Mother's education, infant nutrition and child's health outcome.

A micro-level comparative analysis on 39 developing countries.

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Maternal education & child's health

- It is proxy of household **socio-economic status** > protective factor for child's health
- Highly educated mothers more probably access **modern health services + childcare behaviours enhancing child health**

Malnutrition as child's health indicator

Among developing countries:

- the **quality of the child nutrition** during the first months of life is one of the **main predictors of child health**.

- **breastfeeding** is considered one of the first **protective factors** for child's health during her life

For this reason, the *World Health Organization* prescribes exclusive **breastfeeding for children at least up to 6 months of age**, and formula-milk only when breast-milk is not available or sufficient.

Definition of malnutrition

Malnutrition = Underweight + Overweight

The WHO operatively defines children malnutrition as the condition of those children **falling under the 2.3rd percentile or above the 97.7th percentile of the gender-specific infant weight-for-height distribution** in the population.

Maternal education & child malnutrition

From the literature:

- **Overweight**: maternal education has predominantly a positive effect in reducing the risk.

- **Underweight**: maternal education significantly reduces the risk but the effect is weaker when controlling for household income

> **context features** (e.g. access to health services)

The contextual features of developing countries

The relationship between mother's education and child malnutrition can be shaped by:

- The level of **economic development** of the country: in countries with high per-capita GDP, expensive products are accessible to a larger part of population (e.g. formula milk).

- The level of **gender equality:** women empowerment, the presence of policies for working mothers and for enhancing maternal health

Economic development & child malnutrition

Cross-national comparison studies and time-series analyses have confirmed strong associations between **child mortality and malnutrition** in developing countries, and **economic indicators** such as gross national product (GNP) and gross domestic product (GDP) per capita

Gender equality & child malnutrition

- Mixed findings on the relationship between gender equality at societal level and child malnutrition
- However, the effect seems to the positive in **reducing the risk of child malnutrition**

Research questions

1 – *Is mother's education protective against child malnutrition*?

2 – Is the relationship between mothers' education and child malnutrition *mediated by the type of adopted feeding practice*?

3 – Does the *degree of economic development and gender equality* change the relationship between mother's education, the choice of feeding practices and child malnutrition?

Data & Sample

Demographic and Health Survey > cross-sectional survey on representative sample of the population of 90 developing countries.

It collects information on the *socio-demographic* characteristics of the households, *family planning* behaviours and attitudes, and the *health conditions* of their members.

For each country, we took the last survey year available.

We selected a sample of mothers with a child < 7 months

Malnutrition

We adopted the WHO definition of malnutrition (based on percentiles of weight for height distribution)

2 dependent variables (dummies):

1. overweight
2. underweight

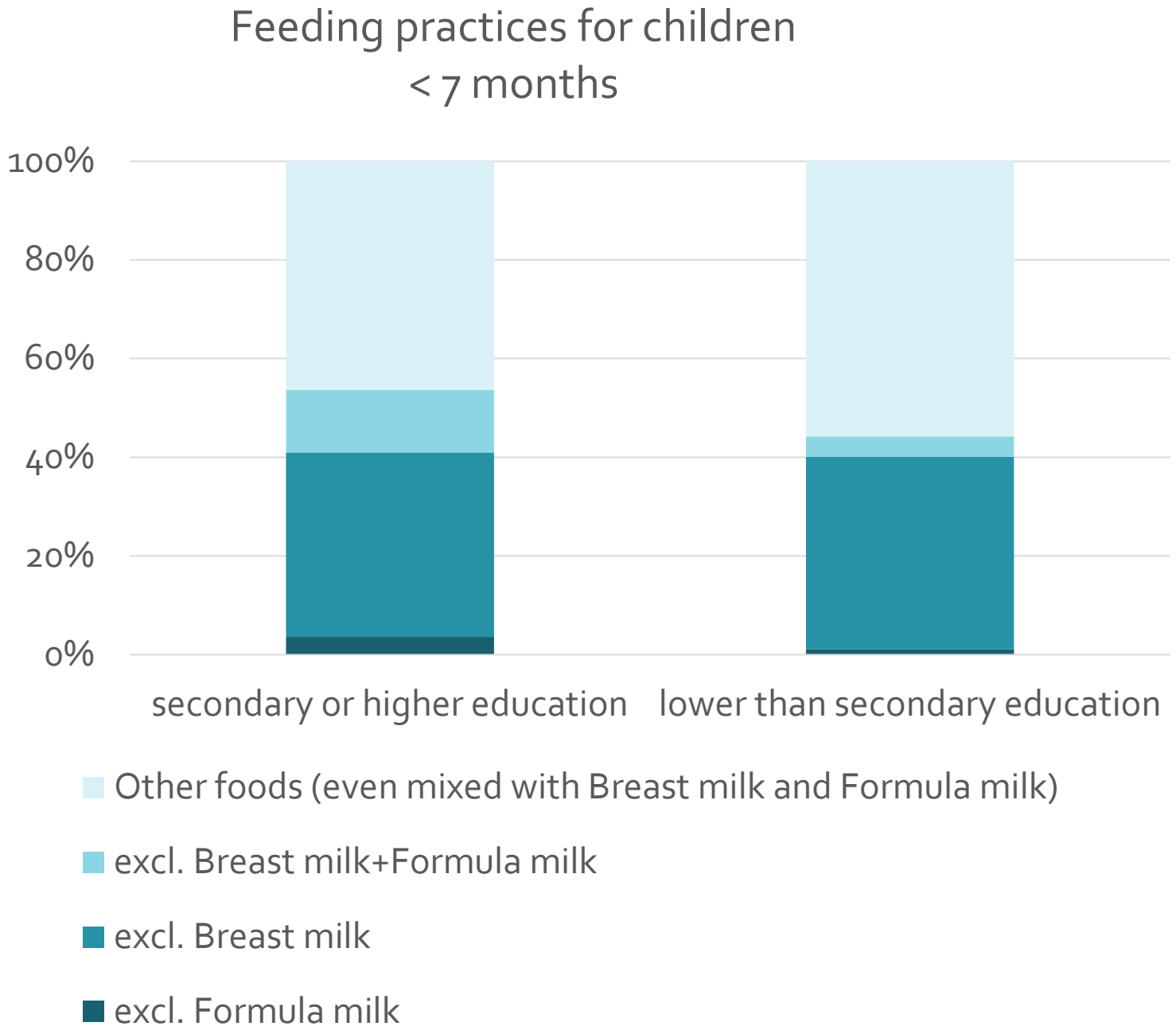
Feeding practices

The DHS provides information on the **type of food** received by the child, but **not about the frequency** > *we are not able to say which is the child's main feeding practice when more than one coexist*.

For this reason, feeding practices are operationalized as child is fed:

1. **exclusively with breast-milk** ("top choice");
2. **exclusively with formula-milk**;
3. **exclusively with a combination of breast-milk and formula-milk**;
4. **also with other food than breast-milk and formula-milk** (including baby-food)

Mother's education



Economic development & Gender equality

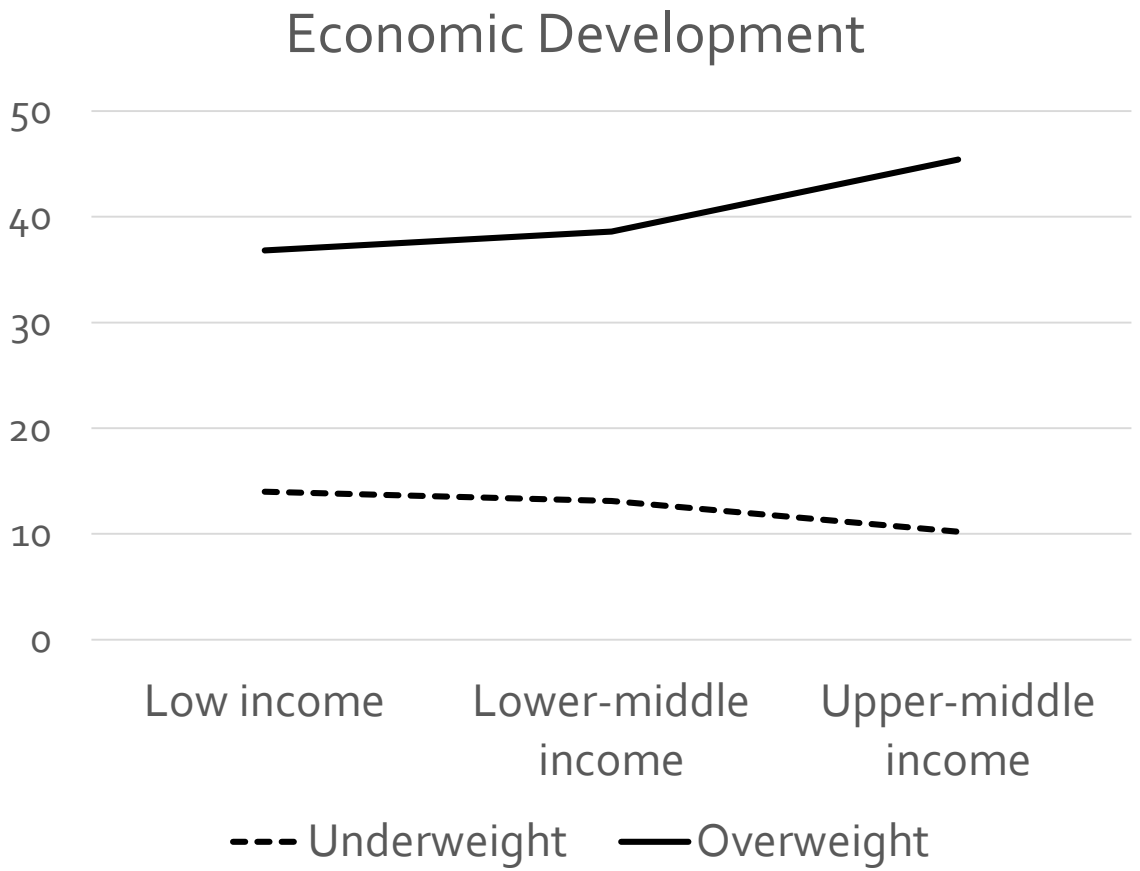
- the **2017 World Bank's country classification by income level**.

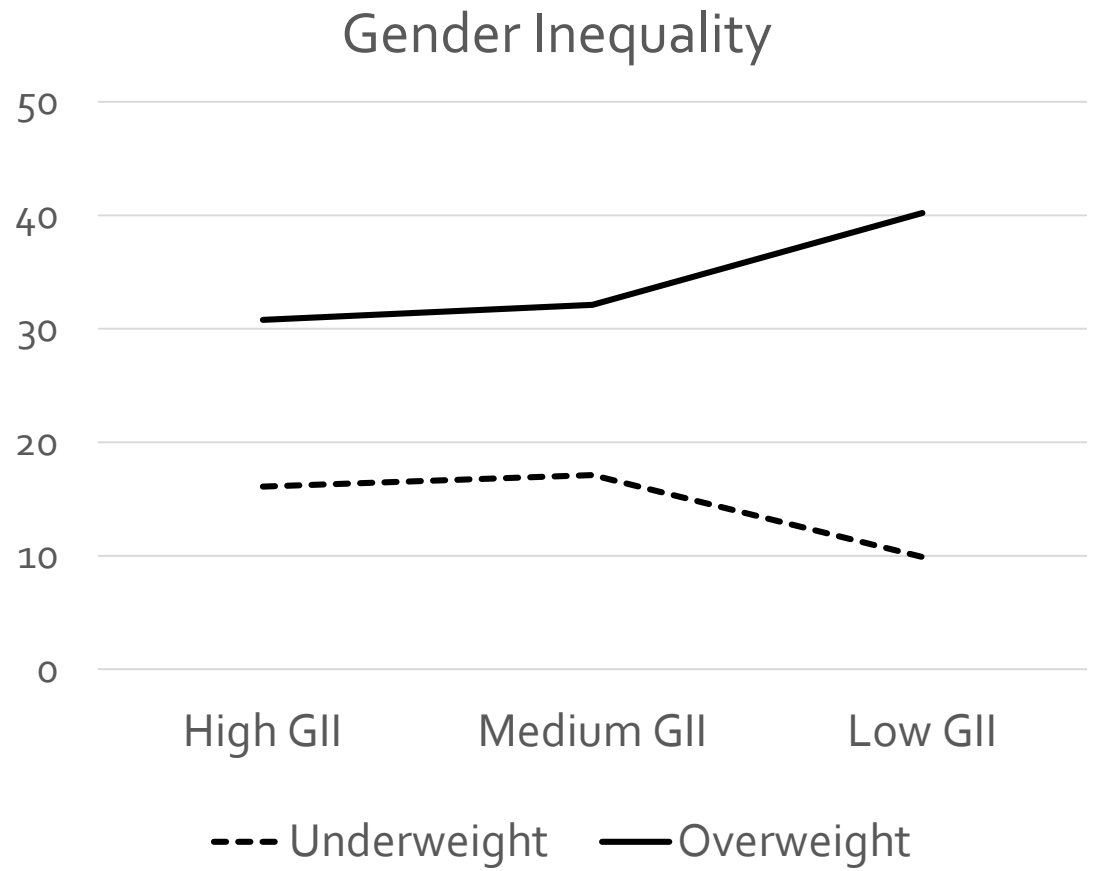
It is based on the 2016 per capita GNI. DHS countries come from the groups of *low income countries* (<1,005 US$), *lower-middle income* countries (1,006 – 3,955 US$), *upper-middle income* countries (3,956 – 12,235 US$)

- the **2016 UN's Gender Inequality Index**

It measures gender inequality in *reproductive health*, *empowerment* and *economic status*. We calculate the tertiles distribution of the GII in our population.

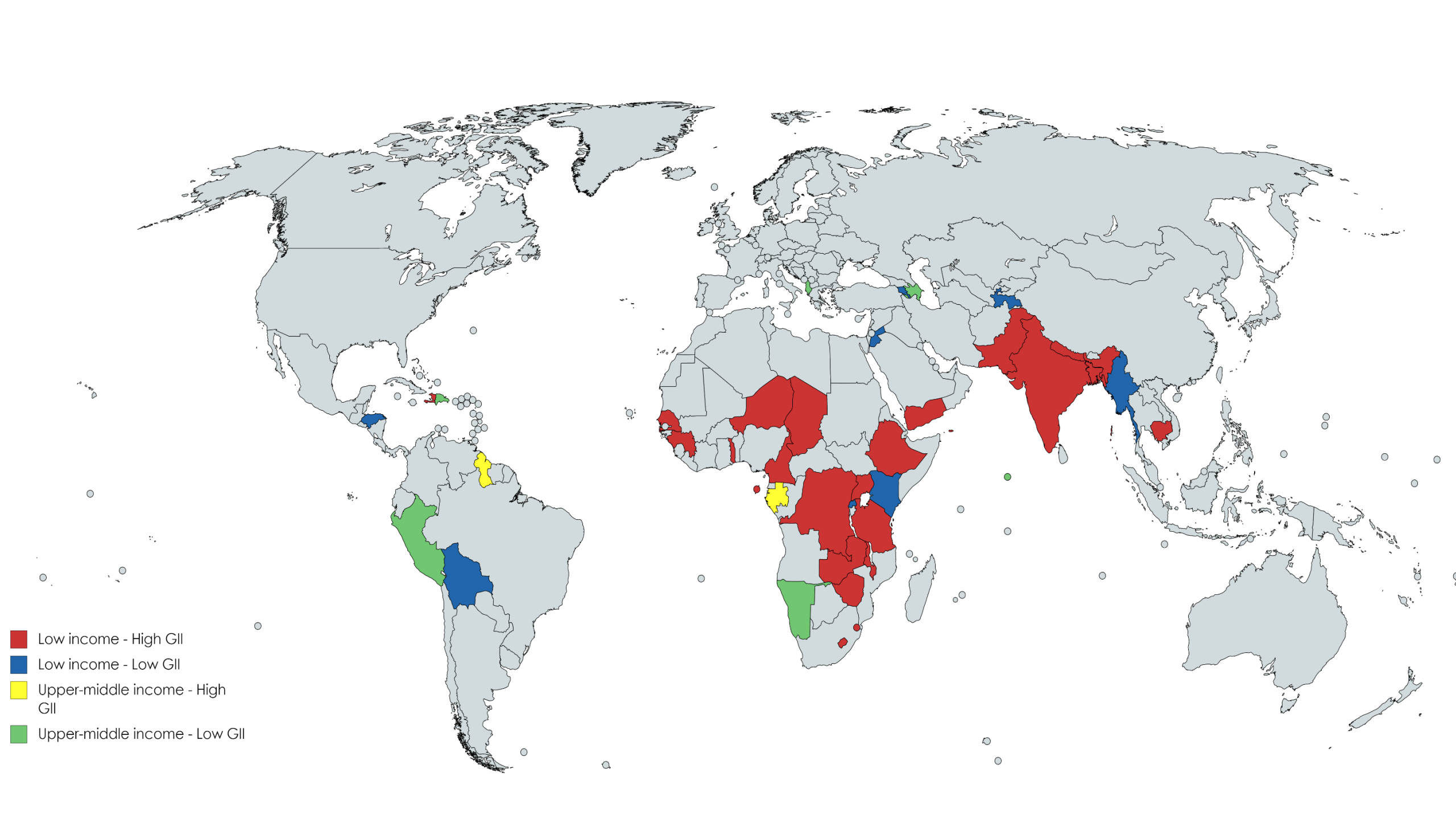
Proportion of overweight and underweight children (< 7 months) among countries with different income and gender inequality level.





Countries cross-classification on the indicators of economic development and gender equality and sample distribution.

	Low income	Upper-middle income	Total
High Gender Inequality (high GII)	Bangladesh, Congo DR, Cameroon, Ethiopia, Guinea, Haiti, India, Cambodia, Lesotho, Malawi, Niger, Nepal, Pakistan, Senegal, Sao Tome, Swaziland, Chad, Togo, Tanzania, Uganda, Yemen, Zambia, Zimbabwe	Gabon, Guyana	
N. observations	20,217 (69.9%)	1,252 (4.3%)	21,469 (74.2%)
Low Gender Inequality (low GII)	Armenia, Bolivia, Honduras, Jordan, Kenya, Myanmar, Rwanda, Tajikistan	Albania, Azerbaijan, Dominican Republic, Maldives, Namibia, Peru	
N. observations	3,779 (13.1%)	3,676 (12.7%)	7,445 (25.8%)
Total	23,996 (83%)	4,928 (17%)	28,924 (100%)


Low income - High GII
Low income - Low GII
Upper-middle income - High GII
Upper-middle income - Low GII

Comparing contexts

- Low income VS Upper-middle income countries
- High gender inequality VS Low gender inequality

- *Most favourable context* (i.e. High income & Low gender inequality) VS other countries
- *Most unfavourable context* (i.e. Low income & High gender inequality) VS other countries

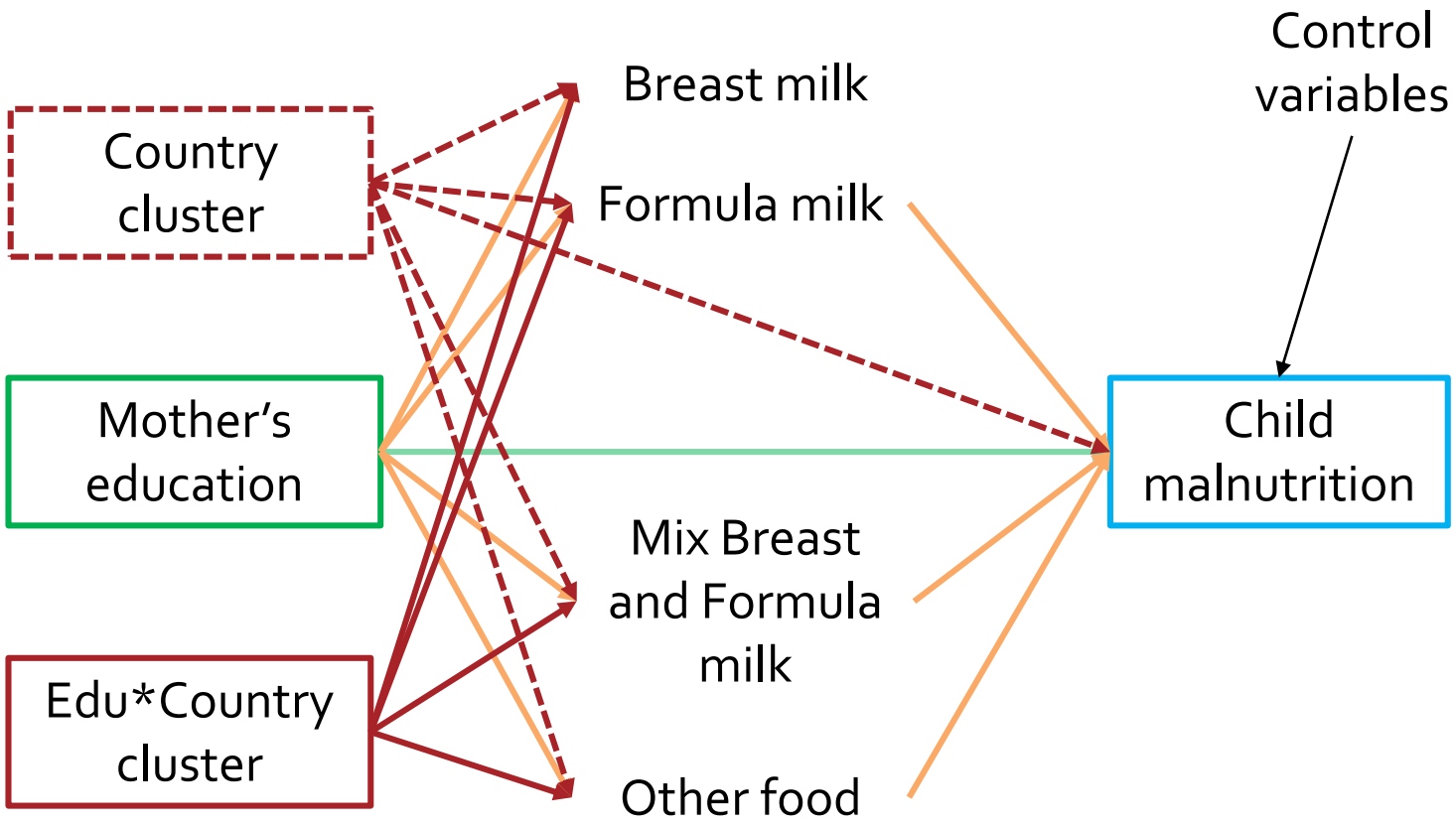
The method

In order to test our hypothesis, we developed a **logit mediation model with single-group effect**.

In the single-group model, a **categorical variable indicating the group membership** (i.e. the cluster of countries) is used as a covariate in the model and in the **interaction with the main explanatory variable** (i.e. mother's education)

> differences between groups of countries (Ryu and Cheong, 2017).

The model


Control variables
Breast milk
Country cluster
Formula milk
Mother's education
Child malnutrition
Mix Breast and Formula milk
Edu*Country cluster
Other food

Control variables

- Mother's age
- Mothers' Body Mass Index (BMI),
- Mother's access to health services prior to the birth
- Household wealth level
- Living in urban or rural area
- The number of other children aged less than 5 in the household

Relationship between mother's education and child malnutrition, with and without including feeding practices, estimated in each country cluster through logistic regressions.

Country cluster	Secondary > Overweight	Secondary + feeding > Overweight	Secondary > Underweight	Secondary + feeding > Underweight
Upper-middle income	.183**	n.s.	n.s.	-
Low income	-.059**	n.s.	n.s.	-
Low GII	-.124***	n.s.	.367***	n.s.
High GII	.087 ***	n.s.	-.062*	n.s.

Feeding practices > malnutrition

Risk of malnutrition compared to breastfed children*

	Formula	Mix	Other
Overweight	-	+	-
Underweight	(+)	(-)	+

***Robustness check**:

1. results do not change for overweight when excluding underweight children from the analysis;
2. excluding overweight children makes results for formula and mix no longer significant for the risk of underweight

Maternal education > feeding > malnutrition

Odds ratio (highly vs lower educatad mothers) from logit single group mediation models

	Overweight	-	+	-
		Formula	Mix	Other
Ref.	*Low income*	1.05	1.01	1.07
	High income	No sign. diff.	No sign. diff.	No sign. diff.
Ref.	*High GII*	1.11	n.s.	1.13
	Low GII	1.13	n.s.	0.86
	Underweight	**(+)**	**(-)**	**+**
		Formula	Mix	Other
Ref.	*High GII*	0.90	n.s.	0.96
	Low GII	1.10	n.s.	0.87

The most favourable and unfavourable context

1. The most favourable: **low gender inequality and upper middle income countries**

2. The most unfavourable: **high gender inequality and low income countries**

The most favourable context (overweight)

In low gender inequality and upper middle income countries

the risk of infant **overweight** for mothers with at least secondary education, feeding the child with:

- ***Exclusively Formula Milk***: 0.77 (ref: 1.06)
- ***Mix of Formula and Breast Milk***: no sign. diff. from reference cluster (1.01)
- ***Other Food***: 0.93 (ref: 1.09)

The most favourable context (underweight)

In low gender inequality and upper middle income countries

The main relationship (i.e. mother's education > child's malnutrition) is not significant

The most unfavourable context (overweight)

In high gender inequality and low income countries

the risk of infant **overweight** for mothers with at least secondary education, feeding the child with:

- ***Exclusively Formula Milk***: 0.75 (ref: 1.19)
- ***Mix of Formula and Breast Milk***: 1.14 (ref: 0.98)
- ***Other Food***: no sign. diff from other countries (1.09)

The most unfavourable context (underweight)

In high gender inequality and low income countries

the risk of infant **underweight** for mothers with at least secondary education, feeding the child with:

- ***Exclusively Formula Milk***: 1.14 (ref:0.72)
- ***Mix of Formula and Breast Milk***: 0.84 (ref: 1.02)
- ***Other Food***: no sign.diff. (ref: 0.92)

Conclusion

By using other types of food than breast milk:

- mother's education seems to be a *protective* factor for children **underweight**
- while mother's education *increases the risk* for children **overweight**

However:

- A **gender egalitarian context** seems to positively interact with mother's education in protecting children from malnutrition
- In particular, **countries matching the two criteria** of higher economic development and higher gender equality guaratee a positive effect of women's education on **preventing especially children overweight**