Income and corruption (1795-2010)

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Project outline & preliminary results

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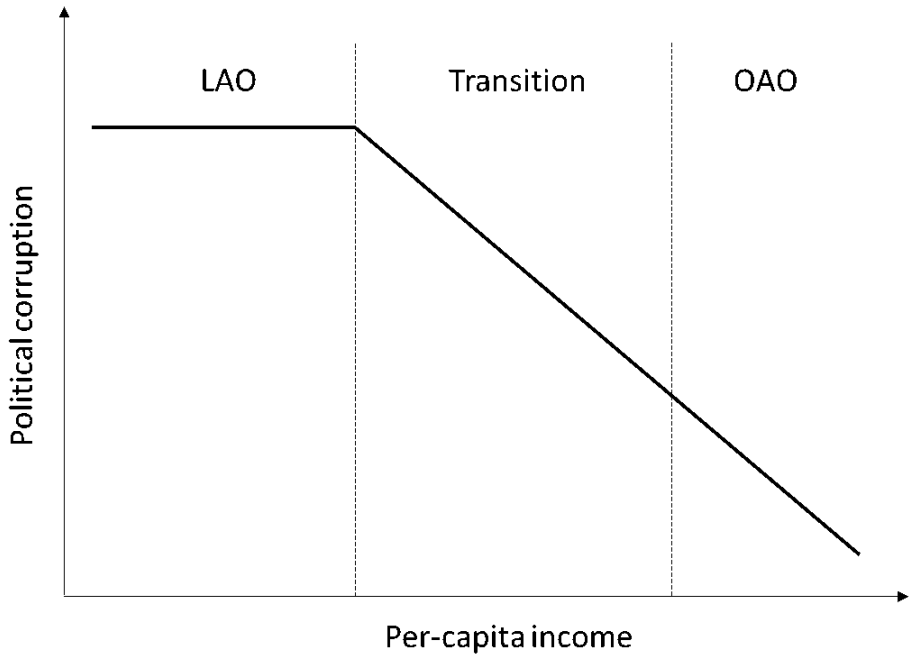
Motivation

- Virtually all developing countries are “limited-access orders”, or LAOs (North et al., 2013).
- In LAOs, rents and rent-seeking are used to buy off powerful organizations with violence capacity $\longrightarrow$ corruption essential to maintaining social stability.
- Corruption cannot decline substantially until an LAO begins its transition to an “open-access order” (OAO).
- Yet, there is still room for LAOs to experience economic growth (North et al., 2013).
- Khan and Jomo (2000) and Paldam (2021) argue that the transition from limited (LAO) to open access (OAO) is driven by an increase in technological and economic sophistication

Motivation

Corruption does not begin to decline substantially until an income threshold has been crossed, leading to two corruption regimes and a structural break:

1. **LAO**: corruption is stable across different levels of economic development
2. **Transition + OAO**: corruption declines with economic development



Previous empirical literature

- Cross-country studies document a negative relationship between per-capita income and political corruption (La Porta et al., 1999; Ades & Di Tella, 1999; Treisman, 2000; Paldam, 2002; Goel & Budak 2006)

- Saha and Gounder (2013) report a non-linear relationship with a non-negative slope across low- to middle-income levels (1995-2008)

  - Replicate Saha and Gounder's (2013) cross-sectional analysis using data from V-Dem and Fariss et al. (2017) (see next slide)
  - 10 cross-sections over 1960-2010 $\longrightarrow N = 1,715$
  - Including a squared term increases adjusted-R^2 from .35 to .41
  - Income threshold $\approx \exp 8 \approx 3,000$ USD

$\longrightarrow$ As an economy (e.g. China, Brazil, India) achieves upper-middle income status, it becomes a "mature LAO" and begins its transition to a low-corruption regime, or OAO (North et al., 2013).

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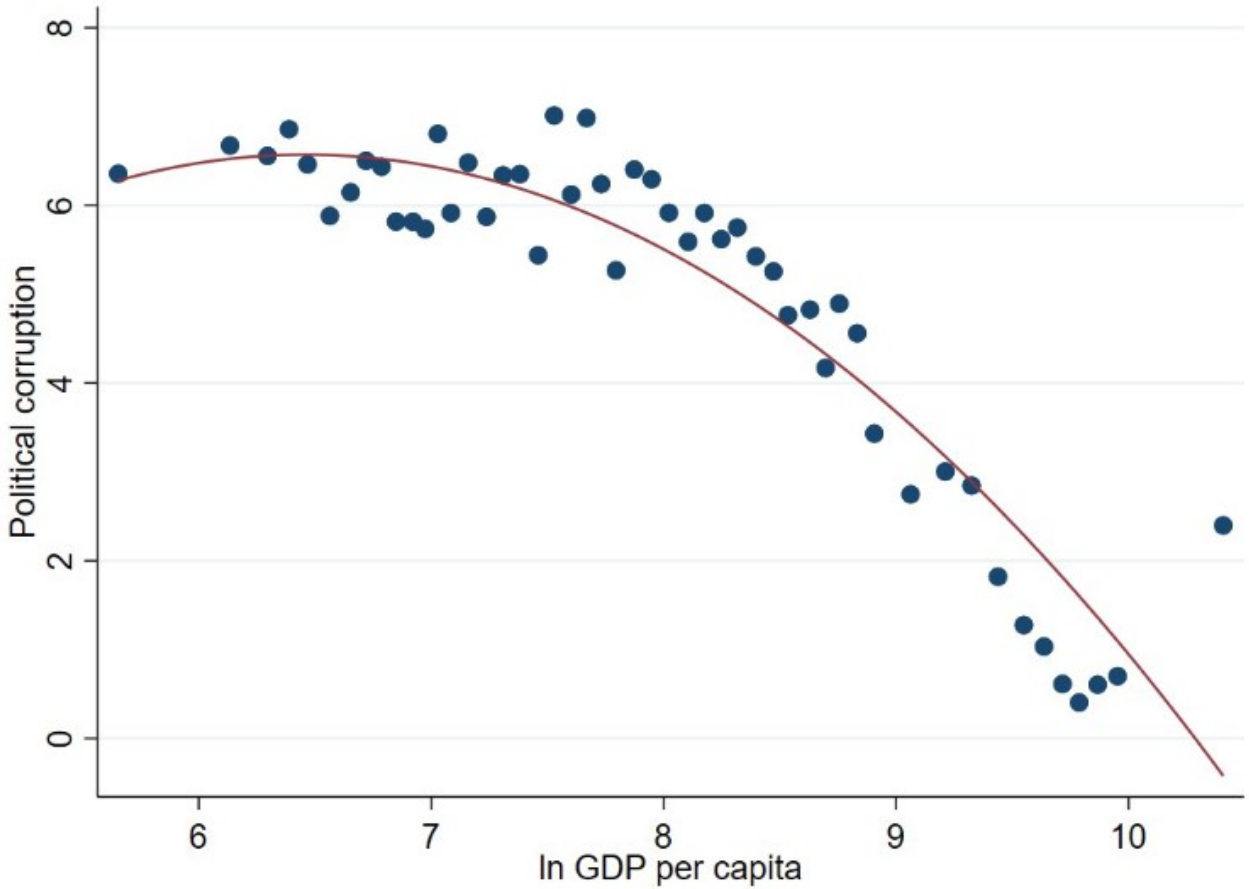
Replicating Saha and Gounder (2013)

FIGURE 1 - Income and corruption: cross-sectional evidence (1960-2010)



Notes: The plot displays a (conditional) binned scatterplot of the relationship between political corruption and (once-lagged) per-capita income, controlling for period fixed effects. It also displays a quadratic OLS fit of the conditional relationship. The (residualized) x-axis observations are grouped into 50 equal-size bins.

This paper

- All previous studies (including Saha and Gounder, 2013) are cross-sectional $\longrightarrow$ they cannot conclusively establish causation
- We use a three-pronged strategy:
  1. OLS and IV regressions *with country FE* to examine the robustness of the stylized fact reported by Saha and Gounder (2013)
  2. Regression kink model with unknown threshold (Hansen, 2017) to estimate the income level ($\ln y = \sigma$) at which the structural break occurs (TBD)
  3. A DiD estimator (Chaisemartin & d'Haultefoeuille, 2024) and a sharp (nonstaggered) design with a binary treatment ($D = 1$ IF $\ln y > \sigma$) to obtain causal estimates $\longrightarrow$ we test whether achieving upper-middle income status *causes* a decrease in political corruption

Preview of results

1. A non-linear, monotonic relationship between income and corruption is also observed using within-country variation over time only.

2. The structural break occurs, roughly, at an income level of $\ln GDPpc = 8.2$ (threshold models TBD)

3. Using a heterogeneity-robust DiD estimator, we find that crossing the upper middle-income threshold *causes* political corruption to start declining

4. The effect is driven primarily by a drop in 'petty' corruption in the state bureaucracy. Improvements in state capacity may provide the link between economic development and corruption control.

Contribution to the literature

1. **What are the causes of corruption?**

   Treisman, 2000

2. **Does institutional development cause economic development, or the other way round?**

   Acemoglu et al., 2001; 2002; Glaeser et al., 2004; Paldam and Gundlach, 2008

3. **Modernization hypothesis: income and democracy**

   Heid et al., 2012; Moral-Benito and Bartolucci, 2012; Benhabib et al., 2013; Cervellati et al., 2014; Paleologou, 2017

Content

Data

- **Indep. Var.:** Historical time series on GDP and population computed by Fariss et al. (2017), who employ a dynamic latent-trait model to produce less error-prone estimates of per-capita income (in constant 2011 US$) than other data sources (e.g., the Maddison Project data).

- **Dep. Var.:** Political corruption index from *Varieties of Democracy* (*V-Dem*): 1900-2010 (or 1789-2010 for a number of countries), with variation at the country-year level.

  - Independent information provided by at least five expert coders, or up to two for the 'historical' (pre-1900) segment of the dataset (Knutsen et al., 2019)

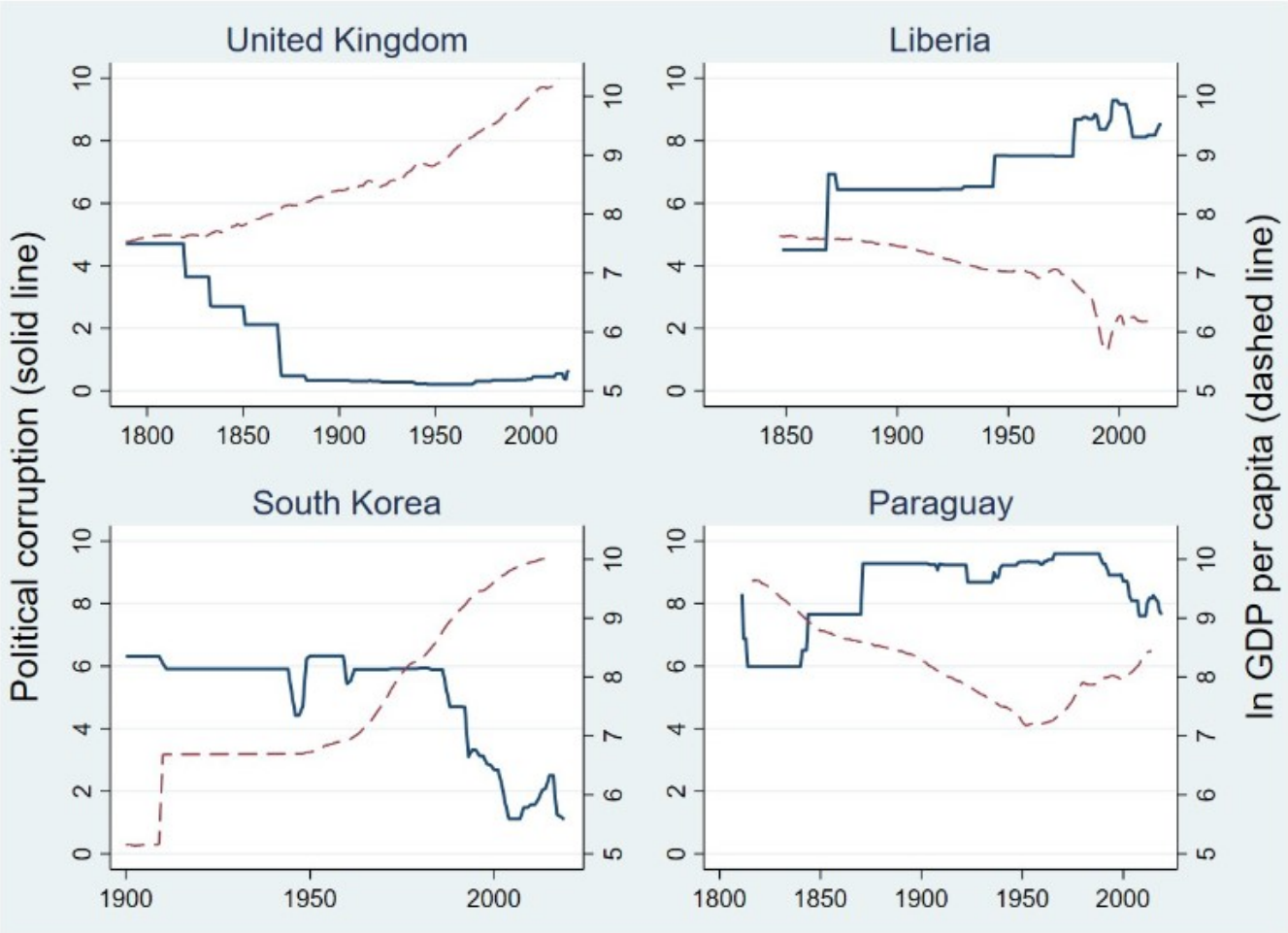
  - The ordinal ratings provided by the expert coders are aggregated using a Bayesian Item Response Theory (IRT) model (Pemstein et al., 2020), which leads to a continuous measure of corruption.

The V-Dem Political Corruption index

- Four variables quantifying the incidence of corruption in the state bureaucracy, the legislature, the executive branch of government, and the judiciary, respectively. Correlation coefficients range between .69 and .87.
- We use *v2x_corr* (V-Dem Political Corruption index), an unweighted average of these four indicators
- *v2x_corr* measures the extent to which political corruption is 'pervasive,' 'tap[ping] into several [distinct] types of corruption: both "petty" and "grand"; both bribery and theft; both corruption aimed [at] influencing law-making and that affecting implementation.'
- *v2x_corr* ($\in [0, 10]$) has a mean (median) value of 4.8 (5.2) and an overall (within) standard deviation of 2.9 (1.3)

Data illustration

FIGURE 2 - Income (dashed) and corruption (solid) over time (1795-2010)



Notes: The plots display the evolution over time of income and political corruption in four illustrative countries.

(1) Panel-data regressions with country FE

FE regressions: Specification

$$corr_{it} = \beta \ln Y_{it-1} + \gamma X_{it} + \mu_i + \tau_t + \epsilon_{it} \quad (1)$$

- X_{it}: additional controls in alternative specifications, including:
  - Geo-political region(j)-level quadratic trends ($\phi_j t + \theta_j t^2$)
  - Vector of time-varying observables (democracy, log of population, log of life-expectancy, election dummies, war dummies)
  - Time-varying political regime dummies (which absorb μ_i), to capture the influence of regime changes (e.g. revolutions, decolonizations).
  - One (or more) lags of corruption: $corr_{it-k}$, with $1 < k < 4$
- IV: instrument for $\ln Y_{it-1}$ using a jack-knife average of corruption in country i's geo-political region (j)

FE regressions: Specification

- Equation (1) controls flexibly for:
  - Country-level omitted confounders (e.g. culture)
- Equation (1) also addresses the confounding influence of:
  - Time-varying processes that may affect both economic and institutional outcomes (e.g. historical events and “critical junctures”)
- Use lags of corruption and instrument for income $\longrightarrow$ correct for reverse causal effects of corruption control on economic growth and development.

FE regressions: Specification

- Assumptions required for causal identification:

  1. *OLS with country FE*: no time-varying unobservable confounders (strong!)

     OR

  2. *IV with country FE*: instrument's exclusion restriction holds: growth (or other) spill-overs do not directly affect the incidence and magnitude of corruption (strong!)

$\longrightarrow$ The FE estimates cannot be given a causal interpretation

$\longrightarrow$ Yet, they confirm Saha and Gounder's (2013) stylized fact, suggesting an unambiguously negative relationship starting at $\ln(GDPpc) \approx 8.2$ (see vertical lines in diagrams, next slides)

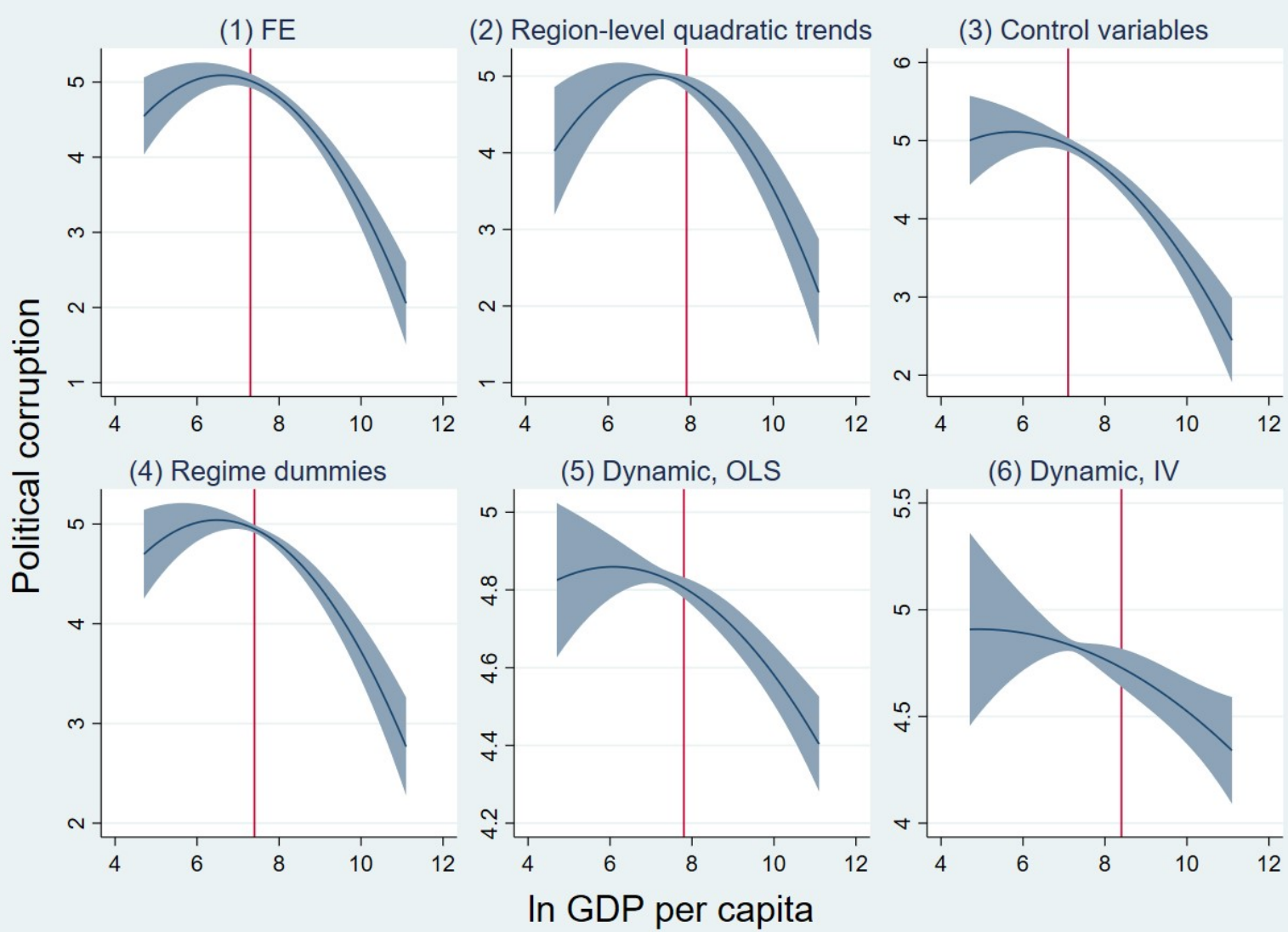
FE regressions: Results

TABLE 1 - Income and corruption: FE regressions (1795-2010)

Dependent variable: Corruption$_t$	FE (1)	Trends (2)	Controls (3)	Regimes (4)	Dynamic OLS (5)	Dynamic IV (6)
Corruption$_{t-1}$					0.826***	0.815***
					(0.023)	(0.024)
ln GDP per capita$_{t-1}$	1.983***	2.497***	1.089**	1.389***	0.220	0.146
	(0.424)	(0.588)	(0.459)	(0.346)	(0.141)	(0.333)
(ln GDP per capita$_{t-1}$)^2	−0.150***	−0.176***	−0.094***	−0.107***	−0.018**	−0.015
	(0.027)	(0.035)	(0.028)	(0.021)	(0.008)	(0.019)
Joint test, F-stat	32***	22***	24***	24***	14***	9**
Long-run effects:						
ln GDP per capita$_{t-1}$					1.267*	0.794
					(0.756)	(1.765)
(ln GDP per capita$_{t-1}$)^2					−0.104**	−0.081
					(0.042)	(0.099)
Joint test, F-stat					30***	13***
Country FE	YES	YES	YES		YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Region-level quadratic trends		YES				
Control variables			YES			
Regime dummies				YES		
One lag of the DV					YES	YES
Region-level average corruption						YES
Within R-squared	0.18	0.24	0.16	0.67	0.74	–
Number of countries	186	186	162	185	186	185
Observations	3,831	3,831	3,116	3,821	3,820	3,804

OLS in col. 1-5, 2SLS in col. 6. Driscoll-Kraay standard errors in parentheses. Panels with 5-year intervals.

FE regressions: Results



(2) Threshold Models

Threshold models: specification

- We estimate a continuous threshold/regression kink model with piecewise linear regression segments and an unknown threshold (Hansen, 2017).
- A quadratic specification returns an estimate of the global maximum. The exact value of per-capita income at which the slope becomes significantly negative cannot be computed easily (only in post-estimation..?).
- The kink model returns an estimate of the value of per-capita income at which the slope turns negative.
- In progress...

(3) Difference-in-difference estimates

DiD: Specification

$$D_{it} = \begin{cases} 1 & \text{IF } \ln(GDPpc)_{it} > 8.2, \ (i \text{ treated at } t) \\ 0 & \text{IF } \ln(GDPpc)_{it} \leq 8.2, \ (\text{untreated}) \end{cases}$$

DiD model:

$$corr_{it} = \beta D_{it} + \mu_i + \tau_t + \epsilon_{it}$$

- The treatment is binary but there is variation in treatment timing & the design is non-staggered, i.e. the treatment is non-absorbing (it can switch on and off)
- The TWFE (OLS) estimator of β is biased for the ATE unless we assume no heterogeneity in treatment effects across either time or units – a very strong assumption (Roth et al., 2023)

DiD: Specification

- We use de Chaisemartin & D'Haultefoeuille's (2024) treatment effect (DiD_L) estimator.
- Let F_g be a time period when g's treatment status changes. We obtain three sets of estimates:

1. DiD_L: the average, across all switchers (countries that go from $D_{it} = 0$ to 1, or viceversa), of DiD estimators comparing the outcome evolution of g between F_{g-1+L} and F_{g-1} (with $L \in 1, ..., 8$ denoting up to eight 5-year periods) to that of groups that remain untreated ($D_{it} = 0$) over the same period $\longrightarrow$ event-study graph
2. Average total effects: weighted average of DiD_L across L (comparable to $\hat{\beta}_{TWFE}$)
3. Placebo estimators, comparing the outcome (*corr*) of switchers and non-switchers before the switchers switch.

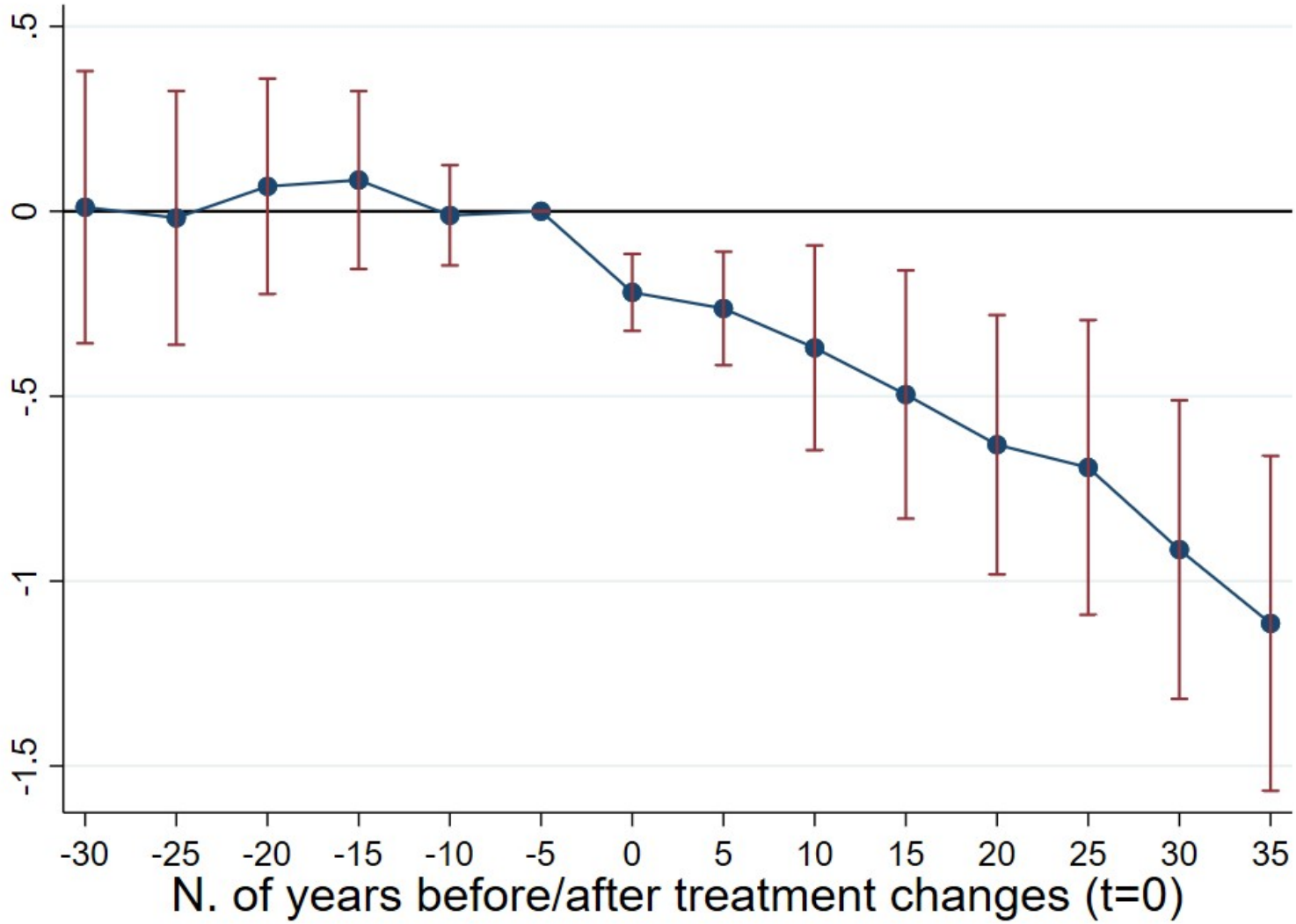
DiD: Specification

- DiD_L is robust to heterogeneous and dynamic treatment effects – that is, treatment effects that vary across groups (countries), across adoption cohorts, and over time (since treatment).
- It requires a (stronger version of) the parallel trends (PT) and no-anticipation (NA) assumptions
- The PT and NA assumptions can be tested by testing the null that all placebo effects $= 0$.

DiD: Specification

- We also:
  - Compare the weighted average of DiD_L (average total effect) to $\hat{\beta}_{TWFE}$
  - Control for X_{it} (democracy, population, etc.) $\longrightarrow$ weaker PT assumption that allows groups to experience differential trends provided those trends are fully accounted for by X_{it}
  - Match countries by level of democratic quality $\longrightarrow$ weaker PT assumption that only assumes that countries *with a similar starting level of democratic quality* experience parallel trends (Callaway and Sant'Anna, 2021)
  - Focus on same set of switchers to estimate all L effects (avoid compositional effects)
  - Corruption is measured with error $\longrightarrow$ weight the estimates by the number of expert coders used to obtain each observation $\longrightarrow$ increase efficiency of DiD estimator

DiD: Event-study estimates



DiD: Average treatment effects

TABLE 2 - DiD estimates (average total effects)

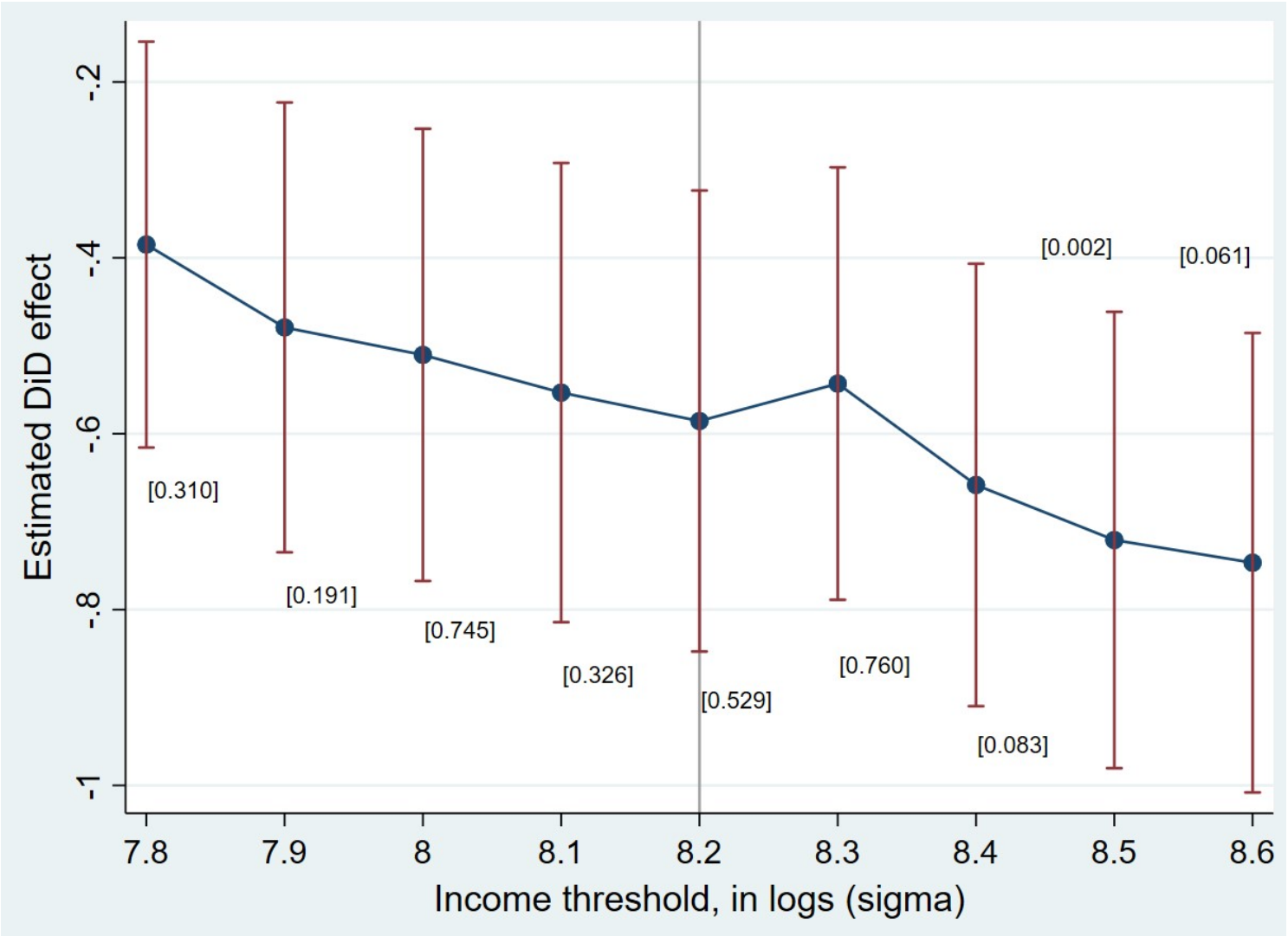
Dependent variable: Corruption$_t$	Baseline (1)	TWFE (2)	Controls (3)	Matched (4)	Same switchers (5)	Weights (6)
I(ln GDP per capita> 8.2)	−0.586***	−0.528***	−0.478***	−0.617***	−0.510***	−0.720***
	(0.159)	(0.159)	(0.175)	(0.185)	(0.178)	(0.198)
Joint nullity of placebos [p-value]	[0.529]	–	[0.224]	[0.830]	[0.132]	[0.945]
Switch x Periods	609	–	453	591	478	608
Observations	2,985	4,007	2,098	2,769	2,407	2,208

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

DiD: Sensitivity analysis

- Sensitivity to using different income thresholds (σ) to define the treatment. We use I(ln GDP per capita $> \sigma$) as the treatment variable, with $7.8 < \sigma < 8.6$.
- The results are stable around our preferred threshold (8.2)
- Past 8.4, the DiD estimate is not well-identified: reject the null of no pre-trends (*p*-values in brackets)
- DiD estimates (average treatment effects) on the vertical axis (coefficient plot on next slide). Each bar corresponds to a different DiD regression.

DiD: Sensitivity analysis



Mechanisms:

Components of the V-Dem Political Corruption index

- Use the components of *v2x_corr* separately as dependent variables.
- Which types of corruption are more sensitive to the transition to upper-middle income status (i.e. to the treatment)? 'Petty' corruption in the state bureaucracy

Components of the V-Dem Political Corruption index

TABLE 3 - Types of corruption

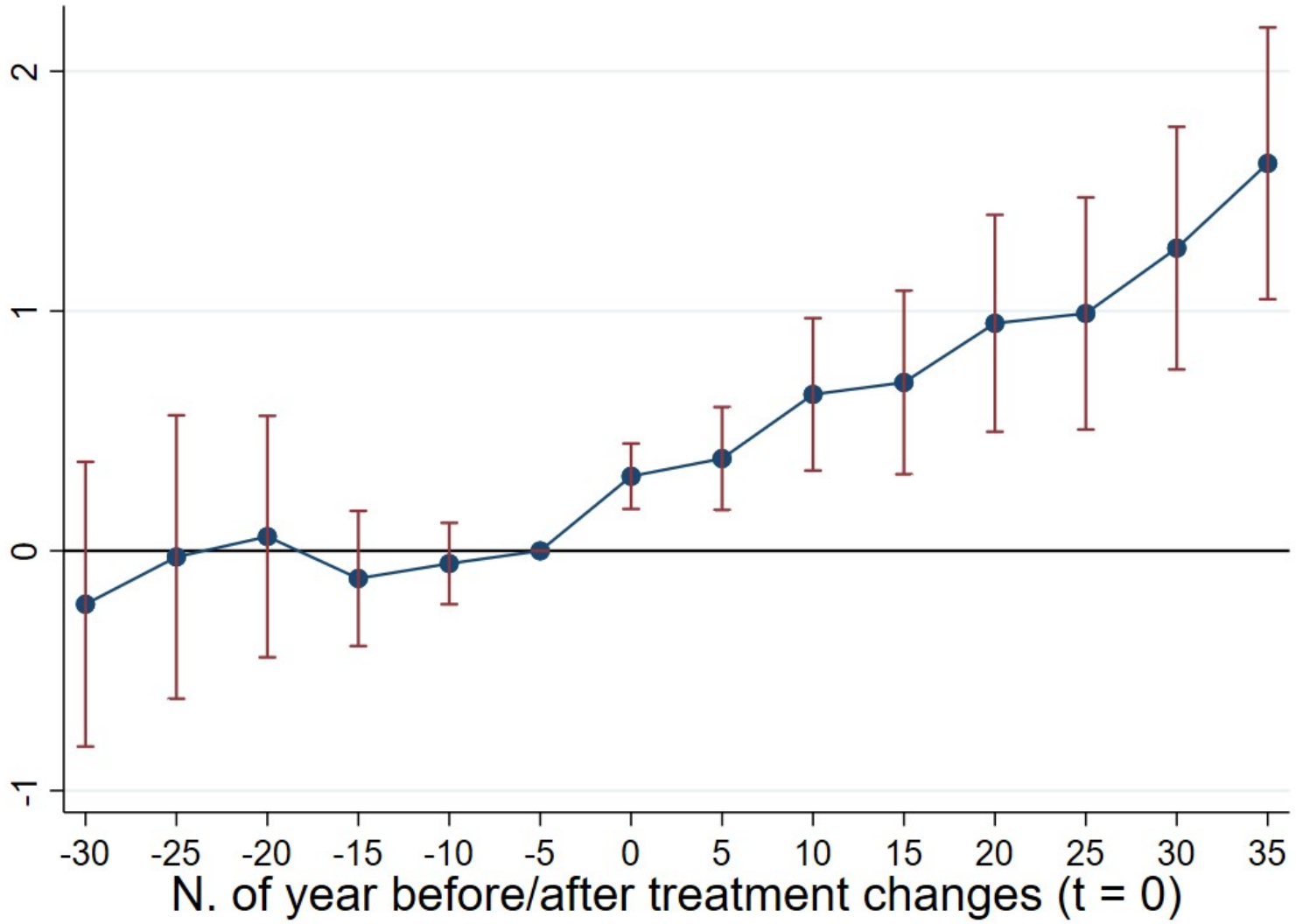
Dependent variable: Corruption in the..	Bureaucracy		Legislature	Executive		Judiciary
	Corrupt exchange	Embezzlement		Corrupt exchange	Embezzlement	
	(1)	(2)	(3)	(4)	(5)	(6)
I(ln GDP per capita> 8.2)	−0.806***	−0.193***	−0.907***	−0.584***	−0.244***	−0.532***
	(0.179)	(0.072)	(0.236)	(0.239)	(0.090)	(0.226)
Joint nullity of placebos [*p*-value]	[0.149]	[0.454]	[0.042]	[0.734]	[0.264]	[0.805]
Switch x Periods	617	617	521	617	617	611
Observations	3,036	3,009	2,079	3,030	3,023	3,044

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

State capacity

- Possible explanation: past the upper-middle income threshold, bureaucratic corruption may be brought under control through improvements in state capacity
- We construct an index of state capacity by taking an unweighted average of two V-Dem variables (as in Uberti, 2023):
  1. a measure of meritocratic recruitment/promotion in the civil service
  2. an index of impartiality in the state administration.
- Correlation between political corruption and state capacity $= -0.69$ ($N = 4,616$)
- *Result*: the transition to upper-middle income status causes significant improvements in state capacity (next slide)

State capacity



Next steps

FE regressions:

- Non-parametric specification?

Threshold models:

- Static (Hansen, 1999) vs dynamic estimators (Seo and Shin, 2016)

DiD model:

- Explore non-binary (discrete) treatments in addition to our binary treatment, e.g. three levels of treatment (?).
- Match switchers to control group based on additional time-invariant characteristics (other than initial democratic quality)
- Sensitivity analysis (different thresholds)
- Exclude countries that switch in and out (staggered design).