

# ‘Mother’s milk’: Is there a social reversal in breastfeeding practices along with economic development?

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ELODIE ROSSI (BORDEAUX SCHOOL OF ECONOMICS)

PIERRE LEVASSEUR (INRAE)

MATTHIEU CLEMENT (BORDEAUX SCHOOL OF ECONOMICS)

# Why not breastfeeding (BF) is a major issue?

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## ○ Health consequences

- For children, via a greater exposure to **infectious diseases, obesity and diabetes**, and a reduction in **cognitive and non-cognitive skills**, even in rich countries (e.g. Belfield & Kelly, 2012; Girard et al., 2017).
- For mothers, by increasing risks of **post-partum depression**, ovarian and breast **cancer, heart disease and type-2 diabetes** (UNICEF, 2018).
- **600,000 children and 100,000 women die each year** due to inadequate BF behaviors worldwide (Walters et al., 2019).

## ○ Economic consequences

- Negative impacts on **educational attainment and labor market outcomes** in adulthood (e.g. Fletcher, 2010; Cesur et al., 2017), even in rich countries.
- Walters et al. (2019) estimated the **global economic losses** associated with not BF to be **more than \$340.3 billions** (including costs linked to child and maternal mortality as well as cognitive losses), accounting for approximately **0.7% of global GNI**.

*Appropriate BF practices are well below the 2030 international targets of the WHO (40% vs. 70%).*

# Causes of the choice to not breastfeed

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HOUSEHOLD  
WEALTH

## *Household-level determinants*

- **Socioeconomic causes** (Rippeyoung & Noonan, 2012, Volk & Franklin 2020, Sarki et al. 2019, Victora et al. 2016)
  - Preference for the present: temporal trade-off between short-term **opportunity cost** and future health benefits
  - Formula milk is used as signal of **social distinction** (since formula milk has a direct cost and is associated with progress)
  - Lack of nutritional and health **knowledge**
  - Maternal **employment** after birth

NATIONAL  
WEALTH

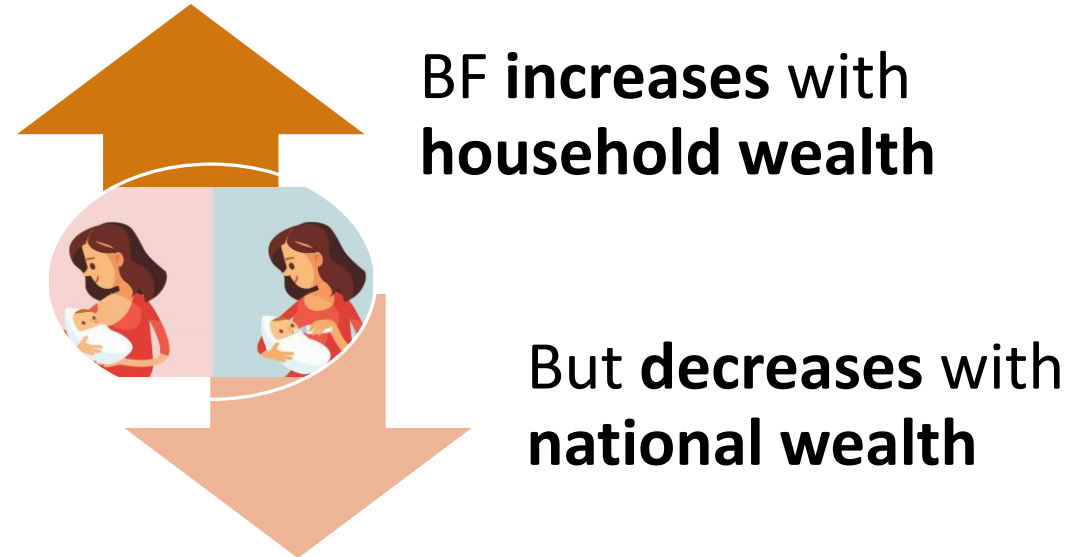
## *Country-level determinants*

- **Environmental and cultural causes** (Baker et al. 2016; Rollins et al. 2016, Neves et al. 2020)
  - Low accessibility to **safe water, and health and education services**
  - Development of the **milk formula market** (intensive marketing)
  - **Cultural constraints** against BF (or against formula milk in some contexts, e.g. China)
  - Lack of **BF-friendly policy** (e.g., maternity leaves), public health campaigns and regulation of the milk formula market

# Literature review

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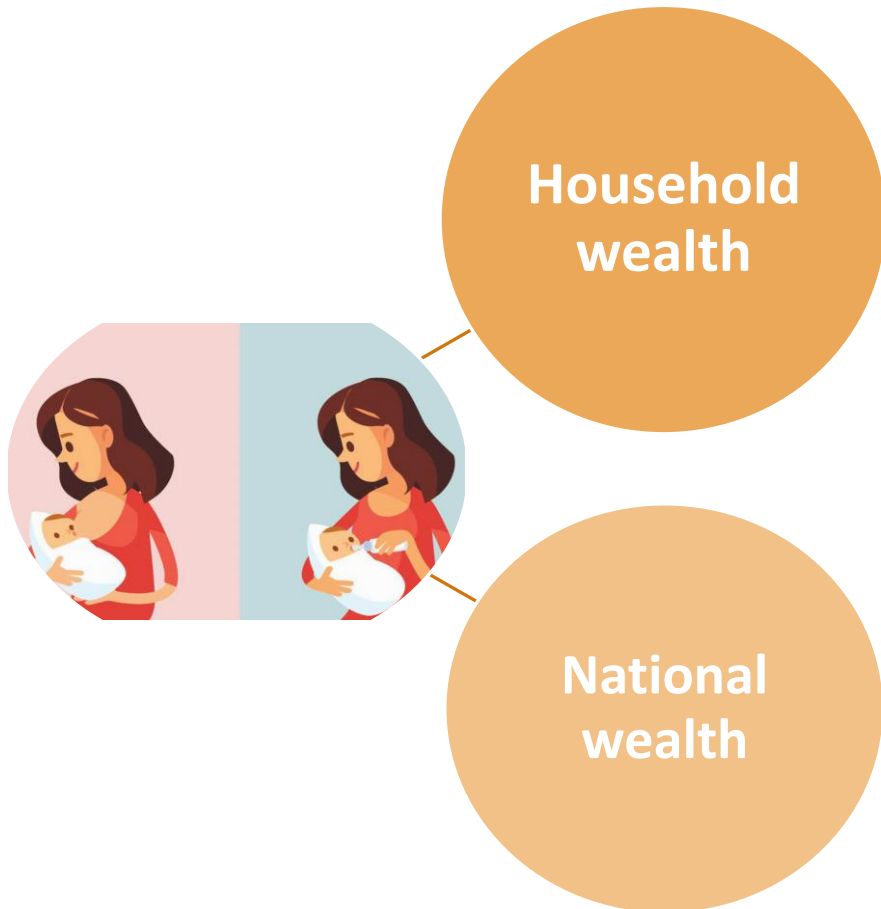
- A **paradox** between wealth and appropriate BF practices among **high-income countries** (e.g. Jones et al., 2011; Kohlhuber et al., 2008; Oakley et al., 2014; Sarki et al., 2019; Victora et al., 2016).



- **In developing countries, results are mixed.** Further investigations are needed!

# Research questions applied to developing countries

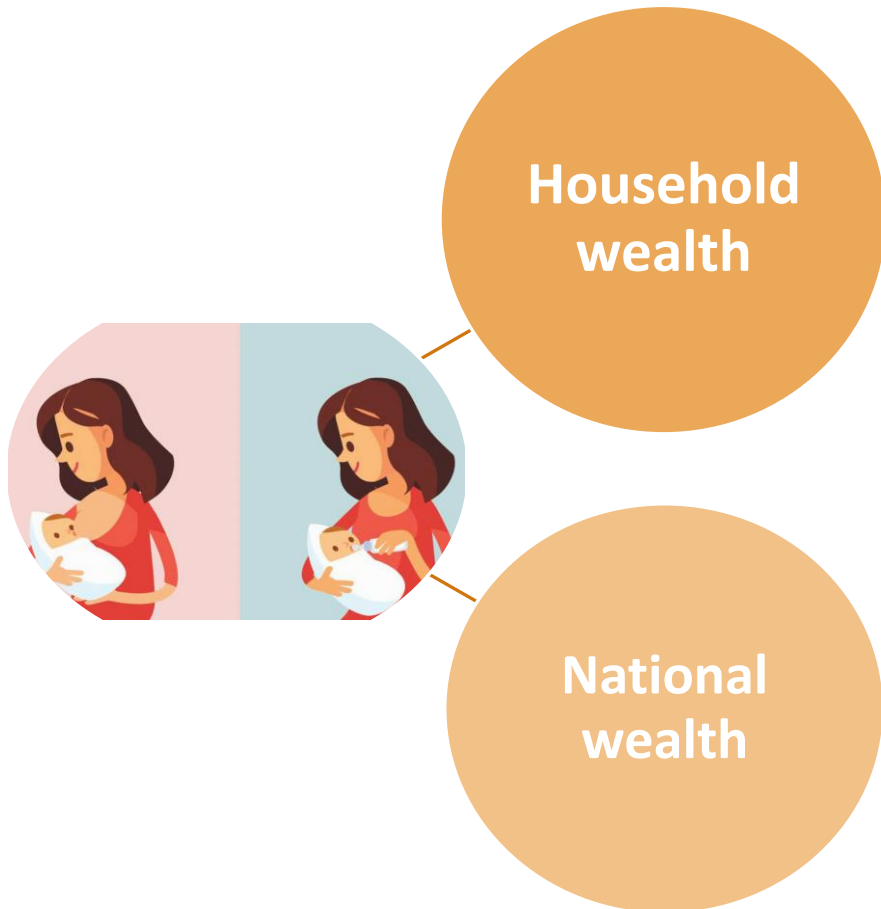
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- How household wealth affects the trade-off between the choice to breastfeed or not?
  - *H1: Presence of **within-country inequality***

# Research questions applied to developing countries

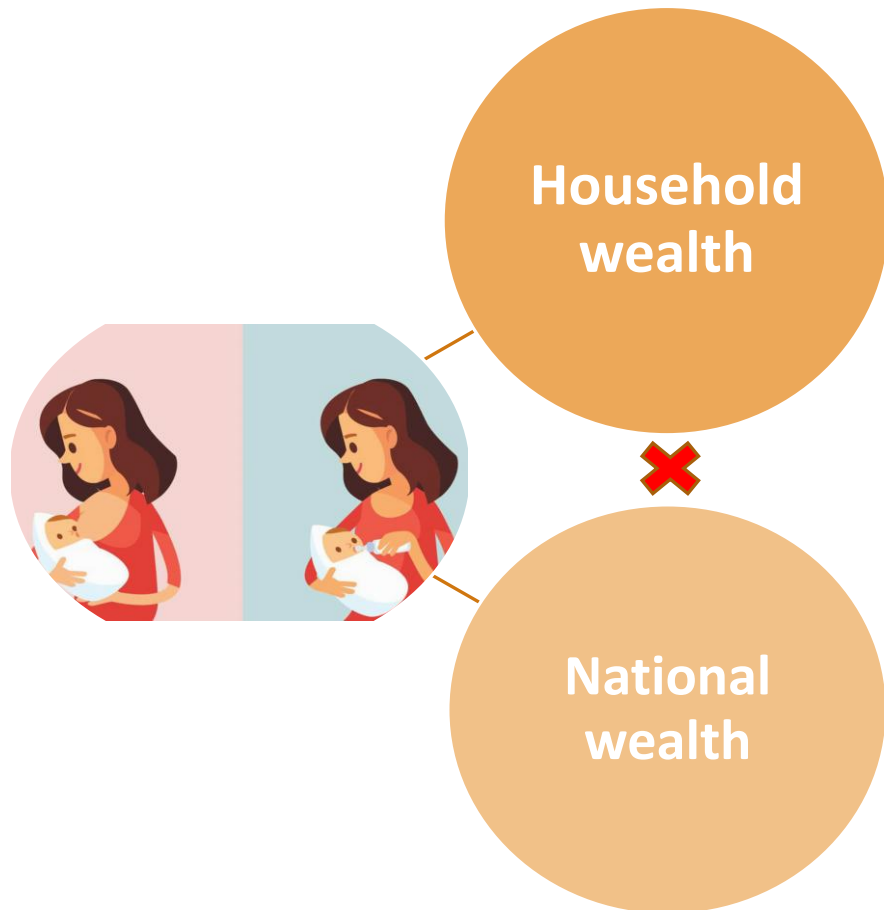
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- How household wealth affects the trade-off between the choice to breastfeed or not?
  - *H1: Presence of within-country inequality*
- How national wealth affects this trade-off?
  - *H2: Presence of **cross-country inequality***

# Research questions applied to developing countries

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- How household wealth affects the trade-off between the choice to breastfeed or not?
  - *H1: Presence of within-country inequality*
- How national wealth affects this trade-off?
  - *H2: Presence of cross-country inequality*
- How national wealth moderates and changes the household wealth-BF association
  - *H3: Existence of a **social reversal** along with economic development*
  - *While the richer household adopt healthier (physiological) behaviors, the poorest have higher access to formula milk*

# Data and indicators

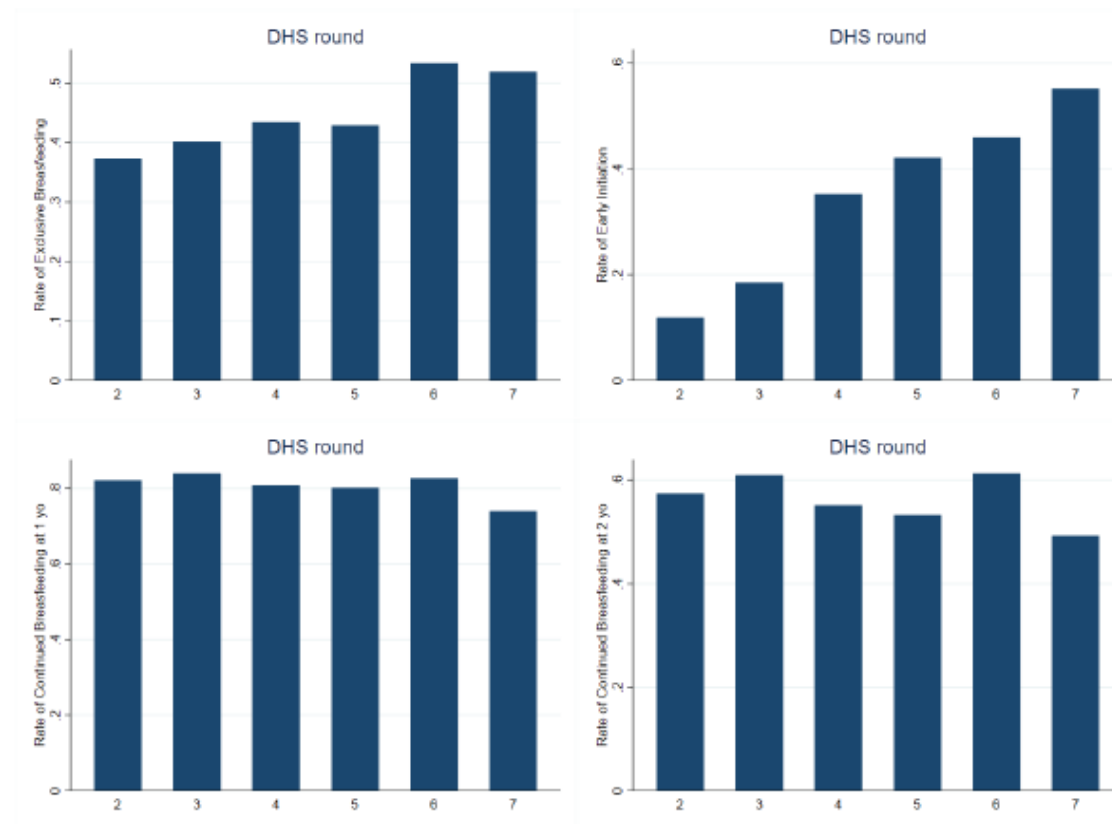
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- We merged all the ***Demographic and Health Surveys (DHS)*** available for the **Asian continent**
  - Our analyses rely on **37 DHS conducted in 16 countries b/w 1990 and 2017** (a sample of 2,445,656 young children)
  - Asia concentrates mostly **40% of the global health and economic costs** of inappropriate BF practices
- We constructed:
  - **4 dummy indicators of adequate BF practices** (according to the WHO & UNICEF)
    - Exclusive BF (EBF) for the 6 first months
    - Early initiation of BF (EIBF)
    - Continued BF at one year (CBF1), 12-15months, and at two years (CBF2)
  - **2 household wealth scores** allowing for comparison across DHS waves and countries (as proxy of SES)
    - Using PCA and MCA approaches including 7 dummies of durables ownership (radio, TV, refrigerator, bicycle, motorcycle, car, and phone), 2 dummies of access to public facilities (water and electricity), and 3 dummies of housing conditions (number of sleeping rooms, quality of floor material, and toilet facility)
    - Each score varies from 0 to 1
  - **3 indicators of national wealth** at a given time (low vs. medium vs. high)
    - Based on tercile of GNI per capita (\$PPP 2017), tercile of GDP per capita (\$PPP 2017), and tercile of HDI.



# Descriptive: BF across time

Figure 1: Rates of BF practices across DHS rounds.



Source: Authors from Asian DHS data (rounds 2 to 7).

→ Improvement of EBF & EIBF across time, but not for CBF

# Descriptive: BF across national wealth

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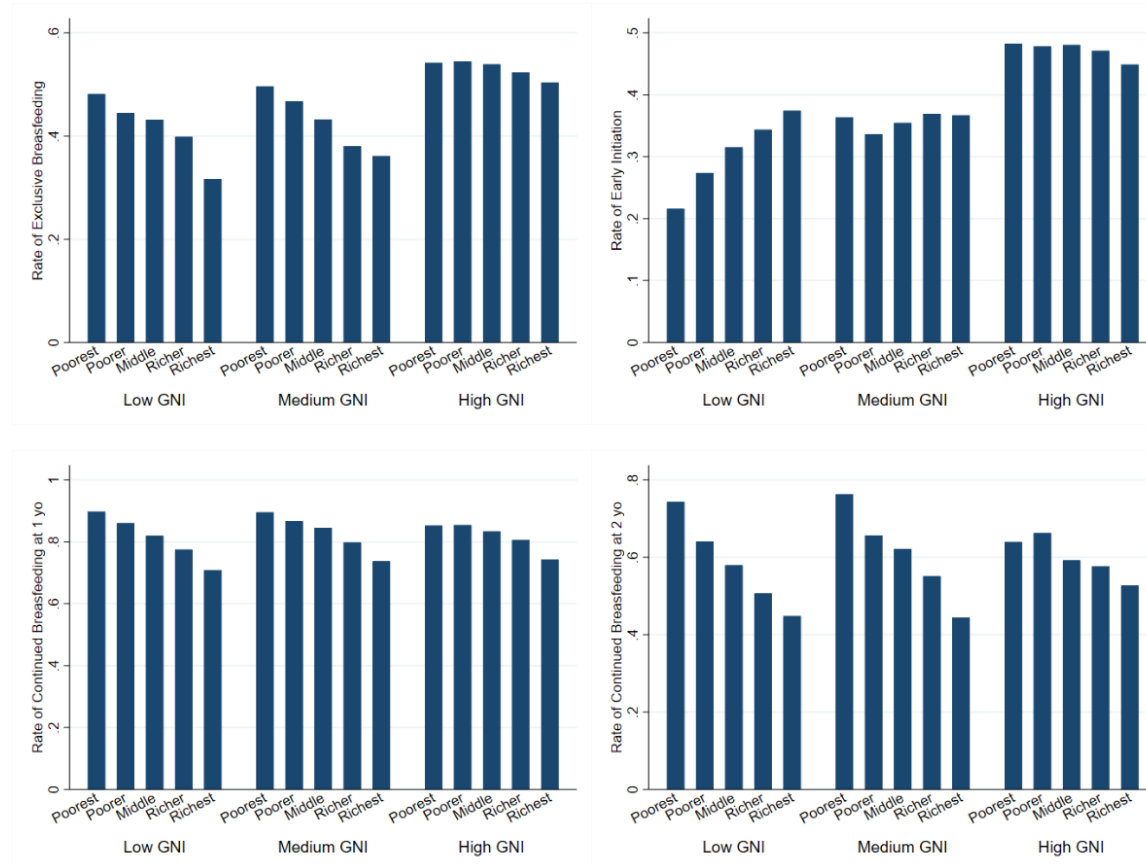
**Table 1: BF practices rates by groups of GNI/capita (\$PPP2017).**

<b>Groups of GNI/capita (\$PPP2017)</b>	<b>EBF</b>	<b>EIBF</b>	<b>CBF1</b>	<b>CBF2</b>
Low	42.75%	25.11%	82.45%	60.09%
Medium	44.69%	38.50%	82.23%	59.52%
High	49.57%	48.37%	77.09%	54.52%
<b>ALL</b>	46.11%	38.33%	79.93%	57.22%

Source: Authors from Asian DHS data (rounds 2 to 7).

# Descriptive: BF across household & national wealth

**Figure 2: Rates of BF practices by groups of household wealth (based on PCA quintiles) and GNI/capita (\$PPP2017).**



→ A social convergence across national wealth

# Econometric OLS models

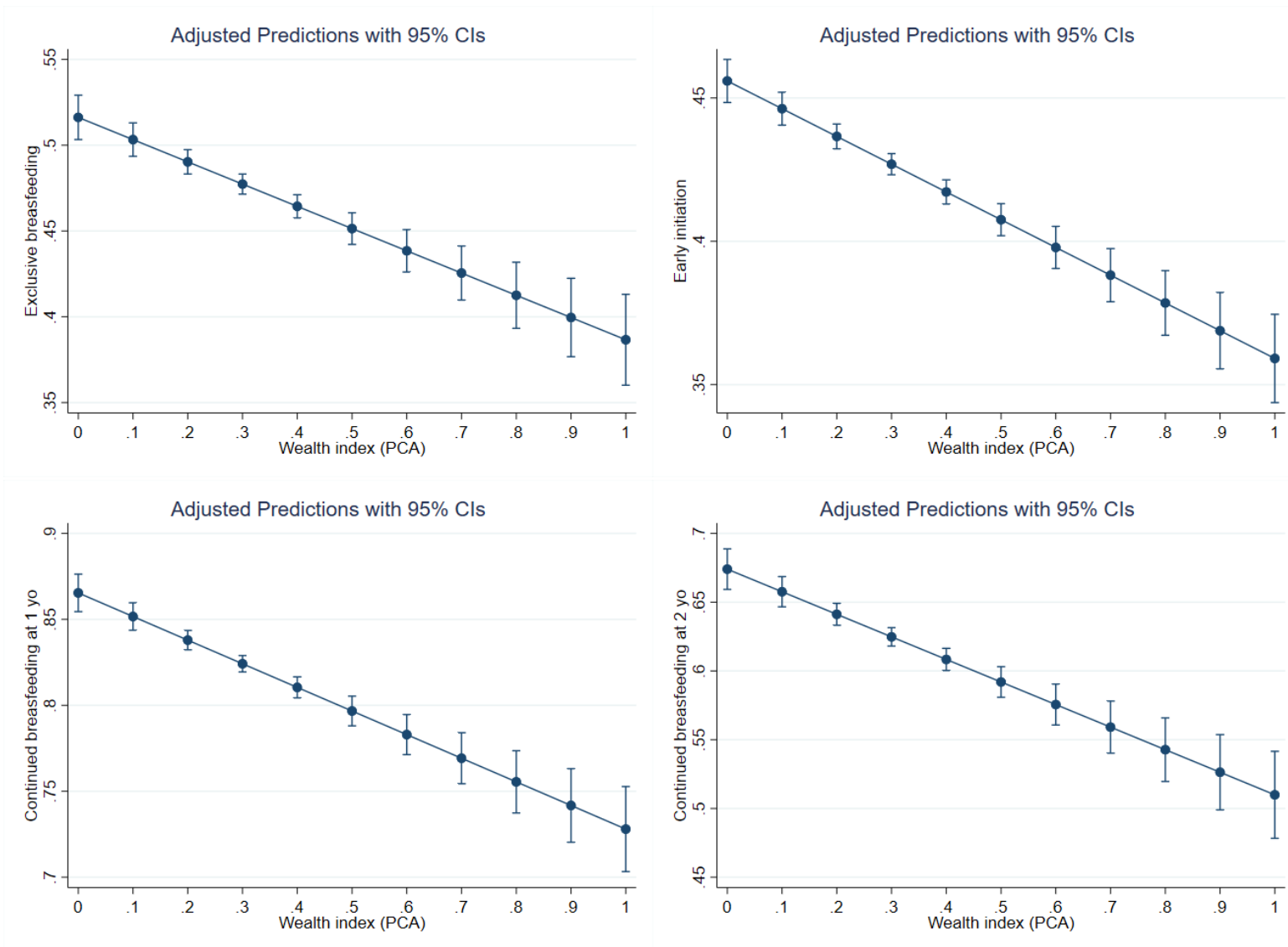
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$$BF_i = \beta_0 + \beta_1 Wealth_j + \beta_2 Dev_k + \beta_3 X_i + \beta_4 X_j + \omega_t + \varepsilon_i \quad [1]$$

$$BF_i = \alpha_0 + \alpha_1 Wealth_j + \alpha_2 Dev_k + \alpha_3 Wealth_j * Dev_k + \alpha_4 X_i + \alpha_5 X_j + \omega_t + \mu_i \quad [2]$$

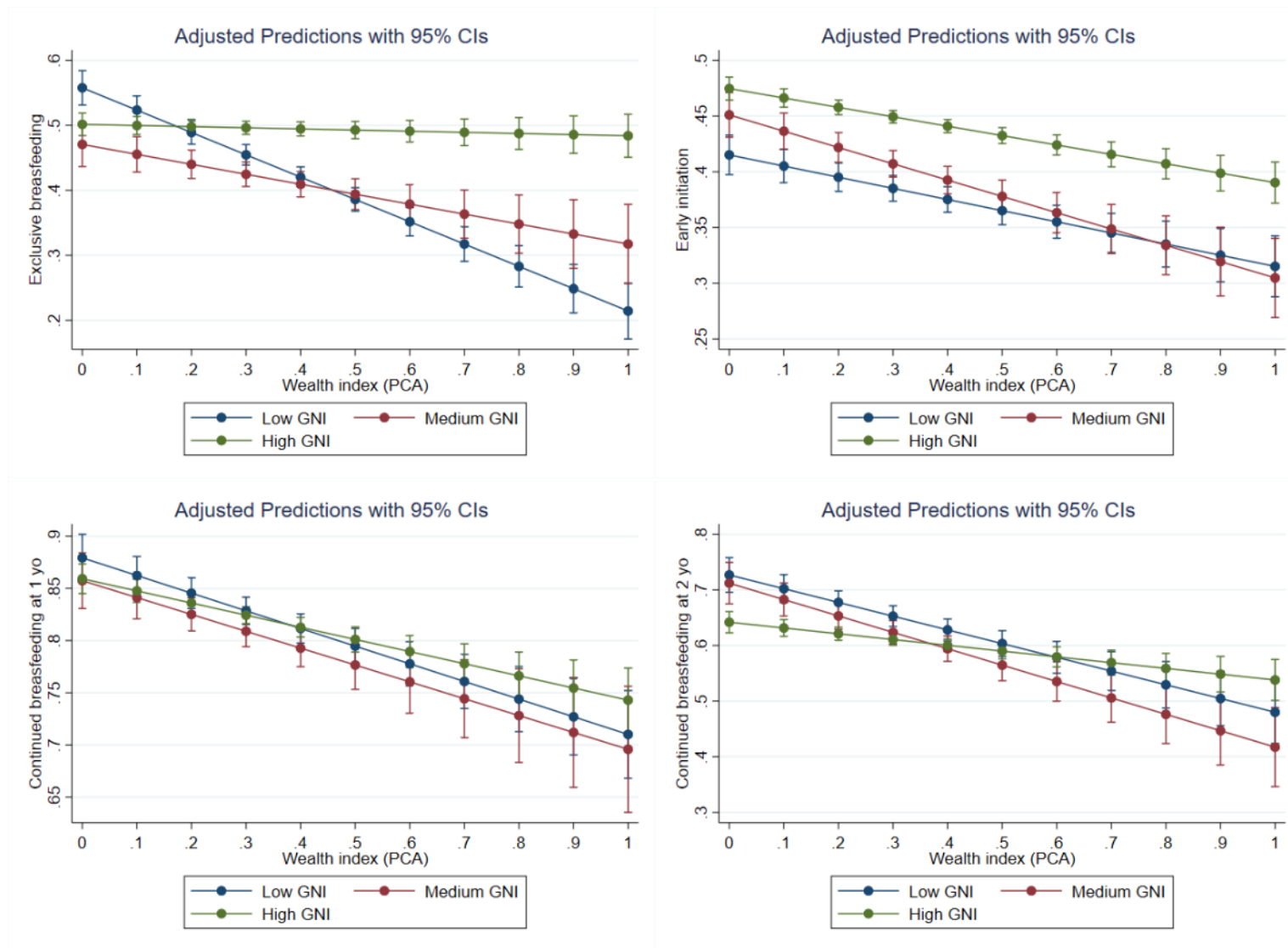
Control variables (X): The **infant's characteristics (Xi)** include sex, age (in months), birth order, birth interval (in months), size at birth (5-point score), multiple births. **Obstetric data (Xi)** include wantedness of pregnancy, number of antenatal visits, mode of delivery (C-section or not), place of delivery (at home or not). The **mother's characteristics (Xj)** include her age (in years), marital status (married or not), number of children, level of education (no education; primary; secondary; higher), place of residence (urban or rural).  $\omega$  refers to rounds of DHS.

**Figure 2: Marginal effects of OLS regression of BF behaviors on household wealth (including covariates).**



→ Existence of within-country heterogeneity (appropriate BF practices are more common among the poorest)

**Figure 3: Marginal effects of OLS regression of BF behaviors on household wealth interacted by the level of a GNI/capita (\$PPP2017) (including covariates).**



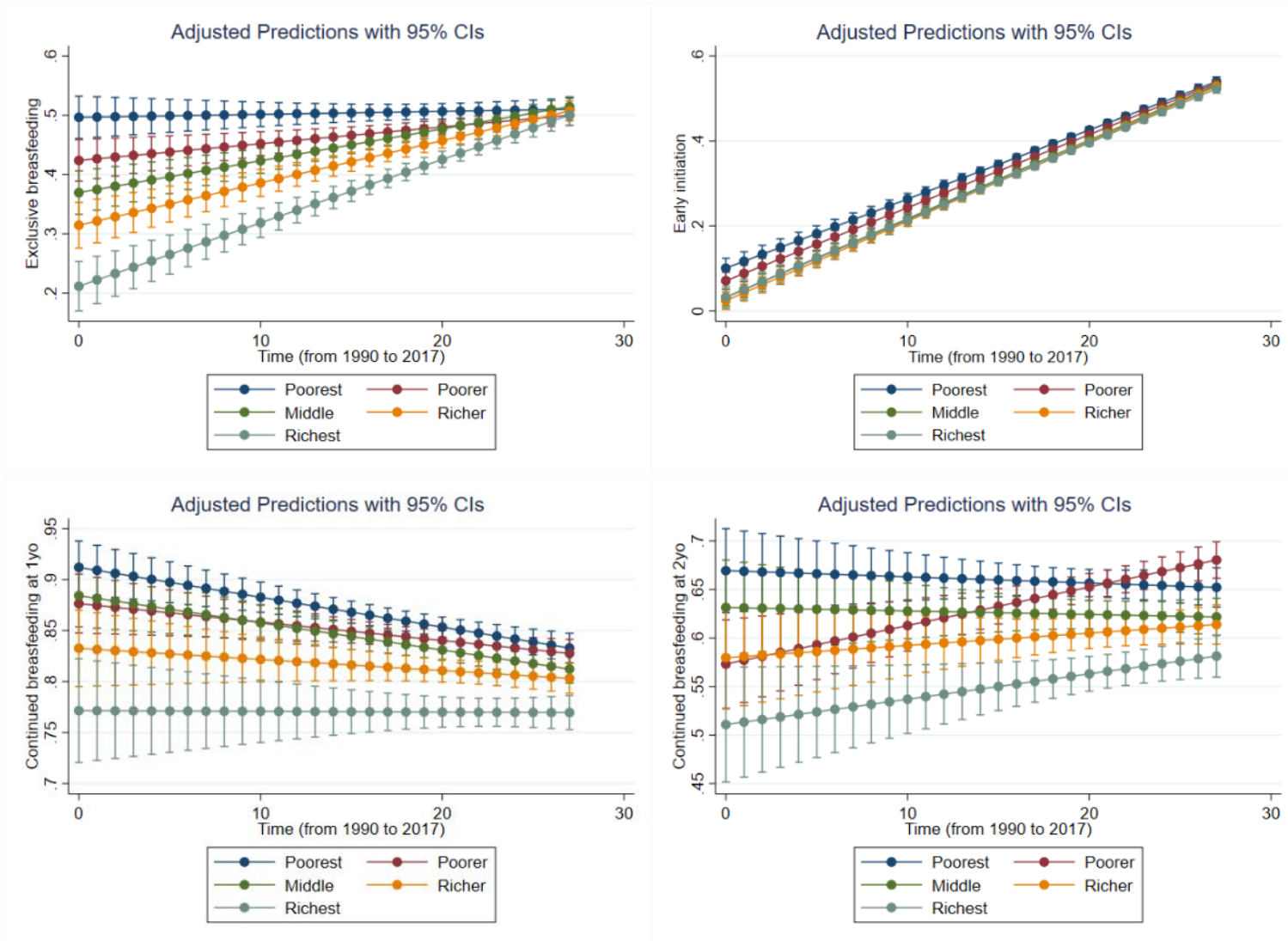
→ Towards a social convergence of EBF and CBF2 in richer Asian countries (suggesting a future social reversal?)<sup>14</sup>

# OLS results

Dependent outcome:	Exclusive breastfeeding (dummy)		Early initiation (dummy)		Continued breastfeeding at 1 yo		Continued breastfeeding at 2 yo	
	<i>Linear</i>	<i>Interacted</i>	<i>Linear</i>	<i>Interacted</i>	<i>Linear</i>	<i>Interacted</i>	<i>Linear</i>	<i>Interacted</i>
Household wealth score	-0.144*** (0.019)	-0.366*** (0.031)	-0.097*** (0.011)	-0.100*** (0.020)	-0.137*** (0.017)	-0.169*** (0.030)	-0.164*** (0.022)	-0.247*** (0.040)
Medium GNI per capita (dummy)	-0.017 (0.011)	-0.088*** (0.021)	0.021** (0.008)	0.036*** (0.014)	-0.019* (0.010)	-0.022 (0.018)	-0.030** (0.014)	-0.015 (0.025)
High GNI per capita (dummy)	0.039*** (0.010)	-0.077*** (0.017)	0.064*** (0.007)	0.060*** (0.011)	-0.002 (0.009)	-0.020 (0.014)	-0.038*** (0.013)	-0.085*** (0.020)
Wealth*MediumGNI		0.208*** (0.052)		-0.046 (0.031)		0.008 (0.049)		-0.048 (0.062)
Wealth*HighGNI		0.336*** (0.036)		0.016 (0.023)		0.053 (0.034)		0.143*** (0.044)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
Observations	34,452	34,452	133,506	133,506	25,449	25,449	21,890	21,890
R-squared	0.086	0.088	0.084	0.084	0.080	0.080	0.118	0.119
Children age interval (in month)	[0-5]	[0-5]	[0-23]	[0-23]	[12-15]	[12-15]	[20-23]	[20-23]

Notes: Standard errors are clustered at the PSU-level. Robust standard errors are in parenthesis: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Figure 4: Marginal effects of OLS regression of BF behaviors on household wealth quintiles interacted with time (including covariates).**



→ Towards a social convergence across time



# Robustness checks

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- **Two IV regression models** using two sets of instruments
  - IV1: proportion of households equipped with clean and modern fuel for cooking (i.e., biogas, LPG, electricity, ethanol, or natural gas) compared to dirty traditional fuel (i.e., charcoal, wood, or other organic combustibles) at the PSU level, excluding household j (Kim et al., 2010; Barnes et al., 2013; Kpelitse et al., 2014; Bonnefond & Clément, 2014; Clément, 2017; Daran & Levasseur, 2022)
  - IV2: the average height of mothers at the PSU level, excluding the household j (Case & Paxson, 2008)
- **Including confounding covariates:** mother's BMI (body mass index), mother's employment (yes or no), and religion (Muslim, Christian, Hindu, Buddhist, and others)
- **Other measurements** of household wealth (MCA approach) and national wealth (GDP/capita and HDI)

Approved

# Robustness: IV regression I

Dependent outcome:	Exclusive breastfeeding (dummy)		Early initiation (dummy)		Continued breastfeeding at 1 yo		Continued breastfeeding at 2 yo	
	<i>Linear</i>	<i>Interacted</i>	<i>Linear</i>	<i>Interacted</i>	<i>Linear</i>	<i>Interacted</i>	<i>Linear</i>	<i>Interacted</i>
Household wealth score	-0.751*** (0.089)	-1.219*** (0.148)	-0.509*** (0.047)	-0.776*** (0.071)	-0.335*** (0.074)	-0.499*** (0.118)	-0.676*** (0.095)	-0.782*** (0.162)
Medium GNI per capita (dummy)	-0.006 (0.012)	-0.143*** (0.050)	-0.007 (0.009)	-0.126*** (0.029)	-0.028** (0.011)	-0.132*** (0.042)	-0.006 (0.015)	0.081 (0.058)
High GNI per capita (dummy)	0.016 (0.012)	-0.205*** (0.042)	0.034*** (0.009)	-0.091*** (0.024)	-0.015 (0.011)	-0.079** (0.034)	-0.040*** (0.014)	-0.103** (0.046)
Wealth*MediumGNI/c		0.391*** (0.140)		0.331*** (0.077)		0.312*** (0.121)		-0.276 (0.171)
Wealth*HighGNI/c		0.623*** (0.104)		0.340*** (0.056)		0.169** (0.085)		0.198* (0.117)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
Number of instruments	1	3	1	3	1	3	1	3
Instruments	Area clean cooking fuel use	Area clean cooking fuel use and its interactions with with medium GNI/c and high GNI/c	Area clean cooking fuel use	Area clean cooking fuel use and its interactions with with medium GNI/c and high GNI/c	Area clean cooking fuel use	Area clean cooking fuel use and its interactions with with medium GNI/c and high GNI/c	Area clean cooking fuel use	Area clean cooking fuel use and its interactions with with medium GNI/c and high GNI/c
Observations	33,999	33,999	131,359	131,359	25,061	25,061	21,486	21,486
Children age interval (in month)	[0-5]	[0-5]	[0-23]	[0-23]	[12-15]	[12-15]	[20-23]	[20-23]

# Robustness: IV regression II

Dependent outcome:	Exclusive breastfeeding (dummy)		Early initiation (dummy)		Continued breastfeeding at 1 yo (dummy)		Continued breastfeeding at 2 yo (dummy)	
	<i>Linear</i>	<i>Interacted</i>	<i>Linear</i>	<i>Interacted</i>	<i>Linear</i>	<i>Interacted</i>	<i>Linear</i>	<i>Interacted</i>
Household wealth score	-0.425*** (0.140)	-1.325** (0.517)	-0.575*** (0.079)	-0.293 (0.268)	-0.367*** (0.131)	-0.203 (0.419)	-1.165*** (0.168)	-2.381*** (0.605)
Medium GNI per capita (dummy)	0.025 (0.021)	-0.097 (0.153)	0.056*** (0.014)	0.199** (0.082)	-0.033 (0.021)	-0.040 (0.125)	-0.072*** (0.026)	-0.341** (0.168)
High GNI per capita (dummy)	0.052*** (0.019)	-0.322** (0.161)	0.078*** (0.012)	0.183** (0.085)	-0.020 (0.019)	0.054 (0.129)	-0.094*** (0.024)	-0.572*** (0.178)
Wealth*MediumGNI/c		0.471 (0.524)		-0.480* (0.283)		0.011 (0.427)		1.003* (0.601)
Wealth*HighGNI/c		1.268** (0.545)		-0.357 (0.288)		-0.248 (0.434)		1.658*** (0.628)

# Robustness: adding confoundings

Table S15: Alternative regressions including (less well-answered) additional covariates about mothers' characteristics (working status, BMI, and religious affiliation).

Dependent outcome:

	Exclusive breastfeeding (dummy)		Early initiation (dummy)		Continued breastfeeding at 1 yo		Continued breastfeeding at 2 yo	
	<i>Linear</i>	<i>Interacted</i>	<i>Linear</i>	<i>Interacted</i>	<i>Linear</i>	<i>Interacted</i>	<i>Linear</i>	<i>Interacted</i>
Household wealth score	-0.147*** (0.046)	-0.595*** (0.073)	-0.090*** (0.024)	-0.126** (0.050)	-0.100** (0.042)	-0.222*** (0.085)	-0.024 (0.049)	-0.243*** (0.089)
Medium GNI per capita (dummy)	0.173*** (0.039)	0.036 (0.048)	0.162*** (0.023)	0.163*** (0.028)	-0.057 (0.036)	-0.099** (0.040)	-0.112*** (0.043)	-0.208*** (0.046)
High GNI per capita (dummy)	-0.001 (0.035)	-0.121*** (0.042)	0.069*** (0.021)	0.056** (0.025)	-0.092*** (0.034)	-0.125*** (0.038)	-0.269*** (0.040)	-0.319*** (0.044)
Wealth*MediumGNI		0.670*** (0.127)		-0.008 (0.074)		0.201* (0.114)		0.477*** (0.123)
Wealth*HighGNI		0.535*** (0.083)		0.052 (0.054)		0.144 (0.091)		0.239** (0.098)

# Contributions & conclusions

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- This paper is the first:
  - To empirically demonstrate from a large sample of developing countries the **occurrence of a shift in the wealth-BF association across levels of economic development.**
  - To provide **econometric evidence on this topic** and to intend to **address endogeneity issues.**
- We can speculate that the household wealth-BF relationship will become positive when developing Asian countries will reach higher levels of economic development
- Important **implication for BF-friendly public policies** (a need to target the poorest households of developing countries).

# Appendix

**Table S1: List of countries and waves included in the study.**

Countries	Region <sup>a</sup>	Classification by income level <sup>b</sup>	Years of surveys
Afghanistan	South Asia	LIC	2015
Armenia	Europe & Central Asia	LMIC	2000; 2005; 2010; 2015-2016
Azerbaijan	Europe & Central Asia	UMIC	2006
Bangladesh	South Asia	LMIC	1993-1994; 1996-1997; 1999-2000; 2004; 2007; 2011; 2014
Cambodia	East Asia & Pacific	LMIC	2000; 2005; 2010; 2014
India	South Asia	LMIC	1992-1993; 1998-1999; 2005-2006; 2015-2016
Indonesia	East Asia & Pacific	UMIC	1991; 1994; 1997; 2002-2003; 2007; 2012; 2017
Kazakhstan	Europe & Central Asia	UMIC	1995; 1999
Kirghizstan	Europe & Central Asia	LMIC	1997; 2012
Maldives	South Asia	UMIC	2009; 2016-2017
Myanmar	East Asia & Pacific	LMIC	2015-2016
Nepal	South Asia	LMIC	1996; 2001; 2006; 2011; 2016
Pakistan	South Asia	LMIC	1990-1991; 2006-2007; 2012-2013; 2017-2018
Papua New Guinea	East Asia & Pacific	LMIC	2016-2018
Philippines	East Asia & Pacific	LMIC	1998; 2003; 2008; 2012; 2017
Tajikistan	Europe & Central Asia	LIC	2012; 2017
Timor-Leste	East Asia & Pacific	LMIC	2009-2010; 2016
Turkey	Europe & Central Asia	UMIC	1993; 1998; 2003; 2008; 2013
Uzbekistan	Europe & Central Asia	LMIC	1996
Viet Nam	East Asia & Pacific	LMIC	1997; 2002

Notes: (a) UNICEF definition; (b) World Bank FY21 analytical classification according to 2020 per capita GNI, calculated using the World Bank Atlas method. Lower-income countries (LIC) with per capita GNI of \$1,045 or less in 2020. Lower-middle income countries (LMIC) with per capita GNI between \$1,046 and \$4,095). Upper middle-income countries (UMIC) have a per capita GNI between \$4,096 and \$12,695. Source: Authors.

# Robustness: IV regression I

Figure 5: Marginal effects of IV regression of BF behaviors on household wealth interacted by the level of a GNI/capita (\$PPP2017) (including covariates).

