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Abstract

This paper examines the effect of financial development on growth volatility with the dynamic panel data analysis. It demonstrates empirically that financial development has a hump-shaped effect on growth volatility. In early stages of financial development, growth rates are less volatile. As the financial sector develops, an economy is highly volatile. However, as the financial sector matures and the financial market approaches a perfect one, the economy becomes less volatile once again.

Keywords: Growth Volatility; Financial Development; Dynamic Panel Models.

JEL Classification Numbers: E44, E51, O16.

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1 Introduction

The relationship between financial development and volatility of growth rates has not been made clear in the literature, although several researchers provide some evidence for this (e.g. Easterly, et al (2000), Denizer, et al. (2002), Raddatz (2006), and Beck, et al. (2006)). Almost all show that economies with fully developed financial sectors experience low volatility of growth rates.[1]

Their findings are consistent with our intuition. As a financial sector develops in an economy, credit market imperfections are resolved. Accordingly, financial resources are efficiently used, allocated to the most productive investment projects. In such an economy, even if shocks occur, there are no persistent effects of them on economic variables except for the first-order effect and thus an economy is quite stable. On the other hand, if an economy is with a poorly developed financial sector, financial resources are not necessarily used efficiently due to, say, credit constraints. In such an economy, if shocks positively affect the value of collateral, investments are promoted and the fixed capital formation increases.[2] In this case, there are persistent effects on economic variables and such an economy is unstable due to the higher-order effects of the shocks.

Meanwhile, what happens to an economy in which there is no financial sector? No one can borrow from others nor can save if goods are perishable. For this case, we may consider the Malthusian epoch without any financial sector. In the Malthusian regime, people only enjoy the survival level of consumption and the economy slightly fluctuates around the steady state (e.g. Galor and Weil (2000) and Galor (2005)). There are no persistent effects of shocks on the fixed capital formation in the economy.

Judging from the above discussion, the influence of financial development on volatility of growth rates must be hump-shaped. That is to say, early

[1] Beck, et al. (2006) do not discover a robust relationship between financial development and growth volatility. They give empirical evidence that in economies with poorly developed capital markets, financial intermediaries do not reduce but magnify the impact of inflation volatility on growth volatility.

[2] There are many theoretical articles dealing with this case. For instance, see Kiyotaki and Moore (1997).

stages of financial development, an economy is less volatile. As the financial sector in an economy develops, it is subject to the persistent effects of shocks and thus highly volatile. However, as the financial market approaches a perfect one, the economy becomes less volatile once again. In this paper, we demonstrates this claim with the dynamic panel data analysis.

2 Estimation Method

As described in the next section, we prepare an unbalanced panel data set for the variances of growth rates (VAG) and the ratios of private credit to GDP (PCR) for 90 countries. The ratio of private credit to GDP is a common measure for financial deepening (Levine, et al. (2000)).

We use the GMM estimators developed for dynamic panel models by Arellano and Bond (1991) and Arellano and Bover (1995). The basic estimation equation is as follows:

$$LNVAR_{it} = c + aLNPCR_{it} + b(LNPCR_{it})^2 + d'X_{it} + \lambda_i + u_{it},$$

where i and t stand for a country and time, respectively. LNPC is the log of PCR and LNVAR is the log of VAG. X_{it} is the set of control variables. λ_i is the country-specific effect and u_{it} is the error term. X_{it} includes the lagged dependent variable $LNVAR_{it-1}$, *financial openness* (FOPEN) (created by Chinn and Ito (2006, 2007)), the log of the variance of government expenditure (LNVAGV), the log of variance of real exchange rates (LNVEX), and the growth rate in the initial year (IG). We include the lagged dependent variable in the right-hand side in order to control a persistent effect of the variable. We control exogenous shocks by incorporating LNVAGV and LNVEX which are related to real shocks, although we cannot entirely eliminate the effects of exogenous shocks. We incorporate FOPEN to control the effect of financial openness. However, these variables cannot be thought of as econometrically exogenous. Therefore, we execute the instrumental variables estimations using the lagged variables as instruments.

From our discussion in the introduction, we predict a hump-shaped relationship between LNPCR and LNVAR, i.e., $b < 0$.[3]

Under the assumptions that (i) the error terms u_{it} are not serially correlated and (ii) the explanatory variables other than the lagged dependent variable are uncorrelated with the future error terms, Arellano and Bond (1991) propose a two-step GMM estimator with moment conditions such that:[4]

$$E[LNVAR_{it-s}(u_{it} - u_{it-1})] = 0 \quad for\ s \geq 2,\ t = 3, ..., T,$$
$$E[\hat{X}_{it-s}(u_{it} - u_{it-1})] = 0 \quad for\ s \geq 2,\ t = 3, ..., T,$$

where $\hat{X}$ includes explanatory variables other than the lagged dependent variable. We call the GMM estimator using these moment conditions the GMM difference estimator following Beck and Levine (2004).

While by using these moment conditions, we might be able to avoid inconsistency of estimators due to the lagged dependent variable in the right-hand side, there are sometimes shortcomings with the GMM difference estimator. That is to say, as pointed out by Blundell and Bond (1998), if explanatory variables are persistent, the lagged variables are weak instruments for the regression. In order to correct the imprecision with the GMM difference estimator, we use additional moment conditions proposed by Arellano and Bover (1995) such that:

$$E[(LNVAR_{it-s} - LNVAR_{it-s-1})(\lambda_i + u_{it})] = 0 \quad for\ s = 1,$$
$$E[(\hat{X}_{it-s} - \hat{X}_{it-s-1})(\lambda_i + u_{it})] = 0 \quad for\ s = 1.$$

These four moment conditions give consistent and efficient estimates. We call this the GMM system estimator.

[3] One cannot predict the sign of a, because the data points of LNPC might be negative.

[4] For a two-step GMM estimator, it is assumed that in the first step, the error terms are independent and homoskedastic between countries and across time. In the second step, the residuals from the first step are used to produce a consistent estimate for the variance-covariance matrix. See also Beck and Levine (2004) for the discussion.

3 Data

We create an (unbalanced) panel data set for 90 countries. The data, except for the indicator of financial deepening and financial openness (FOPEN), are collected from International Financial Statistics 2004 created by the International Monetary Fund (the IMF). For the indicator of financial deepening, we use "the ratio of private credit by deposit money banks and other financial institutions to GDP" (PCR) created by Levine, Loayza, and Beck (2000), which was updated in 2006.[5] FOPEN is an index of the level of capital account openness created by Chinn and Ito (2006, 2007). They produce the index for 163 countries from 1970 to 2004, which is based on dummy variables from the tabulation of financial restrictions on international financial transactions reported in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions.*

In order to produce the panel data, we assemble the annual data from 1971 to 2000 and divide them into the six sub-periods each one of which includes the data points for five years. For the measure of volatility of growth rates of real per capita GDP (for which nominal per capita GDP is deflated by the consumer price index), we take the variances of the growth rates for each sub-period. We take the average of PCR for each sub-period. Likewise, for the volatility of real government expenditure (GV) (for which nominal government expenditure is deflated by the consumer price index), of real exchange rates (EX), and of inflation rates (INFLATION), we take the variances of each variable for each sub-period as well. The real exchange rates are indices whose base year is 1995 computed from the nominal exchange rates and the consumer price indices for each country and for the USA. For the real exchange rates for the USA, the real effective exchange rates are used. The data in the first period 1971-1976 are used as instrumental variables for the second period. Therefore, the estimation periods are five, i.e., 1976-1980, 1981-1985, 1986-1990, 1991-1995, and 1996-2000. The panel data

[5] In their data set, the notation, pcrdbofgdp, is used for PCR. In this paper, we exclusively use the notation, PCR.

is unbalanced: some countries have data points only for two periods.

4 Results

The difference results are reported in table 1. The minimized GMM criterion function is used to test the validity of instruments in the case of overidentification (the Sargan test). As seen in table 1, the p-values of the Sargan tests show that the overidentification restrictions of the model cannot be rejected. For (1)-(5), the coefficients of LNPC are negative and significant at the conventional level. The coefficients of LNPC*LNPC are negative and significant as well except for (3). It seems that there are few effects of the control variables except for FOPEN and LNVAGV on the volatility of growth rates. The significance of the effect of LNPC*LNPC is consistent with our predictions. That is to say, if a financial sector is fully developed or poorly developed, an economy is stable, whereas if financial deepening is at an intermediate level, it is volatile. We include a control variable, FOPEN, which does not vary so much within each country over the estimated periods.[6] In such a case, the fixed effects estimations may lead to imprecise outcomes. Therefore, (6)-(8) exclude FOPEN from the control variables; however, the results do not change.

Table 2 provides the system results. Again, as seen in table 2, the p-values of the Sargan tests show that the overidentification restrictions of the model cannot be rejected. While the coefficients of LNPC and LNPC*LNPC change relative to the difference results, those are significant for all the regressions. In the case of the system estimator, there are significant effects of control variables except for LNVEX on the volatility of growth rates.

5 Concluding Remarks

New evidence for the relationship between financial development and volatility of growth rates has been provided. The relationship is hump-shaped,

[6]For sixteen countries, the FOPENs take the same values over the estimated periods. For forty seven countries, the FOPENs vary at most once over the estimated periods.

i.e., in early stages of financial development, as the financial sector develops in an economy, it becomes highly volatile. However, as the financial sector matures and the credit market approaches a perfect one, the volatility starts to reduce once again.

The empirical results are consistent with the recent theoretical results provided by, for instance, Aghion, et al. (1999). All of them investigate the relationship between the dynamic property of an economy and financial development measured by the degree of credit market imperfections and derive the hump-shaped relationship between them.

References

[1] Aghion, P., A. Banerjee, and T. Piketty, 1999, Dualism and Macroeconomic Volatility, Quarterly Journal of Economics 114, 1359-1397.

[2] Arellano, M. and S. Bond, 1991, Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations, Review of Economic Studies 58, 277-297.

[3] Arellano, M. and O. Bover, 1995, Another Look at the Instrumental-Variable Estimation of Error-Components Models, Journal of Econometrics 68, 29-52.

[4] Beck, T. and R. Levine, 2004, Stock Markets, Banks, and Growth: Panel Evidence, Journal of Banking and Finance, 423-442.

[5] Beck, T., M. Lundberg, and G. Majnoni, 2006, Financial Intermediary Development and Growth Volatility: Do Intermediaries Dampen or Magnify Shocks?, Journal of International Money and Finance 25, 1146-1167.

[6] Blundell, R. and S. Bond, 1998, Initial Conditions and Moment Restrictions in Dynamic Panel Data Models, Journal of Econometrics 87, 115-143.

[7] Chinn, M.D. and H. Ito, 2006, What Matters for Financial Development? Capital Controls, Institutions, and Interactions, Journal of Development Economics 81, 163-192.

[8] Chinn, M.D., and H. Ito, 2007, A New Measure of Financial Openness, Department of Economics, University of Wisconsin, mimeo.

[9] Denizer, C., M.F. Iyigun, and A.L. Owen, 2002, Finance and Macroeconomic Volatility, Contributions to Macroeconomics 2, Article 7.

[10] Easterly, W., R. Islam, and J.E. Stiglitz, 2000, Shaken and Stirred: Explaining Growth Volatility, In: Annual World Bank Conference on Development Economics 2000, 191-211.

[11] Galor, O., 2005, From Stagnation to Growth: Unified Growth Theory, in Handbook of Economic Growth, Vol IA, eds. by Aghion, P. and S. N. Durlauf, Elsevier North-Holland, Amsterdam, The Netherlands.

[12] Galor, O., and D.N. Weil, 2000, Population, Technology and Growth: From the Malthusian Regime to the Demographic Transition, American Economic Review 110, 806-828.

[13] Kiyotaki, N. and J. Moore, 1997, Credit Cycles, Journal of Political Economy 105, 211-248.

[14] Levine, R., N. Loayza, and T. Beck, 1999, A New Database on Financial Development and Structure, Policy Research Working Paper: No. WPS 2146, The World Bank.

[15] Levine, R., N. Loayza, and T. Beck, 2000, Financial Intermediation and Growth: Causality and Causes, Journal of Monetary Economics 46, 31-77.

[16] Raddatz, C., 2006, Liquidity Needs and Vulnerability to Financial Underdevelopment, Journal of Financial Economics 80, 677-722.

Table 1: GMM Difference Estimator

	Dependent Variable: LNVAR							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LNPC	−3.688	−3.621	−2.520	−2.142	−2.197	−3.649	−3.287	−3.152
	(0.611)***	(0.432)***	(0.309)***	(0.283)***	(0.193)***	(0.387)***	(0.346)***	(0.275)***
	[0.919]***	[0.864]***	[0.857]***	[0.600]***	[0.542]***	[0.771]***	[0.780]***	[0.749]***
LNPC*LNPC	−0.699	−0.592	−0.261	−0.320	−0.333	−0.475	−0.540	−0.484
	(0.145)***	(0.113)***	(0.075)***	(0.066)***	(0.036)***	(0.086)***	(0.083)***	(0.061)***
	[0.278]***	[0.284]***	[0.264]	[0.145]**	[0.122]***	[0.202]**	[0.243]**	[0.212]**
FOPEN			−0.470	−0.424	−0.437			
			(0.070)***	(0.051)***	(0.034)***			
			[0.156]***	[0.134]***	[0.115]***			
LNVAGV				0.239	0.273		0.297	0.348
				(0.033)***	(0.028)***		(0.060)***	(0.042)***
				[0.111]**	[0.120]**		[0.150]**	[0.164]**
LNVEX			0.103		0.045	0.148		0.098
			(0.033)***		(0.023)*	(0.042)***		(0.032)***
			[0.066]		[0.067]	[0.076]**		[0.094]
IG		−2.991	−2.170	−3.214	−2.444	−2.330	−3.214	−3.291
		(0.935)***	(0.660)***	(0.874)***	(0.678)***	(0.607)***	(0.845)***	(0.754)***
		[2.178]	[1.647]	[2.103]	[2.012]	[1.569]	[1.865]*	[1.973]*
LNVAR(−1)	0.405	0.164	0.004	0.172	0.110	0.075	0.223	0.163
	(0.120)***	(0.078)**	(0.044)	(0.039)***	(0.020)***	(0.063)	(0.056)***	(0.039)***
	[0.237]*	[0.169]	[0.144]	[0.097]*	[0.094]	[0.131]	[0.143]	[0.125]
constant	−8.499	−10.61	−10.71	−7.030	−7.060	−10.90	−7.045	−6.480
	(1.219)***	(0.700)***	(0.412)***	(0.489)***	(0.375)***	(0.657)***	(0.689)***	(0.557)***
	[2.443]***	[1.545]***	[1.278]***	[1.564]***	[1.720]***	[1.385]***	[1.866]***	[2.028]***
Sargan test (p−value)	0.343	0.317	0.664	0.584	0.480	0.552	0.437	0.273
Critical Point	−2.64	−3.06	−4.82	−3.34	−3.29	−3.84	−3.04	−3.25
Countries	90	90	90	90	90	90	90	90
Obs.	278	278	278	278	278	278	278	278

Notes: (1) The estimations are two−step GMM difference estimations. (2) The values in parentheses are standard errors and the values in square brackets are robust standard errors. (3) *, **, and *** indicate significance at the 10%, 5%, and 1% level for two sided tests, respectively.

Table 2: GMM System Estimator

	Dependent Variable: LNVAR							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LNPC	−1.928	−2.067	−1.138	−0.997	−0.981	−1.979	−1.750	−1.682
	(0.274)***	(0.187)***	(0.045)***	(0.055)***	(0.073)***	(0.112)***	(0.112)***	(0.059)***
	[0.553]***	[0.589]***	[0.622]*	[0.568]*	[0.471]**	[0.503]***	[0.527]***	[0.462]***
LNPC*LNPC	−0.533	−0.505	−0.292	−0.296	−0.264	−0.448	−0.438	−0.390
	(0.073)***	(0.049)***	(0.012)***	(0.013)***	(0.017)***	(0.027)***	(0.029)***	(0.016)***
	[0.151]***	[0.167]***	[0.158]*	[0.170]*	[0.131]**	[0.142]***	[0.168]***	[0.148]***
FOPEN			−0.313	−0.372	−0.327			
			(0.014)***	(0.016)***	(0.012)***			
			[0.135]**	[0.118]***	[0.112]***			
LNVAGV				0.282	0.263		0.248	0.249
				(0.015)***	(0.014)***		(0.024)***	(0.014)***
				[0.144]*	[0.110]**		[0.122]**	[0.137]*
LNVEX			0.075		0.046	0.093		0.058
			(0.008)***		(0.010)***	(0.013)***		(0.006)***
			[0.067]		[0.075]	[0.064]		[0.073]
IG		−4.279	−3.917	−3.288	−4.556	−4.454	−3.749	−4.200
		(0.627)***	(0.195)***	(0.259)***	(0.536)***	(0.362)***	(0.534)***	(0.259)***
		[2.310]**	[1.853]**	[2.238]	[1.967]**	[1.991]**	[2.318]*	[2.208]*
LNVAR(−1)	0.497	0.424	0.408	0.374	0.342	0.399	0.387	0.332
	(0.039)***	(0.029)***	(0.010)***	(0.008)***	(0.011)***	(0.018)***	(0.021)***	(0.011)***
	[0.072]***	[0.104]***	[0.092]***	[0.087]***	[0.099]***	[0.106]***	[0.101]***	[0.106]***
constant	−5.771	−6.644	−5.669	−3.508	−3.728	−6.387	−4.345	−4.519
	(0.345)***	(0.222)***	(0.087)***	(0.205)***	(0.224)***	(0.162)***	(0.316)***	(0.146)***
	[0.808]***	[0.947]***	[0.931]***	[1.798]*	[1.346]***	[0.064]	`[1.562]***	[1.601]***
Sargan test (p-value)	0.272	0.138	0.442	0.431	0.904	0.358	0.269	0.527
Critical Point	−1.81	−2.05	−1.95	−1.68	−1.86	−2.20	−1.99	−2.16
Countries	90	90	90	90	90	90	90	90
Obs.	368	368	368	368	368	368	368	368

Notes: (1) The estimations are two-step GMM difference estimations. (2) The values in parentheses are standard errors and the values in square brackets are robust standard errors. (3) *, **, and *** indicate significance at the 10%, 5%, and 1% level for two sided tests, respectively.