JICA Research Institute

Aid Fragmentation and Aid Effectiveness: Infant and Child Mortality and Primary School Completion

21 February 2014

JICA-RI
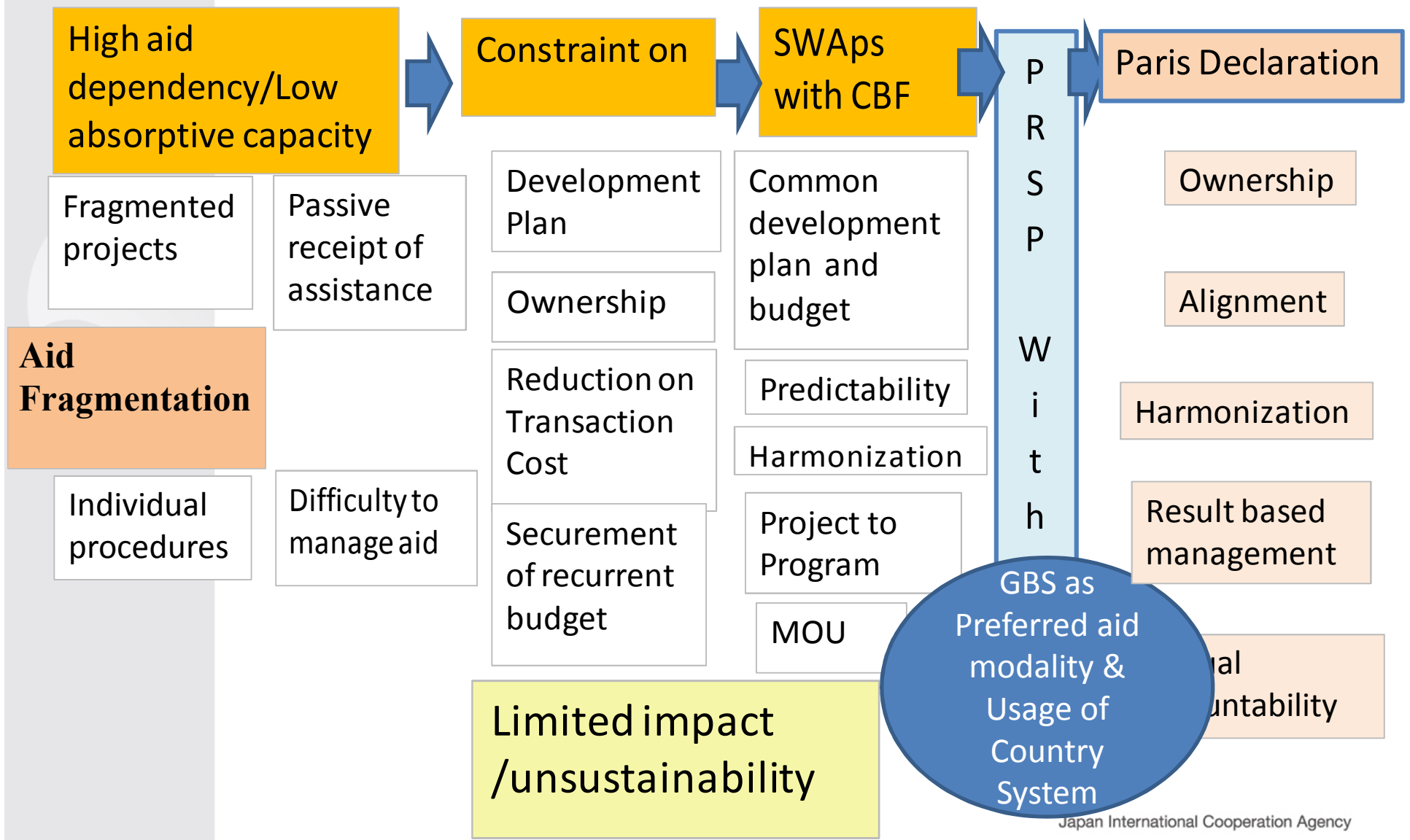
Mitsuaki Furukawa

Contents

- ➢ Background

- ➢ Main problems with the existing literatures

- ➢ Empirical study (model, data, etc)

- ➢ Results

- ➢ Conclusion

1. Background(1)
Why is Aid Fragmentation matter ?

High aid dependency/Low absorptive capacity → Constraint on → SWAps with CBF → P R S P W i t h → Paris Declaration

Fragmented projects | Passive receipt of assistance

Aid Fragmentation

Individual procedures | Difficulty to manage aid

Development Plan

Ownership

Reduction on Transaction Cost

Securement of recurrent budget

Common development plan and budget

Predictability

Harmonization

Project to Program

MOU

Ownership

Alignment

Harmonization

Result based management

ual untability

Limited impact /unsustainability

GBS as Preferred aid modality & Usage of Country System

Japan International Cooperation Agency

1. Background(2)

☐ What is **Aid Fragmentation** ?

✓ The situation where large numbers of fragmented and non-coordinated donor projects in developing countries bring high transaction costs because they are implemented according to processes determined by the donors.

☐ What is the problem?

✓ Aid fragmentation is a burden on governments in developing countries, creating inefficiencies in development aid, damaging government effectiveness in developing countries, and subtracting from the development effect.

☐ Why is Aid fragmentation the matter?

✓ Led to the Paris Declaration on Aid Effectiveness
✓ but not sufficiently clarified of the impact of aid fragmentation on economic growth, poverty reduction and other outcomes

2. Main problems with the existing literatures

☐ Aid has been dealt with homogenously regardless of its form.

☐ Even though project aid does not uniformly cover all sectors in a developing country, discussions have treated the transaction cost burden on the government in a developing country as if it applied uniformly to the whole government of that country.

☐ Much of the prior research covering aid fragmentation have used the amounts of aid to measure the fragmentation index even though the main cause for the expanding transaction costs in developing countries is donor supported projects.

☐ The DAC CRS is widely accessed for the data, but the analyses have also adopted data outside the reliable coverage periods despite problems with the data coverage.

➢ 90% of coverage:

Commitment data after 2000 and disbursement data after 2002

Disbursement data to measure no of projects reflect more true picture

➡ analyze the impact of aid fragmentation on infant and child mortality and primary school completion.

3. Aid Fragmentation Index

☐ To quantify the extent of aid fragmentation

➤ Herfindahl-Hirschman Index (HHI) : summing the squared shares of all donor projects in the sector $S_i \equiv q_i / Q$

✓ q_i denotes the number of projects from donor *i* to a specific recipient country in a specific year

✓ Q denotes the total number of aid projects provided to the recipient country.

$$HHI = \sum_{i=1}^{N} s_i^2$$

μ : the average share of the number of projects in the sector

N : the number of donors in the sector, σ^2 :variance is,

$$\mu \equiv \frac{\sum s_i}{N} = \frac{1}{N} \qquad\qquad \sigma^2 \equiv \frac{\Sigma(s_i - \mu)^2}{N} = \frac{\Sigma s_i^2 - N\mu^2}{N} = \frac{HHI}{N} - \frac{1}{N^2}$$

$$HHI = N\sigma^2 + \frac{1}{N}$$

➤ If the number of donors is constant, a higher variance will result in a higher index value. On the other hand, if all donors have identical shares, the variance becomes zero and HHI equals 1/*N*. Consequently, this index decreases when aid fragmentation becomes serious.

3-1. Aid Fragmentation Index

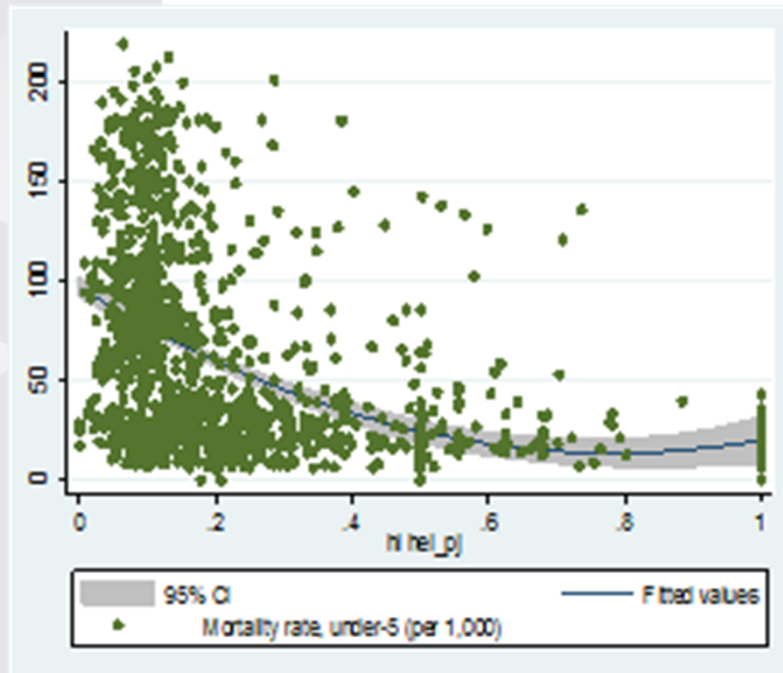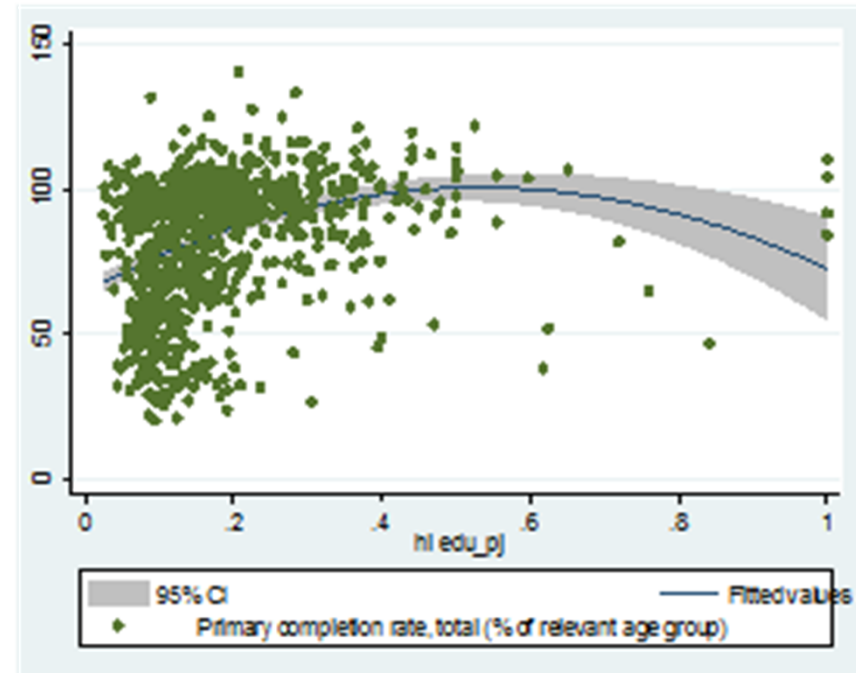**Fig. 1 Infant and child mortality rate and health project HHI (2002-2010)**

Fig. 2 Primary school completion rate and education project HHI (2002-2010)

4. Data

☐ HHI measured for each sector by DAC CRS disbursment data from 2002-2010

✓ commitment data: amounts for the applicable year are reported, but projects extend over several years, actual annual disbursements are not reported.

✓ Shall count projects reflected in the programs of developing countries

➢ the 400 codes of DAC CRS

☐ Economic indicators : WDI and Penn World table

☐ Governance indicators : Kaufmann, Kraay and Mastruzzi

4-1. Data: Descriptive Statistics

Variable	Observations	Average	Standard deviation	Minimum value	Maximum value
Infant & child mortality rate	1289	61.30	51.70	0.00	219.60
Primary school completion rate	877	83.42	22.21	20.55	140.17
Health project HHI	1334	0.26	0.26	0.00	1.00
Health project HHI^2	1334	0.13	0.26	0.00	1.00
Education project HHI	1366	0.22	0.19	0.00	1.00
Education project HHI^2	1366	0.09	0.18	0.00	1.00
Health aid as % of GDP	1244	0.55	1.25	0.00	27.25
Education aid as % of GDP	1244	0.79	1.50	0.00	15.82
Gov't health expenditure as % of GDP	1253	3.50	2.71	0.03	21.11
Health aid * Health HHI	1220	0.13	0.48	0.00	10.22
Health aid * Health HHI^2	1220	0.05	0.22	0.00	3.83
Education aid * Education HHI	1240	0.18	0.55	0.00	7.27
Education aid * Education HHI^2	1240	0.06	0.23	0.00	3.34
Population (logarithm)	1049	2.33	1.55	-0.69	7.20
GDP per capita (logarithm)	1244	7.43	1.19	4.65	10.23
M2 (Financial Deepening)	1160	49.34	34.34	4.89	247.82
Investment	1230	5.18	7.94	-37.62	161.80
Openness	1235	86.36	38.82	1.86	260.63
Control of Corruption	1274	-0.48	0.65	-1.92	1.55
Government Effectiveness	1272	-0.50	0.66	-2.45	1.59
Political Stability	1270	-0.37	0.95	-3.32	1.54
Regulatory Quality	1272	-0.49	0.72	-2.68	1.54
Rule of Law	1280	-0.49	0.72	-2.67	1.45
Voice and Accountability	1281	-0.39	0.86	-2.28	1.34
Countries	1379	87.62	56.15	1.00	182.00

5. Empirical analysis
Model and Analysis(1)

☐ System GMM

$$y_{it} = \beta_1 y_{i,t-1} + (\beta_2 HHI_{it} + \beta_3 HHI^2{}_{it}) \times Aid_{it} + \beta_{En} En_{it} + \beta_{Ex} Ex_{it} + \alpha_i + \alpha_t + \varepsilon_{it}$$

✓ Dependent variable: infant and child mortality rate
✓ Major Independent Variables: health project HHI, HHI², Aid=the amount of donor health aid as a percentage of GDP, their respective interaction terms
✓ En_{it}: predetermined and endogenous variables including amount of government spending on health as a percentage of GDP, GDP per capita (logarithm), voice and accountability, investment, openness, and M2 (financial depth).
✓ Ex_{it}: exogenous variables such as time dummy
✓ the instrumental variables: time dummy and degree of corruption control

Model and Analysis(2)

□ System GMM

✓ Dependent variable :primary school completion rate

✓ Major Independent Variables: education project HHI, HHI^2, the amount of donor education aid as a percentage of GDP, their respective interaction terms

✓ En_{it}: GDP per capita (logarithm), voice and accountability, government effectiveness, investment, etc.

✓ Ex_{it} & IV: time dummy and degree of corruption control

5-1. Estimation Results: Project fragmentation and Infant and Child Mortality Rates

☐ Results

✓ the effect of aid fragmentation on the infant and child mortality rate is an inverted-U curve relationship.

✓ infant and child mortality rates improve with higher GHE.

| Estimation Method	System GMM	System GMM	System GMM	System GMM	System GMM	System GMM	System GMM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Explanatory variable/ Explained variable	Infant & Child mortality	Infant & Child mortality	Infant & Child mortality	Infant & Child mortality	Infant & Child mortality	Infant & Child mortality	Infant & Child mortality
Infant and child mortality rate (t-1)	0.972***	0.973***	0.976***	0.967***	0.972***	0.974***	0.965***
	(0.00831)	(0.00837)	(0.00911)	(0.00935)	(0.00870)	(0.00928)	(0.00910)
Health project concentration index (HHI) (endogenous)	8.860***	9.454***	11.13***	12.60***	7.470***	8.821***	10.00***
	(2.746)	(2.919)	(3.010)	(4.435)	(2.331)	(2.354)	(2.953)
HHI squared (HHI^2) (endogenous)	-5.516**	-7.048**	-7.344***	-10.21***	-5.323**	-5.601***	-8.745***
	(2.396)	(2.854)	(2.631)	(3.687)	(2.553)	(2.113)	(2.720)
Amount of health aid as % of GDP (endogenous)	8.823**	8.603**	10.32***	10.61*	7.563**	8.743**	11.08*
	(4.190)	(3.550)	(3.613)	(5.495)	(3.673)	(3.829)	(6.149)
Amount of health aid as % of GDP * HHI (endogenous)	-10.28**	-9.707**	-12.02***	-12.29*	-8.426**	-10.04**	-12.43*
	(4.607)	(4.093)	(4.191)	(6.754)	(3.971)	(4.184)	(6.998)
Amount of health aid as % of GDP * HHI^2 (endogenous)	-1.557*	-1.425*	-1.907**	-1.659	-1.199	-1.561*	-1.667
	(0.912)	(0.776)	(0.759)	(1.174)	(0.794)	(0.826)	(1.241)
Government health expenditure as % of GDP (endogenous)	-0.238*	-0.384***	-0.275***	-0.565***	-0.351**	-0.235**	-0.692**
	(0.126)	(0.139)	(0.105)	(0.165)	(0.174)	(0.118)	(0.271)
GDP growth rate per capita (logarithm) (endogenous)	-0.727*	-0.648*	-0.858**	-0.768	-0.515	-0.643*	-0.752
	(0.369)	(0.390)	(0.388)	(0.503)	(0.346)	(0.376)	(0.493)
Voice and accountability (endogenous)	-0.263				-0.165	-0.224	0.278
	(0.405)				(0.412)	(0.367)	(0.576)
Openness (endogenous)		0.00759			0.00795		
		(0.00793)			(0.00906)		
Investment (endogenous)			-0.00450			-0.00200	
			(0.0542)			(0.0500)	
M2/GDP (endogenous)				-0.00766			-0.00602
				(0.0101)			(0.0108)
Arellano-Bond test AR (1)	0.032	0.034	0.027	0.03	0.041	0.034	0.03
Arellano-Bond test AR (2)	0.721	0.803	0.755	0.54	0.786	0.71	0.619
Hansen test	0.546	0.524	0.232	0.272	0.41	0.229	0.244
Number of observations	1,053	1,037	1,045	985	1,037	1,045	985
Number of countries	137	135	137	130	135	137	130

the overall effect of HHI

❑ the overall effect of HHI on infant and child mortality rate when the amount of health aid as a percentage of GDP is constant at each value by inputting the amount of aid

- as a percentage of GDP for the first to third quartile,

- as a percentage of GDP in the reference regions of Sub-Saharan Africa and East Asia

Overall effect of HHI on infant and child mortality rate = (HHI coefficient + Aid * Coefficient of the interaction term between HHI and aid) x HHI + (HHI^2 coefficient + aid * Coefficient of the interaction term between HHI^2 and aid) x HHI^2 (1)

Overall HHI effect on infant and child mortality rate: 1st-3rd quartile and health aid as % of GDP in Sub-Saharan Africa, East Asia
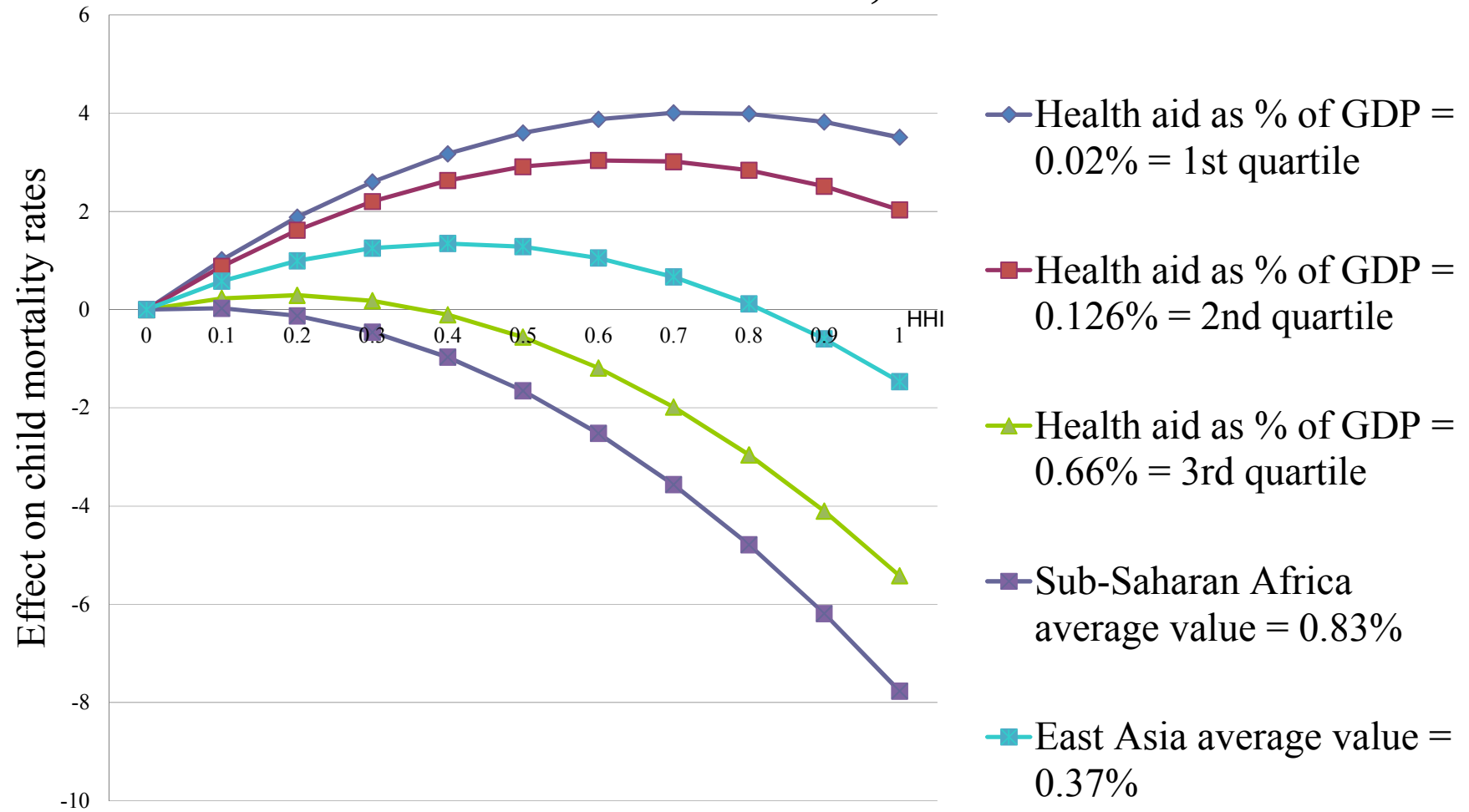
Health project HHI average by region (2002-2010 average)

Region	Health project HHI	Standard error	95% confidence interval	
N. Africa	0.240	0.035	0.171	0.308
Sub-Saharan Africa	0.179	0.011	0.158	0.200
N. and Central America	0.451	0.017	0.419	0.484
S. America	0.253	0.022	0.211	0.296
East Asia	0.126	0.023	0.082	0.171
Near & Middle East	0.262	0.025	0.212	0.312
S. & Central Eurasia	0.136	0.018	0.100	0.172
Europe	0.220	0.024	0.174	0.266
Oceania	0.523	0.020	0.485	0.562

Health aid average by region (Health aid as a percentage (%) of GDP) (2002-2010 average)

Region	Health aid average (aid as % of	Standard error	95% confidence interval	
N. Africa	0.027	0.174	-0.315	0.369
Sub-Saharan Africa	0.830	0.054	0.723	0.936
N. and Central America	0.081	0.084	-0.083	0.245
S. America	0.107	0.107	-0.104	0.318
East Asia	0.377	0.118	0.146	0.608
Near & Middle East	0.146	0.130	-0.109	0.400
S. & Central Eurasia	0.290	0.093	0.108	0.472
Europe	0.090	0.119	-0.143	0.323
Oceania	2.145	0.112	1.925	2.365

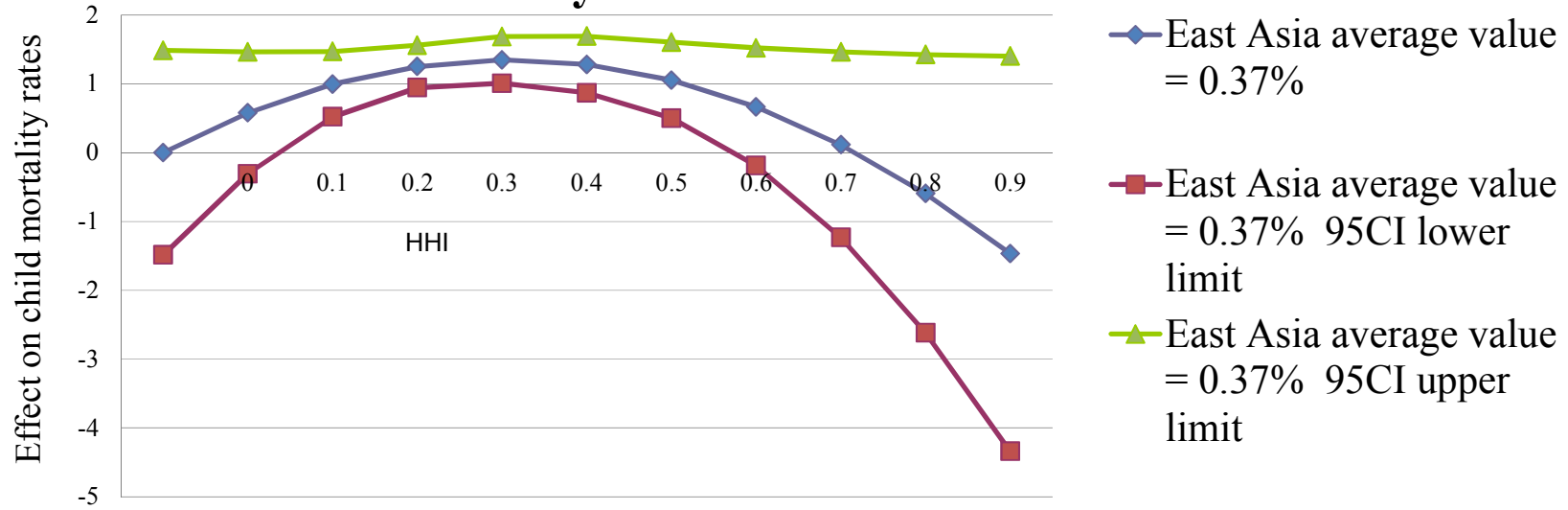**95% Confidence Interval for overall HHI effect on infant and child mortality rate:1st quartile**

- Aid as % of GDP = 0.02% = 1st quartile
- Aid as % of GDP = 0.02% = 1st quartile 95CI lower limit
- Aid as % of GDP = 0.02% = 1st quartile 95CI upper limit
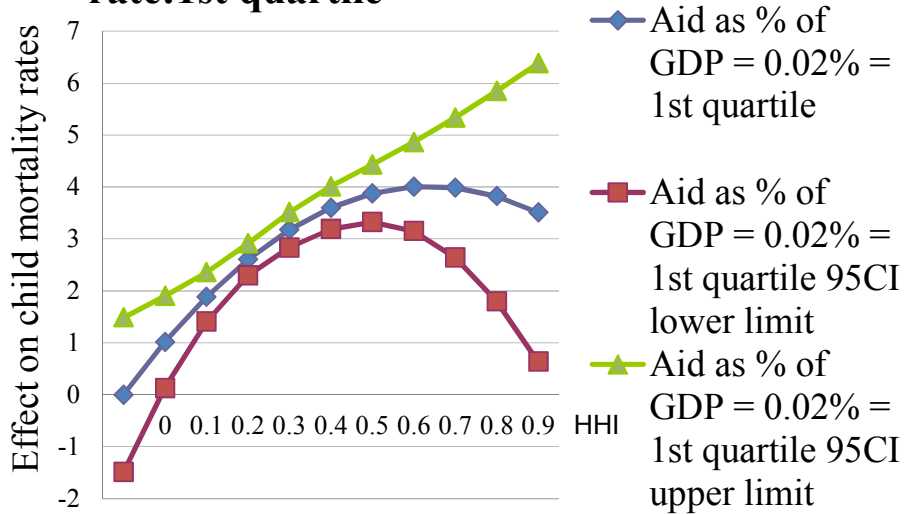
95% Confidence Interval for overall HHI effect on infant and child mortality rate:2nd quartile

- Aid as % of GDP = 0.126% = 2nd quartile
- Aid as % of GDP = 0.126% = 2nd quartile 95CI lower limit
- Aid as % of GDP = 0.126% = 2nd quartile 95CI upper limit
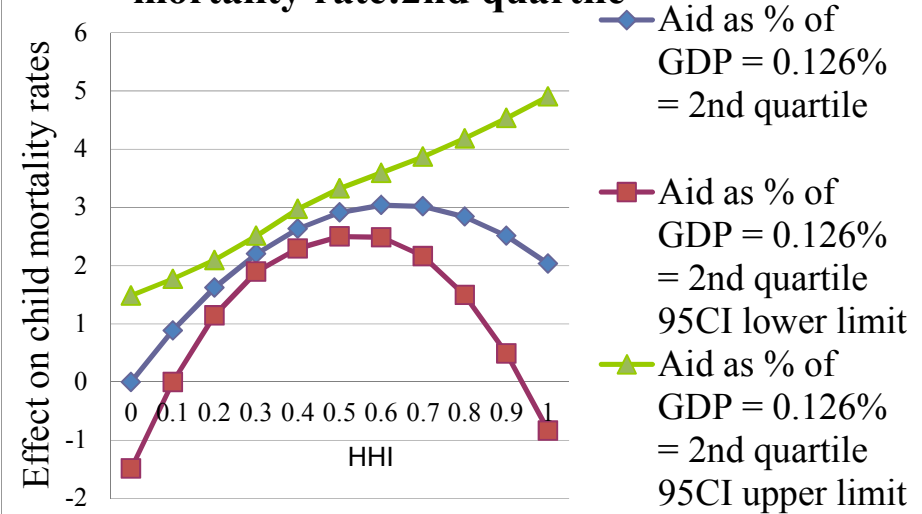
95% Confidence Interval for overall HHI effect on infant and child mortality rate: 3rd quartile

- Aid as % of GDP = 0.66% = 3rd quartile
- Aid as % of GDP = 0.66% = 3rd quartile 95CI lower limit
- Aid as % of GDP = 0.66% = 3rd quartile 95CI upper limit
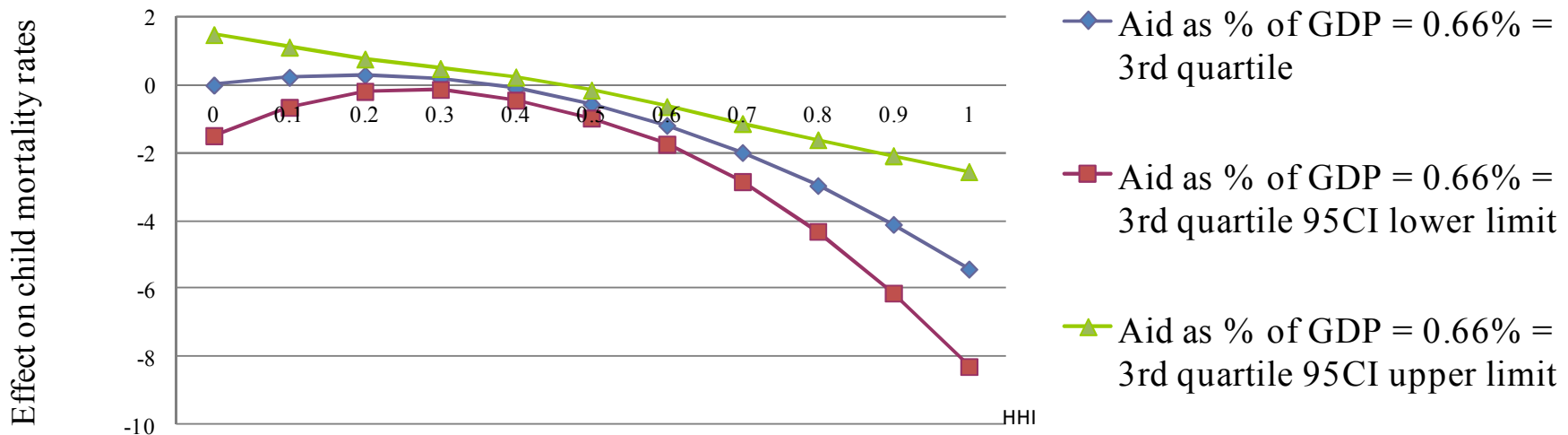
95% Confidence Interval for overall HHI effect on infant and child mortality rate: East Asia

95% Confidence Interval for overall HHI effect on infant and child mortality rate: Sub-Saharan Africa
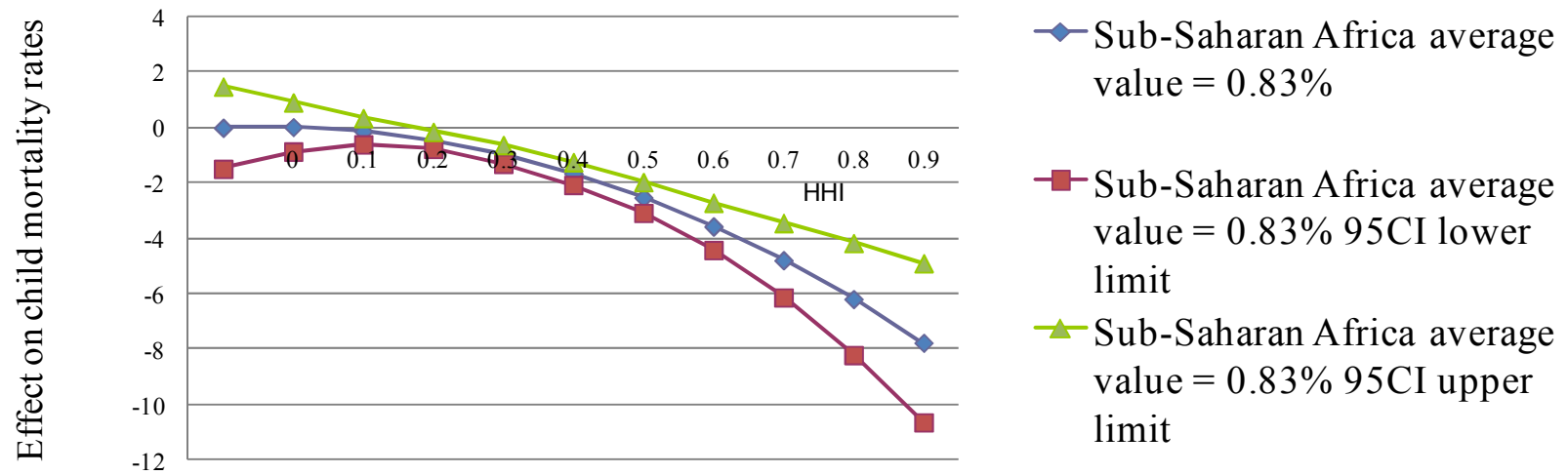
Case where overall HHI effect on infant and child mortality rates always has a negative impact (Health aid as % of GDP=0.27 or less), and case where the impact is always positive (Health aid as % of GDP=0.86% or above)
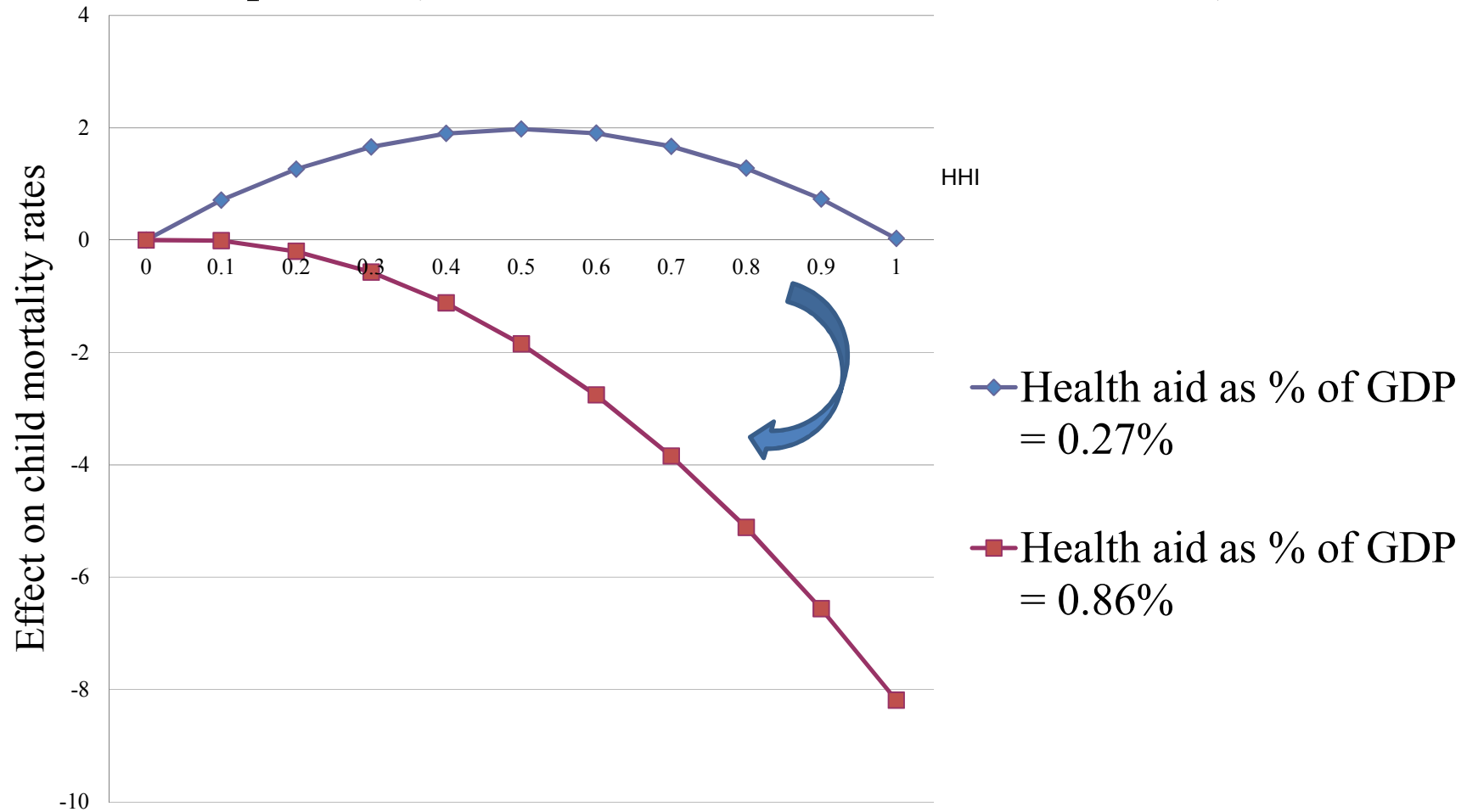
5-2.Estimation Results: Project Fragmentation and primary school completion rate

☐ Results
- ✓ the effect of aid fragmentation on the infant and child mortality rate is U-curve relationship.

Estimation Method	System GMM	System GMM	System GMM	System GMM	System GMM	System GMM
	(1)	(2)	(3)	(4)	(5)	(6)
Explanatory variable/ Explained variable	Primary school completion rate	Primary school completion rate	Primary school completion rate	Primary school completion rate	Primary school completion rate	Primary school completion rate
Primary school completion rate (t-1)	0.859***	0.868***	0.862***	0.851***	0.862***	0.842***
	(0.0320)	(0.0322)	(0.0370)	(0.0350)	(0.0343)	(0.0407)
Education project concentration index (HHI) (endogenous)	-19.78*	-17.63*	-11.89	-19.07*	-18.38*	-15.06
	(10.56)	(9.731)	(10.62)	(10.63)	(9.755)	(10.46)
HHI squared (HHI^2) (endogenous)	36.32**	31.83**	27.39*	36.64**	34.32**	32.09**
	(16.78)	(13.93)	(14.18)	(17.45)	(15.05)	(15.77)
Amount of education aid as % of GDP (endogenous)	-3.698*	-3.467*	-3.702**	-3.580*	-3.432	-2.791
	(1.954)	(2.051)	(1.734)	(2.013)	(2.158)	(1.820)
Amount of education aid as % of GDP*HHI (endogenous)	22.34**	20.28*	21.50**	22.02*	20.38	17.46*
	(10.73)	(11.60)	(9.263)	(11.19)	(12.30)	(9.844)
Amount of education aid as % of GDP*HHI^2 (endogenous)	-30.59**	-27.09*	-28.87**	-30.72**	-27.66	-24.41*
	(14.47)	(16.01)	(12.46)	(15.16)	(17.02)	(13.24)
GDP growth rate per capita (logarithm) (endogenous)	0.485	0.502	0.407	0.688	0.636	1.256
	(0.868)	(0.799)	(0.917)	(0.886)	(0.847)	(0.775)
Government effectiveness (endogenous)	0.775			0.555		
	(0.855)			(0.894)		
Regulatory quality (endogenous)		0.766			0.620	
		(0.857)			(0.930)	
Voice and accountability (endogenous)			-0.282			-0.182
			(0.696)			(0.710)
Investment (En)				0.00426	0.0188	0.0244
				(0.0656)	(0.0719)	(0.0711)
Arellano-Bond test AR (1)	0	0	0	0	0	0
Arellano-Bond test AR (2)	0.997	0.995	0.986	0.994	0.987	0.972
Hansen test	0.671	0.579	0.672	0.605	0.572	0.576
Number of observations	664	664	664	664	664	664
Number of countries	123	123	123	123	123	123

Overall HHI effect on primary school completion rates: 1st-3rd quartile and amount of aid as % of GDP in Sub-Saharan Africa and East Asia
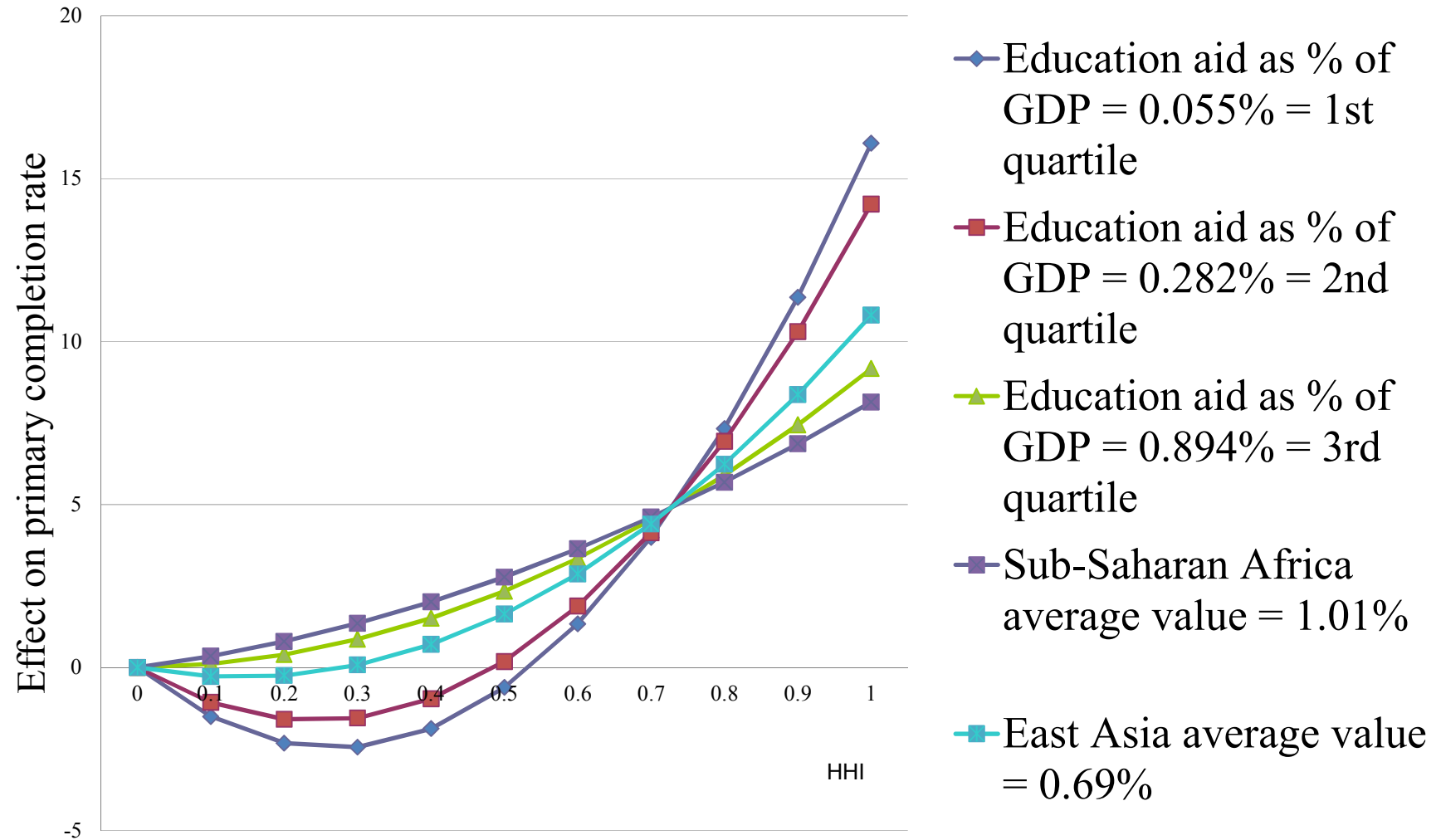
Education project HHI average by region (2002-2010 average)

Region	Education project HHI (average)	Standard error	95% confidence interval	
N. Africa	0.158	0.025	0.109	0.207
Sub-Saharan Africa	0.174	0.008	0.159	0.189
N. and Central America	0.309	0.012	0.286	0.332
S. America	0.205	0.016	0.174	0.235
East Asia	0.137	0.016	0.105	0.169
Near & Middle East	0.212	0.018	0.177	0.248
S. & Central Eurasia	0.124	0.013	0.098	0.150
Europe	0.211	0.017	0.178	0.244
Oceania	0.472	0.014	0.445	0.499

Education aid average by region Education aid as a percentage (%) of GDP) (2002-2010 average)

| Region	Education aid average (aid as % of GDP (%))	Standard error	95% confidence interval	
N. Africa	0.221	0.196	-0.163	0.605
Sub-Saharan Africa	1.018	0.061	0.898	1.137
N. and Central America	0.188	0.094	0.004	0.373
S. America	0.155	0.121	-0.082	0.391
East Asia	0.695	0.132	0.436	0.954
Near & Middle East	0.274	0.146	-0.012	0.560
S. & Central Eurasia	0.413	0.104	0.208	0.618
Europe	0.191	0.133	-0.071	0.453
Oceania	3.362	0.126	3.115	3.609

95% Confidence Interval for overall HHI effect on primary school completion rate:1st quartile
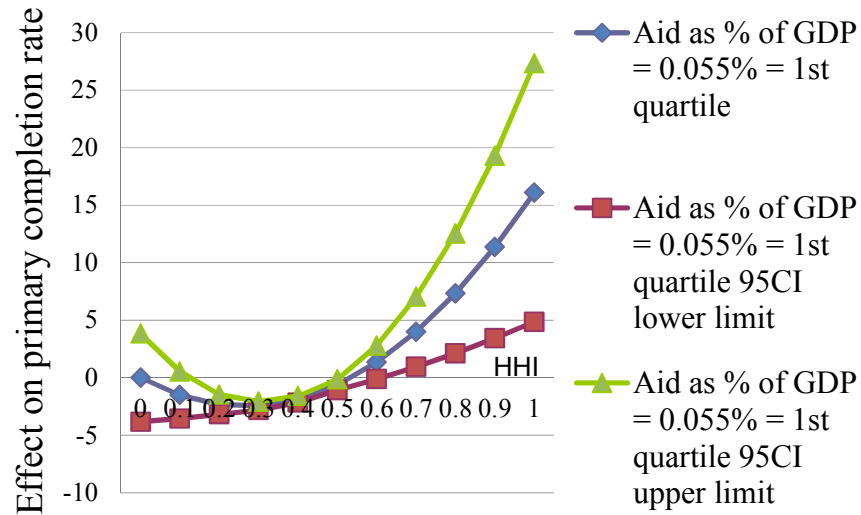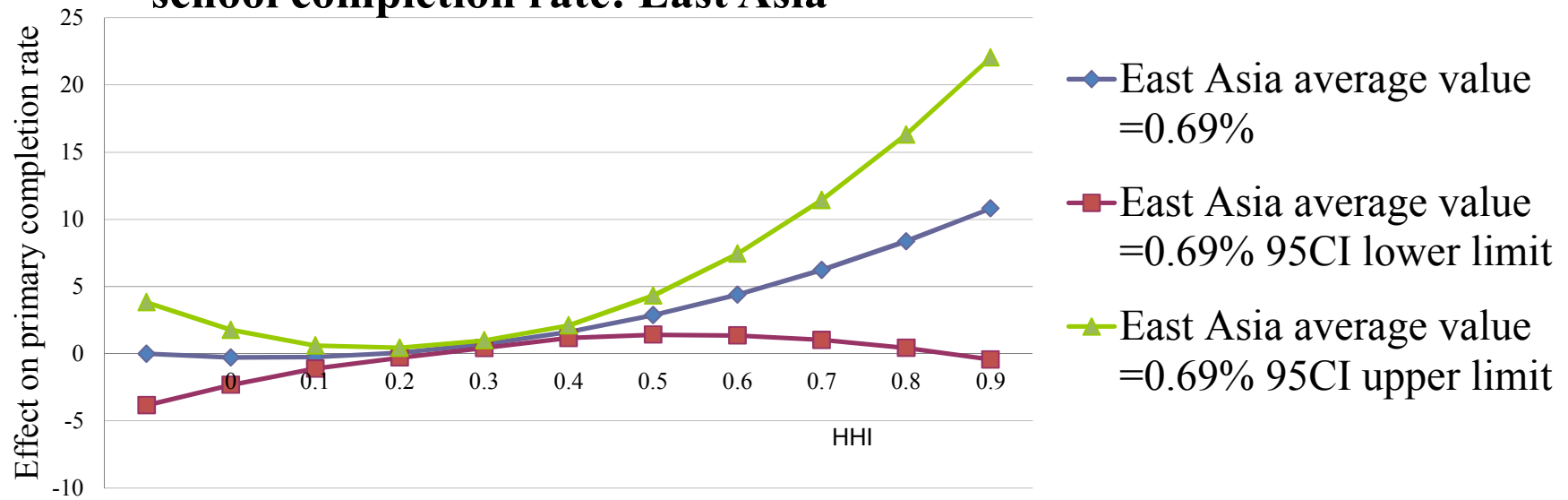
95% Confidence Interval for overall HHI effect on primary school completion rate:2nd quartile
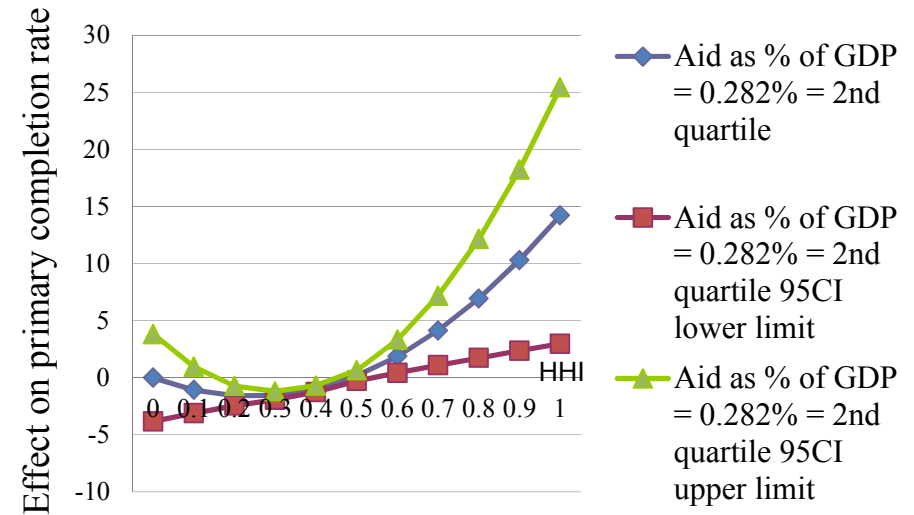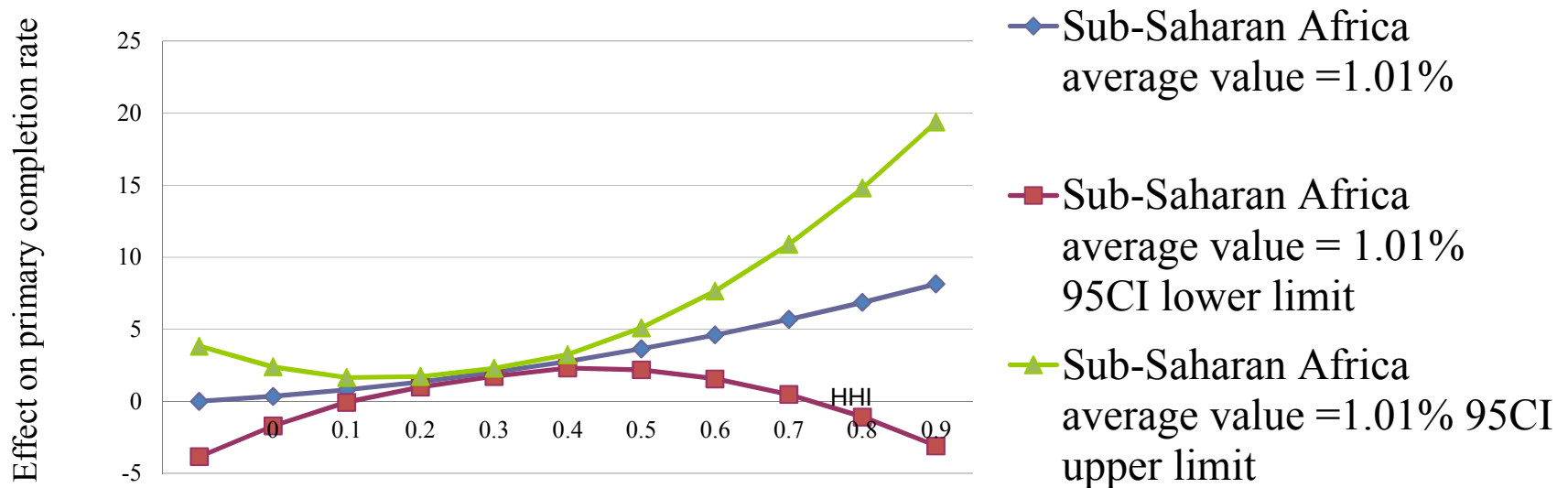
95% Confidence Interval for overall HHI effect on primary school completion rate: 3rd quartile
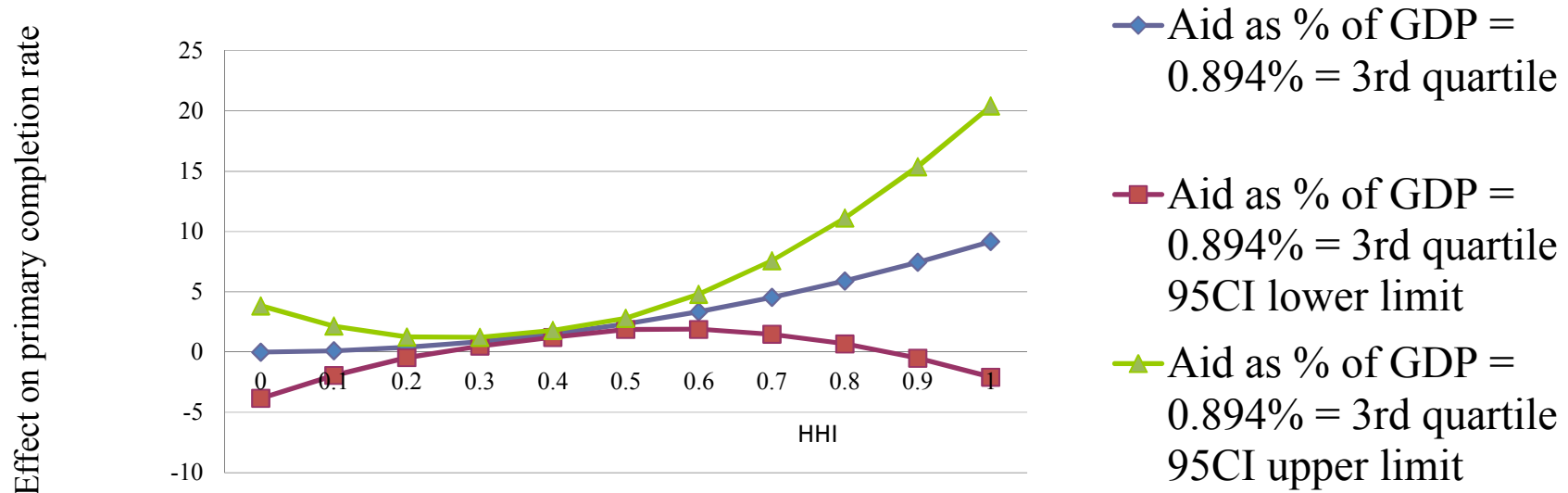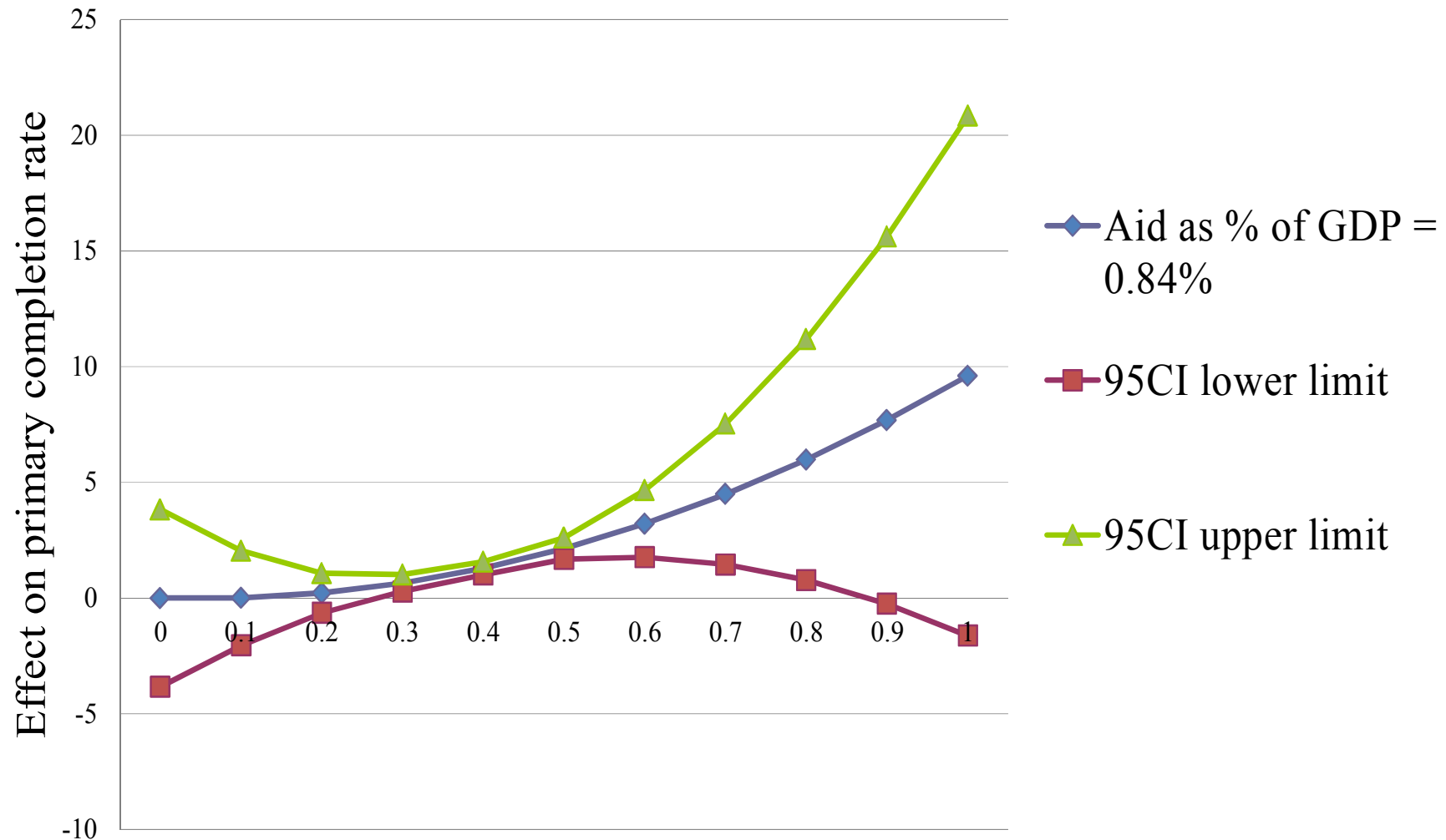
95% Confidence Interval for overall HHI effect on primary school completion rate: East Asia

95% Confidence Interval for overall HHI effect on primary school completion rate: Sub-Saharan Africa

Case where overall HHI effect on primary school completion rates always has a positive impact (case of education aid as % of GDP=0.84 or above)

6. Conclusion

☐ a need for initiatives that consider the degree of aid dependence in developing countries and the aid fragmentation situation in the country concerned.

☐ infant and child mortality

✓ project aid concentration is important and increases the effect in poor countries with a high degree of aid dependence.

☐ primary school completion

✓ in poor countries where dependence on aid is high, concentrating the aid brings improvements as long as the project aid is not excessively concentrated.

➢ Further analysis is required of the factors behind the varying results such as the aid absorptive capacity of developing countries, etc

Thank you for your attention!