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Intellectual property rights, technical progress and the volatility of economic growth

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ABSTRACT

In this note, we analyze the effects of intellectual property rights on the volatility of economic growth. Our analysis is motivated by the observation that the strengthening of patent protection and the increase in R&D in the US coincide with a reduction in growth volatility beginning in the mid 1980s. To analyze this phenomenon, we develop an R&D-based growth model with aggregate uncertainty in the innovation process and apply the model to ask whether increasing patent strength and R&D can lead to a significant reduction in growth volatility. We find a small but non-negligible effect that explains no less than 10% of the observed reduction in growth volatility in the US.

1. Introduction

In the early 1980s, the strength of patent rights gradually increased in the US. For example, the Ginarte–Park index of patent rights increased from 3.83 in 1975 to 4.88 in 1995.[1] After this patent reform, private R&D expenditure as a percentage of gross domestic product (GDP) in the US increased from 1.2% in 1980 to an average of 2.5% in recent time. Cross-country empirical studies, such as Varsakelis (2001), Kanwar and Evenson (2003) and Park (2005), employ the Ginarte–Park index to examine the effects of patent strength on R&D and innovation, and they generally find a positive and significant effect.[2] As for the effects of technical progress on the volatility of economic growth, empirical studies, such as Tang (2002) and Tang et al. (2008), generally find a negative effect; in other words, technical progress reduces growth volatility.

In this note, we analyze the effects of patent policy on the volatility of economic growth through technical progress. Our analysis is motivated by the observation that the strengthening of patent rights and the increase in R&D in the US coincide with a reduction in growth volatility beginning in the mid 1980s. To explore this issue, we develop an R&D-based growth model with aggregate uncertainty in the innovation process and apply the model to ask whether the strengthening of patent rights and the increase in R&D in the US can lead to a quantitatively significant reduction in growth volatility.

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[1] The Ginarte–Park index is on a scale of 0–5, and a larger number indicates stronger patent rights. See Ginarte and Park (1997) and Park (2008a) for a detailed discussion on the construction of this patent index.

[2] See for example Park (2008b) for a survey of this empirical literature.

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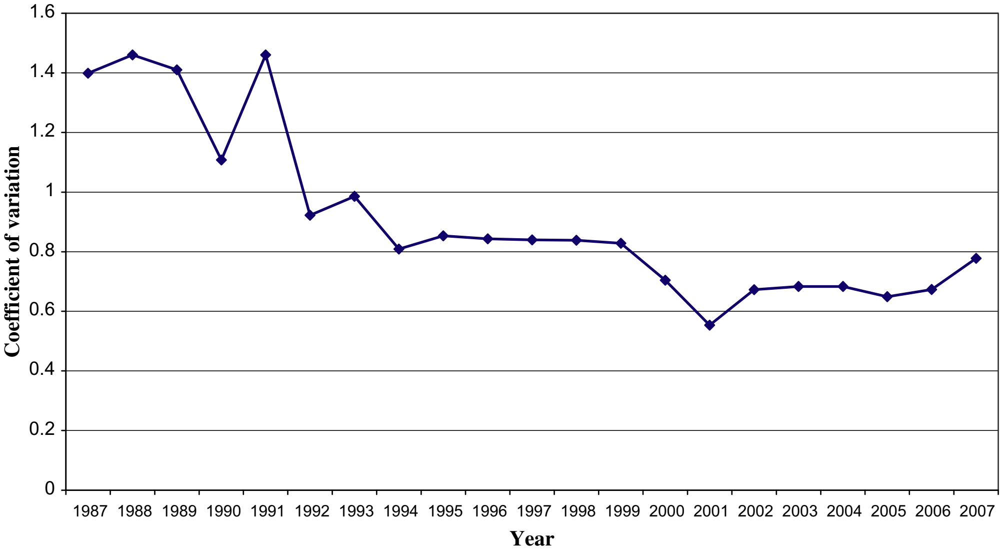

Fig. 1. The 10-year rolling coefficient of variation of annual growth in real GDP per capita using data from the Penn World Table.

Fig. 1 presents the US time series of growth volatility measured by the coefficient of variation of annual growth in real GDP per capita and shows a well-known pattern that volatility of economic growth in the US fell overtime until the recent crisis.[3] Specifically, the coefficient of variation decreased from 1.4 in the mid 1980s to 0.78 in 2007. In the numerical analysis, we calibrate the R&D-based growth model to quantify the fraction of this volatility reduction that can be explained by the increase in R&D and the strengthening of patent protection in the US. In summary, we find a small but non-negligible effect that explains no less than 10% of the observed reduction in growth volatility in the US.

Our study relates to the theoretical literature on growth and volatility. Greenwood and Jovanovic (1990) and Acemoglu and Zilibotti (1997) analyze the effect of financial development on volatility and find that financial development can reduce aggregate volatility through financial diversification across firms. Koren and Tenreyro, 2007a,b) consider technological diversification instead of financial diversification and show that technological progress improves diversification by increasing the number of input varieties that are subject to imperfectly correlated shocks. Leung et al. (2006) show that rent-seeking behaviors can also give rise to a negative effect of technical progress on growth volatility. Taking the negative growth-volatility relationship as a basic premise that is supported by empirical evidence,[4] our study relates to this literature by showing that patent policy can be a useful policy instrument for reducing growth volatility.

This study also relates to the literature on patent policy and economic growth. In this literature, one branch of studies analyzes the effects of patent length on growth,[5] whereas another branch analyzes the growth effects of other patent levers, such as patent breadth, patentability requirement, intellectual appropriability, protection against imitation, and blocking patents.[6] Our paper complements these studies by providing a novel growth-theoretic analysis on the effects of patent policy on the volatility of economic growth.

The rest of this note is organized as follows. Section 2 describes the model. Section 3 defines the equilibrium. Section 4 analyzes the effects of patent policy on growth volatility. The final section concludes with a discussion of the model.

2. The model

To provide a theoretical analysis on patent protection and growth volatility, we consider the quality-ladder growth model in Grossman and Helpman (1991). Specifically, we incorporate into the model mainly two features (a) patent breadth as in Li (2001) and (b) aggregate uncertainty in the innovation process. Given that the quality-ladder model has been well-studied, the familiar components of the model will be briefly described to conserve space while the new features will be described in more details below.

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[3] The coefficient of variation is the ratio of the standard deviation to the mean. This scale-invariant index is an appropriate measure for growth volatility because it is not affected by changes in the average growth rate overtime.

[4] See for example Ramey and Ramey (1995), Aghion and Banerjee (2005), Tang (2002) and Tang et al. (2008).

[5] See for example Judd (1985), Horowitz and Lai (1996), Iwaisako and Futagami (2003), Futagami and Iwaisako (2007), Chu (2010a), Chen and Iyigun (2011) and Fung et al. (forthcoming).

[6] See for example Cozzi (2001), Li (2001), Kwan and Lai (2003), O'Donoghue and Zweimuller (2004), Cozzi and Spinesi (2006), Horii and Iwaisako (2007), Furukawa (2007, 2010), Chu (2009, 2010b, 2011), Chu and Furukawa (2011), Chu and Pan (forthcoming), Chu and Peng (2011), Iwaisako and Futagami (forthcoming), Sorek (2011) and Spinesi (2011).