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ScienceDirect
Economics Letters 100 (2008) 135 – 137
economics letters
www.elsevier.com/locate/econbase

Growth, volatility and political instability: Non-linear time-series evidence for Argentina, 1896–2000 ☆

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Received 23 March 2007; received in revised form 7 October 2007; accepted 3 December 2007
Available online 15 December 2007

Abstract

We investigate the growth volatility–political instability relationship in a power-ARCH framework (for Argentina, 1896–2000). Main finding is that while "informal" political instability (e.g., assassinations) has a direct negative effect on economic growth, "formal" instability has an indirect impact (through growth volatility).

Keywords: Economic growth; Volatility; Political instability; Power-ARCH

JEL classification: C14; D72; E23; O40

1. Introduction

What is the relationship between economic growth and its volatility? How does political instability affect growth? This paper tries to answer such questions using a power-ARCH (PARCH) framework and annual time-series data for Argentina covering the period from 1896 to 2000.

The paper tries to make three contributions. One is to bridge the literature on the macroeconomics of political instability (based on cross-sectional and short-panels evidence) with that on the relationship between growth and volatility (time-series based).[1] A second is to try to shed light on two puzzles. One is on the sign of the relationship between volatility and growth: Ramey and Ramey (1995) show that output growth rates are adversely affected by their volatility, while Grier and Tullock (1989) find that higher standard deviations of growth are associated with higher mean rates. The second puzzle regards the duration of the political instability effects: while the conventional wisdom is that these are severe in the long run, Campos and Nugent (2002) and Murdoch and Sandler (2004) argue that they are significantly stronger in the short than in the long run. The third intended contribution is to put forward novel econometric evidence on the Argentine puzzle: "Argentina's ratio to OECD income *fell* to 84 percent in 1950, 65 percent in 1973, and a mere 43 percent in 1987 (…) Argentina is therefore unique" (della Paolera and Taylor, 2003, p. 5, italics added). Argentina is the only country that was classified as developed in 1900, and as developing in 2000. Although a large literature associates this decline to political factors,[2] we are unaware of studies that do it econometrically.

☆ The authors thank Joseph Locke and George Stephenson for the encouragement, and seminar participants at the University of Macedonia and an anonymous referee for valuable comments on a previous version. The usual disclaimer applies.
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[1] Durlauf et al. (2005) survey the former, and Grier et al. (2004) and Fountas and Karanasos (2007) review the latter. One paper that tries to link these literatures and is close to ours in this sense is Asteriou and Price (2001), which has time series evidence from UK quarterly data after 1960.

[2] Acemoglu and Robinson observe that: "The political history of Argentina (…) reveals an extraordinary pattern where democracy was created in 1912, undermined in 1930, re-created in 1946, undermined in 1955, fully re-created in 1973, undermined in 1976, and finally reestablished in 1983" (2006, p. 7). See also della Paolera and Taylor (2003) and references therein.

0165-1765/$ - see front matter
doi:10.1016/j.econlet.2007.12.013

2. Model

The PARCH model was introduced by Ding et al. (1993) and gained currency fast in the finance literature.[3] Let growth (y_t) follow a white noise process augmented by a "risk premium" defined in terms of volatility

$$y_t = c + kh_t + \lambda x_{it} + \varepsilon_t, \quad (1)$$

with

$$\varepsilon_t \equiv e_t h_t^{\frac{1}{2}},$$

where h_t denotes the conditional variance of growth, x_{it} is the political instability variable (where i denotes assassinations, strikes, constitutional or legislative changes) and the symbol '≡' indicates equality by definition. In addition, $\{e_t\}$ are independently and identically distributed (i.i.d) random variables with $E(e_t)=E(e_t^2-1)=0$, while h_t is positive with probability one and is a measurable function of the sigma-algebra $\sum_{t-1}$, which is generated by $\{y_{t-1}, y_{t-2}, \ldots\}$.

Moreover, h_t is specified as an asymmetric PARCH(1,1) process with lagged growth included in the variance equation

$$h_t^{\frac{\delta}{2}} = \omega + \alpha h_{t-1}^{\frac{\delta}{2}} f(e_{t-1}) + \beta h_{t-1}^{\frac{\delta}{2}} + \gamma_l y_{t-1} + \phi x_{it}, \quad (2)$$

with

$$f(e_{t-1}) \equiv [|e_{t-1}| - \varsigma e_{t-1}]^{\delta},$$

where δ (with $\delta>0$) is the "heteroscedasticity parameter," α and β are the ARCH and GARCH coefficients respectively, ς with $|\varsigma|<1$ is the "leverage" term and γ_l is the "level" term for the lth lag of growth.[4] In order to distinguish the general PARCH model from a version in which δ is fixed we refer to the latter as (P)ARCH.

The PARCH model increases the flexibility of the conditional variance specification by allowing the data to determine the power of growth for which the predictable structure in the volatility pattern is the strongest. This feature in the volatility process has important implications for the relationship between political instability, growth and its volatility. There is no strong reason for assuming that the conditional variance is a linear function of lagged squared errors. The common use of a squared term in this role is most likely to be a reflection of the normality assumption traditionally invoked. However, if we accept that growth data are very likely to have a non-normal error distribution, then the superiority of a squared term is unwarranted and other power transformations may be more appropriate.

3. Data

Our data are from the Cross National Time-Series Data set (Banks, 2005) which contains historical series on income per capita and various dimensions of political instability.[5] Data are available yearly for Argentina from 1896 until 2000, excluding the World War years. Income per capita is in constant U.S. dollars.

We use two measures of "formal" political instability: the *number of legislative elections* (defined as number of elections for the lower house each year) and the *number of constitutional changes*. The latter "reflects the number of basic alterations in a state's constitutional structure, the extreme case being the adoption of a new constitution that significantly alters the prerogatives of the various branches of government." These series are available since 1896.

We use two measures of "informal" political instability. *Assassinations* are defined as "any politically motivated murder or attempted murder of a high government official or politician," while *general strikes* are defined "as any strike of 1000 or more industrial or service workers that involves more than one employer and that is aimed at national government policies or authority." The variable *assassinations* reaches its maximum in 1974 (16 assassinations registered) with second and third highest values (12 and 10) registered in the immediately subsequent years. Notice that *general strikes* does not cover sector-specific strikes. This peaks in 1969 (13 general strikes registered) with the second highest count registered in the subsequent year (7 strikes). These series are available since 1919.

The political instability measure with the largest average (standard deviations in parenthesis) is general strikes with 1.1 per year (0.2), followed by assassinations with 0.8 (0.3), legislative elections with 0.4 (.05) and constitutional changes with 0.08 (0.02).

Table 1
In-mean (P) ARCH (model 1: $\phi=\gamma_l=0$)

	κ	λ	α	β	δ
Assassinations	1.43	−0.0012	0.55	0.52	0.50
	(2.39)	(2.26)	(3.57)	(2.40)	–
Strikes	0.84	−0.0012	0.56	0.53	0.50
	(2.75)	(2.27)	(4.26)	(3.43)	–
Constitutional	1.80	−0.0027	0.56	0.48	0.80
	(1.88)	(1.35)	(2.01)	(1.35)	–
Legislative	1.91	−0.0003	0.38	0.69	0.80
	(2.69)	(0.15)	(3.43)	(5.79)	–

Table 1 reports parameter estimates for the following model:

$$y_t = c + kh_t + \lambda x_{it} + \varepsilon_t,$$
$$h_t^{\frac{\delta}{2}} = \omega + \alpha h_{t-1}^{\frac{\delta}{2}} |e_{t-1}|^{\delta} + \beta h_{t-1}^{\frac{\delta}{2}}.$$

The numbers in parentheses are absolute t statistics.

4. Results

We proceed with the estimation of the PARCH(1,1) model in Eqs. (1) and (2) in order to take into account the serial correlation observed in the levels and power transformations of

[3] See, for example, Karanasos and Kim (2006). Karanasos and Schurer (2005) use this process to model output growth in Italy.

[4] The model imposes a Box–Cox power transformation of the conditional standard deviation process and the asymmetric absolute residuals.

[5] Banks is a commercial dataset that has been used extensively in the scholarship on growth and political instability (Durlauf et al. 2005).

Table 2
In-mean-level (P) ARCH (model 2: $\lambda=0$)

	κ	α	β	γ_6	ϕ	δ
Assassinations	1.09	0.68	0.27	0.27	−0.0038	0.80
	(2.72)	(5.30)	(5.84)	(5.84)	(1.45)	–
Strikes	2.25	0.42	0.57	0.20	0.0035	0.50
	(1.88)	(4.83)	(6.23)	(3.75)	(1.50)	–
Constitutional	1.18	0.69	0.45	0.18	−0.0077	1.00
	(1.94)	(4.40)	(4.15)	(3.75)	(3.40)	–
Legislative	1.34	0.45	0.57	0.12	−0.0083	1.00
	(1.40)	(2.79)	(5.45)	(4.71)	(2.16)	–

Table 2 reports parameter estimates for the following model:

$$y_t = c + kh_t + \varepsilon_t,$$
$$h_t^{\frac{\delta}{2}} = \omega + \alpha h_{t-1}^{\frac{\delta}{2}}|e_{t-1}|^{\delta} + \beta h_{t-1}^{\frac{\delta}{2}} + \gamma_{\varepsilon} y_{t-\varepsilon} + \phi x_{it}.$$

The numbers in parentheses are absolute t statistics.

our time-series data. Tables 1 and 2 report the estimated parameters of interest for the period 1896–2000. These were obtained by quasi-maximum likelihood estimation (QMLE) as implemented in EVIEWS. The best fitting specification is chosen according to the Likelihood Ratio (LR) results and the minimum value of the Information Criteria (IC) (not reported). Once heteroscedasticity in the conditional mean has been accounted for, our specifications appear to capture the serial correlation in the growth series.[6]

In order to study the direct effects of political instability we specify model 1 with $\varphi=\gamma_l=0$, while model 2 (with $\lambda=0$) allow us to investigate their indirect effects. In most of the cases the estimates for the "in-mean" parameter (k) are statistically significant and positive. The estimated ARCH and GARCH parameters (α and β) are highly significant in almost all cases. For model 1 ($\varphi=\gamma_l=0$), when the "informal" political stability variables are used, the IC choose (P)ARCH model with power term parameter δ equal to 0.5 (the corresponding value for the "formal" political stability variables specification is 0.8.) For model 2 ($\lambda=0$), with the "formal" political instability variables Akaike IC (AIC) selects (P)ARCH models with δ equal to 1, while when strikes are used the chosen value of δ (0.5) is lower than that for the specification with the assassinations (0.8).[7]

From the results for model 1 reported in Table 1, the parameters λ for assassinations and strikes (our measures of "informal" political instability) reveal their direct, negative impact on economic growth, while the equivalent effects for our "formal" political instability variables (constitutional and legislative changes) are not statistically significant. It is worth noting that the former impact disappears after 6 years (results not reported). On the other hand, examining the results for model 2 (reported in Table 2), and focusing our attention on the φ parameters we can see that our "formal" political instability variables have indirect (through volatility) negative effects on growth, while these effects from assassinations and strikes are statistically insignificant. Interestingly, we find evidence that such indirect effect becomes stronger after 3 years (results not reported).

5. Conclusions

Our main finding is that while "informal" political instability has a direct, negative effect on economic growth, "formal" political instability has mostly an indirect impact (through volatility). One main suggestion for future work is to investigate whether the effects of "formal" political instability are stronger in the long run while those of "informal" political instability are stronger in the short run (an idea for which we find preliminary support, as noted above).

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[6] For all cases, we find the leverage term to be insignificant and therefore we re-estimate the model excluding this parameter.

[7] In the expressions for the conditional variances reported in Table 2, various lags of growth (from 1 to 12) were considered with the best model ($l=6$) chosen on the basis of the minimum value of the AIC. For all cases, there is strong evidence that growth affects its uncertainty positively. Hence, there is a positive bidirectional feedback between growth and its volatility (note the existing empirical literature focuses almost exclusively on the effect of volatility on growth, see Fountas and Karanasos, 2007).