Climate shocks and economic growth: evidence from the last half century

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The background question

- What are the effects of climate changes on overall economic activity?

The methodology

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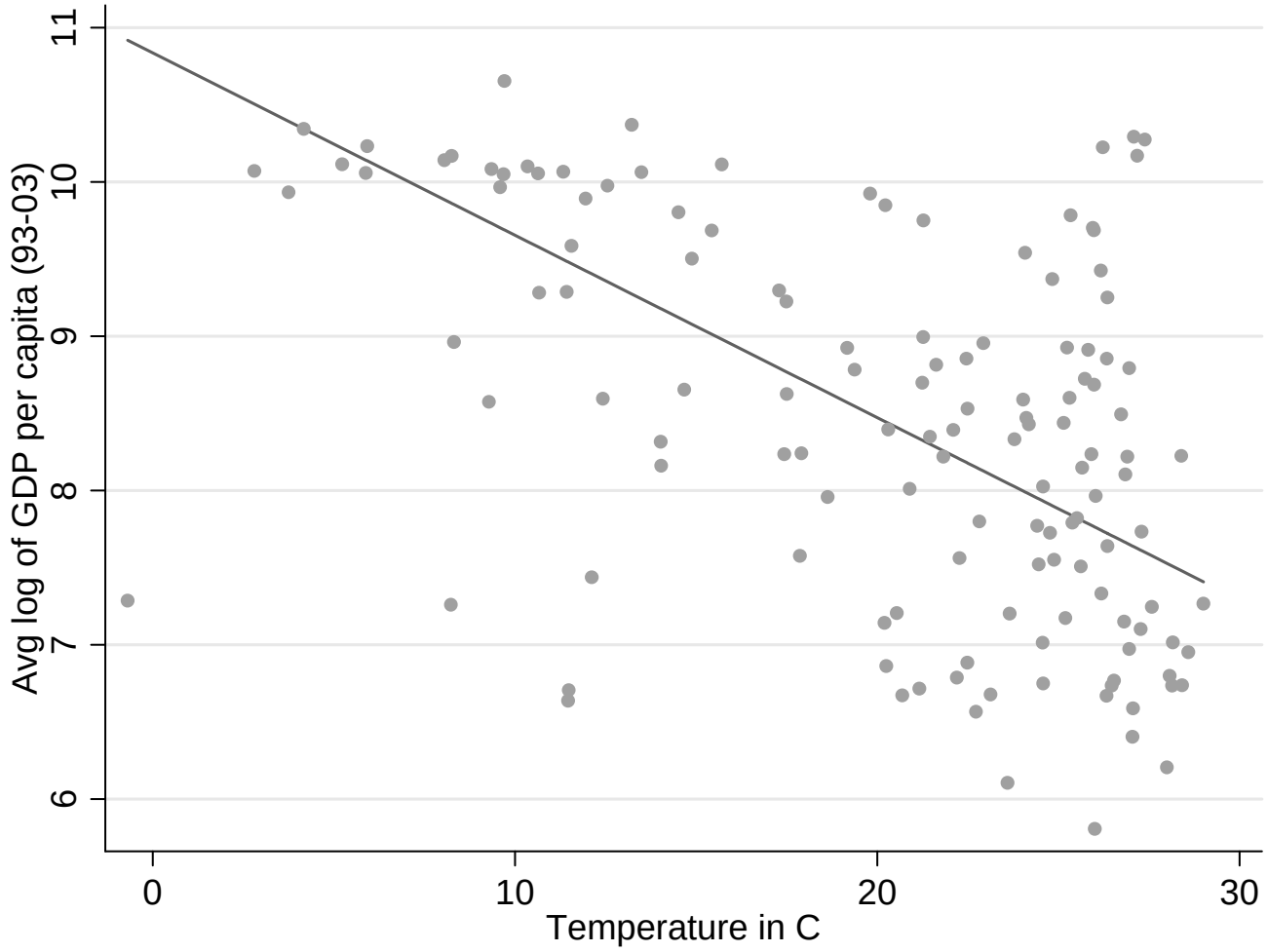
- Merge it with standard macro variables (PWT)
- Document and quantify statistical relations between climate and economic activity
- Assess what can we learn

My comments

- A review of the findings
- An identification issue
- A suggestion

The backgroud fact



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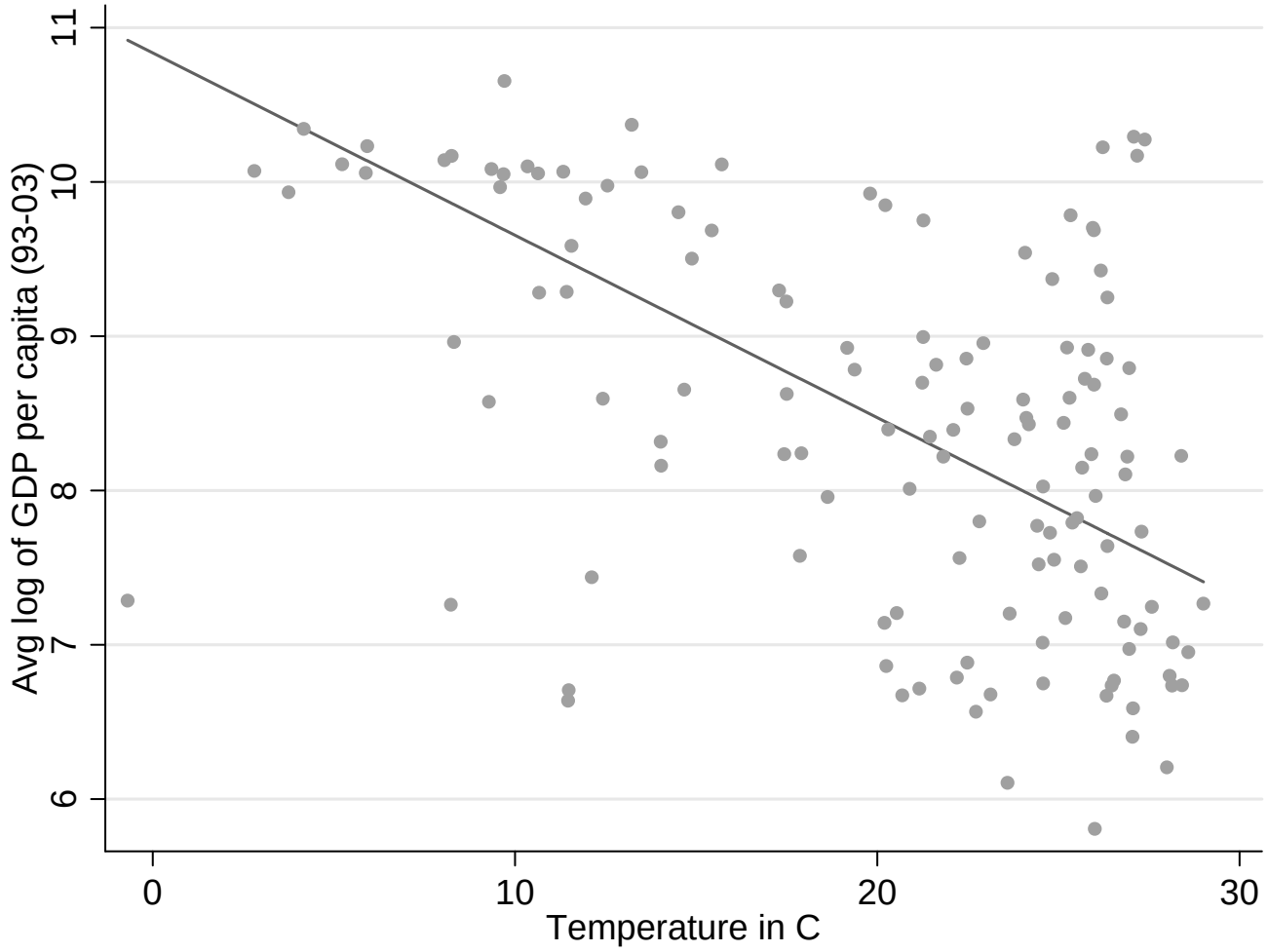

Hot countries are pooreer: an extra 1C is associated with 10% lower GDP

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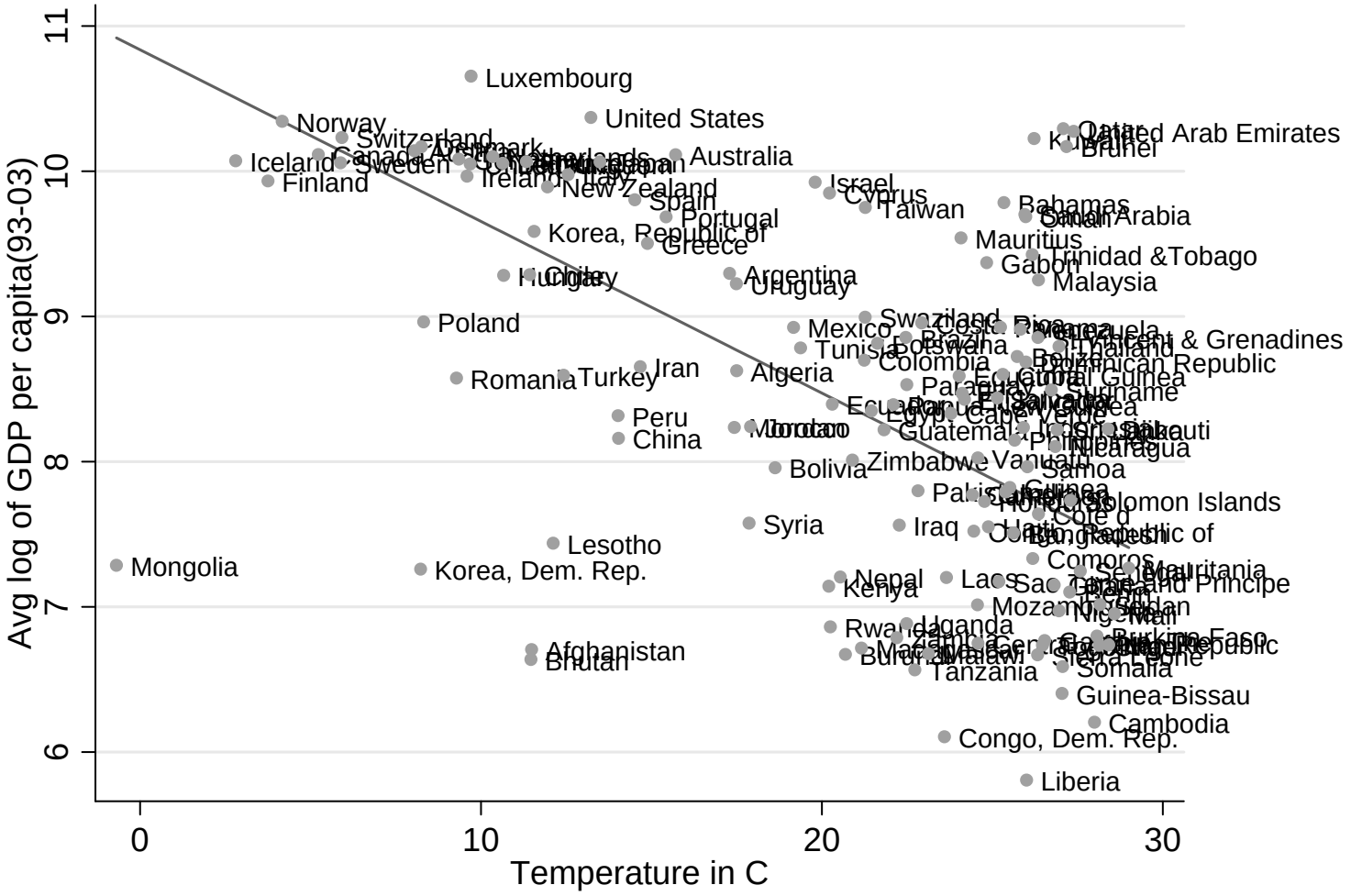

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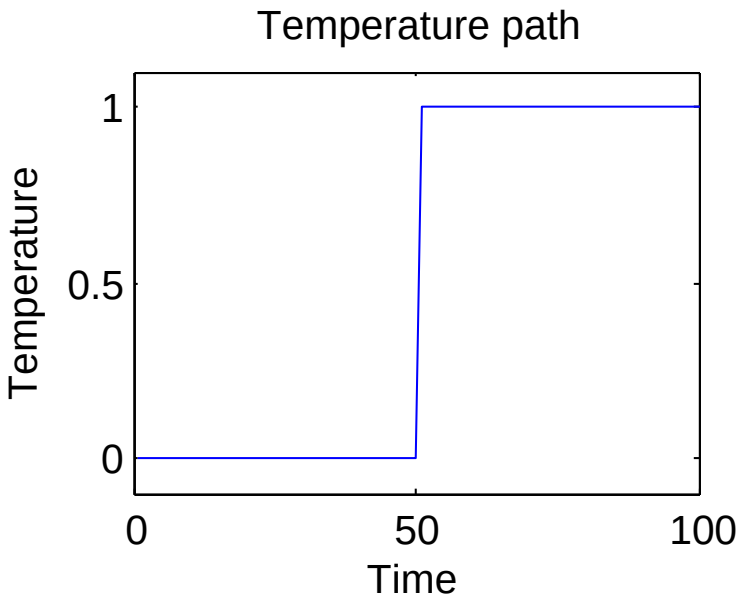
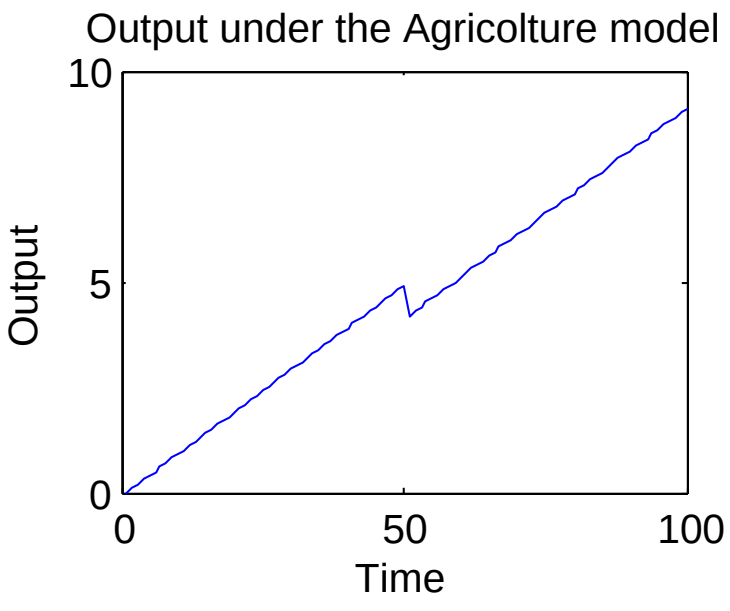
- One explanation for cross sectional temperature/growth relation is that hot countries (maybe because they are hot) received poor institutions and these caused slow growth
- Global warming debate searches effects of climate change (keeping institutions constant), so cross sectional evidence not informative
- The paper focuses on temperature changes over the last 50 years, with the idea that institutions over the period are constant (and not correlated with temperature changes) and thus isolate effects of temperature changes

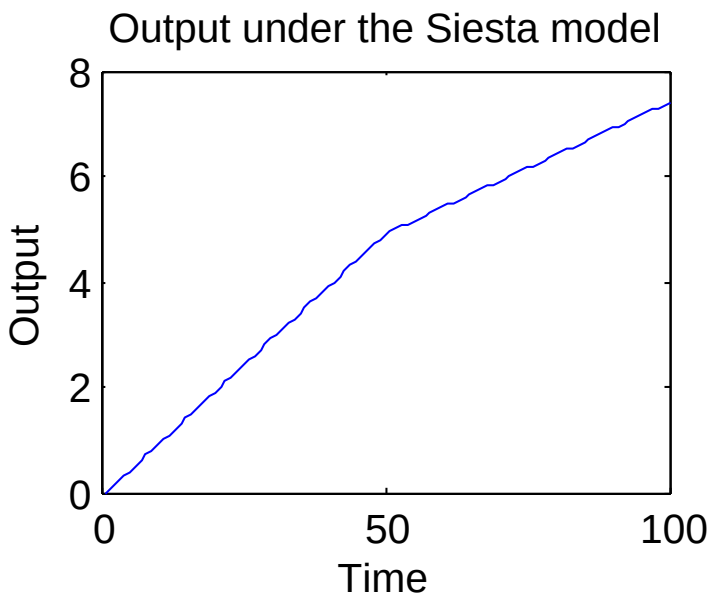
Two models

- The "agricolture" model
- Temperature changes affect GDP growth
- The "siesta" model
- Temperature levels affect GDP growth

The effect of climate change under the two models







How are the models identified?

Run the following regression

$$g_{it} = \beta_0 T_{it} + \beta_1 T_{it-1}$$

- Under the agricolture model $\beta_0 + \beta_1 = 0, \beta_0 = \beta < 0$

$$g_{it} = \beta \left(T_{it} + T_{it-1} \right)$$

- Under the siesta model $\beta_0 + \beta_1 > 0$
- In general $\beta_0 + \beta_1$ identifies the siesta effect, β_1 the agricolture effect

An interesting test

	Dependent variable is Agr. output growth	
	β_0	β_1
Rich countries	-0.5%	0.4%
	(0.4%)	(0.4%)
Poor countries	-4.2%	3.3%
	(1.1%)	(1.2%)

Note: include country and time effects, s.e. are clustered

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- The agricultural model works well for agriculture in poor countries!
- In poor countries weather changes have large effect on crops (one extra degree lowers output by 4%)

Key findings

When model is estimated using overall GDP growth:

- Precipitation has little overall effect
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- For poor countries strong evidence of siesta effect, not much agricolture effect

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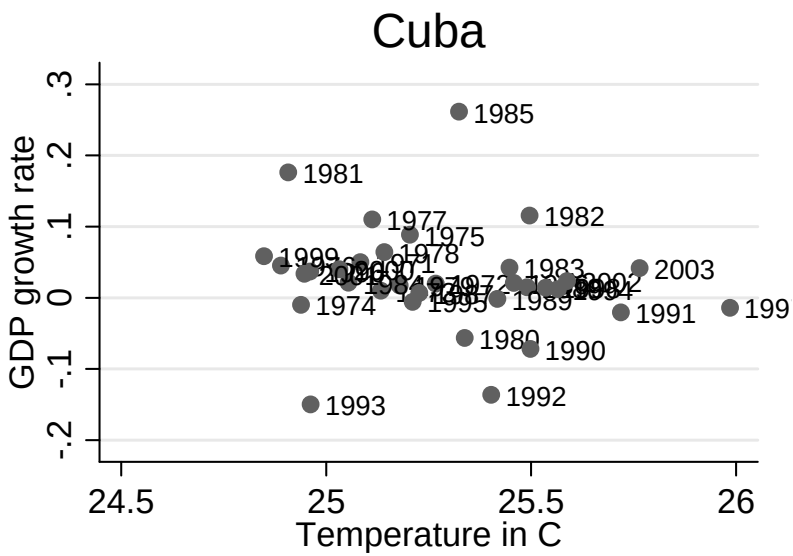
When model is estimated using overall GDP growth:

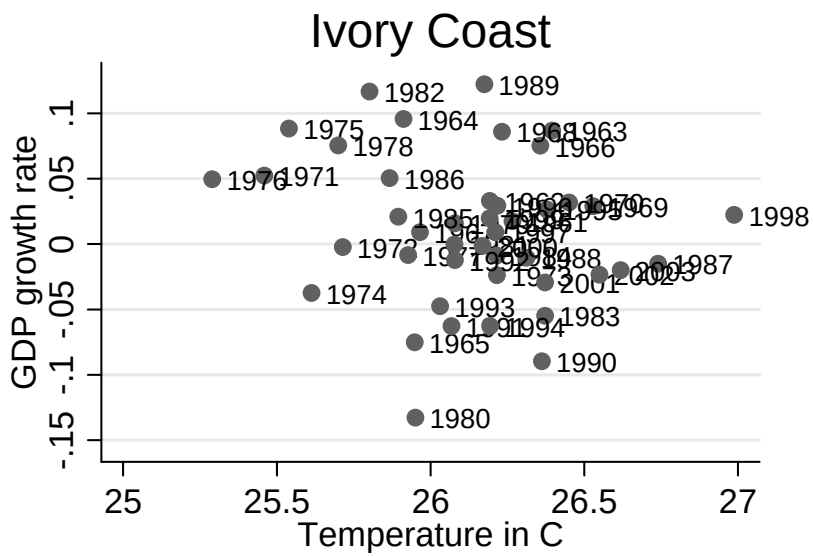
- Precipitation has little overall effect
- For rich countries temperature has very little effect
- For poor countries strong evidence of siesta effect, not much agricolture effect
- A $1C$ permament increase in temperature levels is associated with $\simeq 1\%$ decline in overall growth
- Effects are quantitatively very large!

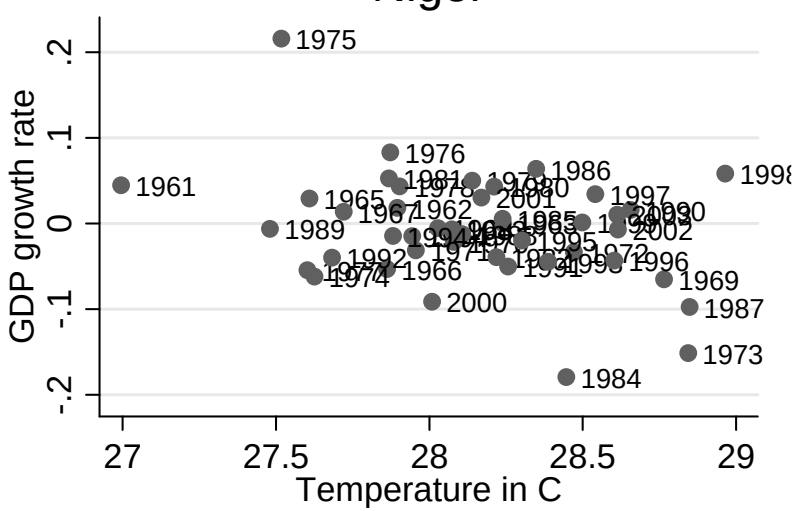
The identification

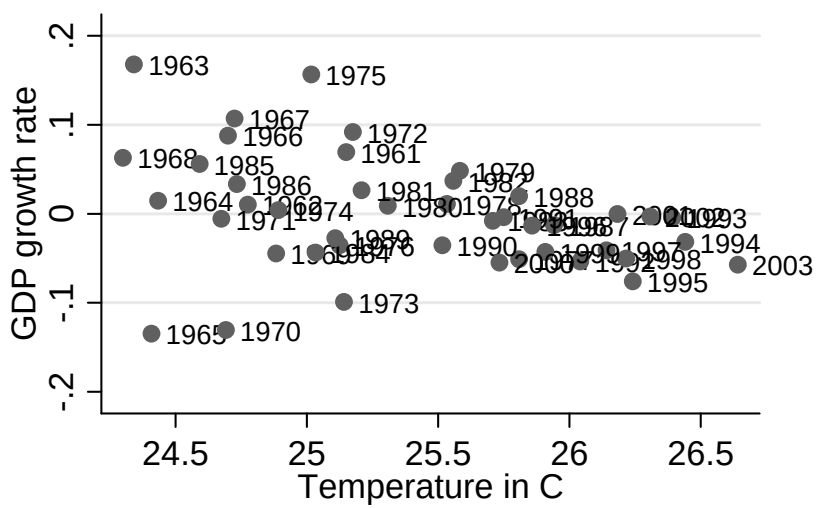
- Regression include country fixed effects so the relation is identified purely through time series i.e. variation in temperature within country are associated with variation in growth in the same country
- Some countries with large and significant "Siesta Effect" are: Cuba (13%) Niger (7%) Comoros (3.8%), Ivory Coast (2%)
- Driven by episodes of very large or small growth (not common in rich countries)

Temperature and growth in 4 countries









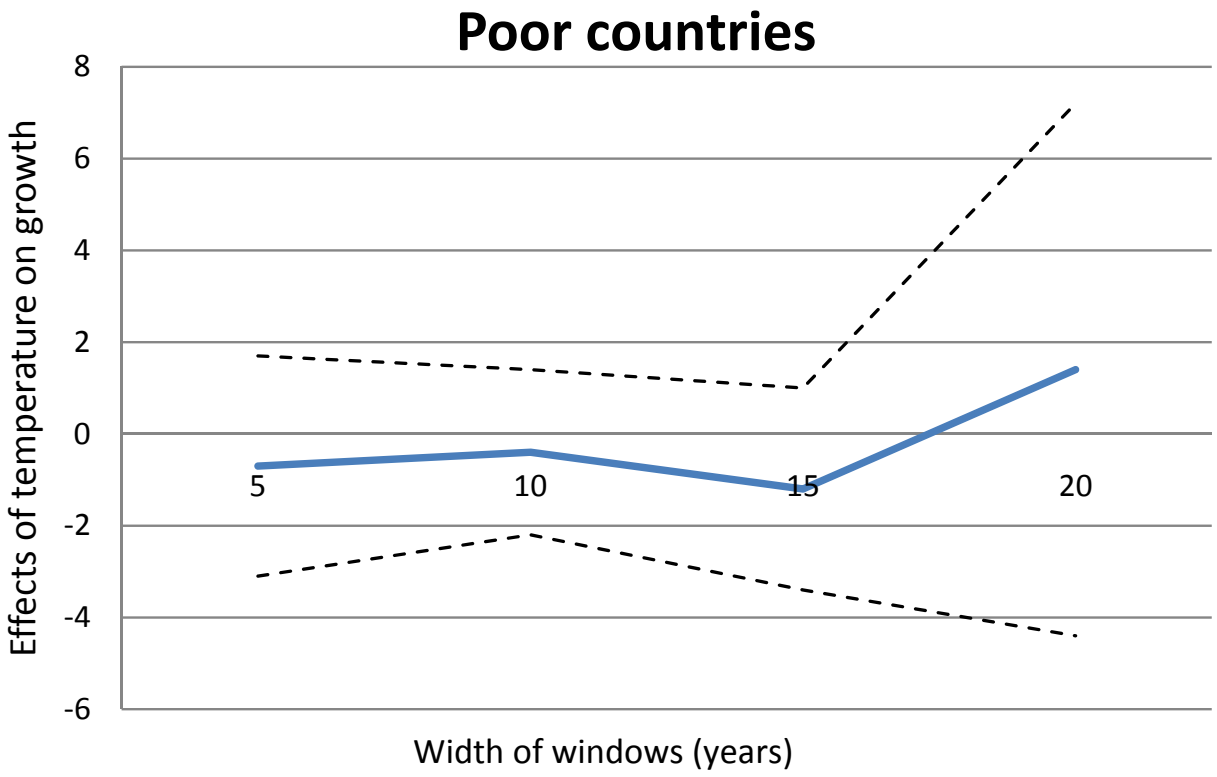
A longer run approach

- A different way of measuring the effect (more robust to large temporary growth episodes) is to focus on longer periods of time and see if long run changes in temperature (within a country) are associated changes in growth
- DJO do that by splitting the sample in 2 and find strong effects of changes in temperature on changes in growth but results depend on the particular sample split

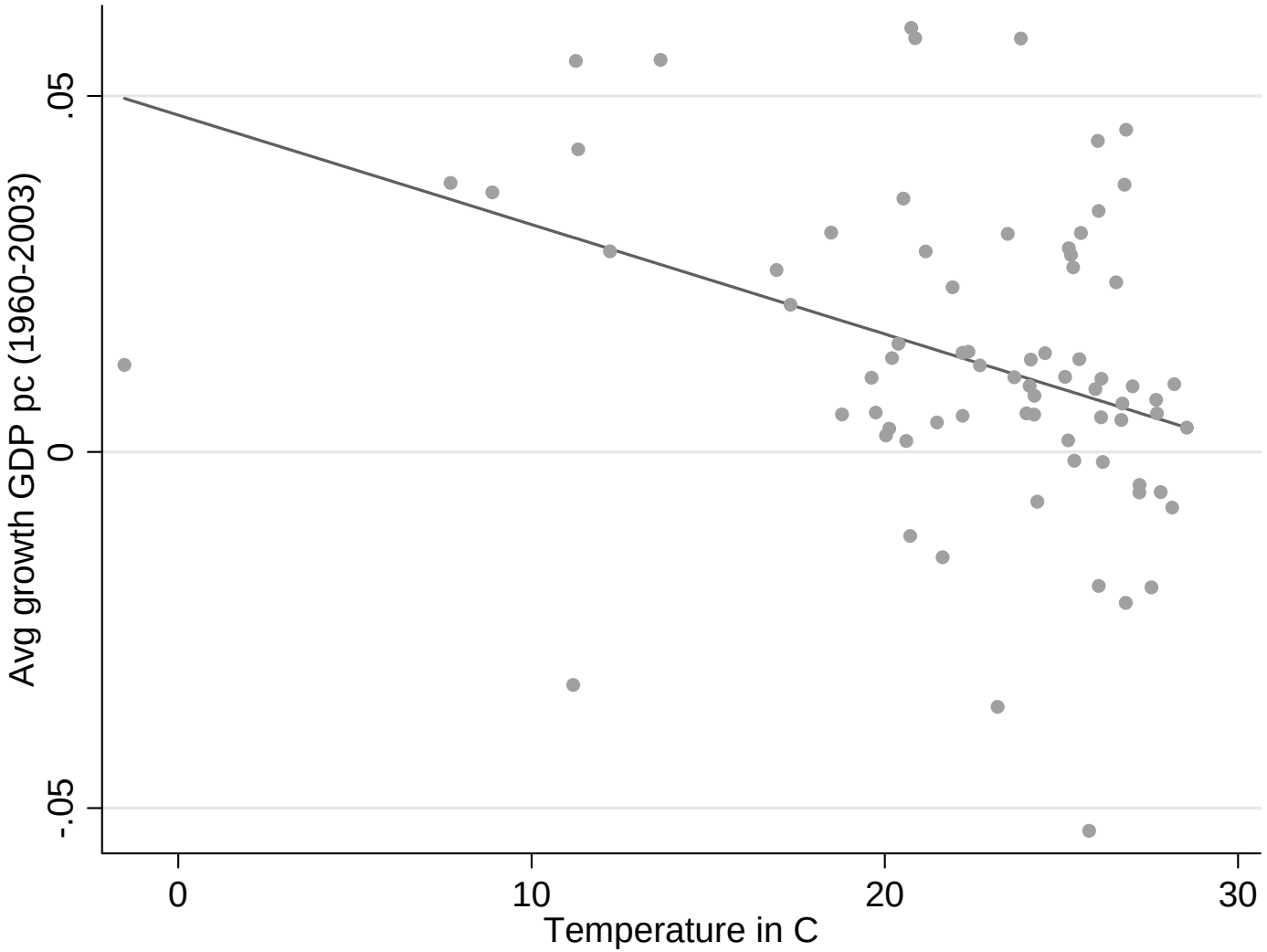
A more robust exercise

- Consider all possible non overlapping windows (i.e. 1960-1969 v/s 1970-1979, 1961-1970 v/s 1971-1980 etc.) and regress changes in growth on changes in temperature
- Do this for windows of different lengths (5,10,15,20 years)

Effects of changes in levels of temperature on growth



Long run growth (40yrs) and temperature, poor countries



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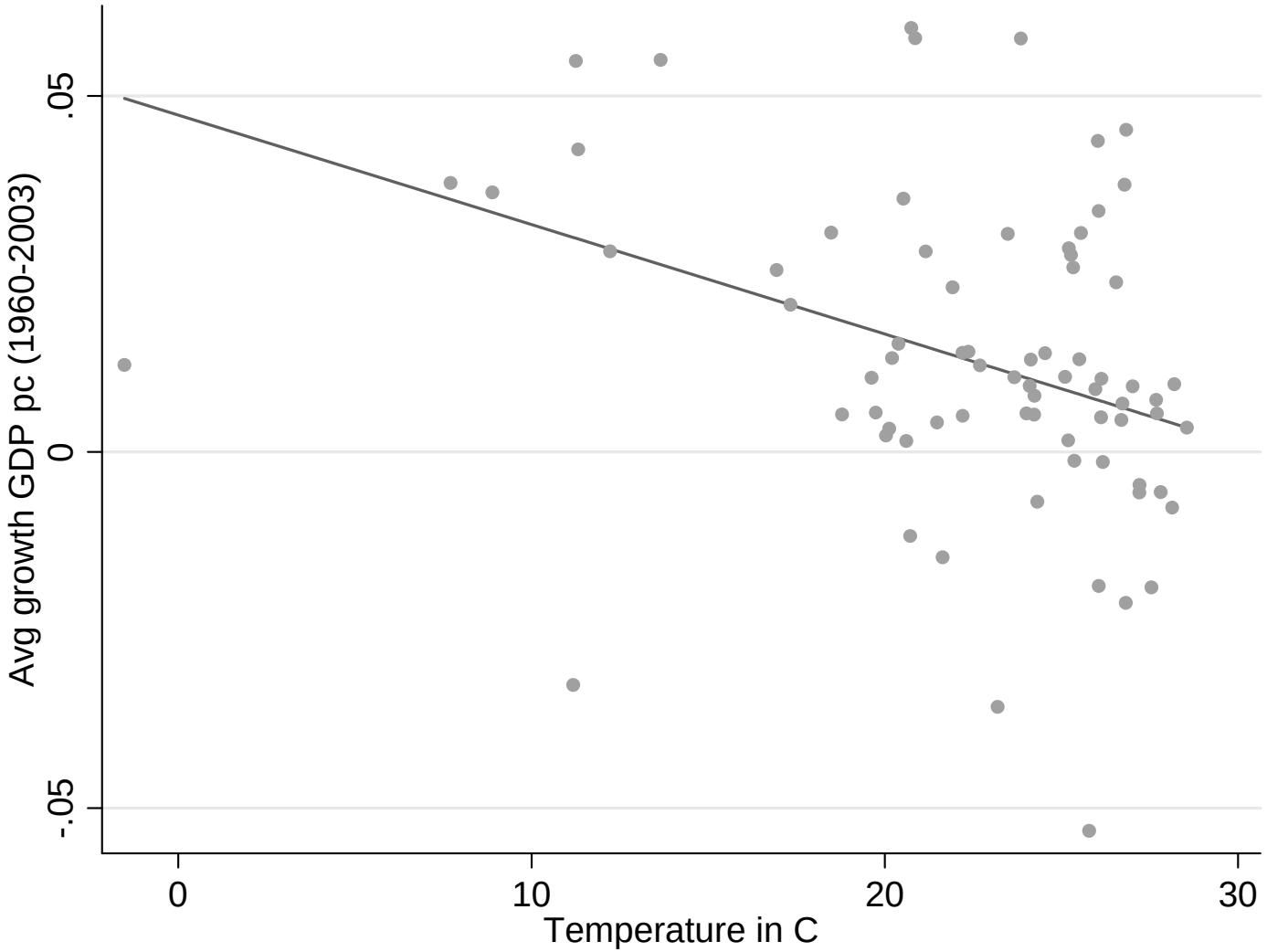

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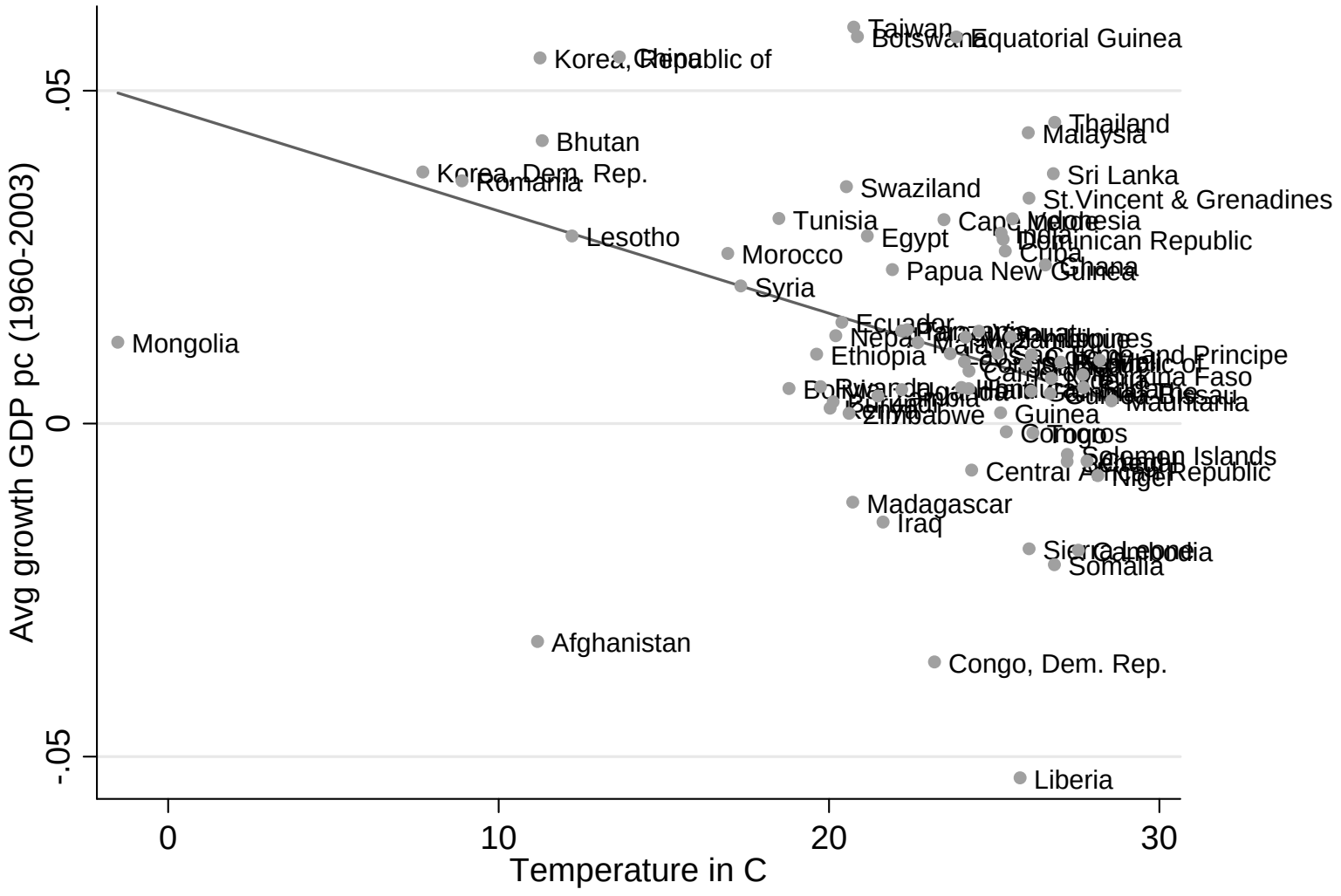

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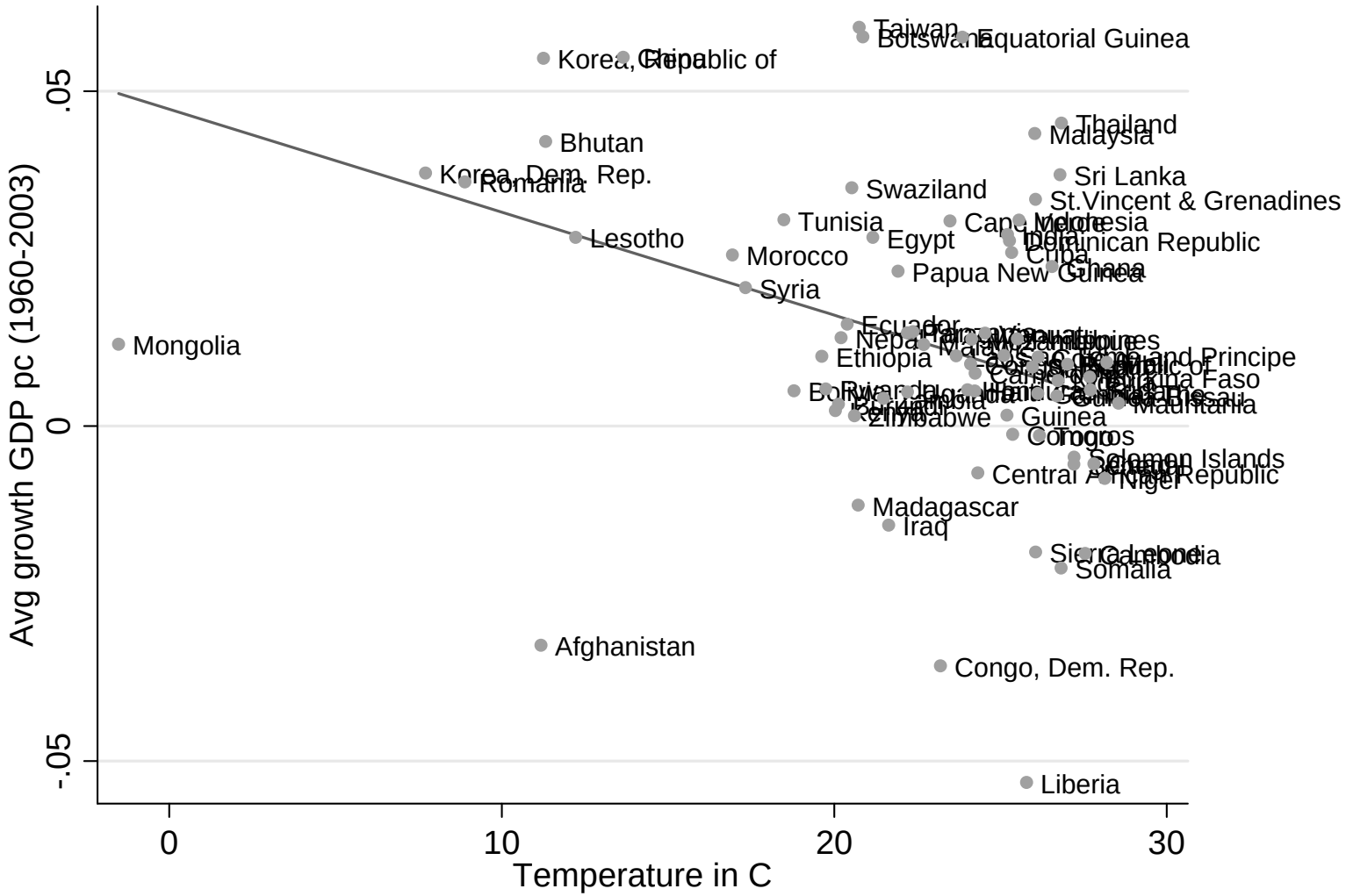

An extra 1C associated with only 0.1% lower ann. growth

Results

- For poor countries find negative effects of temperature on growth
- Evidence of adaptation (i.e. effects much smaller at longer horizon)
- Large standard errors

Conclusions

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- Temperature changes have a sizeable effect on agricoltural output of poor countries
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- Aggregate approach of evaluating damages not too informative for policy analysis