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

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Director General, Security Department
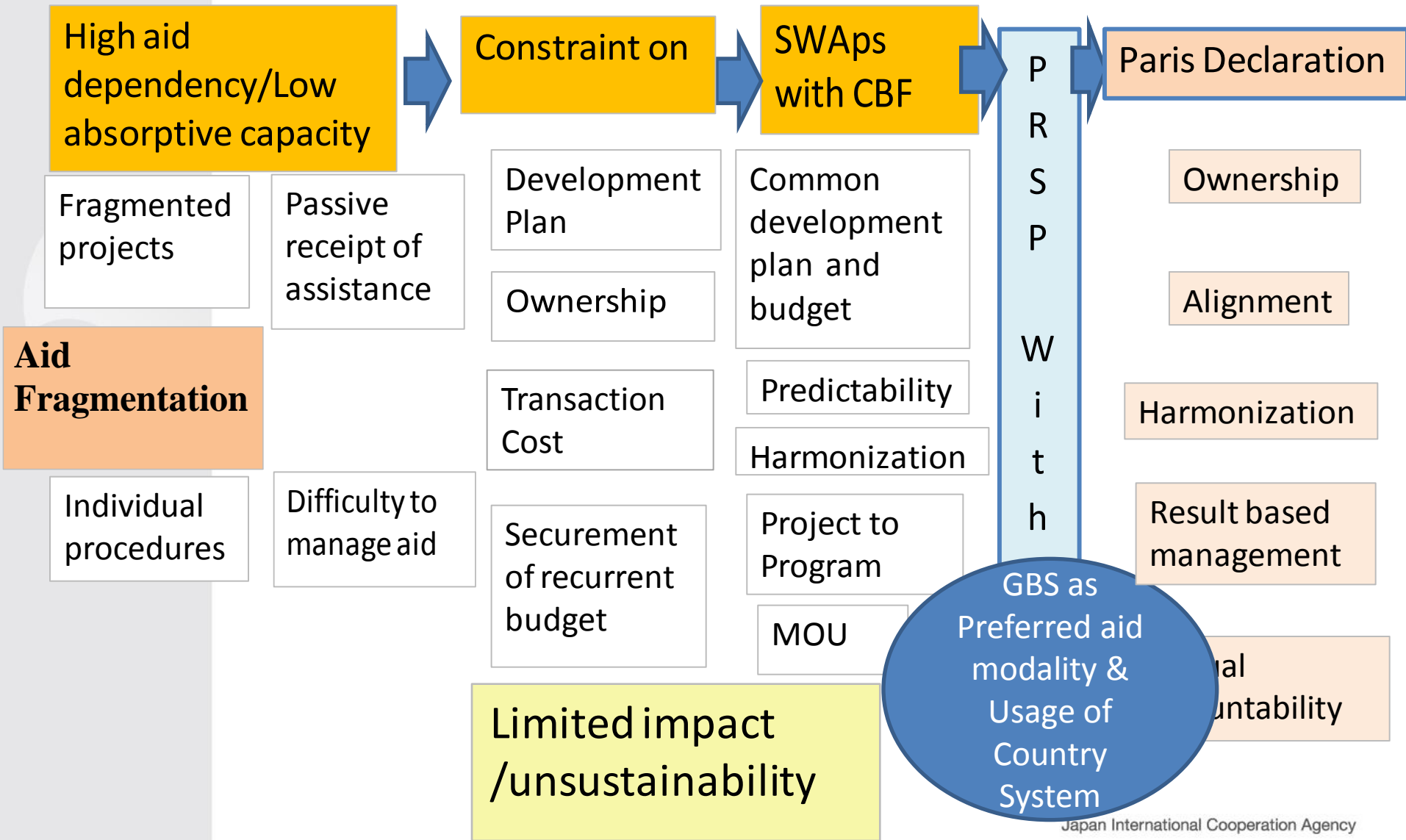JICA
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➢ Background

➢ Main problems with the existing literatures

➢ Empirical study (model, data, etc)

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# 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

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

GBS as Preferred aid modality & Usage of Country System

Limited impact /unsustainability

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.

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

$\mu$ ：the average share of the number of projects in the sector

$N$ ：the number of donors in the sector, $\sigma^2$ ：variance is,

$$\mu \equiv \frac{\sum s_i}{N} = \frac{1}{N}$$

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

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

➢ 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.

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# 3-1. Aid Fragmentation Index

**Fig. 1 Infant and child mortality rate and health project HHI (2002-2010)**
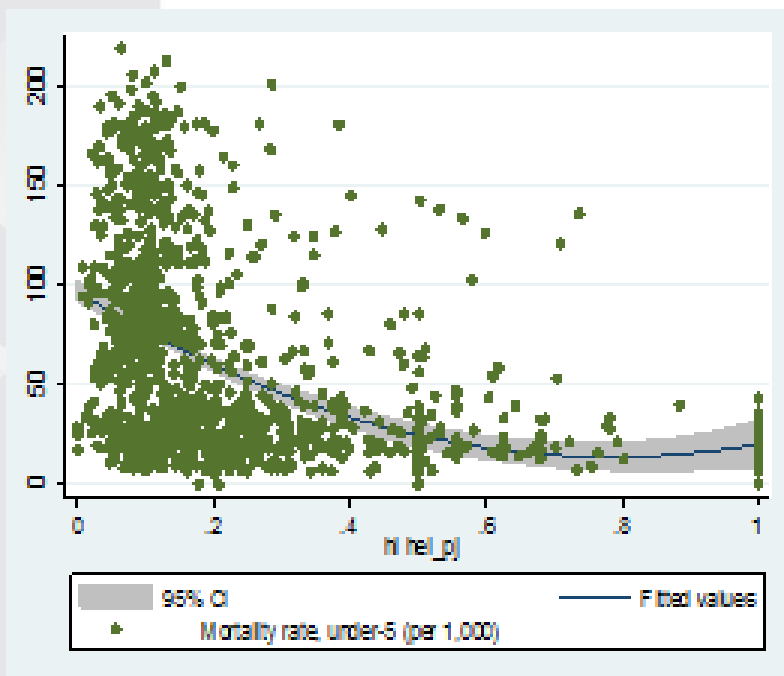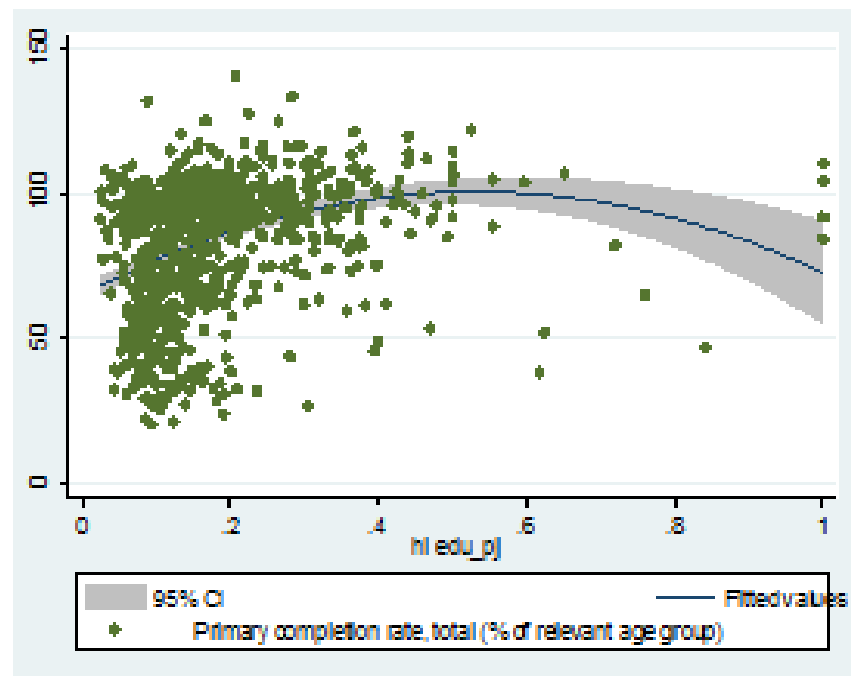
**Fig. 2 Primary school completion rate and education project HHI (2002-2010)**

# 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: 'Nordic Plus focus' dummy and time dummy

# 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 'Nordic Plus focus' dummy

# 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.

| Dependent variable | Infant & Child Mortality | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Infant and child mortality rate (t−1) | 0.976*** | 0.978*** | 0.981*** | 0.977*** | 0.980*** | 0.982*** |
| | (0.00851) | (0.00928) | (0.00940) | (0.00910) | (0.0101) | (0.0108) |
| Health project concentration index (HHI) (endogenous) | 7.690** | 8.408** | 10.67** | 8.277** | 8.837*** | 6.236** |
| | (3.067) | (3.368) | (4.376) | (3.598) | (3.043) | (2.745) |
| HHI squared ($HHI^2$) (endogenous) | −4.192* | −7.479*** | −8.423** | −6.185** | −4.954* | −4.233* |
| | (2.513) | (2.843) | (3.876) | (2.840) | (2.588) | (2.328) |
| Amount of health aid as % of GDP * HHI (endogenous) | 5.319 | 8.115* | 8.106* | 7.786* | 5.936** | 5.112* |
| | (3.456) | (4.351) | (4.369) | (4.210) | (2.986) | (2.881) |
| Amount of health aid as % of GDP * $HHI^2$ (endogenous) | −6.974 | −9.606* | −9.840* | −9.467* | −7.774** | −6.387* |
| | (4.417) | (5.273) | (5.331) | (5.159) | (3.881) | (3.623) |
| Amount of health aid as % of GDP (endogenous) | −0.818 | −1.097 | −1.066 | −1.033 | −0.933 | −0.867 |
| | (0.696) | (0.889) | (0.926) | (0.931) | (0.580) | (0.571) |
| Government health expenditure as % of GDP (endogenous) | −0.164** | −0.523** | −0.443*** | −0.388*** | −0.176** | −0.203** |
| | (0.0793) | (0.204) | (0.142) | (0.141) | (0.0748) | (0.0972) |
| GDP growth rate per capita (logarithm) (endogenous) | −0.0333 | 0.0887 | −0.0406 | −0.125 | −0.0435 | 0.310 |
| | (0.402) | (0.423) | (0.409) | (0.401) | (0.412) | (0.510) |
| Population growth rate (exogenous) | 0.260 | 0.360 | 0.0233 | 0.194 | 0.193 | 0.403** |
| | (0.206) | (0.255) | (0.182) | (0.211) | (0.191) | (0.190) |
| Voice and accountability (endogenous) | | 0.856 | | | | 0.747 |
| | | (0.938) | | | | (0.580) |
| Government effectiveness (endogenous) | | | −0.437 | | | |
| | | | (0.982) | | | |
| Regulatory quality (endogenous) | | | | 0.355 | | |
| | | | | (1.216) | | |
| M2/GDP (endogenous) | | 0.000381 | 0.0126 | −0.00161 | | |
| | | (0.0103) | (0.0108) | (0.0119) | | |
| Investment (endogenous) | | | | | −0.0147 | −0.0151 |
| | | | | | (0.0474) | (0.0446) |
| Arellano-Bond test AR (1) | 0.043 | 0.04 | 0.039 | 0.044 | 0.04 | 0.056 |
| Arellano-Bond test AR (2) | 0.632 | 0.665 | 0.572 | 0.569 | 0.613 | 0.65 |
| Hansen test | 0.276 | 0.326 | 0.28 | 0.361 | 0.155 | 0.255 |
| lag(difference) | lag(3 3) | lag(3 3) | lag(3 3) | lag(3 3) | lag(3 3) | lag(3 3) |
| Number of observations | 1,058 | 985 | 984 | 984 | 1,050 | 1,050 |
| Number of countries | 137 | 130 | 130 | 130 | 137 | 137 |
| Number of instruments | 104 | 128 | 128 | 128 | 116 | 128 |

# 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 + (HHI² coefficient + aid * Coefficient of the interaction term between HHI² and aid) x HHI²          (1)

## 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 |

# Fig. 1: Overall HHI effect for the infant and child mortality rate among different groups
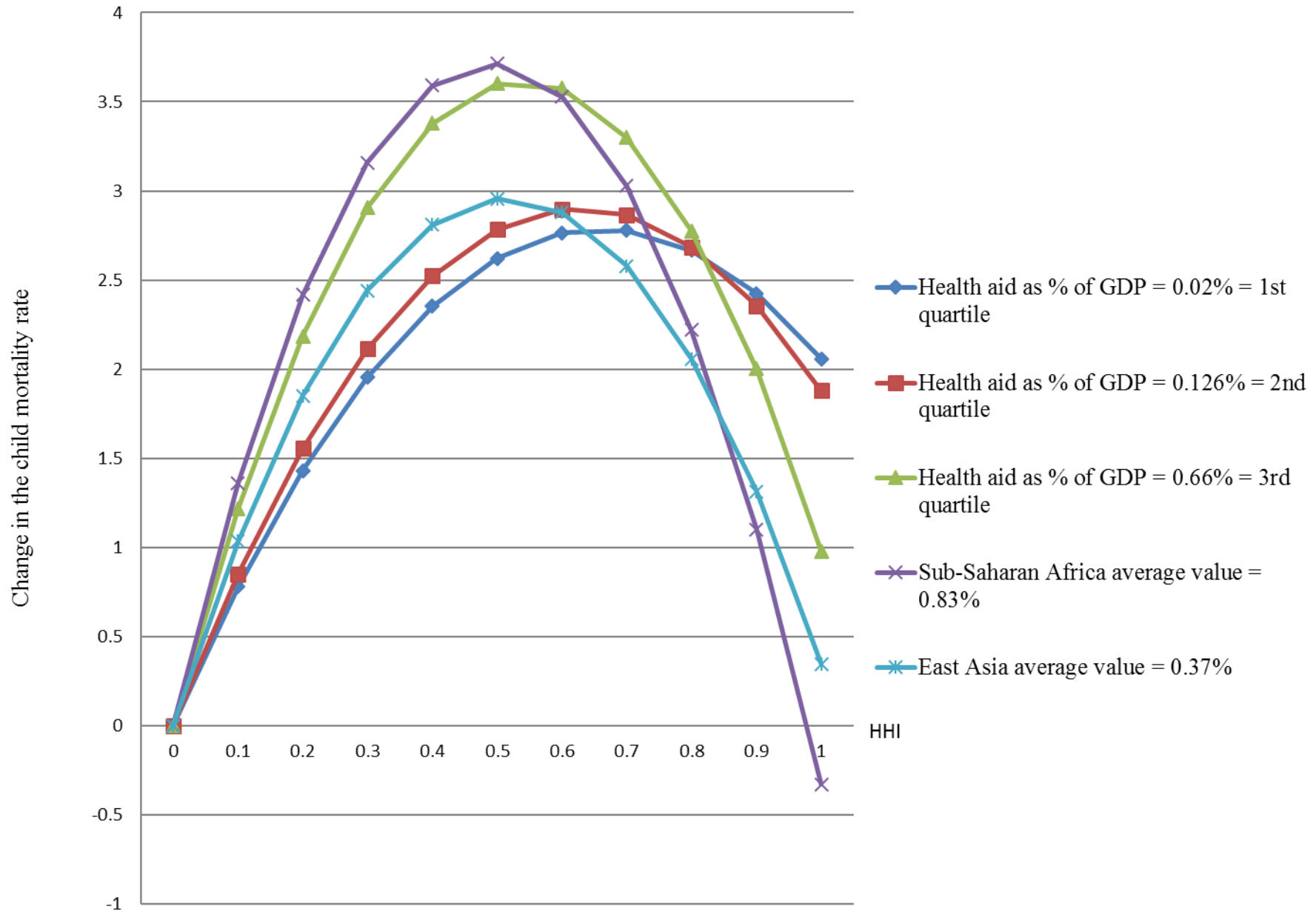
# 5-2.Estimation Results: Project Fragmentation and primary school completion rate

☐ Results

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

✓ when the amount of education aid as a percentage of GDP is high, aid concentration helps improve the primary school completion rate.

| Dependent Variable | Primary School Completion Rate | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Primary school completion rate | 0.849*** | 0.848*** | 0.847*** | 0.858*** | 0.834*** | 0.838*** | 0.850*** |
| (t-1) | (0.0368) | (0.0376) | (0.0358) | (0.0345) | (0.0407) | (0.0377) | (0.0362) |
| Education project concentration | −18.11* | −16.63 | −19.02* | −20.31** | −17.11 | −19.97* | −21.55** |
| index (HHI) (endogenous) | (10.36) | (10.75) | (11.34) | (10.06) | (11.09) | (11.13) | (10.16) |
| HHI squared ($HHI^2$) | 34.10** | 32.78** | 36.36** | 35.72** | 33.72** | 37.30** | 37.88** |
| (endogenous) | (13.93) | (13.71) | (16.37) | (14.22) | (14.67) | (16.44) | (14.77) |
| Amount of education aid as % of | 23.84** | 21.51** | 24.26** | 21.94* | 18.80* | 23.08** | 21.07* |
| GDP*HHI (endogenous) | (11.40) | (9.344) | (10.92) | (11.66) | (9.761) | (11.38) | (12.38) |
| Amount of education aid as % of | −32.00** | −29.10** | −32.78** | −29.08* | −26.26** | −31.96** | −28.65* |
| $GDP*HHI^2$ (endogenous) | (15.15) | (12.49) | (14.57) | (16.04) | (13.02) | (15.29) | (17.07) |
| Amount of education aid as % of | −4.157* | −3.676** | −4.219** | −3.856* | −3.038* | −3.854* | −3.560 |
| GDP (endogenous) | (2.134) | (1.749) | (2.031) | (2.076) | (1.814) | (2.078) | (2.184) |
| GDP growth rate per capita | −0.0912 | 0.0329 | −0.111 | 0.0388 | 0.545 | 0.283 | 0.333 |
| (logarithm) (endogenous) | (0.987) | (0.873) | (0.990) | (0.843) | (0.826) | (0.930) | (0.852) |
| Population growth rate (exogenou | −0.871* | −0.898* | −0.970** | −0.780* | −0.884* | −0.855* | −0.689 |
| | (0.456) | (0.457) | (0.457) | (0.441) | (0.459) | (0.436) | (0.429) |
| Voice and accountability | | −0.219 | | | −0.311 | | |
| (endogenous) | | (0.647) | | | (0.677) | | |
| Government effectiveness | | | −0.289 | | | 0.0217 | |
| (endogenous) | | | (0.996) | | | (0.990) | |
| Regulatory quality (endogenous) | | | | 0.0491 | | | 0.425 |
| | | | | (1.105) | | | (1.107) |
| Investment (endogenous) | | | | | 0.0147 | 0.00346 | 0.0141 |
| | | | | | (0.0701) | (0.0662) | (0.0704) |
| Arellano-Bond test AR (1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Arellano-Bond test AR (2) | 0.964 | 0.953 | 0.967 | 0.965 | 0.947 | 0.977 | 0.971 |
| Hansen test | 0.702 | 0.805 | 0.884 | 0.694 | 0.705 | 0.786 | 0.697 |
| lag(difference) | lag(3 3) | lag(3 3) | lag(3 3) | lag(3 3) | lag(3 3) | lag(3 3) | lag(3 3) |
| Number of observations | 664 | 664 | 664 | 664 | 664 | 664 | 664 |
| Number of countries | 123 | 123 | 123 | 123 | 123 | 123 | 123 |
| Number of instruments | 92 | 104 | 104 | 104 | 116 | 116 | 116 |

## 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 |

# Fig. 2: Overall HHI for the primary school completion rate among different groups
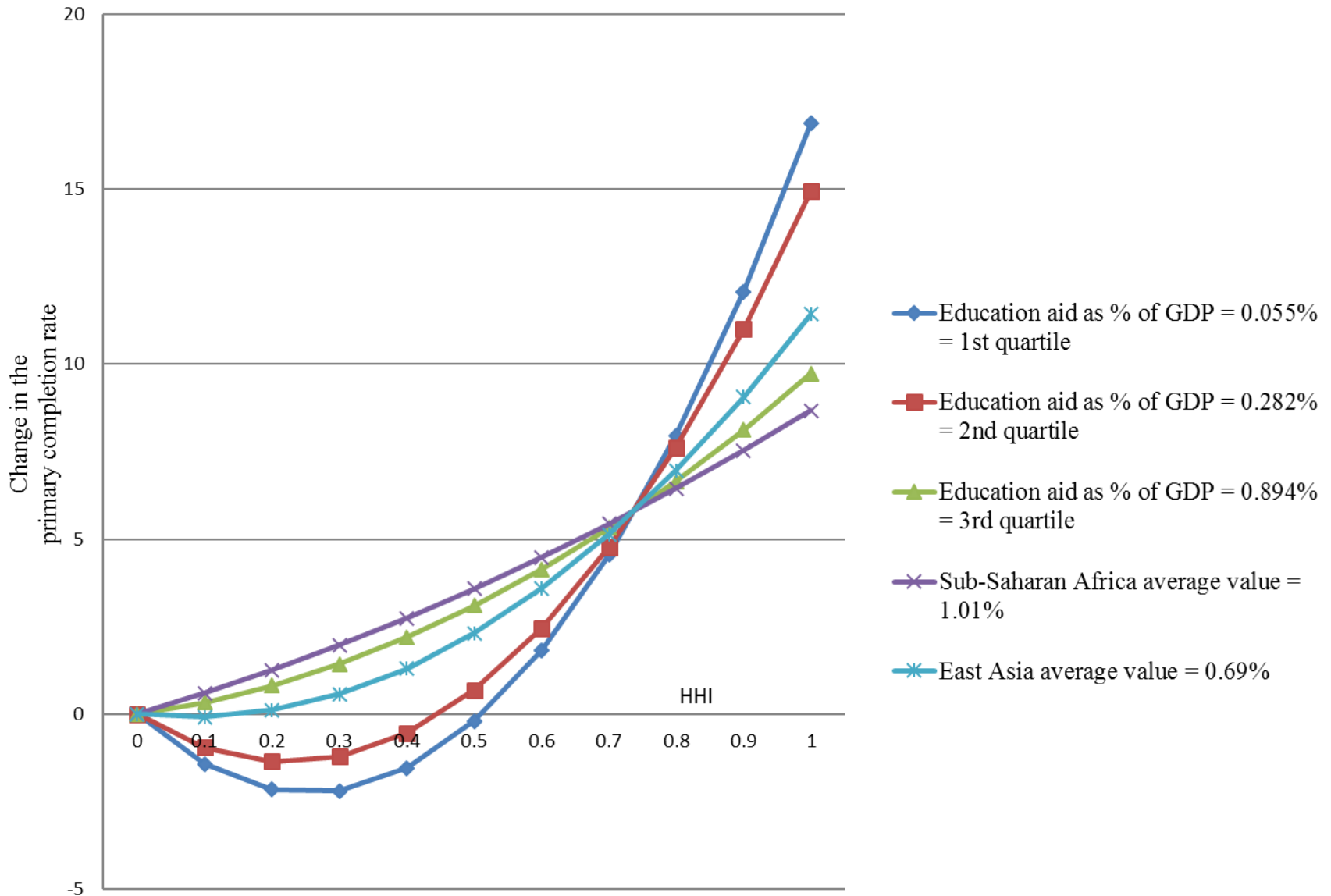
# 6. Conclusion

☐ 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

✓ improves only in the case where the recipient country is heavily dependent on health aid and the HHI is exceptionally high.

☐ primary school completion

✓ Especially in the countries whose dependence on aid is relatively high in education, consistently positive impacts from the concentration of project aid can be expected.

☐ the effect of aid concentration (the reduction of aid fragmentation) varies among different sectors and depends on the level of dependence on aid of each recipient country in each sector.

➢ 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!