All I Really Need to Know I Learned in Kindergarten?

Evidence from the Philippines

Jeffrey R. Bloem[†] and Bruce Wydick[‡]

[†]University of Minnesota

[‡]University of San Francisco and Westmont College

#DIYCSAE

Introduction

- Early childhood education is fundamentally important
  - Mediates the success of other economic development policies and programs
  - Extensive literature suggests investments have large, positive, and lasting effects
    - See, e.g., Currie 2001; Behrman et al. 2004; Cunha et al. 2006; Heckman 2006; Chetty et al. 2011; Heckman et al. 2013
- Important caveats exist
  - Effectiveness hinges on the behavioral response of parents
    - See, e.g., Das et al. 2013; Heckman et al. 2006; Bouguen et al. 2018
  - Less agreement about specific ways to design education program and systems

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Primary Education in the Philippines

- First decade of the 21st century defined by declining educational standards
  - The net enrollment rate for primary schools
    - 96% in 2000
    - 84% in 2005
  - In 2005, the primary school completion rate was below 70%
- The cost of this reality lingers into the future
  - In 2013, one in ten—about 4 million—Filipino youth between the ages of 6 and 24 was not enrolled in school

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Responses to this Trend

- International Care Ministries (ICM)
  - Started the Jumpstart kindergarten program in 2005
    - Private kindergarten option in a small number of villages

- The Philippine government
  - Passed the Kindergarten Education Act in 2011
    - Mandated kindergarten education prior to primary school

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ICM REACHING THE POOR

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[REPUBLIC ACT NO. 10157]

AN ACT INSTITUTIONALIZING THE KINDERGARTEN EDUCATION INTO THE BASIC EDUCATION SYSTEM AND APPROPRIATING FUNDS THEREFOR

Research Questions

- Core questions:
  - What is the effect of Jumpstart on academic performance in primary school?
  - What is the effect of gov't kindergarten on academic performance in primary school?
- Secondary questions:
  - Did either program out-perform the other?
  - What potential mechanisms (e.g., academic or psychological) explain these results?

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Data

- Household survey of mothers implemented in 2017
  - Includes 2,437 kids in 943 households across 88 villages
- Key outcome: Primary school academic performance
  - As reported by mothers:
    - *Which child performed best in third grade?*
    - *Which child performed best in elementary school?*
  - **Pro**: Within-household comparison of primary school academic performance
  - **Con**: Not administrative data, relies mother's reporting
    - Control for: child age, sex, and birth order
- Alternative outcomes
  - Placed in "top section" in third grade
  - Enrollment status — among "school aged" kids (age 4 - 24)

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Identification Strategy

- Baseline OLS specification

$$y_{hi} = \beta_0 + \beta_1 Jumpstart_{hi} + \beta_2 Government_{hi} + X'_{hi}\Gamma + \omega_h + \epsilon_{hi} \quad (1)$$

  - y_{hi} represents a binary outcome variables
    - Best in third grade
    - Best in elementary
    - Placed in "top section"
    - Currently enrolled
  - $Jumpstart_{hi} = 1$ if child i attended Jumpstart
  - $Government_{hi} = 1$ if child i attended a gov't kindergarten
  - X_{hi} is a vector of child-level control variables
  - ω_h is a household/mother fixed effect
  - ϵ_{hi} is the error term
- Robustness: Use village-level fixed effects with household/mother control variables

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Instrumental Variables

- Within households enrollment in kindergarten may still be endogenous
  - Parents could make strategic choices about which of their children to enroll
- Exploit the rollout of the Jumpstart and government kindergarten programs
  - Use the age of children when Jumpstart entered their village to instrument for Jumpstart enrollment
    - Between 2008 - 2015, depending on village
  - Use the age of children when the Kindergarten Education Act passed
    - In practice some villages introduced gov't kindergarten as early as 2008
  - **Relevant**: Age determines kindergarten eligibility
  - **Excludable**: Timing of rollout is exogenous to parental choices
    - Kindergarten enrollment, to have kids, etc.

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IV Specification

- Two-stage least squares

$$Jumpstart_{hi} = \sum_{j=1}^{11} I_{ji} + \sum_{g=1}^{11} I_{gi} + X'_{hi}\Pi + \tau_h + \mu_{hi} \tag{2}$$

$$Government_{hi} = \sum_{j=1}^{11} I_{ji} + \sum_{g=1}^{11} I_{gi} + X'_{hi}\Psi + \kappa_h + \eta_{hi} \tag{3}$$

$$Y_{hi} = \delta_0 + \delta_1 \hat{Jumpstart}_{hi} + \delta_3 \hat{Government}_{hi} + X'_{hi}\Xi + \rho_h + \nu_{hi} \tag{4}$$

- y_{hi} same as equation (1)
- $Jumpstart_{hi} = 1$ if child i attended Jumpstart
- $Government_{hi} = 1$ if child i attended gov't kindergarten
- X_{hi} is a vector of child-level control variables
- τ_h, κ_h, and ρ_h are household/mother fixed effects
- μ_{hi}, η_{hi}, and ν_{hi} are the error terms

Effect on Primary Outcomes — OLS and IV Estimates

	Performed Best in Third Grade		Performed Best in Elementary		Placed in Top Third Grade Section		Currently Enrolled	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Jumpstart	0.282***	0.259***	0.178***	0.165**	0.229***	0.213***	0.112**	0.0865**
	(0.0652)	(0.0615)	(0.0576)	(0.0773)	(0.0505)	(0.0548)	(0.0483)	(0.0421)
Gov't kindergarten	0.00997	-0.0122	-0.00782	-0.0735	0.177***	0.188***	0.0479	-0.0858*
	(0.0506)	(0.0823)	(0.0544)	(0.0881)	(0.0492)	(0.0622)	(0.0519)	(0.0483)
Jumpstart = Gov't test (p-value)	0.000	0.000	0.000	0.007	0.218	0.685	0.018	0.000
Observations	2,437	2,437	2,437	2,437	2,437	2,437	2,437	2,437
No kindergarten mean	0.27		0.29		0.35		0.60	
R-squared	0.254	0.253	0.185	0.184	0.638	0.638	0.672	0.665
Weak IV test								
Jumpstart (F-stat)		78.08		78.08		78.08		54.72
Gov't kindergarten (F-stat)		25.19		25.19		25.19		24.50
Child controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household/mother fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Results are relative to a child who did not attend kindergarten. Child controls include the child's age, the sex of the child, and birth order dummy variables. In columns (1) through (6) an additional control variable indicates if a child is less than 9 years old. In columns (7) and (8) two additional control variables indicate if the child is less than 4 or over 24 years old. Weak instrument tests report the Sanderson and Windmeijer (2016) F-statistic. In columns (1) through (4) and (7) through (8) standard errors are clustered at the village level. In columns (5) and (6) standard errors are bootstrapped with 1000 replications. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Measuring academic and socio-emotional skills

- Ask a list of questions to mothers about their children.
  - "Relative to children his/her age [child i] practices math frequently."
  - "Relative to others his/her age [child i] is easily discouraged."
- Create scales measuring the following concepts:
  - Academic and scholastic indices
  - Grit, peer-affiliation, self-control, and self-identity indices
  - Behavior and spiritual indices
- An alternative organization of questions, measure the "Big 5" characteristics
  - Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism

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Mediation Analysis

- Use the approach of Preacher and Selig (2012)

$$M_{hi} = \alpha_0 + \alpha_1 Jumpstart_{hi} + \alpha_2 Government_{hi} + X'_{hi}\Theta + \psi_h + \xi_{hi} \tag{5}$$

$$Y_{hi} = \gamma_0 + \gamma_1 Jumpstart_{hi} + \gamma_2 Government_{hi} + M'_{hi}\Lambda + X'_{hi}\Delta + \varphi_h + \zeta_{hi} \tag{6}$$

  - Direct effect: γ_1 and γ_2 in equation (6)
  - Indirect effect: α_1 or α_2 $\times$ corresponding Λ
- Use Monte Carlo simulations to calculate a distribution of indirect effects
  - Easy to implement, but causal inference is tricky
    - Adding an endogenous mediating variable M_{hi} can lead to bias Acharya et al. (2016)
  - We argue our mediating variables are not endogenous
    - Implement coefficient stability tests Oster (2017)
    - The "Big 5" are "comprehensive" measures of personality (Heckman et al. (2013)

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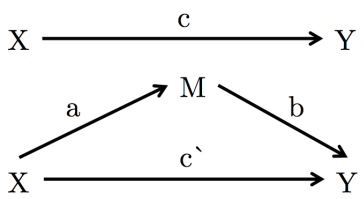
Mediation Example with a DAG

- A visual example of mediation (Preacher and Selig 2012)
  - Direct effect $= c'$
  - Indirect effect $= a \times b$



Effect on Psychological Attributes — OLS and IV Estimates

First-stage Mediation

	Grit index		Peer affiliation index		Self control index		Self identity index	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Jumpstart	0.131*	0.141**	0.113	0.0498	0.136**	0.158*	0.184**	0.207**
	(0.0699)	(0.0687)	(0.0716)	(0.0798)	(0.0679)	(0.0839)	(0.0803)	(0.0857)
Gov't kindergarten	0.0763	0.131	0.0180	0.157**	0.0732	0.190**	0.0925	0.0769
	(0.0676)	(0.0805)	(0.0645)	(0.0738)	(0.0557)	(0.0885)	(0.0918)	(0.0978)
Jumpstart = Gov't test (p-value)	0.473	0.902	0.136	0.215	0.334	0.706	0.220	0.178
Observations	2,437	2,437	2,437	2,437	2,437	2,437	2,437	2,437
R-squared	0.795	0.795	0.832	0.829	0.775	0.774	0.749	0.749
Weak IV test								
Jumpstart (F-stat)		78.08		78.08		78.08		78.08
Gov't kindergarten (F-stat)		25.19		25.19		25.19		25.19
Child controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household/mother fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Each of the indices are standardized using the technique used by Kling et al. (2007). Results are relative to a child who did not attend kindergarten. Child controls include the child's age, the sex of the child, and birth order dummy variables. Weak instrument tests report the Sanderson and Windmeijer (2016) F-statistic. Standard errors are clustered at the village level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Effect on Other Indices — OLS and IV Estimates

First-stage Mediation

	Behavior index		Spirituality index		Academic expectations index		Academic skills index	
	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV	(7) OLS	(8) IV
Jumpstart	-0.0162	0.0231	0.0358	0.104*	0.114	0.230***	0.230**	0.305***
	(0.0450)	(0.0520)	(0.0688)	(0.0620)	(0.0927)	(0.0825)	(0.0962)	(0.0812)
Gov't kindergarten	-0.0371	0.0301	0.0721	0.133*	0.106	0.235**	0.152*	0.320***
	(0.0481)	(0.0562)	(0.0488)	(0.0711)	(0.0640)	(0.111)	(0.0853)	(0.112)
Jumpstart = Gov't test (p-value)	0.667	0.910	0.514	0.680	0.921	0.969	0.414	0.905
Observations	2,437	2,437	2,437	2,437	2,437	2,437	2,437	2,437
R-squared	0.898	0.898	0.834	0.834	0.728	0.727	0.639	0.637
Weak IV test								
Jumpstart (F-stat)		78.08		78.08		78.08		78.08
Gov't kindergarten (F-stat)		25.19		25.19		25.19		25.19
Child controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household/mother fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Each of the indices are standardized using the technique used by Kling et al. (2007). Results are relative to a child who did not attend kindergarten. Child controls include the child's age, the sex of the child, and birth order dummy variables. Weak instrument tests report the Sanderson and Windmeijer (2016) F-statistic. Standard errors are clustered at the village level. *** p<0.01, ** p<0.05, * p<0.1

Effect on "Big 5" Characteristics — OLS and IV Estimates

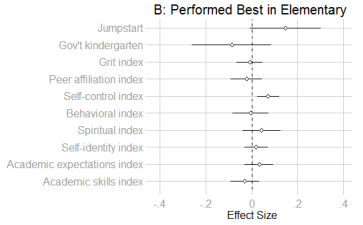
First-Stage Mediation

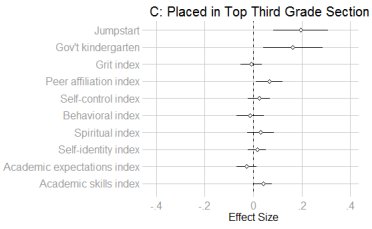
	Openness index		Conscientiousness index		Extraversion index		Agreeableness index		Reverse(Neuroticism) index	
	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV	(7) OLS	(8) IV	(9) OLS	(10) IV
Jumpstart	0.181**	0.226**	0.183**	0.192**	0.0590	0.0384	0.0850	0.104	-0.00358	0.00335
	(0.0902)	(0.0935)	(0.0794)	(0.0833)	(0.0836)	(0.0812)	(0.0643)	(0.0702)	(0.0497)	(0.0627)
Gov't kindergarten	0.104	0.127	0.0863	0.170*	0.0309	0.127	0.0231	0.172**	0.0231	0.0917
	(0.0837)	(0.123)	(0.0738)	(0.102)	(0.0648)	(0.0875)	(0.0695)	(0.0803)	(0.0510)	(0.0700)
Jumpstart = Gov't test (p-value)	0.299	0.356	0.249	0.855	0.728	0.371	0.345	0.424	0.581	0.137
Observations	2,437	2,437	2,437	2,437	2,437	2,437	2,437	2,437	2,437	2,437
R-squared	0.677	0.677	0.720	0.720	0.768	0.768	0.784	0.782	0.885	0.885
Weak IV test										
Jumpstart (F-stat)		78.08		78.08		78.08		78.08		78.08
Gov't kindergarten (F-stat)		25.19		25.19		25.19		25.19		25.19
Child controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household/mother fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

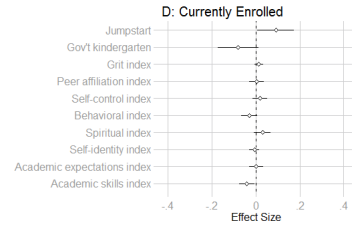
Notes: Each of the indices are standardized using the technique used by Kling et al. (2007). Results are relative to a child who did not attend kindergarten. Child controls include the child's age, the sex of the child, and birth order dummy variables. Weak instrument tests report the Sanderson and Windmeijer (2016) F-statistic. Standard errors are clustered at the village level. *** p<0.01, ** p<0.05, * p<0.1

Second-Stage Mediation

Core Indices

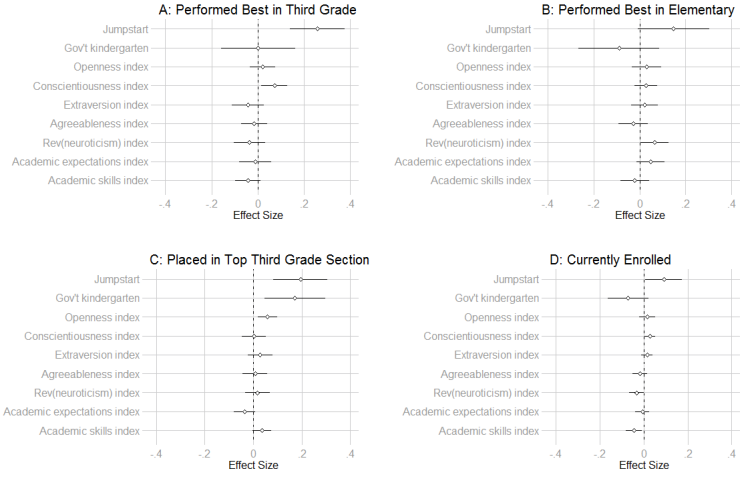






Second-Stage Mediation

"Big 5" Indices



Indirect Effects

95% Confidence Intervals

	Performed best in third grade (1)	Performed best in elementary (2)	Placed in top section (3)	Currently enrolled (4)
Panel A: Core indices				
Grit index	[-0.001; 0.022]	[-0.011; 0.008]	[-0.007; 0.007]	[-0.001; 0.007]
Peer affiliation index	[-0.015; 0.005]	[-0.017; 0.006]	[-0.003; 0.015]	[-0.005; 0.006]
Self-control index	[-0.005; 0.017]	[0.000; 0.029]	[-0.002; 0.016]	[-0.002; 0.011]
Self-identity index	[-0.019; 0.005]	[-0.007; 0.017]	[-0.004; 0.013]	[-0.007; 0.004]
Behavior index	[-0.009; 0.005]	[-0.005; 0.004]	[-0.003; 0.003]	[-0.005; 0.003]
Spirituality index	[-0.003; 0.019]	[-0.004; 0.019]	[-0.003; 0.012]	[-0.001; 0.010]
Panel B: Alternative "Big 5" indices				
Openness index	[-0.008; 0.021]	[-0.008; 0.026]	[0.002; 0.029]	[-0.005; 0.015]
Conscientiousness index	[0.001; 0.033]	[-0.004; 0.019]	[-0.010; 0.011]	[0.000; 0.014]
Extraversion index	[-0.013; 0.007]	[-0.005; 0.008]	[-0.005; 0.009]	[-0.003; 0.005]
Agreeableness index	[-0.011; 0.005]	[-0.013; 0.005]	[-0.006; 0.008]	[-0.008; 0.002]
Reverse(neuroticism) index	[-0.007; 0.006]	[-0.009; 0.010]	[-0.004; 0.004]	[-0.005; 0.005]
All "Big 5"	[-0.009; 0.043]	[-0.013; 0.036]	[-0.003; 0.037]	[-0.005; 0.023]

Notes: We calculate these confidence intervals using the Monte Carlo approach detailed by Preacher and Selig (2012). Figures showing the distributions of these indirect effects are presented in the appendix.

Summary and Concluding Thoughts

- Substantial effects of enrollment in Jumpstart kindergarten
  - Twice as likely to be the best third grade student within their household
  - 70 percent more likely to be the best elementary student within their household
  - More than 50 percent more likely to be placed in the "top section" in third grade
  - About 15 percent more likely to be currently enrolled
- Socio-emotional skill mediation
  - First-Stage
    - Jumpstart increases grit, self-control, self-identity, openness, and conscientiousness
    - Generally weaker effects for the government kindergarten
  - Second-Stage
    - Significant indirect effects of some socio-emotional skills
    - The direct effect of Jumpstart enrollment remains strong

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    - Jumpstart increases grit, self-control, self-identity, openness, and conscientiousness
    - Generally weaker effects for the government kindergarten
  - Second-Stage
    - Significant indirect effects of some socio-emotional skills
    - The direct effect of Jumpstart enrollment remains strong

Summary and Concluding Thoughts

- Substantial effects of enrollment in Jumpstart kindergarten
  - Twice as likely to be the best third grade student within their household
  - 70 percent more likely to be the best elementary student within their household
  - More than 50 percent more likely to be placed in the "top section" in third grade
  - About 15 percent more likely to be currently enrolled
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Thank you!
Any questions and/or feedback?

Summary Statistics

Panel A: Household Variables	Mean	Std. Dev.	Obs.
HH income	4,982	4,246	921
IHS HH income$^{\alpha}$	9.00	0.73	921
HH size	6.08	2.36	942
Mother's age	42.73	9.35	943
Mother attended high school	0.48	0.50	943
Mother attended college	0.10	0.30	943
Mother married	0.86	0.34	943
Mother "stay-at-home"	0.58	0.49	943
Mother graduated VHL	0.83	0.38	943

Summary Statistics

Panel B: Child Variables	Mean	Std. Dev.	Obs.
Child age			
Jumpstart	11.67	2.30	565
Gov't Kindergarten	9.54	2.68	791
No Kindergarten	17.71	4.67	1,081
Child current grade			
Jumpstart	5.86	2.02	544
Gov't Kindergarten	4.18	2.38	774
No Kindergarten	9.57	2.40	647
Sex of Child (1 = Male)			
Jumpstart	0.51	0.50	565
Gov't Kindergarten	0.54	0.50	791
No Kindergarten	0.57	0.49	1,081
Performed best in third grade			
Jumpstart	0.51	0.50	565
Gov't Kindergarten	0.27	0.44	791
No Kindergarten	0.27	0.45	1,081
Performed best in elementary school			
Jumpstart	0.49	0.50	565
Gov't Kindergarten	0.30	0.46	791
No Kindergarten	0.29	0.46	1,081
Placed in top third grade section[b]			
Jumpstart	0.44	0.50	565
Gov't Kindergarten	0.38	0.49	791
No Kindergarten	0.35	0.48	1,081
Child currently enrolled in school			
Jumpstart	0.96	0.19	565
Gov't Kindergarten	0.98	0.15	791
No Kindergarten	0.60	0.49	1,081