

Corruption and Reforms: A Dynamic Panel Data Study

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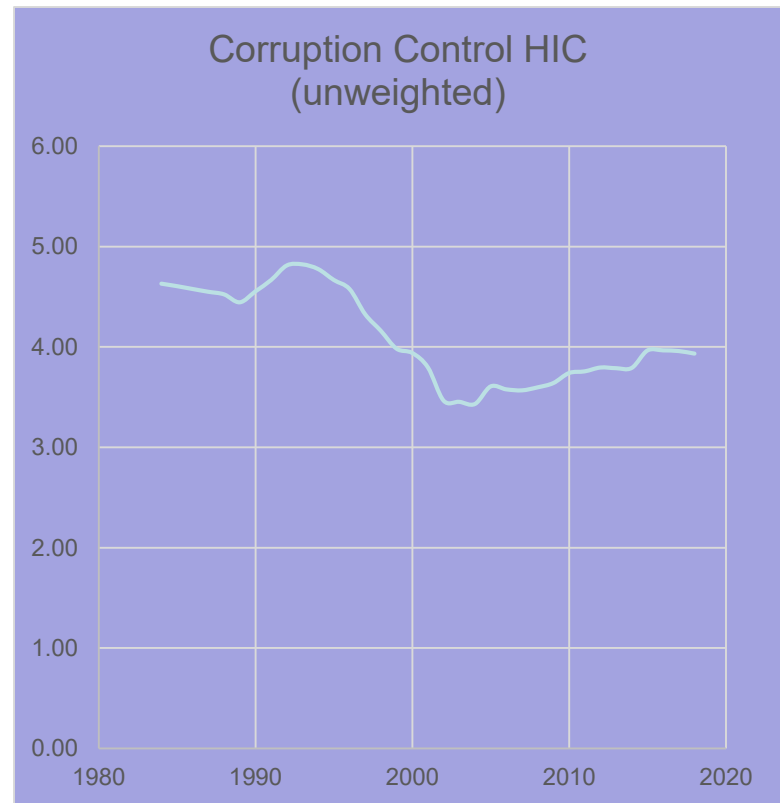
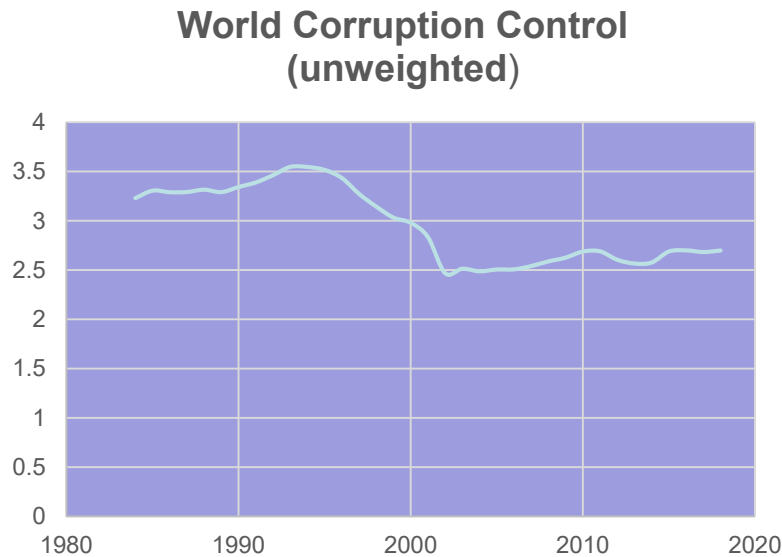
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Motivation

- Corruption is major roadblock to economic development
- Reforms may play a crucial role in corruption control
- Here, we focus on two types of reforms:
 - Political reforms = democratization
 - Economic Integration reforms:
 - Trade policies
 - International investment policies

Motivation (cont'd)

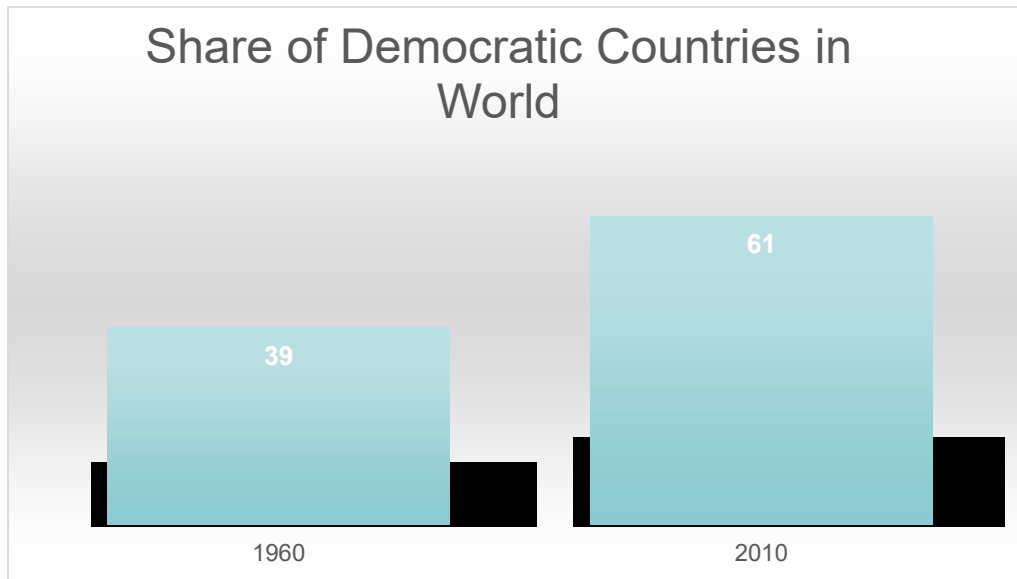
- Corruption Control (ICRG data set, 1984-2018)
 - Scale 0-6



Motivation (cont'd)

- Democratization

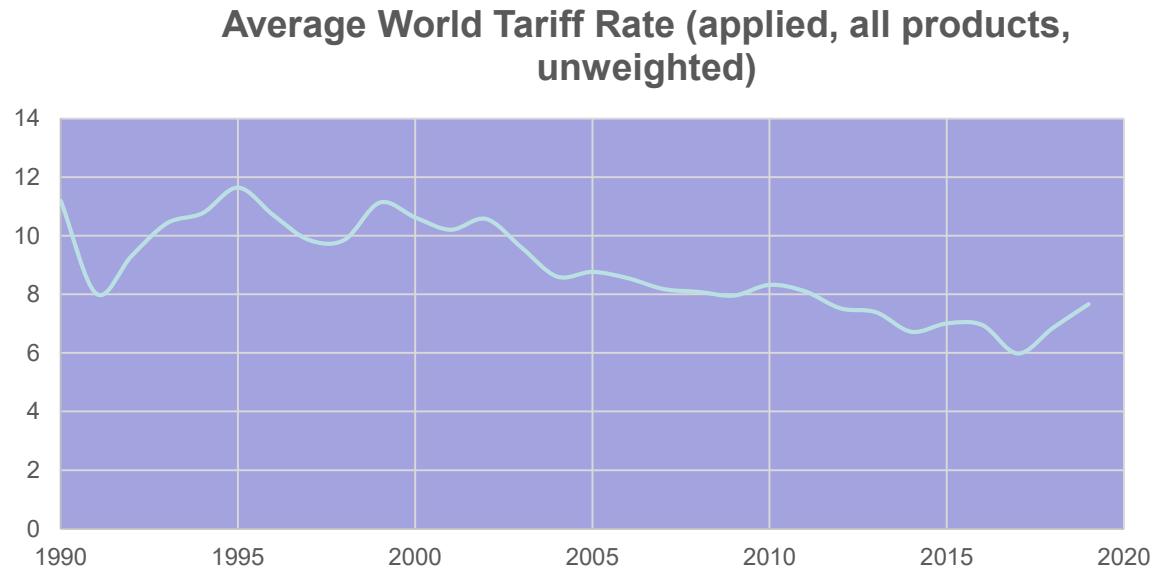
- Since the 1960s, there has been a substantial increase in the number of democratic countries
 - End of colonialism (Africa)
 - End of cold war/communism (Eastern Europe)



(Polity Score democracy variable)

Motivation (cont'd)

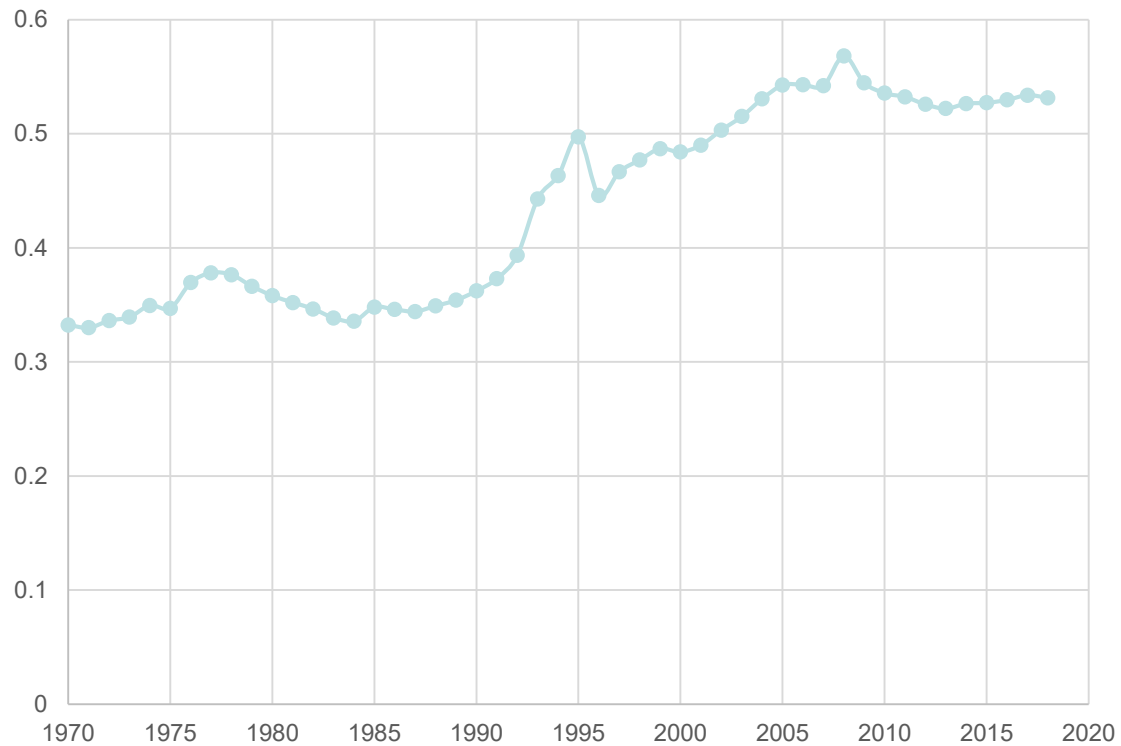
- Economic Reforms:
 - Major economic policies reforms since 1960s:
 - Trade Liberalization



Motivation (cont'd)

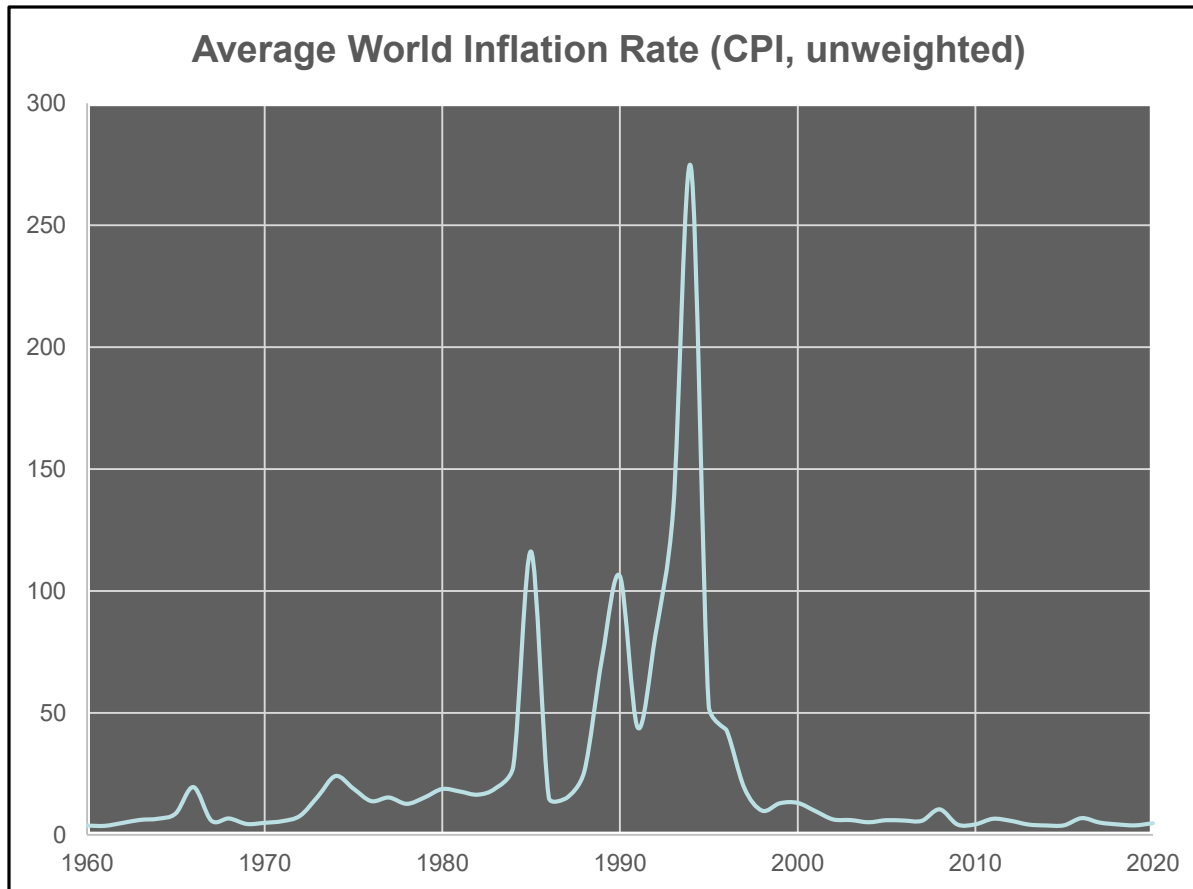
- Global Investment

Chin-Ito Index of World Financial Openness



Motivation (cont'd)

- Inflation Control



Empirical Literature

- Determinants of Corruption:
 - Ata and Arvas, 2011
 - Interviews in Malaysia
 - Power, opportunity and moral impurity (lack of integrity)
 - Rehman and Naveed, 2010
 - Barro Type growth regressions: Corruption lowers GDPpc
 - Public spending on education (-), unemployment (+)
 - Treisman (2000, 2007, 2014)
 - Several studies
 - Mainly cross-section. Looks at both, the historical and current factors.
 - No coherent hypothesis.
 - Basis for our paper.
- Corruption and Trade/Openness:
 - Majeed, 2004
 - Gatti, 2004
 - Larrain and Tavarres, 2000

Empirical Literature

- Corruption and Trade/Openness:
 - Majeed, 2004
 - Kuznets “inverted u-type” relationship between trade and corruption
 - But in subsequent regression, only a linear term is used.
 - No effect of economic development on corruption
 - Gatti, 2004
 - Studies the impact of trade policies, as captured by share of imports, average tariff rates, and percentage of imports subject to quotas
 - Only tariff rates are significant
 - Examines the impact of financial openness as well and finds no link
 - Felipe and Tavares, 2004
 - Static panel data study finds evidence that FDI, GDPpc, as well as trade, decreases corruption
- Somewhat related literature: FDI and Corruption
 - Gossel, 2018
 - Mitchell and Chugh, 2013
 - Egger and Winner, 2006

Empirical Literature

- Somewhat related literature: FDI and Corruption
 - Gossel, 2018
 - SSA region, the dependent variable is FDI and the independent variable is corruption.
 - Finds that controlling corruption lowers FDI (“Helping hand”) but when corruption is interacted with democracy, lowers FDI (“grabbing hand”)
 - Even though DPD, no control for the endogeneity of regressors
 - We can qualitatively replicate the findings with one-step estimator of se but when we correctly specify the estimating model, the results vanish.
 - Egger and Winner, 2006
 - Examine bilateral FDI flows between OECD countries and find that corruption lowers FDI.

Our Contribution

- **Cross-section time-series approach** accounts for unobserved time-invariant country-specific heterogeneity
- **Dynamic panel model** captures the persistence of corruption over time
- **Estimation:**
 - System-GMM estimation
 - Produces estimates of time-invariant covariates
 - Better than GMM in terms of asymptotic efficiency when DV is persistent
 - Use of instruments for endogenous or pre-determined covariates
- **Richer Model Specification**
 - Inclusion of a variety of political reform measures
 - Explore the interaction between the timing of economic and political reforms
 - Control for the endogeneity of explanatory variables.

Empirical Model

- Main estimation equation

$Corr_{it}$

$$= \beta_0 + \beta_1 Corr_{i,t-1} + \beta_2 Dem_{it} + \beta_3 Reform_{it} + \beta_4 X_{it} + \beta_5 Z_i + v_i + \gamma_t + \mu_{i,t}$$

where

- Corr: measure of corruption
- Dem: measure of democracy
- Reform is vector of economic policy variables
- X is vector of time-varying control variables
- Z is vector of time-invariant control variables
- v denotes unobserved country-specific effects
- γ denotes unobserved time effects
- μ denotes the idiosyncratic error term

$Corr_{it}$

$$= \beta_0 + \beta_1 Corr_{i,t-1} + \beta_2 Dem_{it} + \beta_3 Reform_{it-1} + \beta_4 X_{it} + \beta_5 Reform_{it-1} * X_{it} + \beta_6 Z_i + v_i + \gamma_t + \mu_{i,t}$$

System GMM Estimation

- System GMM estimator (Arellano & Bover, 1995; Blundell and Bond, 1998) extends the GMM estimator by adding a regression in levels to the regression in differences:

- Difference Equation

$$y_{i,t} - y_{i,t-1} = \tilde{\beta}_1(y_{i,t-1} - y_{i,t-2}) + \beta^3(X_{it} - X_{i,t-1}) + \tilde{\gamma}_t + (\mu_{i,t} - \mu_{i,t-1})$$

- Problem: $E[(y_{i,t-1} - y_{i,t-2})(\mu_{i,t} - \mu_{i,t-1})] \neq 0$

- Solution: Use two period or more lags of the dependent variable as instruments for the differenced (endogenous) variable assuming

$$E[y_{i,t-s}(\mu_{i,t} - \mu_{i,t-1})] = 0, \text{ for } t = 3, 4 \dots T \text{ and } s \geq 2$$

- Note: If some or all of the ΔX are endogenous or pre-determined, use lags of X as instruments

System GMM Estimation (cont'd)

- Level equation:

$$y_{it} = \beta_0 + \tilde{\beta}_1 y_{i,t-1} + \beta^3 X_{it} + \beta^4 Z_i + v_i + \gamma_t + \mu_{i,t}$$

- If lagged y and/or X violate the independence assumption, use higher order lags of the differenced y and differenced X as instruments assuming

$$E[\mu_{it}(y_{it-1} - y_{i,t-2})] = 0 \text{ for } t = 3, 4 \dots T$$

Econometric Issues with GMM

- Higher-order Autocorrelation
 - Need to test for higher-order autocorrelation since use of lagged instruments requires the absence of second-order serial correlation in errors (Arrelano-Bond, 1991)
 - Use Arrelano-Bond AR(2) test; if it fails, re-estimate with the instrument set lagged by an additional period
 - use Arrelano-Bond AR(3) test

Econometric Issues with GMM (cont'd)

- Validity of Exclusion Restriction
 - difference-in-Hansen test
 - to check the validity of the additional exclusion restrictions that arise from the level equation
- Instrument Proliferation
 - Large number of moment conditions: Set of instruments is large (overfitting) leading to inconsistent estimates due to failure to correct for endogeneity (as indicated by high p values of difference-in-Hansen test)
 - Solution:
 - Restricted instrument set: Set upper limit on lags used as instruments

Dataset and Variables

- More than 150 countries, 1984-2018
- **Corruption control:** ICRG data set, 1984-2018
- **Democracy**
 - *FH democracy index*: Average of Political Rights and Civil Liberty
 - *Polity Score* Autocracy-Democracy Score from -10 to +10
 - *P-IV Democracy* is 0 to 10 score based on 3 elements:
 - » Access to elections; Constraints on executives; Civil liberties
 - *Democratic Capital* (Persson and Tabellini, 2009) – cumulative measure (stock variable) of democracy
 - *Support Vector Machine Democracy Index* (SVMDI): machine learning algorithm from 11 democracy var.

Dataset and Variables (cont'd)

- **Economic Reforms**

- Trade Reforms

- Average tariff rate (applied, all goods, non-weighted)
 - Tax rate on international transactions

- International Finance Reforms

- Chin-Ito index of financial openness

- **Other Variables**

- Share of government expenditure to GDP
 - Inflation rate based on CPI
 - Trade share (exports + imports / GDP)
 - Import share (imports/GDP)
 - FDI inflows (net) as % of GDP

Dataset and Variables (cont'd)

- **Income**
 - GDP per capita (in constant USD)
- **Historical Factors**
 - Colonizing country
 - Origin of legal system
- **Geography**
 - Relative distance from equator (*Dist Equator*)
 - Malaria Ecology

Factors affecting corruption

- Starting point is the approach by Triesman (2007) where the link between corruption and various long-run factors is examined
- We include the various measures of democracy

Table 1: Base Model

	1	2	3
VARIABLES	legalorg	colonial	colonial
L.pf_corrupt_rev	0.517*** (0.064)	0.618*** (0.078)	0.605*** (0.074)
fh_score	-0.039** (0.019)		
polity2		-0.026** (0.011)	
dem_cap99			-1.234*** (0.330)
svmdi			
Ln GDP pc	-0.104* (0.061)	-0.170*** (0.060)	-0.063 (0.069)
legor_english	-0.048 (0.097)		
legor_french	0.061 (0.099)		
legor_german	-0.371 (0.243)		
legor_scand	-0.905*** (0.200)		
col_british		-0.051 (0.109)	0.036 (0.113)
col_french		-0.091 (0.151)	0.027 (0.144)
col_SpaPort		0.177** (0.084)	0.282*** (0.091)
Observations	765	812	792

Table 1: Base Model				
	4	5	6	7
VARIABLES	religion	religion	all	all
L.pf_corrupt_rev	0.601***	0.549***	0.505***	0.515***
	(0.088)	(0.076)	(0.077)	(0.088)
fh_score				
polity2			-0.005	
			(0.015)	
dem_cap99	-1.185***			-1.099***
	(0.450)			(0.400)
svmdi		-0.632**		
		(0.250)		
Ln GDP pc	-0.047	-0.158***	-0.200***	-0.063
	(0.075)	(0.055)	(0.069)	(0.087)
legor_english			0.051	0.158
			(0.108)	(0.122)
col_SpaPort			0.182*	0.301***
			(0.106)	(0.117)
Ln % of Protestnat	-0.043	-0.076***	-0.103***	-0.074**
	(0.030)	(0.028)	(0.031)	(0.032)
Ln % of catholic	-0.005	0.016		
	(0.034)	(0.033)		
Ln % of Islam	-0.038	-0.051		
	(0.038)	(0.046)		
Observations	670	721	622	620
Number of pid	123	135	109	108

Table 3: Longterm factors affecting corruption

	1	2	3	4	5
Lag Corruption	0.434*** (0.061)	0.548*** (0.066)	0.499*** (0.066)	0.518*** (0.076)	0.507*** (0.076)
fh_score	-0.035 (0.023)				
polity2		-0.005 (0.011)			
dem_cap99			-0.619 (0.513)	-0.807* (0.438)	-0.913** (0.384)
Ln FDI	-0.147** (0.061)		-0.124** (0.061)		
Ln Trade Sh		0.024 (0.158)		-0.073 (0.166)	
Ln import share					-0.114 (0.178)
LnGDPpc	-0.211*** (0.062)	-0.171*** (0.061)	-0.118 (0.096)	-0.080 (0.076)	-0.060 (0.071)
col_SpaPort	0.199** (0.099)	0.203* (0.115)	0.253** (0.120)	0.263** (0.113)	0.300*** (0.112)
legor_english	0.063 (0.111)	0.053 (0.097)	0.134 (0.119)	0.114 (0.098)	0.124 (0.103)
Ln % Protestant	-0.065* (0.034)	-0.091*** (0.035)	-0.079** (0.035)	-0.084** (0.034)	-0.085** (0.034)

Interactions between lagged reforms and integration

- Intuition: Mixed evidence on the direction of association between corruption and economic integration
- Here, we investigate whether there is any effect of interaction between lagged reforms and economic integration on corruption

Tables 5: Channels- interaction of lagged political reform and integration

	1	2	3	4	5
L.pf_corrupt_rev	0.570*** (0.050)	0.538*** (0.074)	0.571*** (0.061)	0.624*** (0.054)	0.591*** (0.058)
Lagged P-IV X Ln FDI			-0.004 (0.005)		
Lagged Dem Capital X FDI	-0.341* (0.184)			-0.474*** (0.178)	
Ln FDI	-0.003 (0.084)		-0.115* (0.067)	0.041 (0.084)	
Lagged Dem Capital X Trade Sh		-0.228** (0.101)			-0.190** (0.093)
Ln Trade Share		-0.076 (0.142)			-0.039 (0.159)
LnGDPpc	-0.096 (0.067)	-0.053 (0.076)	-0.180*** (0.046)	-0.072 (0.052)	-0.068 (0.068)
col_SpaPort	0.215*** (0.080)	0.274*** (0.106)	0.210** (0.083)	0.254*** (0.067)	0.230** (0.090)
legor_english	0.072 (0.074)	0.126 (0.096)	-0.005 (0.080)	0.032 (0.062)	0.055 (0.089)
Ln % Protestant	-0.070*** (0.025)	-0.070* (0.036)			

Tables 7: Channels- interaction of lagged financial openness reform and integration

	(1)	(2)	(3)	(4)	(5)	(6)
L.pf_corrupt_rev	0.536*** (0.052)	0.563*** (0.049)	0.561*** (0.066)	0.574*** (0.053)	0.629*** (0.050)	0.627*** (0.053)
fh_score	-0.056*** (0.015)			-0.053*** (0.017)		
polity2		-0.017* (0.010)			-0.023** (0.010)	
dem_cap99			-0.786* (0.441)			-1.105*** (0.366)
Lag Fin Open X FDI	-0.065 (0.059)	-0.119* (0.068)	-0.116* (0.070)			
Ln FDI	-0.033 (0.064)	-0.007 (0.071)	-0.031 (0.077)			
Lag Fin Open X Trade Sh				-0.005 (0.031)	-0.011 (0.035)	0.020 (0.039)
Intrd_gdp				0.004 (0.177)	0.059 (0.111)	-0.096 (0.173)
lnypc10k	-0.154*** (0.042)	-0.179*** (0.040)	-0.121** (0.059)	-0.103* (0.053)	-0.135*** (0.048)	-0.050 (0.051)
col_SpaPort	0.275*** (0.081)	0.270*** (0.081)	0.267** (0.110)	0.252** (0.102)	0.257*** (0.085)	0.260*** (0.089)
legor_english	0.002 (0.069)	-0.004 (0.068)	0.061 (0.098)	0.004 (0.089)	-0.035 (0.084)	0.036 (0.089)

Difference between developed and developing countries?

- In exploring pathways, the strongest mitigating impact on corruption is of the interaction between lagged financial reforms and integration captured by FDI and trade.
- Is this true of all countries?
 - Next, we explore the main pathway among developing countries

Tables 7: Channels- interaction of lagged financial openness reform and integration - developing countries

	1	2	3	4	5	6
L.pf_corrupt_rev	0.458*** (0.061)	0.403*** (0.061)	0.499*** (0.057)	0.512*** (0.049)	0.528*** (0.063)	0.556*** (0.058)
fh_score	-0.020 (0.018)			-0.042** (0.019)		
polity2		-0.003 (0.012)			-0.002 (0.017)	
dem_cap99			-0.856* (0.454)			-0.907 (0.702)
Lag Fin Reform X FDI	-0.102* (0.054)	-0.096* (0.053)	-0.088 (0.062)			
lnfdi	-0.044 (0.056)	-0.056 (0.072)	-0.026 (0.060)			
Lag Fin Reform X Trade Sh				-0.016 (0.030)	-0.025 (0.029)	0.008 (0.033)
Trade Share				-0.006 (0.129)	0.034 (0.150)	-0.092 (0.150)
Ln GDPpc	-0.047 (0.041)	-0.040 (0.047)	-0.014 (0.042)	-0.027 (0.056)	-0.052 (0.063)	0.015 (0.057)
col_SpaPort	0.069 (0.099)	0.028 (0.108)	0.163* (0.098)	0.089 (0.097)	0.029 (0.120)	0.137 (0.169)
legor_english	-0.009 (0.076)	-0.003 (0.082)	0.082 (0.095)	0.023 (0.074)	-0.029 (0.081)	0.107 (0.115)

Conclusions

- Past corruption matters (strong path dependence)
- Political reforms (democratization) lower corruption
 - Among the various democracy measures, *democratic capital* by Rodrik has the strongest impact.
- Impact of economic reforms is mixed
 - FDI/Financial Liberalization reduces corruption
 - Trade/Trade Policies do not matter
- Higher per capita income diminishes corruption
- Historical factors matter
 - Colonization by Spain and Portugal increases corruption
 - German and Scandinavian legal systems decrease corruption
- Timing of financial reforms matters
 - Lagged financial reforms interacted with both, current FDI and current trade share reduce corruption, but this is more evident in countries that are more integrated globally (developed countries).

Extensions/Future Work

- Econometrics
 - Morales-Bonito ssLIML estimator
 - does not require mean stationarity
- Any other suggestions?

Thank You