Pricing the Priceless: The Financing Cost of Biodiversity Conservation

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What the paper does:

This paper examines the (indirect) financial costs of preserving biodiversity.

Setting: China's "Green Shield Action" in 2017 aiming at the preservation of natural reserves.

➢Examine the impact on municipal finance through muni bond yields.

- Municipalities with national nature reserves experience an **increase** in muni yield spreads relative to municipalities without NNRs.
- Channel: Municipalities with NNRs increase related **procurements**, experience steeper **fiscal deficits**.
- The Green Shield Action seems to accomplish its intended goal of **restoring biodiversity** in NNRs.
  - The back-of-the-envelope calculation suggests US$40 billion extra interest costs.

Why I like this paper

Biodiversity conservation benefits vs. costs.

- Important policy implications.

Help us to think hard about whether biodiversity considerations are (geographically) local or global.

- Some aspects of biodiversity benefits are ***local*** in nature:
  - ✓ Environmental amenity, tourism, agriculture outputs, flood protection, etc.
- Other aspects of biodiversity benefits are ***global***:
  - ➢ Climate stabilization, pharmaceutical discovery, genetic resources, etc.

Given these, how should we structure of cost of biodiversity preservation?

- Many placed-based biodiversity/environmental regulations incur local costs.
- **This paper**: the financial costs of biodiversity preservation are borne **locally**.

- Well circulated. 15 conferences + 15 seminars. My discussion may not be new or useful ☹.

- Comments to help contextualize the Chinese muni market and explore economic mechanisms.

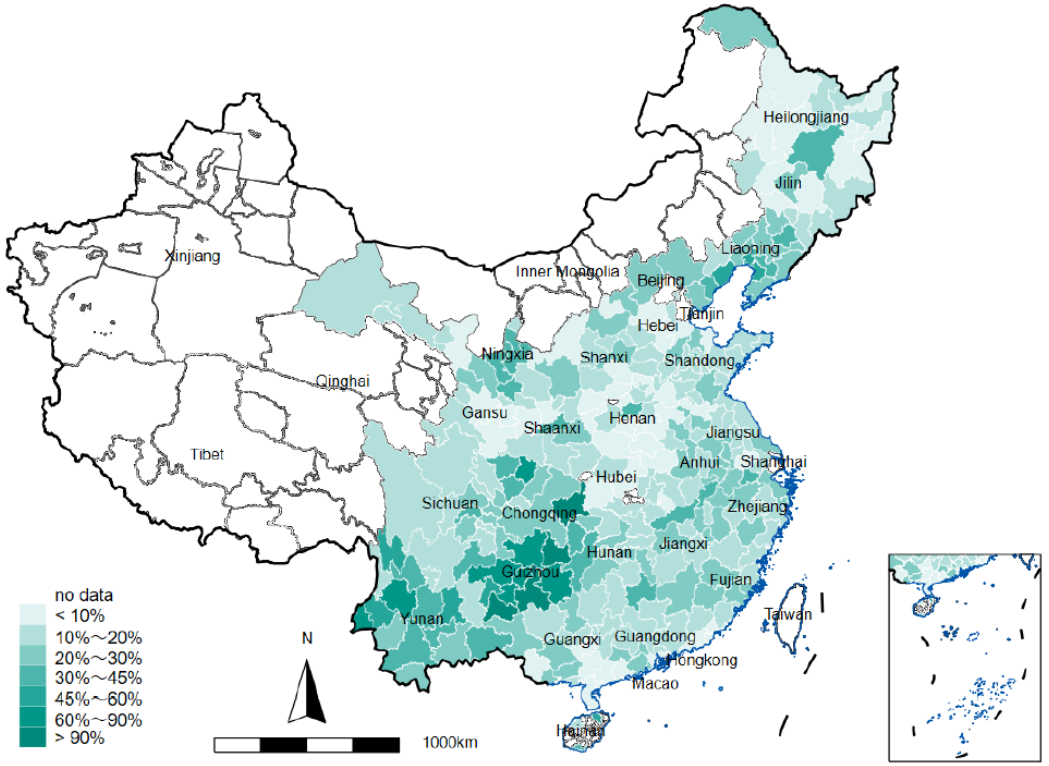
- Much of the discussion is highly anecdotal!

Contemporaneous shocks in China

Increased use of LGFV municipal debt after the Global Financial Crisis

- Four-trillion stimulus plan (Chen, He, Liu 2020)
- Raised through Local Government Financial Vehicles (LGFV). Off-budget funding for local governments.
- This led to unsustainable level of local debt.
- Ambiguity in whether LGFV debt is backed by the full creditworthiness of local governments.

- Starting in 2015, the central government launched a three-year debt-swap program to replace LGFV debt with municipal bonds issued by the provincial government.



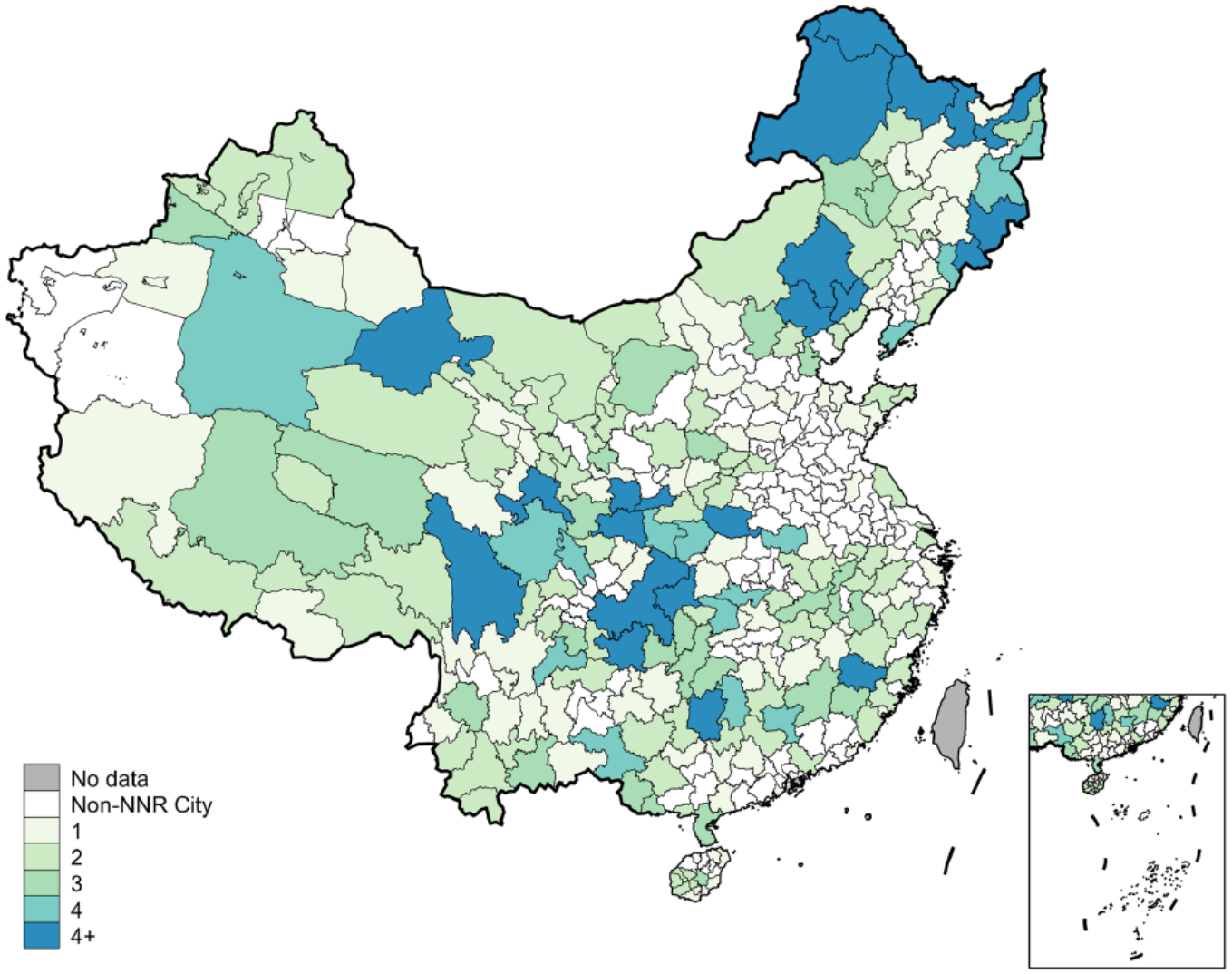
Debt-to-GDP ratio in 2014
(Hu, Hu, Peng, and Zhang 2025)

Geographical distribution of NNRs

- Clustering of NNRs (for example, mountainous areas in Guizhou and Sichuan).

- Table 2 shows lower GDP growth in NNR cities.

FIGURE 2: THE GEOGRAPHICAL DISTRIBUTION OF NNRS AT THE CITY LEVEL



Suggestion:

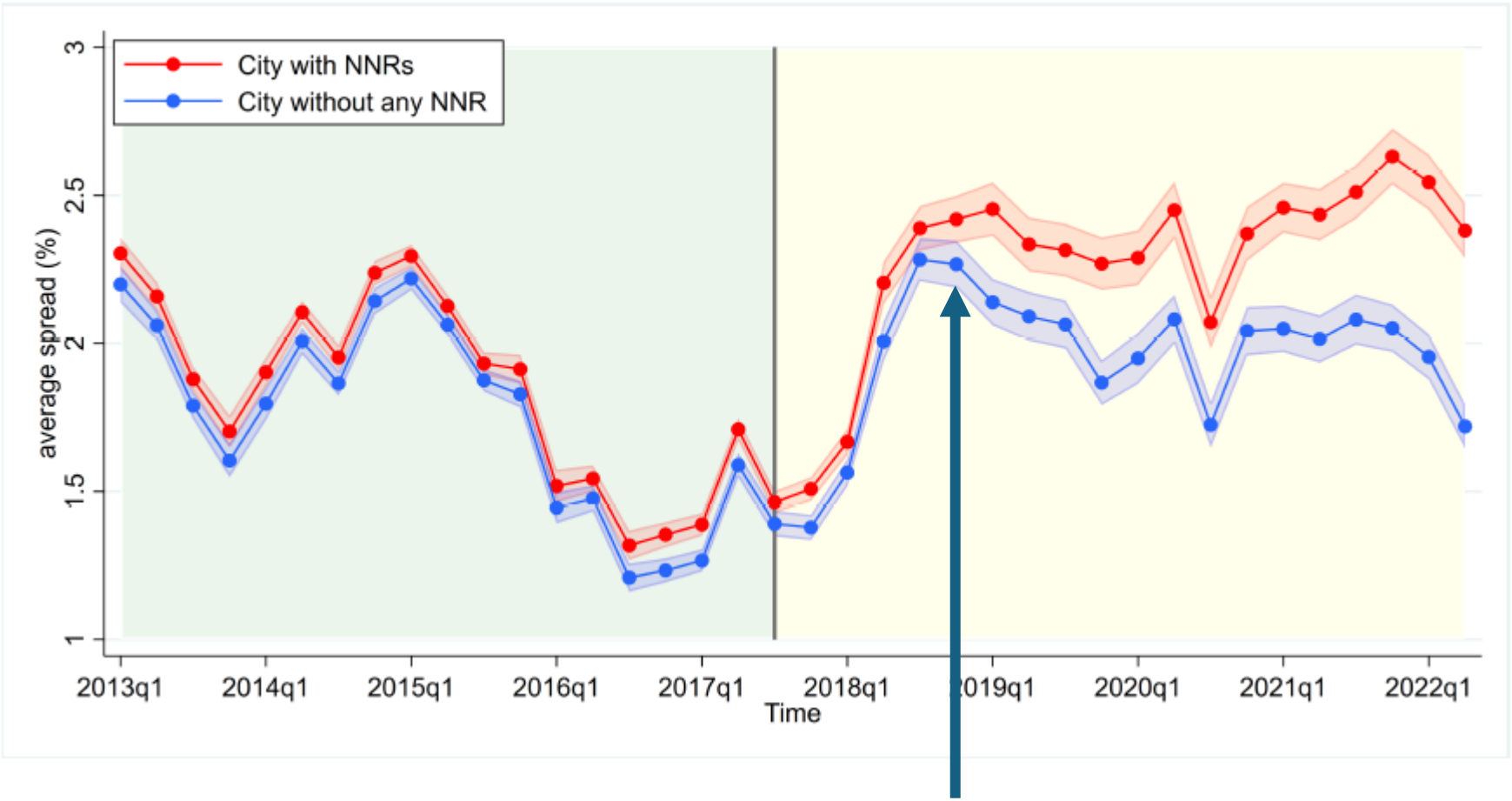
a) Control or match on pre-period local indebtedness.

b) Consider some neighboring city matching exercise.

	NNR=1	NNR=0	Difference
	(1)	(2)	(1)-(2)
ln GDP (ten billion RMB)	2.531	2.669	-0.138
	(0.067)	(0.089)	[0.110]
Δ ln GDP (ten billion RMB)	0.160	0.176	-0.015
	(0.014)	(0.017)	[0.022]
ln GDP per capita (thousand RMB)	3.650	3.682	-0.031
	(0.042)	(0.053)	[0.067]
Δ ln GDP per capita (thousand RMB)	0.140	0.157	-0.017
	(0.014)	(0.016)	[0.021]
GDP annual growth rate (%)	10.228	10.777	-0.549**
	(0.171)	(0.201)	[0.268]
Δ GDP annual growth rate (%)	-3.198	-3.485	0.287
	(0.266)	(0.311)	[0.416]
Tertiary sector GDP (%)	37.727	38.368	-0.642
	(0.734)	(0.813)	[1.126]
Δ Tertiary sector GDP (%)	6.401	6.356	0.045
	(0.375)	(0.446)	[0.590]
ln Nighttime light intensity	1.973	2.043	-0.070
	(0.054)	(0.072)	[0.089]
Δ ln Nighttime light intensity	0.089	0.065	0.023***
	(0.005)	(0.005)	[0.007]
ln Housing price (thousand RMB/ m^2)	1.489	1.528	-0.039
	(0.030)	(0.033)	[0.046]
Δ ln Housing price (thousand RMB/ m^2)	0.091	0.091	-0.001
	(0.012)	(0.013)	[0.018]
ln Fixed investment (ten billion RMB)	2.296	2.371	-0.076
	(0.059)	(0.078)	[0.097]
Δ ln Fixed investment (ten billion RMB)	0.252	0.269	-0.017
	(0.034)	(0.041)	[0.054]
ln Population (million)	1.177	1.280	-0.103
	(0.057)	(0.069)	[0.090]
Δ ln Population (million)	0.007	0.020	-0.013*
	(0.004)	(0.005)	[0.007]
Population annual growth rate (%)	0.266	0.498	-0.233
	(0.104)	(0.117)	[0.160]
Δ Population annual growth rate (%)	-0.048	0.113	-0.161
	(0.156)	(0.209)	[0.257]
Urbanization rate (%)	30.181	29.060	1.121
	(1.101)	(1.399)	[1.775]
High school and above education rate (%)	21.815	21.787	0.029
	(0.573)	(0.831)	[0.978]
ln Local fiscal revenue (million RMB)	2.306	2.413	-0.107
	(0.076)	(0.095)	[0.122]
Δ ln Local fiscal revenue (million RMB)	0.162	0.179	-0.017
	(0.018)	(0.023)	[0.030]
ln Local fiscal expenditure (million RMB)	3.207	3.140	0.067
	(0.052)	(0.062)	[0.081]
Δ ln Local fiscal expenditure (million RMB)	0.281	0.293	-0.011
	(0.012)	(0.015)	[0.019]

Contemporaneous shocks in China

FIGURE 3: THE DYNAMICS OF MCB SPREADS OVER TIME



Aug 13, 2018: First default event of Chinese municipal bond

澎湃

城投债“刚性兑付”信仰打破后，还能是债市上的“香饽饽”吗

澎湃新闻 08-15 16:58

摘要 城投债接二连三出现兑付危机，城投债这一最后的信仰被打破了。这将使重仓城投的投资者信心受损，市场一方面可能会出现城投的抛压。

城投债的市场也不再平静了。

8月13日是超短期融资券“17兵团六师SCP001”（到期本息额5.22亿元）付息兑付日，当日晚间上清所公告称，截至日终仍未足额收到新疆生产建设兵团第六师国有资产经营有限责任公司（下称“兵团六师公司”）支付的付息兑付资金，暂无法代理发行人进行本期债券的付息兑付工作。该事件引起市场广泛关注。

8月15日下午，上海清算所公告称，新疆生产建设兵团第六师国有资产经营有限责任公司已于8月15日上午延期支付“17兵团六师SCP001”本息。

Contemporaneous shocks in China

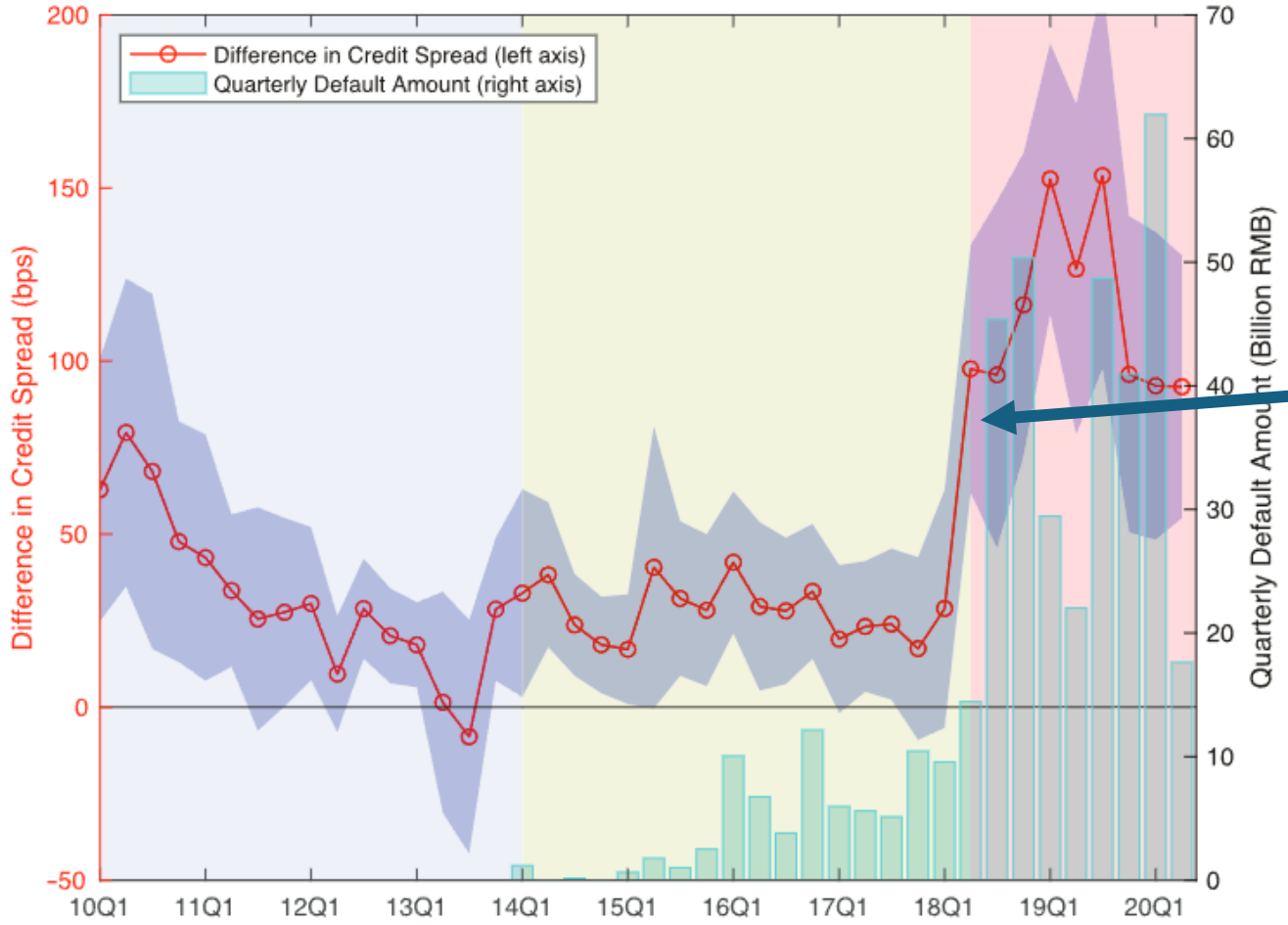


Figure 1. The SOE premium. This figure plots the difference between listed non-SOEs and listed SOEs in credit spread (left axis), estimated using quarterly regressions, controlling for credit ratings and other bond and firm characteristics. The shaded area indicates 95% confidence intervals. Also reported are the total quarterly default amounts in the credit market (right axis). (Color figure can be viewed at wileyonlinelibrary.com)

April 2018: "New Regulation"（资管新规) shrinks the financing and re-financing channels of corporate issuers and weakens the demand for corporate bonds from asset managers (Geng and Pan 2024).

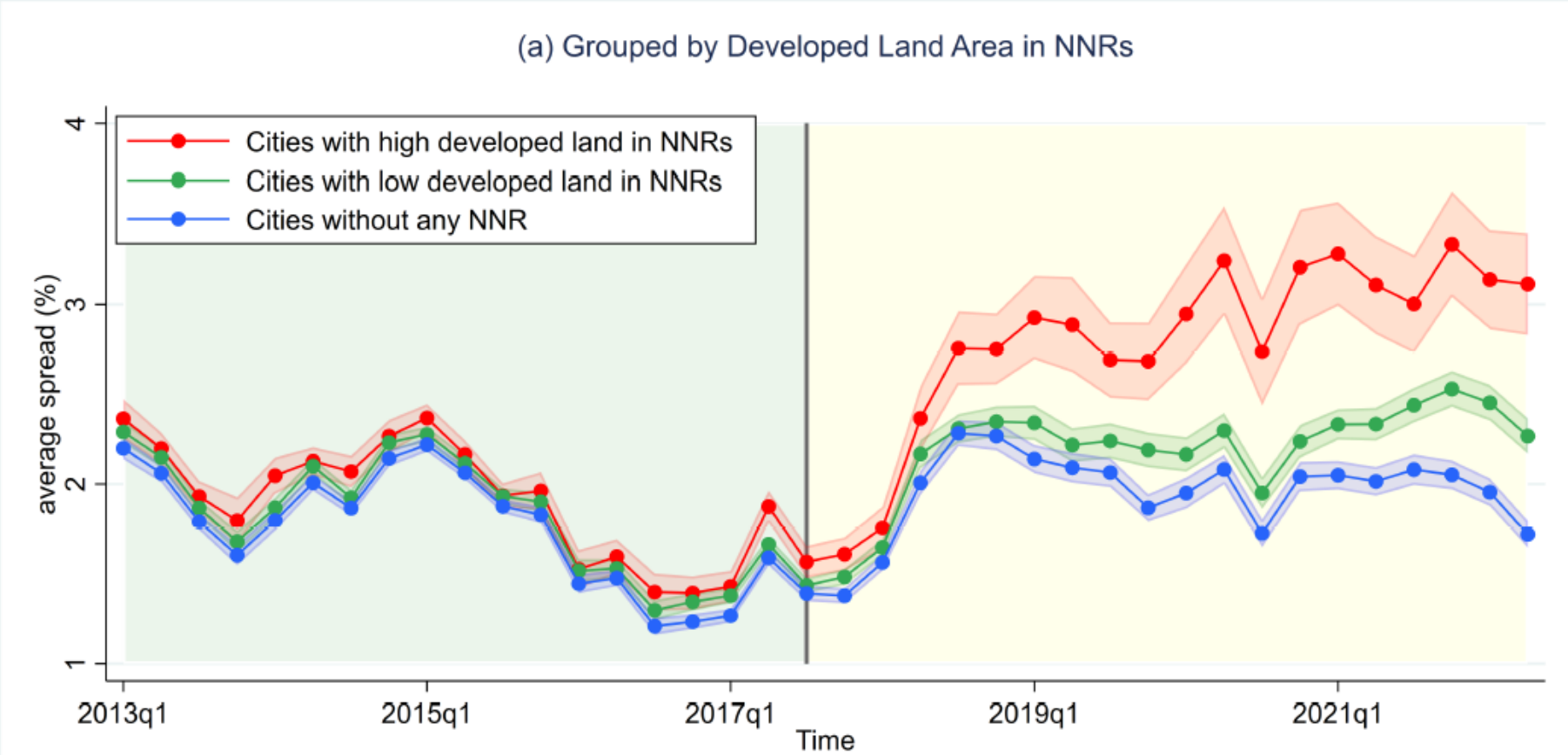
- Asset eligibility?
- Investors become more discerning wrt. credit quality.

Comment: Economic mechanism

The paper currently emphasizes the fiscal expenses of NNR conservations.

- Procurement costs only account for a small % of fiscal expenses/deficits.

FIGURE 5: THE DYNAMICS OF MCB SPREADS OVER TIME: PRE-EXISTING ECONOMIC ACTIVITIES WITHIN NNRS



Comment: Economic mechanism

What about the lost of fiscal revenue from economic activities within the NNR?

> "Utilizing remote sensing data on developed land and nighttime luminosity, we find that a higher presence of human economic activities within NNRs before GSA is associated with a more pronounced pricing effect."

Municipalities that struggled financially might rely more on non-compliant businesses (e.g, mining) to contribute to local taxes.

- Examine the revenue side of local fiscal deficits!
- Can you match business establishment locations to NNR?
- They may provide tax revenue + local employment.

Comment: Economic mechanism

Some anecdotal evidence:

巡查时，甘肃祁连山国家级自然保护区内

中国自然保护区生态亮红灯 保护区边界调整亟待规范

年保玉则位于三江源国家级自然保护区的核心地带，是青藏高原重要水源地和绿色安全屏障，被誉为“天神后花园”。在年保玉则的山麓中，生长着千百年的云杉、松柏，山坡上有虫草、贝母、大黄等名贵药材。山脚下，野牦牛、藏羚羊、岩羊、白唇鹿、黑熊等珍贵动物成群出没， 湖内有多种高原上特有的鱼类。

年保玉则命运的转折开始于2000年。随着三江源国家级自然保护区的成立，年保玉则先后被评为国家地质公园、国家级4A风景区、国家水利风景区……声名鹊起之后，游客蜂拥而至。

2008年后，年保玉则景区人数开始增多，到了2013年、2014年游客更是急剧增加。根据久治县政府工作报告，2017年年保玉则景区共接待游客15.7万人次，旅游综合收入达1.14亿元，贡献了该县1/4的GDP。

但人类活动的日益频繁，难免也对生态环境带来扰动。由于游人素质参差不齐，乱扔垃圾，违规穿越，践踏草场的不文明行为，让年保玉则垃圾成堆，加速了雪山的退化。

Comment: The cost of biodiversity preservation

1) Direct vs. indirect cost

The paper provides back-of-the-envelop calculation (Section 6.4) that the aggregate additional financing cost associated with GSA amounts to US 40 billion dollars in between 2018 and 2021.

- How does this number compare to the direct expense of NNR preservation?
- The paper references Deutz et al. (2020) that that financing gap for biodiversity preservation is ~45 billion USD per year.
- Hence the indirect financial cost is ≈ 25% of the direct cost.
- If the Green Shield Action does not fully cover the financing gap, the estimated % would be even higher!

If indirect financial costs indeed large, one might question what is the best policy design to share the cost of biodiversity preservation.

- ❖ Should the central government foot the bill for biodiversity conservation?

Comment: The cost of biodiversity preservation

2) More "tangible" indirect costs

Local governments experience increasing fiscal deficits for biodiversity preservation. The deficits may hinder the governments' ability to provide other public goods.

- Study more carefully the finance books of local governments.
- Do they cut back on healthcare expenses? Education? Infrastructure construction?
- Contextualize the winners and losers of preserving nature.

Very cool paper on an important and novel topic!

I hope my two cents help.

Look forward to seeing this paper published.