

Supplementary material for "Political instability, institutional change and economic growth in Brazil since 1870"

Nauro Campos^{a,b,c}, Menelaos Karanasos^d, Panagiotis Koutroumpis^e and Zihui Zhang^d

^aUniversity College London, ^bETH-Zurich, ^cIZA-Bonn, ^dBrunel University London,

^eQueen Mary University London

April 11, 2020

Abstract

This supplementary material provides further background information about Brazil, graphical illustrations of the data employed in our analysis, our structural breaks methodology as well as tables with results.

Construction of our New Data Set

When the informal political indicator is revolutions

Further, for reasons of comparison mentioned above, we also investigated the revolutionary events of Brazil during the period of 1919 – 1930. As Fausto (1986) stated, the period between 1922 and 1924 was marked by many conflicts and riots. The Tenente Revolts (Rouquie and Suffern, 1995) occurred in 1922 and once again in 1924, which contributed significantly to the weakening of the political power of the Sao Paulo oligarchy. A few months after the Tenente revolt, other revolts broke out in various cities in Rio Grande do Sul against the government (Fausto, 1986). In the year 1928, a revolt¹ was recorded in a newspaper without many details. "A revolutionary outbreak was reported from Mattogrosso with no details" was the only piece of news which can be found. Two years later, the Revolution of 1930 overthrew President Washington Luis and installed Getulio Vargas as Provisional President (Bethell, 2008). A few months later in 1930, Revolta de Princesa – Paraíba occurred.

Descriptive Statistics and Correlation Matrix

Table A1 below reports the descriptive statistics for the variables employed in our analysis. The Brazilian economy experiences the highest growth rate of GDP at level in 1946. As far as the informal political indicators are concerned, for the variable guerrilla warfare, the highest number of registered incidents is in the year 1969 with the second highest recorded in 1970 whereas for the formal political instability indicator purges reaches its maximum in 1969 (34 purges registered) with the second highest value (of 9 purges) registered in the year 1971. The political instability measure with the largest average (standard deviations in parenthesis) is the size of cabinet, with approximately 12 members (6.32), followed by legislative effectiveness with 1.79 (0.75), legislative selections 1.73 (0.58) and purges 0.60 (3.14).

Table A2 tabulates the correlation coefficients between the variables under examination. No severe multicollinearity is detected among them.

Table A1 Descriptive Statistics for the Informal and Formal Political Instability Indicators

Variable	Mean	Std. Deviation	Minimum	Maximum
Growth Rate of the Level of GDP (GDP)	0.04	0.05	-0.12	0.39
<i>Informal Political Instability</i>				
Anti-Government Demonstrations (dem)	0.32	0.82	0	5
Assassinations (ass)	0.16	0.55	0	4
General Strikes (gs)	0.18	0.44	0	2
Guerrilla Warfare (gw)	0.28	1.35	0	14
Number of Coups d'etat (coup)	0.03	0.17	0	1
Revolutions (rev)	0.21	0.54	0	3
Riots (rts)	0.56	1.10	0	6
<i>Formal Political Instability</i>				
Changes in Effective Executive (ee)	0.26	0.49	0	2
Government Crises (gc)	0.23	0.58	0	3
Legislative Effectiveness (le)	1.79	0.75	0	3
Legislative Selection (ls)	1.73	0.58	0	2
Major Constitutional Changes (cc)	0.08	0.28	0	1
Number of Cabinet Changes (cab)	0.45	0.51	0	2
Purges (pur)	0.60	3.14	0	34
Size of Cabinet (scab)	11.76	6.32	6	28

Table A1 tabulates the descriptive statistics for the sample of informal and formal political instability measurements. In particular it reports the mean, the standard deviation as well as the minimum and maximum across the full sample period, 1870 to 2003 for Brazil.

¹ Available at: <http://newspapers.nl.sg/Digitised/Page/straitstimes19280811.1.10.aspx>

Table A2 Correlation Matrix for the Informal and Formal Political Instability Indicators

Variable	gdp	dem	ass	gs	gw	coup	rev	rts	ee	gc	le	ls	cc	cab	pur	scab
gdp	1.00															
dem	0.04	1.00														
ass	-0.09	0.02	1.00													
gs	0.14	-0.03	0.06	1.00												
gw	0.11	0.09	0.22	-0.04	1.00											
coup	-0.10	-0.07	0.10	-0.07	-0.03	1.00										
rev	-0.21	-0.13	0.01	-0.06	-0.01	0.26	1.00									
rts	0.01	0.04	0.01	0.07	0.04	0.15	0.22	1.00								
ee	0.08	-0.03	0.06	0.05	0.08	0.17	0.17	0.01	1.00							
gc	0.11	0.07	0.05	0.19	0.26	0.08	0.24	0.19	0.38	1.00						
le	0.16	0.02	-0.01	0.11	-0.08	-0.36	-0.18	0.12	0.14	0.03	1.00					
ls	0.16	0.17	-0.01	0.19	0.09	-0.38	-0.19	-0.04	0.11	-0.01	0.53	1.00				
cc	0.10	-0.05	0.01	0.12	-0.02	0.42	0.13	0.04	0.28	0.16	-0.21	-0.19	1.00			
cab	0.02	-0.08	0.06	0.03	0.06	0.10	0.10	0.01	0.60	0.19	0.09	-0.12	0.21	1.00		
pur	0.13	0.05	0.27	-0.05	0.88	0.05	-0.01	0.11	0.13	0.14	-0.11	0.03	0.01	0.05	1.00	
scab	0.01	0.49	0.22	0.24	0.03	-0.03	-0.15	0.07	0.02	0.11	-0.07	0.24	0.08	-0.10	0.04	1.00

Table A2 reports the pairwise correlation coefficients of the gdp as well as the informal and formal political instability measures.

Graphs on Informal and Formal Political Instabilities

Figure A1: Informal Political Instabilities

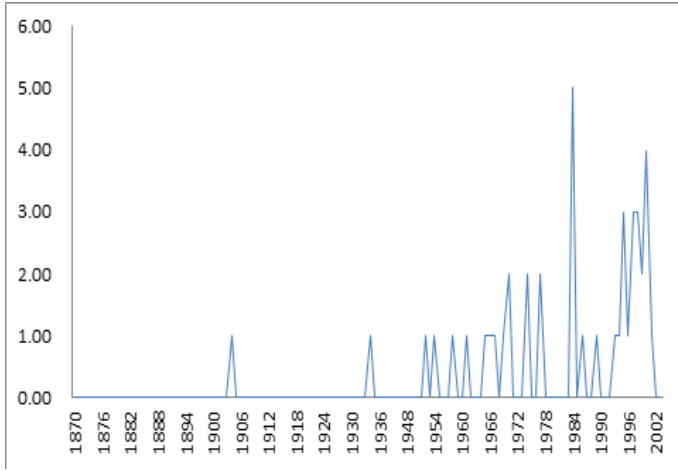


Fig. A1.a: Anti-government Demonstrations

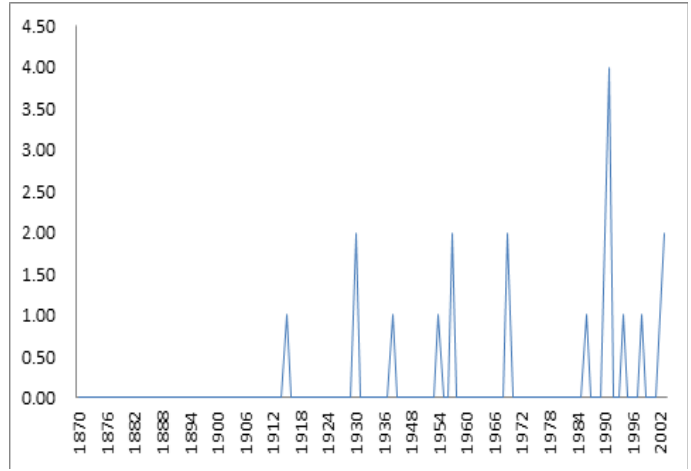


Fig. A1.b: Assassinations

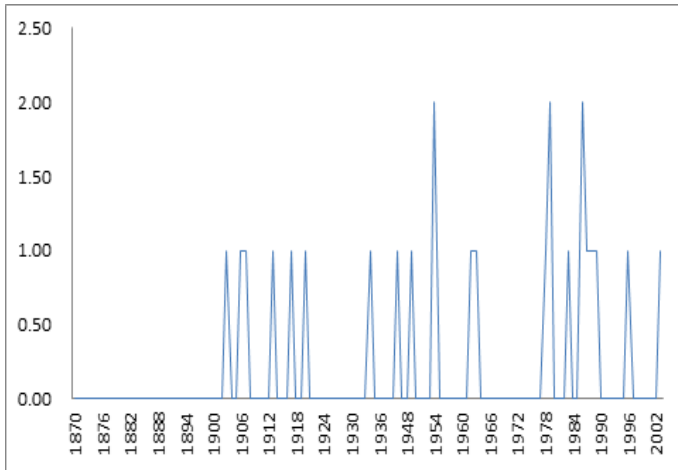


Fig. A1.c: General Strikes

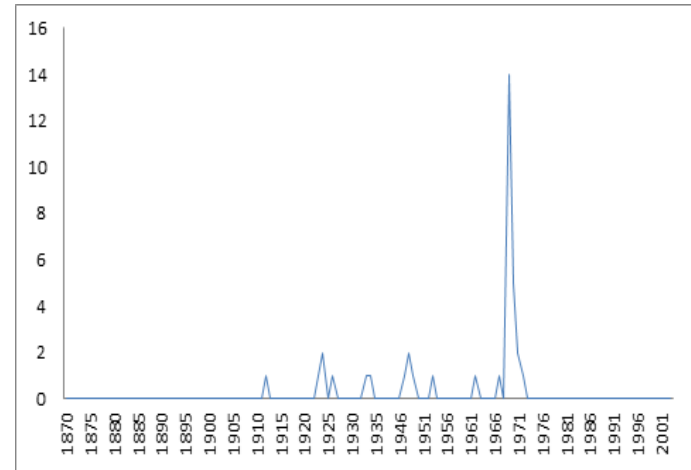


Fig. A1.d: Guerrilla Warfare

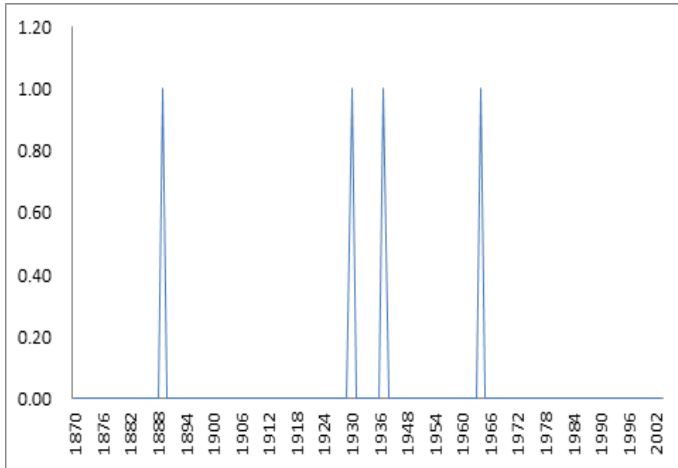


Fig. A1.e: Number of Coups d'etat

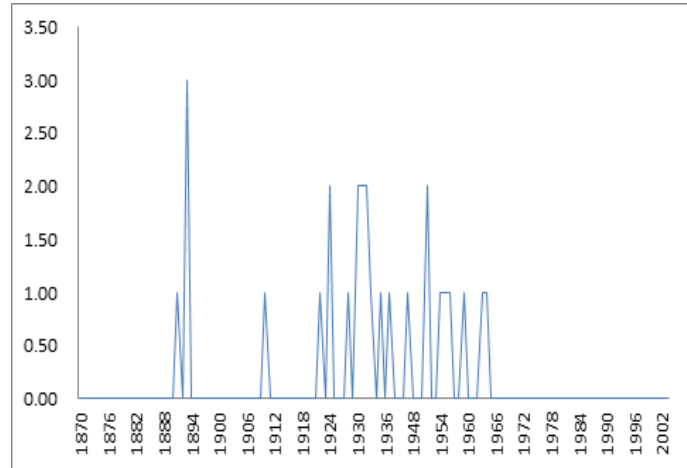


Fig. A1.f: Revolutions

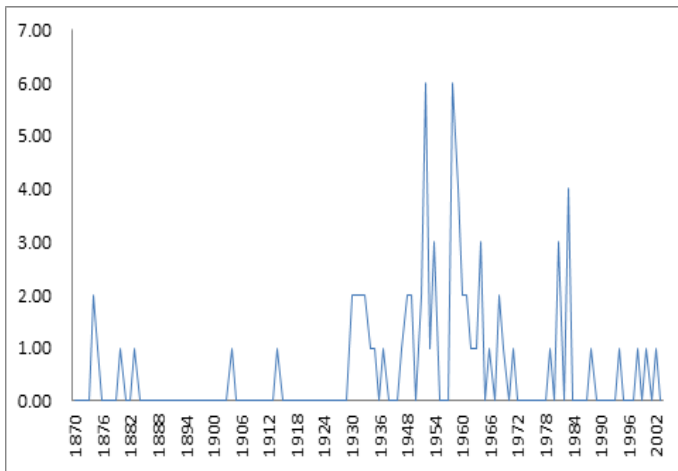


Fig. A1.g: Riots

Figure A2: Formal Political Instabilities

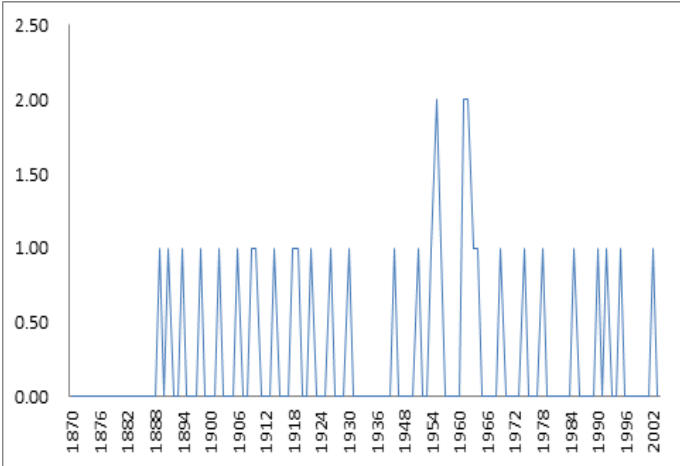


Fig. A2.a: Changes in Effective Executive

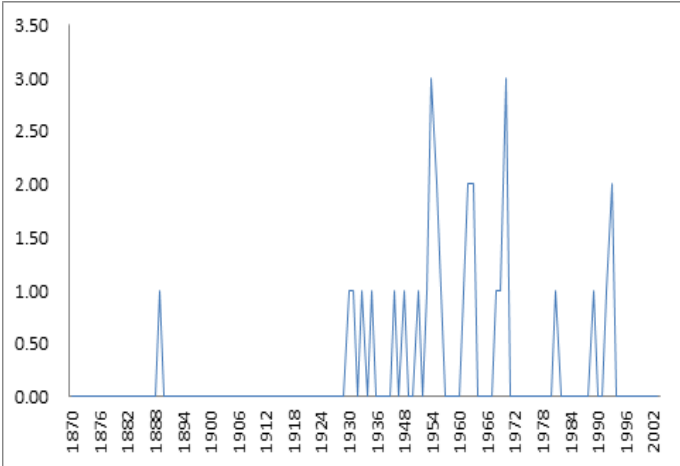


Fig. A2.b: Government Crisis

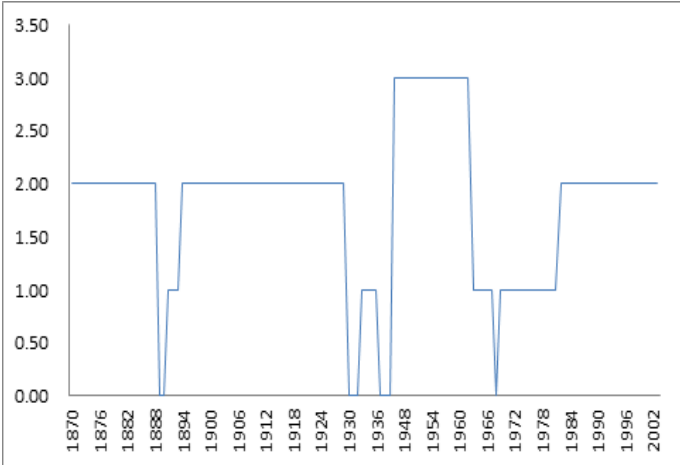


Fig. A2.c: Legislative Effectiveness

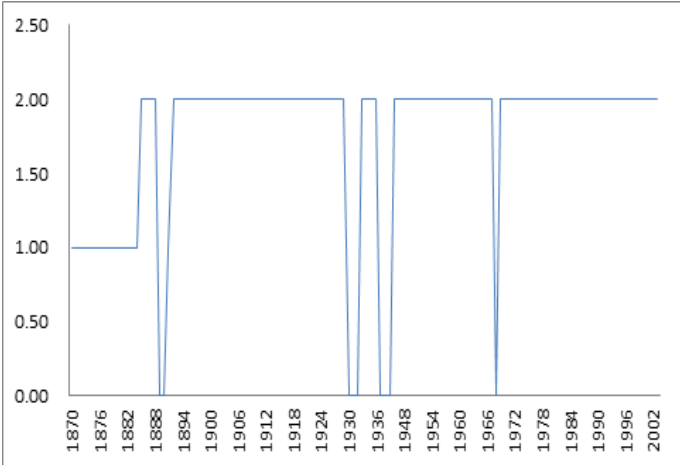


Fig. A2.d: Legislative Selection

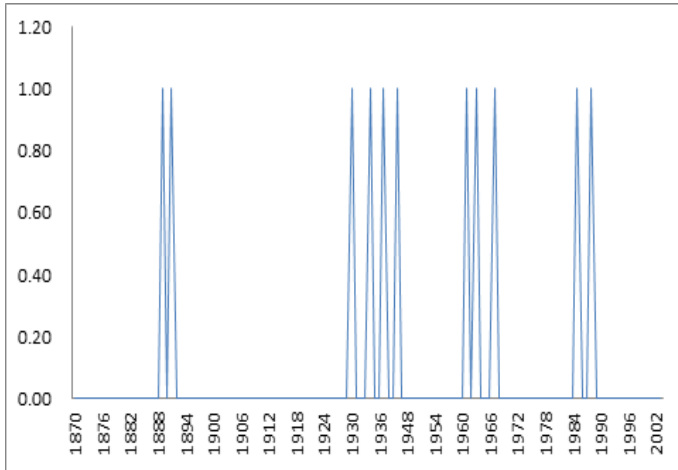


Fig. A2.e: Major Constitutional Changes

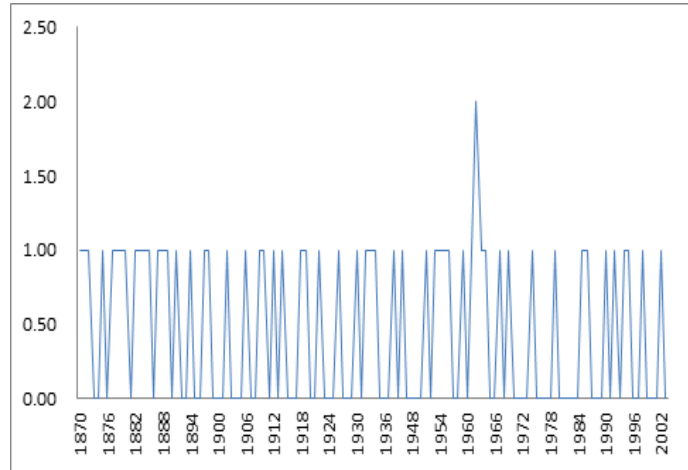


Fig. A2.f: Number of Cabinet Changes

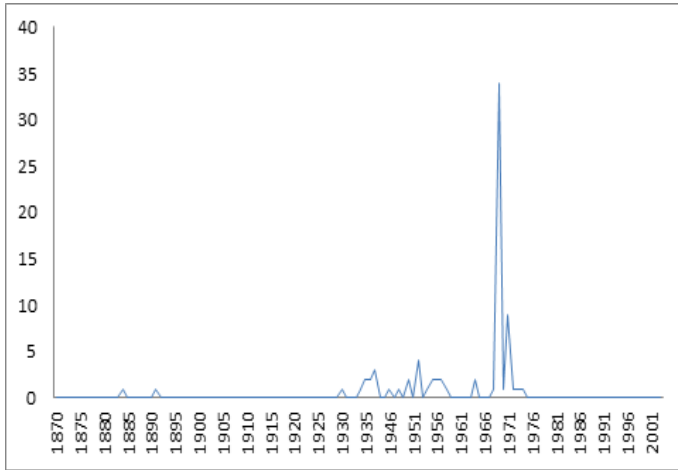


Fig. A2.g: Purges

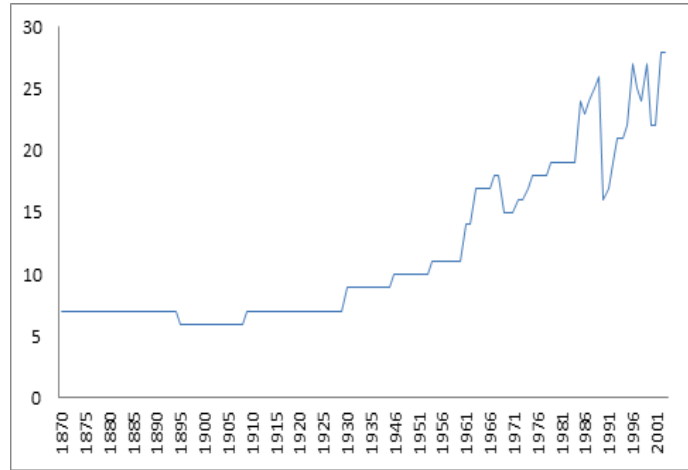


Fig. A2.h: Size of the Cabinet

Comparison With Other Measures of Democracy and Institutional Development

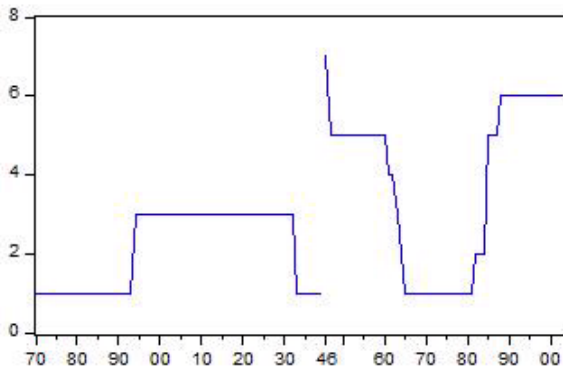


Fig. A3.a: Executive Constraints

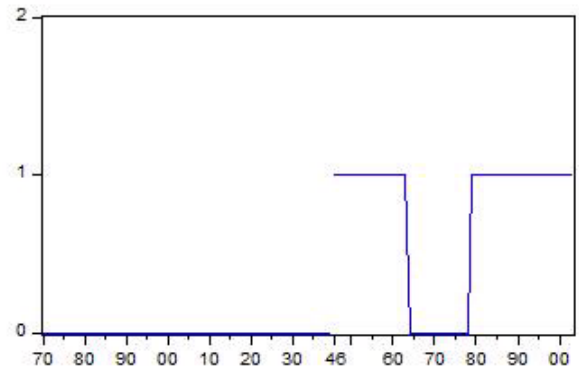


Fig. A3.b: Democracy Dichotomous

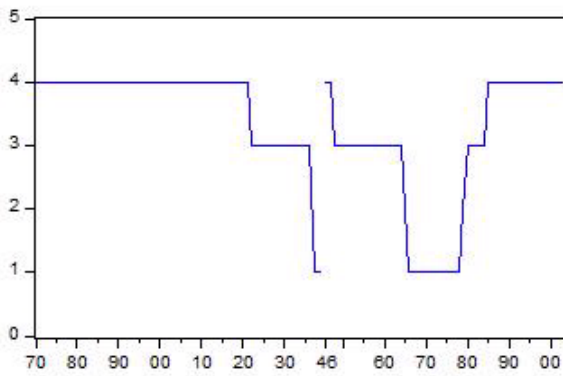


Fig. A3.c: Party Ban

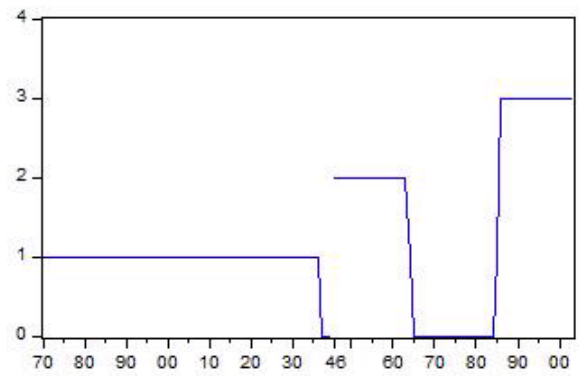


Fig. A3.d: Freedom from Political Killings

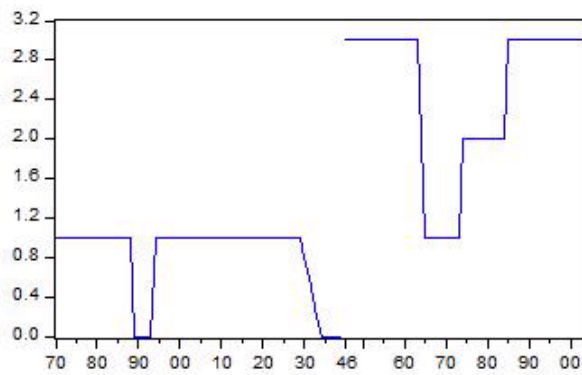


Fig. A3.e: Competitiveness of Executive Recruitment

Figure A3: Other Measures of Democracy and Institutional Development

Sample Autocorrelations, Wald and AIC Statistics

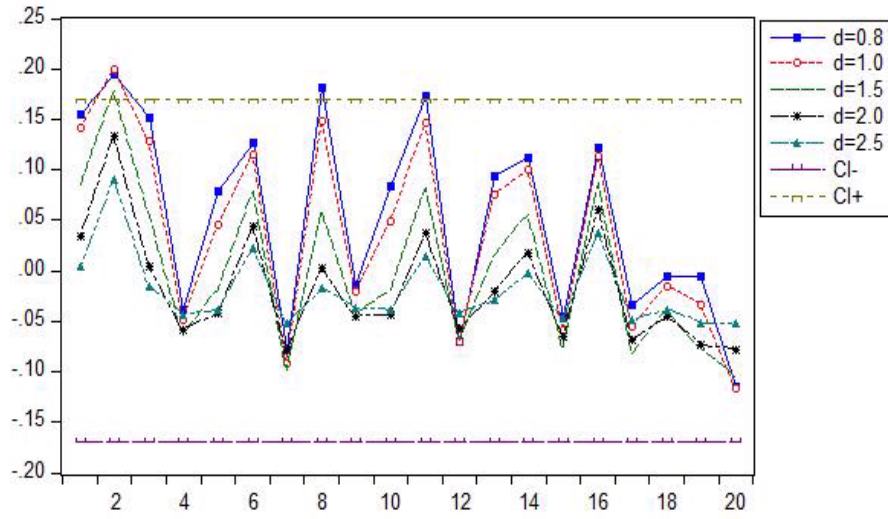


Figure A4.a: Autocorrelation of $|y_t|^d$ from high to low.

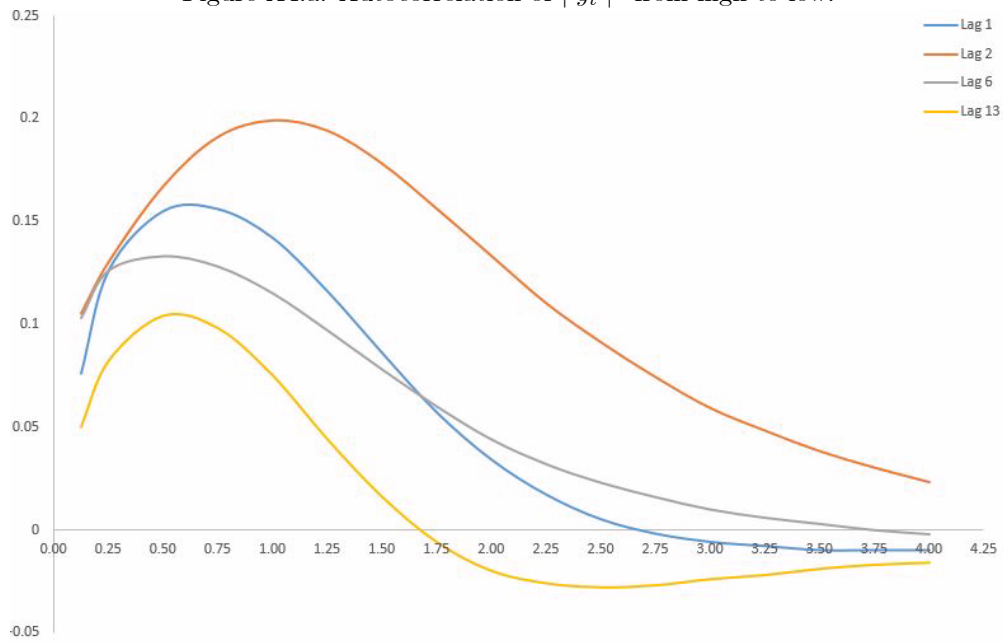


Figure A4.b: Autocorrelation of $|y_t|^d$ at lag 1,2, 6 and 13.

Table A3: Wald Tests - $\chi^2(1)$ and AIC

<i>Panel A - Tests for Restrictions on Power Term</i>				
<i>Parameters</i>				
<i>H₀:</i>	<i>$\delta = 2$</i>			
GDP Growth	27.39[0.00]			
<i>Panel B - AIC</i>				
Direct Effect of Political Instability on Growth	$\delta = 0.8$	$\delta = 0.9$	$\delta = 1.0$	$\delta = 2.0$
Assassinations	-3.01		-2.91	-2.92
General Strikes	-3.03		-3.13	-3.00
Purges		-3.02	-2.92	-2.81
Size of the Cabinet	-3.21		-3.23	-3.00

Panel A reports the value of the Wald statistic of the restricted PARCH(1,1) when $\delta = 2$. The number in square brackets is p-value.

Panel B reports the Akaike Information Criterion (AIC) for each of the restricted PARCH(1,1) in the case of the direct effect of political instability on growth when $\delta = 0.8, 1, 2$.

Omitted Variable Bias

Table A4.a Direct Effect of Informal Political Instability on GDP growth - Omitted Variable Bias

Informal Political Instability									
$x_{it} \downarrow$	k	λ	ζ	θ	ξ	α	β	γ	δ
Anti-government Demonstrations	0.002 (2.13)	-0.01 (-6.72)	-0.45 (-1.92)	-0.04 (-0.96)	0.05 (3.66)	0.62 (2.13)	0.34 (5.99)	0.08 (2.01)	0.80 -
		$l=3$	$j=6$	$m=1$	$s=10$			$n=7$	
General Strikes	0.012 (3.22)	-0.03 (-4.63)	-0.36 (-2.45)	0.01 (0.35)	0.05 (2.49)	0.70 (2.46)	0.33 (2.50)	0.07 (0.85)	1.00 -
		$l=2$	$j=5$	$m=7$	$s=3$			$n=4$	
Number of Coups d'etat	0.014 (3.78)	-0.08 (-4.45)	-0.92 (-5.92)	-0.02 (-0.26)	0.06 (3.29)	0.66 (2.77)	0.20 (1.66)	0.07 (1.73)	0.80 -
		$l=1$	$j=6$	$m=5$	$s=1$			$n=8$	
Revolutions	0.019 (2.91)	-0.01 (-1.67)	-0.67 (-2.09)	0.03 (0.58)	0.09 (4.46)	0.09 (2.89)	1.03 (63.87)	-0.04 (-1.07)	0.80 -
		$l=2$	$j=6$	$m=8$	$s=10$			$n=4$	

Table A4.a reports parameter estimates for the following model:

$$y_t = c + k \log(h_t) + \lambda x_{i,t-l} + \zeta temp_{i,t-j} + \theta rain_{i,t-m} + \xi school_{i,t-s} + \varepsilon_t,$$

$$h_t^{\frac{\delta}{2}} = \omega + \alpha h_{t-1}^{\frac{\delta}{2}} | e_{t-1} |^{\delta} + \beta h_{t-1}^{\frac{\delta}{2}} + \gamma y_{t-n}.$$

$x_{i,t-l}$ is an informal political instability variable.

l, j, m, s and n are the order of the lags.

The numbers in parentheses are t statistics.

Table A4.b Direct Effect of Formal Political Instability on GDP growth - Omitted Variable Bias

Formal Political Instability									
$x_{it} \downarrow$	k	λ	ζ	θ	ξ	α	β	γ	δ
Legislative Effectiveness	0.01 (4.26)	-0.02 (-2.43)	-0.59 (-3.48)	-0.07 (-1.13)	0.15 (7.04)	0.62 (3.28)	0.35 (4.20)	0.06 (1.34)	0.90 -
		$l=3$	$j=6$	$m=1$	$s=10$			$n=3$	
Legislative Selection	0.01 (2.96)	-0.05 (-2.17)	-0.46 (-1.77)	0.04 (0.69)	0.09 (5.47)	0.26 (5.29)	0.85 (15.93)	0.03 (1.68)	0.80 -
		$l=3$	$j=6$	$m=1$	$s=10$			$n=8$	
Major Constitutional Changes	0.01 (13.89)	-0.07 (-2.02)	-0.47 (-2.05)	0.22 (1.48)	0.12 (2.76)	0.30 (5.84)	0.83 (11.77)	0.05 (1.88)	0.80 -
		$l=2$	$j=1$	$m=2$	$s=10$			$n=6$	
Number of Cabinet Changes	0.02 (5.90)	-0.01 (-2.81)	-0.74 (-4.41)	0.03 (0.72)	0.12 (5.81)	0.51 (3.29)	0.42 (6.35)	0.16 (2.31)	0.90 -
		$l=4$	$j=6$	$m=5$	$s=10$			$n=2$	

Table A4.b reports parameter estimates for the following model:

$$y_t = c + k \log(h_t) + \lambda x_{i,t-l} + \zeta temp_{i,t-j} + \theta rain_{i,t-m} + \xi school_{i,t-s} + \varepsilon_t,$$

$$h_t^{\frac{\delta}{2}} = \omega + \alpha h_{t-1}^{\frac{\delta}{2}} | e_{t-1} |^{\delta} + \beta h_{t-1}^{\frac{\delta}{2}} + \gamma y_{t-n}.$$

$x_{i,t-l}$ is a formal political instability variable.

l, j, m, s and n are the order of the lags.

The numbers in parentheses are t statistics.

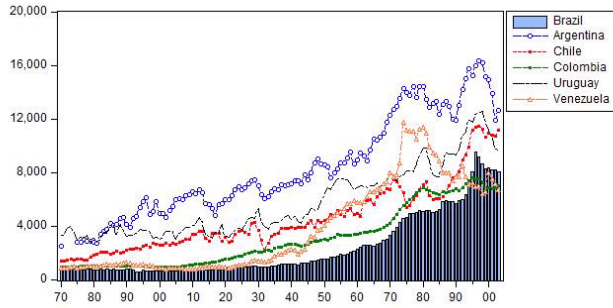


Figure A5.a Per Capita GDP – Brazil vs Latin American Countries

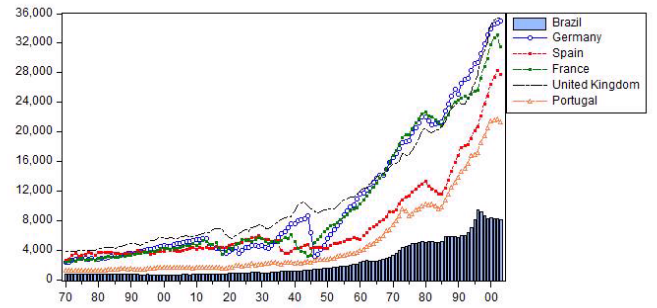


Figure A5.b Per Capita GDP – Brazil vs Western European Countries

Structural Break Tests

Table A5. Break Dates reported by Bai-Perron and Wald-Chow Test

$x_{it} \downarrow$	1 st Break	Bai-Perron		Wald-Chow
		2 nd Break	3 rd Break	Break date
GDP	1893	1938	1979	1893
<i>Informal Political Instability</i>				
dem	1964	–	–	1952
ass	1978	–	–	1915
gs	1902	–	–	1903
gw		no breaks		no break
coup		no breaks		no break
rev		no breaks		1965
rts	1929	1964	–	1930
<i>Formal Political Instability</i>				
ee		no breaks		1891
gc		no breaks		1930
le		no breaks		1963
ls	1939	–	–	1892
cc		no breaks		no break
cab	1889	–	–	1890
pur		no breaks		no break
scab		no breaks		1963

Notes: The table reports the break dates for the gdp, as well as the informal and formal political instability indicators according to the Bai-Perron and Wald-Chow tests. The dates in bold indicate significant break dates at 5% level. The breaks serve as the dummy variable in our model below.

Structural Breaks Methodology

In what follows, we incorporate dummy variables in equations (1) (2) (4) and (7), thus taking into account breaks in growth, informal and formal political instabilities under the Bai-Perron framework. First, we introduce the following notation. D_{1t} and D_{2t} , are (intercept) dummies defined as: $D_{1t} = 1$ in the period 1938-2003, $D_{2t} = 1$ in the period 1979-2003, and $D_{1t} = 0$ and $D_{2t} = 0$ otherwise. Similarly, D_{it} is a (slope) dummy indicating the period which starts from the year of the break in either the informal political factor or formal political variable (x_{it}). For example for the assassinations $D_{it} = 1$ in the period from 1978 to 2003 and for the anti-government demonstrations $D_{it} = 1$ during the period from 1964 until the end of the sample.

The augmented model is given by

$$y_t = c + k \log(h_t) + \lambda x_{i,t-l} + \lambda_d D_{i,t-l} x_{i,t-l} + \epsilon_t, \quad (\text{A.1})$$

and

$$h_t^{\frac{\delta}{2}} = \omega + \omega_1 D_{1t} + \omega_2 D_{2t} + \alpha h_{t-1}^{\frac{\delta}{2}} f(e_{t-1}) + \beta h_{t-1}^{\frac{\delta}{2}} + \phi x_{i,t-l} + \phi_d D_{i,t-l} x_{i,t-l} + \gamma y_{t-n}. \quad (\text{A.2})$$

Recall that the coefficients λ and ϕ capture the impacts of the explanatory variables on growth and its volatility respectively. Similarly, λ_d and ϕ_d correspond to the two effects from the year of the break and onwards. Thus the two effects are captured by λ and ϕ in the period up to the year of the structural break, and by $\lambda + \lambda_d$ and $\phi + \phi_d$ during the period from the year of the break until the end of the sample. As above in order to study the direct effects of political instability we specify model 1 with $\phi = \phi_d = 0$ in equation (A.2), while model 2 with $\lambda = \lambda_d = 0$ in equation (A.1) allows us to investigate their indirect impacts on growth.

We also incorporate intercept dummies and level effects in the error correction equation (4) and conditional variance equation (7), as follows:

$$\Delta y_t = \mu + \theta \Delta x_{i,t-l} + \theta_d D_{i,t-l} \Delta x_{i,t-l} + \varphi (y_{t-1} - c - \zeta x_{i,t-1}) + \epsilon_t, \quad (\text{A.3})$$

$$h_t^{\frac{\delta}{2}} = \omega + \alpha h_{t-1}^{\frac{\delta}{2}} |e_{t-1}|^\delta + \beta h_{t-1}^{\frac{\delta}{2}} + \gamma y_{t-n}. \quad (\text{A.4})$$

Table A6.a Direct Effect of Informal Political Instability on Economic Growth with Dummies

Informal Political Instability									
$x_{it} \downarrow$	k	λ	λ_d	α	β	ω_1	ω_2	γ	δ
Anti-government Demonstrations	0.010 (4.60)	-0.320 (-3.12)	0.270 (2.56)	0.72 (5.50)	0.25 (1.96)	0.041 (4.01)	-0.034 (-4.92)	-0.099 (-0.62)	0.80 -
Assassinations	0.012 (3.57)	-0.677 (-7.95)	0.560 (4.34)	0.63 (4.81)	0.37 (2.65)	0.035 (2.94)	-0.034 (-3.47)	-0.063 (-0.68)	0.90 -
General Strikes	0.013 (5.19)	-0.316 (-6.82)	-	0.72 (5.94)	0.18 (2.33)	0.030 (6.17)	-0.027 (-3.15)	0.043 (0.93)	0.90 -
Guerrilla Warfare	0.015 (5.17)	0.021 (0.45)	-	0.72 (6.36)	0.25 (1.99)	0.021 (5.33)	-0.020 (-5.80)	-0.018 (-0.34)	1.00 -
Number of Coups d'etat	0.008 (5.33)	-0.060 (-1.69)	-	0.84 (4.67)	0.30 (2.39)	0.012 (1.71)	-	-0.054 (-0.82)	0.90 -
Revolutions	0.009 (3.09)	-0.343 (-5.23)	-	0.54 (4.97)	0.56 (5.75)	0.014 (1.29)	-0.016 (-1.88)	-0.088 (-0.87)	0.90 -
Riots	0.009 (4.97)	-0.022 (-0.60)	-	0.85 (6.10)	0.25 (2.17)	0.026 (4.24)	-0.022 (-4.61)	-0.029 (-0.30)	1.00 -

Table A6.a reports parameter estimates for the following model:

$$y_t = c + k \log(h_t) + \lambda x_{i,t-l} + \lambda_d D_{i,t-l} x_{i,t-l} + \varepsilon_t,$$

$$h_t^{\frac{\delta}{2}} = \omega + \omega_1 D_{1t} + \omega_2 D_{2t} + \alpha h_{t-1}^{\frac{\delta}{2}} | e_{t-1} |^{\delta} + \beta h_{t-1}^{\frac{\delta}{2}} + \gamma y_{t-n}.$$

D_{it} is a dummy defined as 1 in the period: 1964-2003 (for anti-government demon.); 1978-2003 (for assassinations), and 0 otherwise. D_{1t} and D_{2t} are intercept dummies defined as 1 in the period 1938 - 2003 and 1979 - 2003 respectively and 0 otherwise. $x_{i,t-l}$ is an informal political instability variable. l and n are the order of the lags.

The numbers in parentheses are t statistics.

Table A6.b Direct Effect of Formal Political Instability on Economic Growth with Dummies

Formal Political Instability									
$x_{it} \downarrow$	k	λ	λ_d	α	β	ω_1	ω_2	γ	δ
Changes in Effective Executive	0.014 (3.93)	-0.079 (-1.43)	-	0.71 (5.43)	0.34 (3.33)	0.022 (5.50)	-0.020 (-3.97)	-0.063 (-0.91)	0.90 -
Government Crises	0.014 (4.77)	-0.040 (-0.86)	-	0.77 (5.56)	0.18 (1.89)	0.019 (7.62)	-0.018 (-4.94)	0.046 (0.98)	1.00 -
Legislative Effectiveness	0.010 (5.83)	-0.622 (-1.68)	-	0.69 (6.03)	0.29 (7.36)	0.030 (3.52)	-0.029 (-3.59)	-0.163 (-1.24)	0.80 -
Legislative Selection	0.010 (3.26)	-2.758 (-4.78)	1.782 (4.19)	0.34 (4.33)	0.77 (17.36)	-0.002 (-0.28)	-0.006 (-1.33)	0.027 (0.52)	0.90 -
Major Constitutional Changes	0.011 (4.20)	-0.083 (-8.71)	-	0.74 (5.59)	0.15 (2.34)	0.031 (3.32)	-0.028 (-2.55)	0.229 (3.24)	0.80 -
Number of Cabinet Changes	0.009 (4.01)	-0.075 (-2.78)	0.074 (1.39)	0.76 (5.60)	0.29 (2.43)	0.017 (3.00)	-0.015 (-3.28)	-0.005 (-0.05)	1.00 -
Purges	0.008 (5.39)	0.023 (0.80)	-	0.87 (6.22)	0.26 (2.79)	0.024 (4.94)	-0.019 (-3.49)	-0.031 (-0.35)	1.00 -
Size of the Cabinet	0.013 (4.22)	-0.016 (-3.03)	-	0.77 (6.05)	0.24 (2.11)	0.032 (4.92)	-0.027 (-4.68)	-0.033 (-0.33)	0.90 -

Table A6.b reports parameter estimates for the following model:

$$y_t = c + k \log(h_t) + \lambda x_{i,t-l} + \lambda_d D_{i,t-l} x_{i,t-l} + \varepsilon_t,$$

$$h_t^{\frac{\delta}{2}} = \omega + \omega_1 D_{1t} + \omega_2 D_{2t} + \alpha h_{t-1}^{\frac{\delta}{2}} | e_{t-1} |^{\delta} + \beta h_{t-1}^{\frac{\delta}{2}} + \gamma y_{t-n}.$$

D_{it} is a dummy defined as 1 in the period: 1939-2003 (for legislative selection); 1889-2003 (number of cabinet changes), and 0 otherwise.

D_{1t} and D_{2t} are intercept dummies defined as 1 in the period 1938 - 2003 and 1979 - 2003 respectively and 0 otherwise.

$x_{i,t-l}$ is an informal political instability variable. l and n are the order of the lags.

The numbers in parentheses are t statistics.

Table A7.a Indirect Effect of Informal Political Instability on Economic Growth with Dummies

Informal Political Instability									
$x_{it} \downarrow$	k	α	β	ϕ	ϕ_d	ω_1	ω_2	γ	δ
Anti-government Demonstrations	0.014 (4.24)	0.72 (6.02)	0.19 (1.68)	-0.263 (-2.88) $l=5$	0.219 (2.17) $l=5$	0.019 (7.81)	-0.011 (-1.62)	0.003 (0.07) $n=7$	1.00 -
Assassinations	0.012 (3.72)	0.67 (5.00)	0.22 (1.65)	-0.235 (-3.09) $l=8$	0.156 (1.88) $l=8$	0.025 (4.59)	-0.021 (-3.00)	0.032 (0.44) $n=4$	0.90 -
General Strikes	0.011 (4.81)	0.76 (5.60)	0.27 (2.24)	-0.151 (-1.78) $l=5$	- $l=8$	0.048 (5.33)	-0.040 (-6.09)	-0.108 (-0.78) $n=4$	0.80 -
Guerrilla Warfare	0.008 (5.14)	0.89 (6.38)	0.27 (2.57)	-0.024 (-0.43) $l=1$	- $l=8$	0.030 (6.91)	-0.024 (-4.76)	-0.036 (-0.45) $n=3$	1.00 -
Number of Coups d'etat	0.006 (4.68)	0.79 (5.57)	0.33 (3.57)	-0.375 (-10.20) $l=1$	- $l=8$	0.017 (4.57)	-0.013 (-3.42)	-0.056 (-0.70) $n=3$	1.00 -
Revolutions	0.011 (4.67)	0.70 (7.33)	0.31 (2.81)	0.120 (1.35) $l=5$	- $l=1$	0.014 (1.76)	-0.013 (-1.79)	-0.062 (-0.96) $n=7$	0.90 -
Riots*	0.006 (3.91)	0.57 (4.40)	0.46 (3.66)	-0.106 (-4.38) $l=1$	0.034 (0.63) $l=1$	0.025 (3.56)	-0.020 (-3.31)	-0.052 (-0.49) $n=4$	0.90 -

Table A7.a reports parameter estimates for the following model:

$$y_t = c + k \log(h_t) + \varepsilon_t,$$

$$h_t^{\frac{\delta}{2}} = \omega + \omega_1 D_{1t} + \omega_2 D_{2t} + \alpha h_{t-1}^{\frac{\delta}{2}} | e_{t-1} |^{\delta} + \beta h_{t-1}^{\frac{\delta}{2}} + \phi x_{i,t-l} + \phi_d D_{i,t-l} x_{i,t-l} + \gamma y_{t-n}.$$

D_{it} is a slope dummy defined as 1 in the period: 1964-2003 (for anti-government demonstrations); 1978-2003 (for assassinations); 1929-2003 and 1964-2003 (for riots) and 0 otherwise.

D_{1t} and D_{2t} are intercept dummies defined as 1 in the period 1938 - 2003 and 1979 - 2003 respectively and 0 otherwise.

$x_{i,t-l}$ is an informal political instability variable. l and n are the order of the lags.

The numbers in parentheses are t statistics.

The coefficient for the second dummy for riots equals -0.109, which is insignificant.

Table A7.b Indirect Effect of Formal Political Instability on Economic Growth with Dummies

Formal Political Instability									
$x_{it} \downarrow$	k	α	β	ϕ	ϕ_d	ω_1	ω_2	γ	δ
Changes in Effective Executive	0.0130 (4.84)	0.83 (6.24)	0.24 (2.07)	-0.048 (-2.14)	-	0.024 (6.79)	-0.023 (-5.22)	-0.009 (-0.24)	1.00 -
Government Crises	0.0103 (5.56)	0.66 (6.08)	0.27 (2.73)	-0.167 (-2.36)	-	0.036 (6.44)	-0.033 (-5.82)	-0.021 (-0.26)	0.80 -
Legislative Effectiveness	0.0081 (5.53)	0.59 (4.23)	0.39 (3.08)	-2.125 (-6.04)	-	0.022 (3.08)	-0.014 (-2.94)	-0.155 (-1.03)	0.80 -
Legislative Selection	0.0179 (3.15)	0.27 (2.53)	0.37 (2.63)	-2.873 (-5.97)	0.308 (0.71)	-	-0.017 (-1.70)	-0.036 (-0.45)	0.90 -
Major Constitutional Changes	0.0091 (4.81)	0.74 (7.53)	0.32 (3.11)	-0.246 (-1.38)	-	0.032 (6.23)	-0.031 (-5.79)	-0.027 (-0.32)	0.90 -
Number of Cabinet Changes	0.0031 (3.78)	0.54 (3.06)	0.38 (3.20)	-0.189 (-4.22)	0.110 (2.08)	0.011 (1.68)	-0.015 (-2.15)	0.023 (0.23)	1.00 -
Purges	0.0122 (4.47)	0.79 (5.90)	0.30 (2.83)	-0.024 (-2.05)	-	0.016 (6.61)	-0.015 (-4.20)	-0.053 (-1.00)	1.00 -
Size of the Cabinet	0.0162 (3.48)	0.51 (5.40)	0.22 (1.71)	-0.078 (-3.16)	-	0.026 (5.72)	-0.025 (-2.56)	0.006 (0.09)	1.00 -

Table A7.b reports parameter estimates for the following model:

$$y_t = c + k \log(h_t) + \varepsilon_t,$$

$$h_t^{\frac{\delta}{2}} = \omega + \omega_1 D_{1t} + \omega_2 D_{2t} + \alpha h_{t-1}^{\frac{\delta}{2}} | e_{t-1} |^{\delta} + \beta h_{t-1}^{\frac{\delta}{2}} + \phi x_{i,t-l} + \phi_d D_{i,t-l} x_{i,t-l} + \gamma y_{t-n}.$$

D_{it} is a slope dummy defined as 1 in the period: 1939-2003 (for legislative selection); 1889-2003 (for number of cabinet changes); 1889-2003 (for number of cabinet changes) and 0 otherwise.

D_{1t} and D_{2t} are intercept dummies defined as 1 in the period 1938 - 2003 and 1979 - 2003 respectively and 0 otherwise.

$x_{i,t-l}$ is an informal political instability variable. l and n are the order of the lags.

The numbers in parentheses are t statistics.

Table A8.a The Short- and Long-run Effects of Informal Political Instability on Economic Growth with Dummy Variables

Informal Political Instability								
$x_{it} \downarrow$	θ	θ_d	ζ	φ	α	β	γ	δ
Anti-government Demonstrations	-0.079 (-7.43) $l=4$	0.052 (2.46) $l=2$	-0.009 (-0.27)	-0.42 (-4.58)	0.94 (2.52)	0.28 (3.38)	0.189 (1.53) $n=5$	1.00 -
Assassinations	-0.205 (-5.56) $l=8$	0.151 (3.97) $l=8$	-0.147 (-2.21)	-0.32 (-4.35)	0.77 (4.65)	0.24 (3.11)	0.023 (0.23) $n=8$	0.80 -
General Strikes	-0.226 (-1.78) $l=4$	-	0.066 (1.27)	-0.51 (-6.35)	0.73 (3.30)	0.50 (5.25)	-0.026 (-0.37) $n=8$	1.00 -
Guerrilla Warfare	0.273 (1.14) $l=4$	-	-0.023 (-0.36)	-0.83 (-10.24)	0.49 (1.85)	0.61 (2.50)	-0.217 (-1.56) $n=1$	0.80 -
Number of Coups d'etat	-0.384 (-2.56) $l=5$	-	-0.031 (-2.62)	-0.51 (-8.16)	0.59 (3.06)	0.39 (3.84)	0.181 (0.78) $n=6$	0.90 -
Revolutions	-0.214 (-1.63) $l=3$	-	-0.109 (-2.14)	-0.55 (-6.50)	0.61 (2.79)	0.61 (6.14)	-0.053 (-0.73) $n=2$	1.00 -
Riots*	-0.054 (-2.83) $l=5$	-0.005 (-0.46) $l=7$	-0.006 (-0.23)	-0.40 (-8.30)	0.95 (2.44)	0.26 (3.68)	0.160 (2.17) $n=5$	1.00 -

Table A8.a. reports parameter estimates for the following model:

$$\Delta y_t = \mu + \theta \Delta x_{i,t-l} + \theta_d D_{it} \Delta x_{i,t-l} + \varphi (y_{t-1} - c - \zeta x_{i,t-1}) + u_t,$$

$$h_t^{\frac{\delta}{2}} = \omega + \alpha |e_{t-1}|^{\delta} + \beta h_{t-1}^{\frac{\delta}{2}} + \gamma y_{t-n}.$$

θ and ζ capture the short- and long-run effects respectively.

φ indicates the speed of adjustment to the long-run relationship.

D_{it} is a slope dummy defined as 1 in the period: 1964-2003 (for anti-government demonstrations); 1978-2003 (for assassinations); 1929-2003 and 1964-2003 (for riots) and 0 otherwise.

$x_{i,t-l}$ is an informal political instability variable. l and n are the order of the lags.

The numbers in parentheses are t statistics.

*The coefficient of the second dummy for riots is -0.045, which is significant at 10% level.

Table A8.b The Short- and Long-run Effects of Formal Political Instabilities on Economic Growth with Dummy Variables

$x_{it} \downarrow$	θ	θ_d	ζ	φ	α	β	γ	δ
Formal Political Variables								
Changes in Effective Executive	-0.116 (-1.92) $l=3$	—	0.0236 (0.53)	-0.41 (-7.36)	0.79 (4.58)	0.31 (4.00)	0.271 (1.07) $n=6$	0.80 —
Government Crisis	-0.156 (-2.22) $l=3$	—	0.1200 (1.29)	-0.62 (-5.75)	0.85 (3.68)	0.53 (5.34)	-0.223 (-1.43) $n=1$	0.90 —
Legislative Effectiveness	-2.313 (-3.14) $l=5$	—	-1.8664 (-1.68)	-0.26 (-3.00)	0.98 (4.44)	0.43 (4.85)	0.064 (1.04) $n=5$	1.00 —
Legislative Selection	-4.869 (-2.43) $l=6$	-0.338 (-0.29) $l=1$	0.3970 (1.44)	-0.74 (-10.61)	0.71 (1.91)	0.54 (2.61)	-0.023 (-0.32) $n=7$	1.00 —
Major Constitutional Changes	-0.504 (-3.05) $l=2$	—	0.0181 (1.26)	-0.32 (-2.39)	0.89 (2.96)	0.51 (3.52)	-0.010 (-0.14) $n=5$	1.00 —
Number of Cabinet Changes	-0.112 (-3.46) $l=8$	0.073 (2.42) $l=2$	-0.1448 (-2.27)	-0.37 (-6.59)	0.92 (4.64)	0.22 (2.77)	0.247 (1.60) $n=6$	0.80 —
Purges	-0.013 (-1.66) $l=5$	—	-0.0032 (-0.11)	-0.34 (-2.57)	0.57 (3.08)	0.53 (4.45)	0.121 (0.80) $n=6$	1.00 —
Size of the Cabinet	-0.051 (-4.64) $l=2$	—	0.0047 (0.98)	-0.32 (-3.17)	0.64 (5.46)	0.55 (4.63)	0.011 (0.28) $n=7$	0.90 —

Table A8.b. reports parameter estimates for the following model:

$$\Delta y_t = \mu + \theta \Delta x_{i,t-l} + \theta_d D_{i,t-l} \Delta x_{i,t-l} + \varphi (y_{t-1} - c - \zeta x_{i,t-1}) + u_t,$$

$$h_t^{\frac{\delta}{2}} = \omega + \alpha |e_{t-1}|^{\delta} + \beta h_{t-1}^{\frac{\delta}{2}} + \gamma y_{t-n}.$$

θ and ζ capture the short- and long-run effects respectively.

φ indicates the speed of adjustment to the long-run relationship.

D_{it} is a slope dummy defined as 1 in the period: 1939-2003 (for legislative selection); 1889-2003 (for number of cabinet changes) and 0 otherwise.

$x_{i,t-l}$ is a formal political instability variable. l and n are the order of the lags.

The numbers in parentheses are t statistics.

Table A9. Trigger Break Dates and Their Association With Growth

$x_{it} \downarrow$	1 st Break	2 nd Break	3 rd Break
Panel A			
GDP	1893	1938	1979
Panel B			
<i>Informal Political Instability</i>			
dem	1964 (0.94)	—	—
ass	1978 (0.06)	—	—
gs	1902 (0.04)	—	—
gw		no breaks	
coup		no breaks	
rev		no breaks	
rts	1929 (0.04)	1964 (0.94)	—
<i>Formal Political Instability</i>			
ee		no breaks	
gc		no breaks	
le		no breaks	
ls	1939 (0.02)	—	—
cc		no breaks	
cab	1889 (0.00)	—	—
pur		no breaks	
scab		no breaks	

Notes: Panel A reports the break dates of gdp whereas Panel B displays the results from the Wald-Chow test on whether breaks of informal and formal instability indicators triggered significant breaks in gdp as well. For example, in the case of ass the estimated breakpoint 1978 triggered a significant break in growth as well. The numbers in parentheses report p-values.

References

- [1] Bethell, L., 2008. Politics in Brazil Under Vargas, 1930 - 1945. The Cambridge History of Latin American Vol.9, Edn. 1.
- [2] Fausto, B., 1986. Brazil: the Social and Political Structure of the First Republic. 1889 - 1930. Cambridge History of Latin American Vol.5, 779-830.
- [3] Rouquie, A., and Suffern, S., 1995. The Military in Latin American Politics since 1930. Cambridge History of Latin American, vol.6. Cambridge University Press.