The Link Between Volatility And Growth: Evidence From The States

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Abstract

We present evidence on the relationship between output volatility and growth using state data. No evidence of such a relationship is found once other correlates of growth are incorporated into the analysis. This finding contradicts published results using international data; some possible explanations for the contradictory results are discussed.

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1. INTRODUCTION

The relationship between long-run growth and business cycle volatility is interesting in its own right and has important implications for the modelling of macroeconomic phenomena. Ramey and Ramey (1995)investigate this relationship by estimating the following equations:

(1)

$$\overline{\Delta y_i} = \alpha + \beta\sigma_i + \mu_i$$

and

(2)

$$\Delta y_{it} = \lambda\sigma_i + \theta \boldsymbol{X}_{it} + \epsilon_{it}$$

(1) is a cross-sectional specification where $\overline{\Delta y_i}$ is average annual growth in output per capita and σ_i is the standard deviation of annual output growth per capita in country *i*. (2) employs time series-cross section data where Δy_{it} is the growth rate of output per capita for country *i* in year *t*, $\boldsymbol{X}_{it}$ is a vector of variables found by Levine and Renelt (1992)to be correlated with growth, and σ_i is the standard deviation of the residuals, $\epsilon_{it} \sim N(0,\sigma_i^2)$. Eq. (1)is estimated using ordinary least squares, and (2) is estimated via maximum likelihood with the σ_i treated as parameters. The coefficients of interest are those on the volatility measures, specifically, β and λ in (1) and (2), respectively. Ramey and Ramey report a significantly negative relationship between volatility and growth using both (1) and (2) in a broad sample of 92 countries. They also report a marginally significant negative volatility–growth relationship using (2) in a sample consisting of the 24 OECD countries.

In this paper, we provide evidence on the volatility–growth relationship using data from the 48 contiguous United States. Our results indicate no significant relationship between volatility and growth once other potential correlates of growth are incorporated in the estimation.

2. CROSS-STATE EVIDENCE ON VOLATILITY AND GROWTH

We begin by estimating an equation analogous to (1) via ordinary least squares. The dependent variable is the average annual growth in gross state product (GSP) per worker (*MGGSPW*) for each of the 48 contiguous states over the years 1970–1988 and the regressor is the standard deviation of annual GSP growth per worker (*SGGSPW*) in each state.[1] The result of this simple cross-sectional regression is

$$MGGSPW = \underset{(4.00)}{0.0052} \quad \underset{(-1.71)}{-0.02555 SGGSPW,}$$

with t-statistics given in parentheses and R^2=0.06. This regression suggests a significantly negative (albeit at the 10% level) relationship between volatility and growth across states. This finding is similar to Ramey and Ramey's significantly negative result using a sample of 92 countries, but contradicts their insignificantly positive finding in the sample of OECD countries.

Next, we estimate Eq. (2)via maximum likelihood using a panel of state data. The estimation uses 912 observations (19 years of data on 48 states). The dependent variable is annual growth in GSP per worker (*GGSPW*). The control variables include four variables corresponding to those employed by Ramey and Ramey: the log of initial output per worker, the annual growth rate of the labor force, the annual net investment (private plus public) to output ratio, and the level of human capital.

Maximum likelihood estimates are reported in column 1 of Table 1. The estimates indicate that the relationship between volatility and economic growth is insignificant, but the other variables are all significantly correlated with economic growth at the 1% level. The unusually high t-statistic on labor force growth (*GLF*) reported in column 1 is noteworthy. Using *GLF* to transform GSP growth rates into growth rates of GSP per worker introduces variation in the dependent variable which is perfectly explained by including *GLF* as a right-hand-side variable, thus resulting in a high t-statistic on *GLF*.[2] To emphasize that this relation is not driving the results, (2) is also estimated using growth in GSP (*GGSP*) rather than *GGSPW* as the dependent variable; the results are reported in column 2 of Table 1. As expected, all results are identical to those in column 1 except for the parameter estimate and significance of *GLF*. Thus, controlling for other factors associated with growth, we find absolutely no evidence that volatility is related to long-run economic performance.

Table 1
Cross-state growth maximum likelihood estimation

Regressor	Dependent variable	
	GGSPW	*GGSP*
Constant	0.178	0.178
	(3.49)	(3.49)
Volatility	0.024	0.024
	(0.17)	(0.17)
Investment share	0.158	0.158
	(5.76)	(5.76)
Labor force growth rate	−0.751	0.249
	(−43.32)	(14.35)
Human capital	0.0012	0.0012
	(3.44)	(3.44)
Initial income	−0.023	−0.023
	(−3.43)	(−3.43)
Log of likelihood function	1915.5	1915.5

Note: Parentheses contain *t*-statistics. 912 observations are used in the estimation. See text and Appendix A for variable definitions.

Fig. 1 and Fig. 2 display the relation between volatility [as estimated in (2)] and mean growth in output per worker and output, respectively. Casual inspection of the figures indicates that outliers are not driving our finding of no relationship; indeed, if anything, the outliers tend to bias the results toward a negative relation. The finding of no relationship between volatility and growth in our time series–cross section estimation contrasts sharply with the Rameys' finding of significantly negative relationships in both their 92-country and OECD samples. We discuss possible explanations for this contrast in the next section.

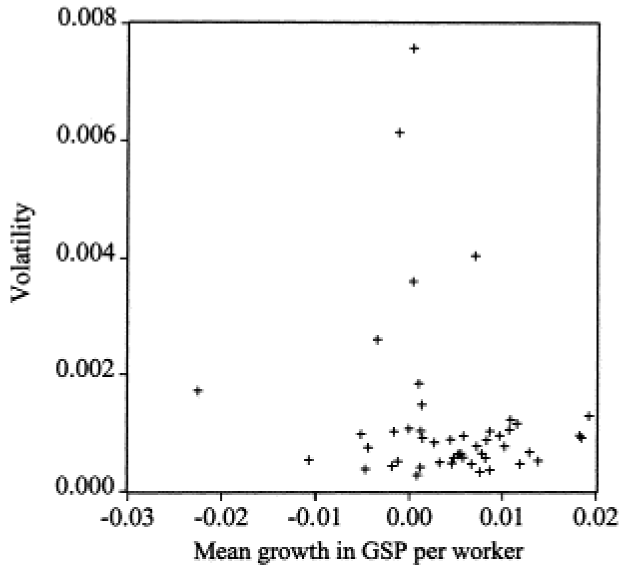

Fig. 1. Mean growth in GSP per worker and volatility across states.

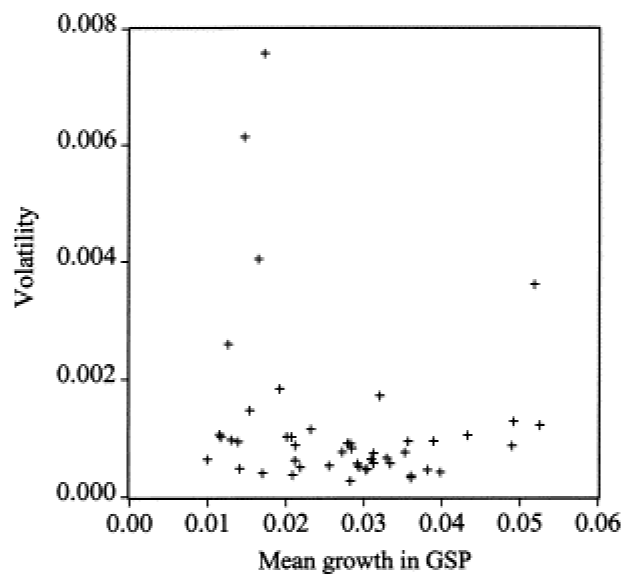

Fig. 2. Mean growth in GSP and volatility across states.

3. CONCLUDING REMARKS

One possible explanation for the difference between our results and those of the Rameys is that the underlying source of volatility is federal government fiscal or monetary policy. However, there is no reason to believe that any particular fiscal or monetary policy action would have an identical impact on the economies of all states. The economies of some states are probably more sensitive to changes in interest rates, and some states are probably more sensitive to fiscal policy changes, than others.[3]

Another possible explanation for the differences between the Rameys' results and our results is that we use a shorter time period than they do and, as a result, are not able to precisely estimate the relationship between volatility and growth. Unfortunately, our choice of time period is constrained by the availability of private capital stock data in Munnell (1990), so this argument may be plausible. However, our sample period is only five years shorter than that used by the Rameys in their broad sample of countries, and it is interesting to note that the Rameys obtained stronger results from their shorter (92 country) sample than from their longer (OECD) sample.

Finally, another possible explanation, discussed in Dawson et al. (1997), is that the Rameys' finding of a negative relationship between volatility and growth results from their use of the Summers and Heston (1991)dataset in which measurement error (and, hence, the residuals used to compute their volatility measure) is systematically related to economic performance. (See Heston and Summers, 1996, p. 24.) If this is the case, then the use of state data, which are of more uniform quality, is better suited for analyzing the relationship between volatility and growth. An additional advantage of state data is that they implicitly control for factors such as the rate of technological advance and institutions that may also affect economic growth, thus avoiding a potential omitted variables problem.

APPENDIX A.

For the estimation, output is measured by real gross state product (GSP) which was obtained on diskette from the Bureau of Economic Analysis. The size of the labor force in each state is measured as the number of people in each state with earnings subject to the Social Security payroll tax. The annual growth rate is calculated as the difference of logarithms for consecutive years. The source for these data is the Social Security Administration's *Social Security Bulletin, Annual Statistical Supplement* (various issues). The values for 1980 and 1981 are obtained by interpolation. Private and public investment are obtained by first-differencing the private and public capital stock series reported in Munnell (1990)and Holtz-Eakin (1993), respectively. Public capital is defined to include highways, sewerage, and utilities. Private capital stock data for Alaska and Hawaii are not available in Munnell. Human capital is measured as the 1980 share of the population over age 25 with college degrees. These data are prepared by the Census Bureau and published in *Statistical Abstract*.

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