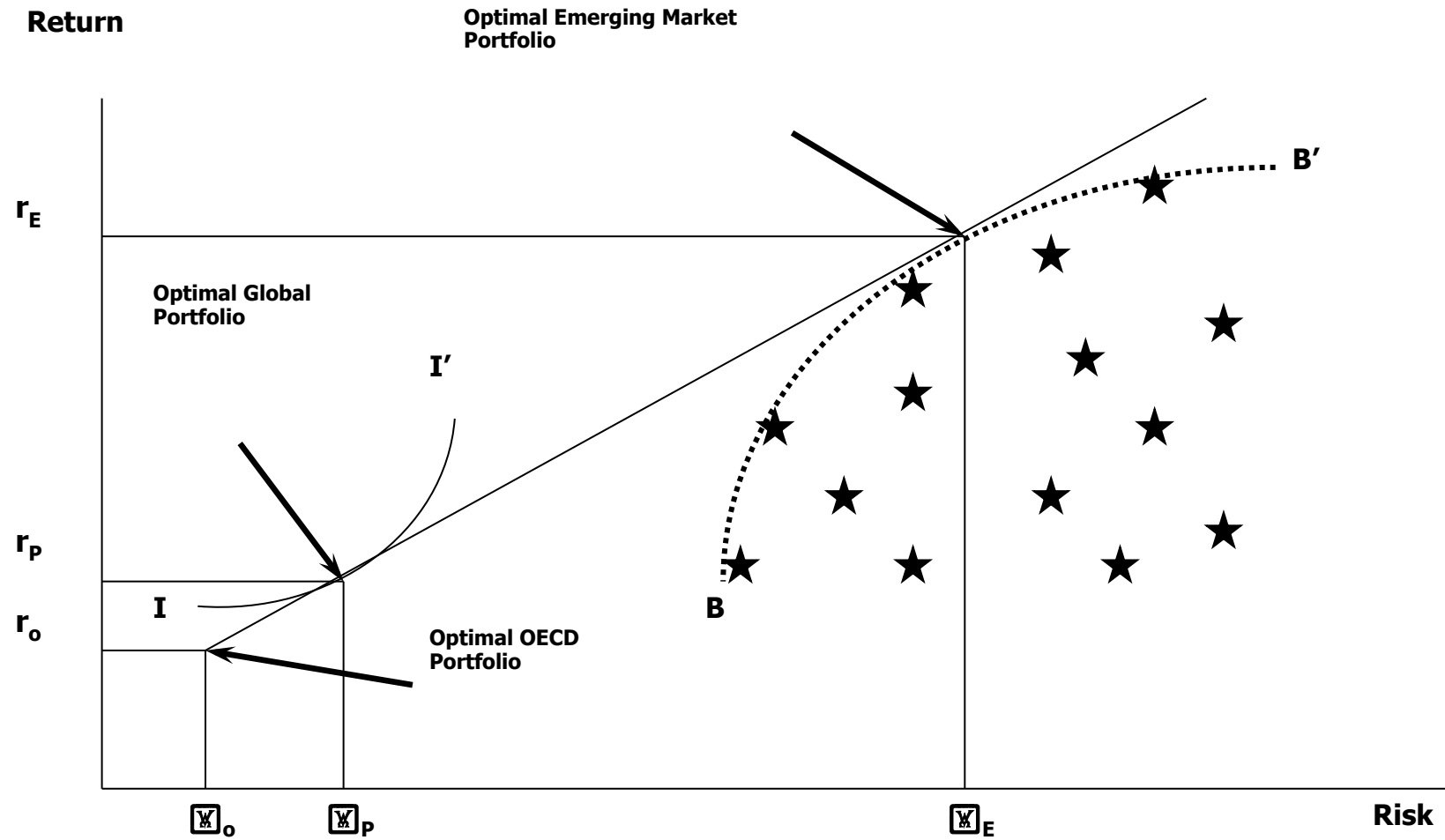




5. FDI and Productivity Growth

- Over the last two decades, the emergence of investment opportunities in Asia has enlarged the universe of choices for multinational firms and financial institutions.
- These markets present above-average expected returns, but also higher volatility.
- More importantly, relatively low correlation with OECD equity markets can reduce the unconditional portfolio risk for a global investor.
- The literature on investment flows and returns to these kind of emerging markets has grown with the scope of this market.
- The paper gives an extensive overview of this literature, but here we only present an example of scenario analysis.

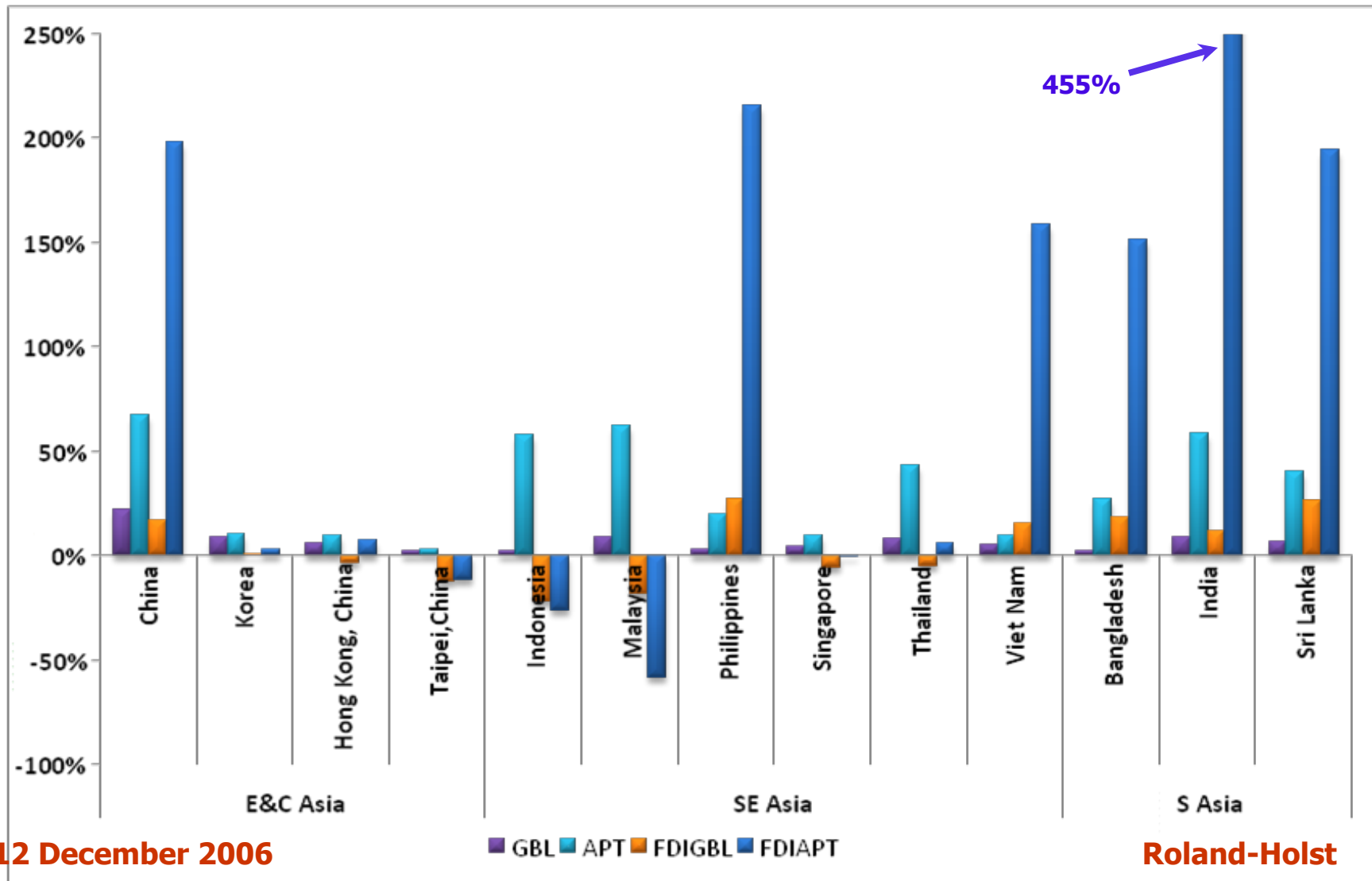
Global Portfolio Arbitrage



Equivalent Variation Aggregate Income (percent change from Baseline in 2025)

Region	Country	Scenario			
		1	2	3	4
		GBL	APT	FDIGBL	FDIAPT
E&C Asia	<u>China</u>	22.38%	67.47%	17.24%	198.46%
	Korea	8.78%	10.11%	1.11%	3.35%
	Hong Kong, China	6.18%	9.40%	-3.77%	7.18%
	Taipei, China	2.03%	3.07%	-12.17%	-11.27%
SE Asia	<u>Indonesia</u>	2.06%	57.51%	-21.78%	-26.30%
	<u>Malaysia</u>	8.65%	61.94%	-18.35%	-58.63%
	<u>Philippines</u>	3.37%	19.78%	27.06%	215.37%
	Singapore	4.44%	9.50%	-5.80%	-0.87%
	<u>Thailand</u>	8.01%	43.35%	-4.84%	6.02%
	<u>Viet Nam</u>	5.15%	9.37%	15.35%	158.80%
S Asia	<u>Bangladesh</u>	2.38%	27.29%	18.38%	151.23%
	<u>India</u>	8.59%	58.50%	11.44%	455.37%
	<u>Sri Lanka</u>	6.45%	40.19%	26.59%	194.29%
	Mean	6.81%	32.11%	3.88%	99.46%
	Standard Deviation	5.33%	23.66%	16.53%	145.69%

Equivalent Variation Aggregate Income (percent change from Baseline in 2025)





6. Conclusions

- International capital mobility has been an essential component of modern globalization and a strong catalyst for growth in Asia. To take full advantage of the transformative role FDI can play, a better understanding of international capital allocation is essential.
- This paper reviews the literature on FDI determinants, and evaluates a variety of empirical approaches to elucidating these issues.
- Firstly, we estimate a simple macroeconomic model of determinants using country specific data on three alternative drivers of inbound FDI, discount rates, domestic relative rental rates, and real domestic GDP growth. We find significant results only for GDP.
- Ambiguous econometric results lead us to apply a simulation framework to the same kind of specification to assess the potential significance of each of the three drivers. For plausible elasticity values (borrowed from the investment literature), we find again that real GDP is the primary driver of regional capital allocation when FDI is endogenous.
- In the context multilateral tariff reduction, this can induce transfers of growth impetus between economies, making former winners from globalization into losers. To the extent that accelerator effects may be amplified by FDI, it is essential to get better estimates of these apparent trade-offs.



Conclusions

- Looking beyond the empirical evidence on macro FDI drivers, we use as CGE model to examine how FDI might be linked to trading efficiency and domestic productivity.
- Here we see that, for moderate levels of efficiency and productivity effects, growth dividends in the Asian region can be very substantial. In particular, our findings echo earlier work indicating that structural barriers to trade are now much more significant impediments to regional integration and expansion than nominal protection.
- We also find, to the extent that regional capital allocation follows principles of modern portfolio theory, capital-productivity linkages can accelerate growth dramatically.
- As Asian regional savings and investment flows rise to unprecedented levels, it becomes ever more important to improve our understanding of FDI-growth linkages. The results presented here offer guidance, but further empirical research on the FDI-growth nexus is needed.



Discussion



Real GDP

(percent changes from Baseline in 2025)

Region	Country	GBL	FDIGBL	FDR	RRW	GGDP
E&C Asia	PRC	14.59%	10.23%	17.01%	25.14%	8.52%
	Korea	3.59%	-3.74%	-3.18%	-3.72%	-3.36%
	Hong Kong, China	1.88%	-10.95%	-6.39%	-8.33%	-9.85%
	Taipei, China	1.85%	-13.25%	-11.59%	-12.16%	-13.07%
SE Asia	Indonesia	1.52%	-15.10%	-16.21%	-15.46%	-16.29%
	Malaysia	2.28%	-21.69%	-22.59%	-21.76%	-22.76%
	Philippines	6.36%	3.97%	4.36%	3.54%	4.76%
	Singapore	2.39%	-11.60%	-5.93%	-10.01%	-8.33%
	Thailand	5.29%	-1.32%	-4.43%	-2.70%	-3.56%
	Viet Nam	3.32%	11.78%	4.40%	4.61%	12.59%
S Asia	Bangladesh	6.01%	13.57%	9.39%	9.99%	13.12%
	India	12.41%	12.45%	12.48%	12.22%	13.03%
	Sri Lanka	6.72%	12.96%	11.23%	11.66%	12.31%
	Mean	5.25%	-0.98%	-0.88%	-0.54%	-0.99%
	Standard Deviation	4.11%	12.58%	11.91%	13.22%	12.51%