

Green Returns to Education: Does Schooling Contribute to Pro-Environmental Behaviours? Evidence from Thailand

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Plan

- Motivations
- Conceptual ideas
- Data
- Empirical strategies: Instrumental variables strategy
- Results
- Discussion and conclusion

1. Motivations

- Look at general broad-based formal education
- Instead of focusing on education or learning specific to ecological economics or the environment in general
- **Why is it interesting?**
- Education is viewed as one of the most important policy areas in most countries. Hence, a lot of investment.
- Education has been found to be related to a number of development outcomes. So, how about pro-environmental behaviours?

2. Conceptual ideas

- **From education to pro-environmental behaviours:**
- Barriers to the adoption of pro-environmental behaviours
 - Climate literacy requires skills and ability to acquire, accommodate and interpret complex issues
 - Lack of awareness and understanding of the problems
 - Doubt about efficacy of one's own actions
 - Lack of knowledge on how to change behaviours to mitigate climate change
- Formal education can lower these barriers
- Formal education can promote cooperative behaviours which may indirectly encourage pro-environmental behaviours

- Correlation evidence from developed countries (McCright and Dunlap 2011; Running 2013; Whitmarsh 2011; Ortega-Egea et al. 2014)
- Specific types of education:
 - e.g. extension education for farmers in Cameroon is negatively correlated with the likelihood of slash and burn practice (Schuck et al. 2002)
- However, with the exception of Meyer (2015), none of the existing studies proves causality

4. Data

- Based on two nationally representative surveys
 - 1) Opinions about the Environmental and Global Warming, 2010
 - 2) Opinions about Natural Disasters and the Environment, 2013
- Representative sample of adult aged 15+ from 3,900 households

- Three levels of pro-environmental attitudes and behaviours:

(1) Concern about global warming

- “How much do you worry about the problem of global warming?”
- (i) a great deal
- (ii) a fair amount
- (iii) a little/not at all

(2) Private actions taken

(2.1) Knowledge-based pro-environmental actions

- Involve more technical and behavioural change
- Require better environmentally-related technical knowledge
- Need effort to give up comfort or convenience
- Acquire new appliances

(2.2) Cost-saving pro-environmental actions

- Not necessarily motivated by environmental concern/knowledge
- Possibly motivated by financial/pecuniary incentive

Table 1: Summary Statistics				
Panel A: Environmental attitudes and behaviours	Scale	% of respondents		
		A great deal	A fair amount	Little/not at all
Concern about global warming (2010)	ordinal	52.4	40.0	7.6
Pro-environmental behaviours (2010)		Regularly	Sometimes	Not at all
<u>Technical/ behavioural change</u>				
Use cloth bag instead of plastic bag	ordinal	13.1	55.4	31.5
Reduce the use of Styrofoam container	ordinal	20.5	57.9	21.6
Use energy-efficient appliances	ordinal	54.5	36.3	9.2
Use energy saving light bulbs	ordinal	38.7	38.5	22.8
<u>Saving behaviour</u>				
Unplug electrical devices when not in use	ordinal	70.1	28.2	1.8
Turn off unused lights	ordinal	81.1	18.0	0.9
Turn off the tap while brushing teeth/taking shower	ordinal	65.4	27.5	7.1
Fill in a container when washing rather than running tap water	ordinal	57.1	33.7	9.2
		Willing	Not willing	
Willingness to pay for environmental tax (2013)	binary	80.3	20.0	

- **(3) Willingness to support further public pro-environmental actions**
- Whether the respondents agree if there is going to be an environmental tax in the future
- Polluter-pay tax

Panel B: Individual characteristics	Scale	2010	2013	
				% of respondents
Female	binary	23.1	52.4	
Age groups				
aged 15-19 years		7.6	5.4	
aged 20-29 years		15.8	14.5	
aged 30-39 years		23.1	20.6	
aged 40-49 years		22.3	24.5	
aged 50-59 years		19.7	21.1	
aged 60 years and over		11.6	13.9	
Education (years)	continuous	9.41	9.37	
		[3.98]	[4.1]	
Average monthly wage by occupation, sex, and region (Baht)	continuous	10,062.32	12,097.81	
		[9796.29]	[9187.79]	
Note: For both 2010 and 2013 data, the number of observations (respondents) are 3,900 persons.				
Standard deviations are in parentheses. Average monthly wage by occupation, sex, and region is constructed from average wage by occupation, sex, and region provided by the quarterly Labor Force Surveys in 2010 and 2013, and the Socio-economic Surveys in 2011 and 2013.				

5. Empirical strategies

5.1 Baseline empirical strategy

$$y_i^* = \beta_0 + \beta_1 \text{education}_i + \beta_2' \mathbf{X}_i + \varepsilon_i,$$

$$y_i = 1 \quad \text{if} \quad y_i^* \leq \gamma_1$$

$$y_i = 2 \quad \text{if} \quad \gamma_1 < y_i^* \leq \gamma_2$$

$$y_i = 3 \quad \text{if} \quad y_i^* > \gamma_2,$$

5.2 Instrumental variables estimation

- Education is potentially endogenous to pro-environmental behaviours
- Omitted variables:
 - Ability, values, risk perception, social desirability and social responsibility
 - E.g. individuals who exhibit temporal discounting (prefer a smaller, more immediate reward than a later, larger one) may be less likely to invest in education and pro-environmental behaviours since the rewards of both are not always tangible and immediate.
- → estimated effect of education becomes inconsistent and biased upwards

- To mitigate endogeneity problem → **instrumental variables strategy**

Exogenous supply of schools: number of state primary school teachers per 1000 children

- For each individual, the variable is the average normalised number of teachers in the region of his or her residence over the years that he or she was in primary school.

Table 2 :Normalised number of teachers by cohort and region, for 2010 and 2013 samples

Cohort	Bangkok	Centre	Northeast	North	South
2010					
15-19	19.160	37.281	34.707	38.835	34.167
20-29	16.692	35.183	32.202	36.321	33.598
30-39	14.739	31.404	27.545	30.332	31.878
40-49	11.298	25.039	19.278	20.935	24.595
50-59	7.070	23.843	15.798	16.918	19.398
60+	7.070	23.843	15.798	16.918	19.398
2013					
15-19	21.314	36.982	36.156	38.717	33.033
20-29	17.451	36.685	33.135	38.267	33.873
30-39	15.124	32.635	29.228	32.946	32.299
40-49	12.883	25.747	21.549	23.438	26.788
50-59	8.380	22.612	16.162	17.174	20.086
60+	8.380	22.612	16.162	17.174	20.086

Source :Annual Statistics Report, Ministry of Education .

Notes :The normalised number of teachers for each region is only available from 1962, we cannot compute the variable for the age group 60+, and we thus make an assumption that the variable takes the same values as those of age group 50-59 for all regions .

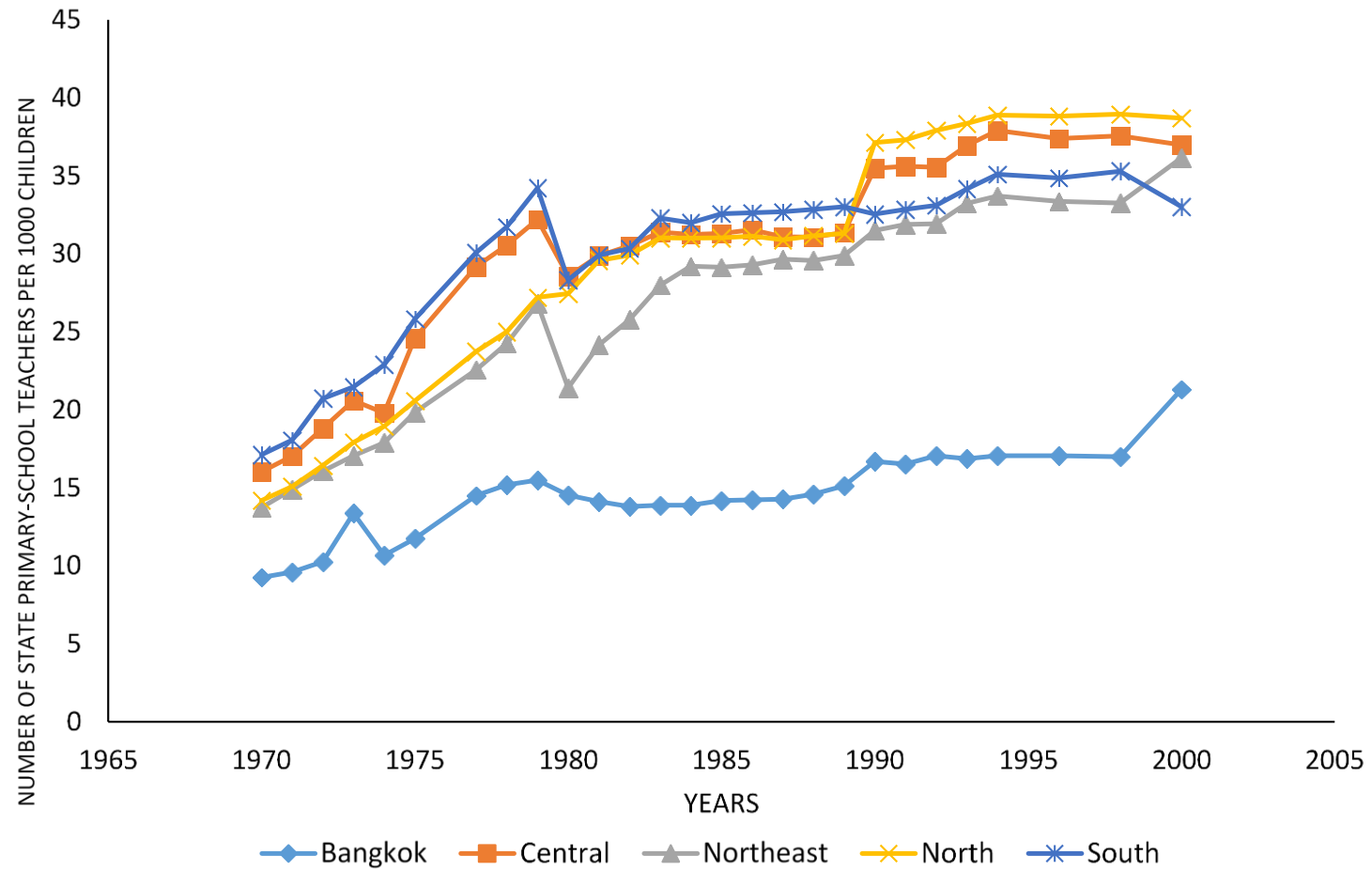
- **First stage: Instrument relevance**

$$education_{icr} = \gamma_0 + \gamma_1 teacher_{cr} + \gamma_2 cohort_c + \gamma_3 region_r + \gamma_4' X_{icr} + u_{icr},$$

Table 3: The impact of the supply of schooling on years of education, controlling for cohort				
	2010 Sample		2013 Sample	
Years of schooling	[1]	[2]	[1]	[2]
Normalised teachers	0.104 [0.008]***	0.067 [0.034]**	0.092 [0.008]***	0.094 [0.04]**
Female		-0.333 [0.109]***		-0.099 [0.112]
Had environmental problem in community		0.044 [0.119]		-0.182 [0.12]
Felt that climate has changed compared to last year		0.032 [0.279]		
Heard about climate change		2.337 [0.261]***		
Had been damaged by natural disasters				0.216 [0.188]
Log(wage)		-0.014 [0.013]		0.041 [0.014]***
Cohort dummies	NO	YES	NO	YES
Regional dummies	NO	YES	NO	YES
Observations	3900	3900	3900	3900
F-Statistics (15, 3884, 2010 sample) (14,3885, 2013 sample)		102.72		110.31
F-Statistics (1, 3898, 2010 sample) (1, 3898, 2013 sample)	188.45		120.5	
on the excluded instrument				
Adjusted R-squared	0.046	0.281	0.03	0.282

Note: Standard errors are in parentheses. ***, ** Significant at the 1%, and 5% level.

- **Instrument exogeneity**
- Control for both cohort (time) effect and regional variation
- Our IV is less likely to be determined by the demand for education, but the supply of it.
- IV is at the aggregate level and each individual (and his or her demand) is likely to be too inconsequential to be able to influence the aggregate outcome
- Lagged IV
- The number of teachers in state schools reflects the centrally-planned supply of schooling by the state.
- The 1977/78 reform established state primary schools in every village. Hence, we should see a sharp increase in the number of teachers during the period as well.



Source: Own depiction based on the data from the *Annual Statistical Reports of the Ministry of Education*.

Figure 1: Number of teachers in state primary schools per 1000 children, by region.

6. Empirical results

6.1 Concern about global warming

Table 3: Concerns about Global Warming				
	Ordered Probit	Ordered Probit	IV	IV
	[1]	[2]	[3]	[4]
Years of schooling	0.034 [0.005]***	0.033 [0.006]***	0.039 [0.012]***	0.021 [0.179]
Female	0.088 [0.038]**	0.086 [0.038]**	0.089 [0.038]**	0.082 [0.071]
Had environmental problem in community	0.354 [0.041]***	0.355 [0.041]***	0.354 [0.041]***	0.355 [0.041]***
Felt that climate has changed compared to last year	0.558 [0.093]***	0.56 [0.094]***	0.557 [0.094]***	0.56 [0.094]***
Heard about climate change	0.204 [0.089]**	0.204 [0.089]**	0.187 [0.096]**	0.232 [0.423]
Log(wage)	0.003 [0.003]	0.003 [0.004]	0.003 [0.003]	0.003 [0.005]
Cohort dummies	NO	YES	NO	YES
Regional dummies	YES	YES	YES	YES
Little versus fair amount/great deal	-0.204 [0.135]	-0.239 [0.14]	-0.176 [0.15]	-0.292 [0.783]
Little/fair amount versus great deal	1.22 [0.136]***	1.185 [0.141]***	1.248 [0.15]***	1.131 [0.818]
Observations	3900	3900	3900	3900
Log likelihood	-3418	-3416	-13772	-13688
LR chi2(10), LR chi2(15), LR chi2(20), LR chi2(27)	198.37 [p=0]	201.19 [p=0]	1284.86 [p=0]	1452.4 [p=0]
Note: Standard errors are in parentheses. **, *** Significant at the 5%, and 1% levels, respectively.				
Panel B: Average Marginal Effects (IV with cohort dummies)				
		A great deal [1]	A fair amount [2]	Little/ Not at all [3]
Years of schooling		0.008 [0.069]	-0.005 [0.044]	-0.003 [0.025]
Note: Standard errors are in parentheses.				

6.2 Private pro-environmental actions

(i) Knowledge-based pro-environmental actions

Table 4: Pro-environmental actions involving technical changes				
Panel B: IV	Bags	Bulbs	Appliances	Styrofoam
	[1]	[2]	[3]	[4]
Years of schooling	0.221 [0.092]**	0.056 [0.013]***	0.255 [0.062]***	0.138 [0.141]
Female	0.318 [0.061]***	-0.002 [0.036]	0.142 [0.035]***	0.126 [0.046]***
Had environmental problem in community	0.144 [0.066]**	0.072 [0.04]*	0.047 [0.046]	0.158 [0.055]***
Felt that climate has changed compared to last year	0.17 [0.11]	0.147 [0.093]	0.159 [0.114]	0.082 [0.095]
Heard about climate change	-0.345 [0.287]	0.206 [0.095]**	-0.144 [0.339]	-0.287 [0.349]
Log(wage)	0.002 [0.004]	0.006 [0.004]	0.004 [0.004]	0.006 [0.004]
Cohort dummies	YES	YES	YES	YES
Regional dummies	YES	YES	YES	YES
Little versus fair amount/great deal	1.202 [0.353]***	-0.087 [0.157]	0.928 [0.367]***	0.199 [0.706]
Little/fair amount versus great deal	2.584 [0.182]***	0.99 [0.157]***	1.811 [0.132]***	1.748 [0.41]***
Observations	3900	3900	3900	3900
Log likelihood	-13819	-14322	-13708	-13982
LR chi2(30)	1495.18 [p=0]	1430.91 [p=0]	1406.92 [p=0]	1399.41 [p=0]
Average marginal effects: Regularly				
Years of schooling	0.05 [0.025]**	0.021 [0.004]***	0.077 [0.012]***	0.037 [0.038]
Average marginal effects: Sometimes				
Years of schooling	0.018 [0.002]***	-0.004 [0.001]***	-0.014 [0.015]	0.002 [0.004]
Average marginal effects: Never				
Years of schooling	-0.067 [0.024]***	-0.016 [0.004]***	-0.063 [0.027]**	-0.039 [0.042]

Note: Standard errors are in parentheses. *, **, *** Significant at the 10%, 5%, and 1% levels, respectively.

(ii) Cost-saving pro-environmental actions

Table 5: Pro-environmental actions involving saving behaviours				
Panel B: IV	Unplug	Lightoff	Wateroff	Water saving
	[1]	[2]	[3]	[4]
Years of schooling	0.081	0.175	0.111	0.204
	[0.181]	[0.135]	[0.158]	[0.083]***
Female	0.138	0.13	0.143	0.12
	[0.059]**	[0.045]***	[0.048]***	[0.036]***
Had environmental problem in community	0.088	0.063	0.044	0.054
	[0.049]*	[0.056]	[0.046]	[0.047]
Felt that climate has changed compared to last year	0.116	-0.028	0.215	0.068
	[0.105]	[0.109]	[0.109]**	[0.096]
Heard about climate change	0.235	-0.016	-0.102	-0.359
	[0.495]	[0.473]	[0.415]	[0.257]
Log(wage)	0.013	0.008	0.002	0.006
	[0.005]***	[0.005]*	[0.005]	[0.004]
Cohort dummies	YES	YES	YES	YES
Regional dummies	YES	YES	YES	YES
Little versus fair amount/great deal	-1.129	-0.877	-0.589	0.147
	[1.013]	[1.209]	[0.924]	[0.668]
Little/fair amount versus great deal	0.437	0.396	0.434	0.957
	[0.791]	[0.74]	[0.714]	[0.359]***
Observations	3900	3900	3900	3900
Log likelihood	-12878	-12260	-13430	-13770
LR chi2(30)	1374.11	1379.47	1381.85	1353.65
	[p=0]	[p=0]	[p=0]	[p=0]
Average marginal effects: Regularly				
Years of schooling	0.027	0.05	0.039	0.067
	[0.059]	[0.042]	[0.051]	[0.02]***
Average marginal effects: Sometimes				
Years of schooling	-0.023	-0.036	-0.021	-0.016
	[0.046]	[0.012]***	[0.017]	[0.012]
Average marginal effects: Never				
Years of schooling	-0.004	-0.013	-0.018	-0.051
	[0.014]	[0.03]	[0.034]	[0.032]*

Note: Standard errors are in parentheses. *, **, *** Significant at the 10%, 5%, and 1% levels, respectively.

6.3 Willingness to pay for future environmental tax

Table 6: Willingness to pay for environmental tax		
	Willingness to pay for tax	
	Probit	IV
	[1]	[2]
Normalised teachers		
Years of schooling	0.009 [0.007]	-0.132 [0.131]
Female	-0.065 [0.046]	-0.069 [0.044]
Had environmental problem in community	-0.016 [0.049]	-0.041 [0.05]
Had been damaged by natural/environmental disasters	-0.162 [0.081]**	-0.111 [0.102]
Log(wage)	-0.003 [0.007]	0.003 [0.008]
Cohort dummies	YES	YES
Regional dummies	YES	YES
Average Marginal Effect: Agree		
Years of schooling		-0.132 [0.131]
Observations	3900	3900
Log likelihood	-1924	-12308
LR chi2(14), LR chi2(28)	52.04 [p=0]	1357.81 [p=0]
F-Statistics (14, 3885)		
F-Statistics (1, 3898) on the excluded instrument		
Adjusted R-squared		

Note: Standard errors are in parentheses. **, *** Significant at the 5% and 1% levels

- **IV Results:**
- Positive impacts of education on
- Knowledge-based pro-environmental actions
- E.g. a one year increase in education raises the probability of regular use of cloth bags by 5%,
- of energy-efficient light bulbs by 2.1%,
- and of energy-efficient appliances by 7.7%
- **But**
- Has no statistically significant impact on concern about the environment and the willingness to pay for environmental tax.

- Larger coefficients under the IV specifications (downward bias of the baseline result).
- Why?
- The compliers of the primary state school supply are likely to be individuals from the lower end of the ability and wealth distributions and constitute a small group that tends to be different from the general population.

7. Conclusion

- **Methodology:**
- Address the endogeneity of education
- Establish a causal relationship between schooling and pro-environmental behaviours
- **Evidence:**
- New evidence from developing country that increasingly contributes more to environmental problems
- New evidence to the literature that is dominated by evidence from developed countries
- **Policy:**
- Government extensive involvement in education can reach beyond classical economic outcomes and help correct for environmentally-related negative externalities