doi: 10.36689/uhk/hed/2020-01-002 HED Hradec Economic Days

Research on the Impact of Innovation Drivers on the Quality of Economic Growth in China

Shujun AN *, Yue GAO and Danyang MAO

Northwest University, Xi'an, China; xdasj@126.com; moon441@live.cn; sunnymao613@qq.com
* Correspondence: xdasj@126.com

Abstract: The quality of economic growth is a prominent issue in the process of economic growth worldwide. This paper builds relevant econometric models and uses the provincial panel data from 2003 to 2015 to analyze the impact of innovation drivers on China's economic growth. The empirical results show that technological innovation and institutional innovation have a significant role in promoting the quality of China's economic growth, and the effect of institutional innovation is stronger than technological innovation. In terms of regions, the innovation driver has the greatest contribution to the quality of economic growth in the eastern region of China, with the western and central parts ranked second and third. However, the role of institutional innovation in the eastern region is prominent, and the role of technological innovation is weak. Only institutional innovation in the central region has a significant role in promoting the quality of economic growth. Only technological innovation in the western region has a positive effect on the quality of economic growth, and the impact is weak. The regional differences in the impact of innovation-driven economic growth are obvious.

Keywords: quality of economic growth; innovation drivers; institutional innovation; technological innovation

JEL Classification: 032; 047

1. Introduction

The quality of economic growth is a prominent problem in the process of which worldwide. At present, in order to solve the contradiction between the people's growing needs for a better life and unbalanced and inadequate development, we need not only the quantitative economic growth, but also steady improvement in the quality of economic growth (Shi and Ren 2018). Xiao and Li (1998) conducted the earliest research on quality of economic growth in China. Subsequently, Yang (2000), Wang (2001), Li (2001) and others started to try to determine the dimensions of the quality of economic growth, establish an evaluation system of which and then to evaluate it in China. Since 2009, the team represented by Baoping Ren and Xiaojing Chao in Northwest University has conducted a concentrated and systematic study on the quality of economic growth. Also, as the quality of economic growth was taken as the theme of the 2011 Davos Forum, it has gradually become a hot topic of domestic economic research and received a lot of attention.

Innovation is the core element of economic growth, and the improvement of the quality of economic growth is inseparable from innovation. Since the reform and opening up, China has always put the increase in R & D investment and the expansion of the scale of R & D personnel in an important position. However, taking 2008 as the cut-off point, the growth rate of total factor productivity (TFP) and its contribution to growth in China have changed from a steadily high level to a continuous decline, and the trend of economic growth quality has also changed significantly, which has been confirmed by increasing studies. The expansion of the "scissors gap" between the intensity of technological innovation input and the growth rate of TFP is an important characteristic fact of economic system in the context of the New Normal in China, which can be referred to as the mystery of innovation in the process of economic development in China (Gao 2017), also known as the "Solow paradox" of R & D investment in China (Li et al. 2017). As innovation plays an important role in transforming the growth mode and improving the

quality of economic growth, it is undoubtedly vital to study the decline in the quality of economic growth since 2008 and the so-called mystery of innovation.

The debate on China's pattern of economic growth in the past and the current strategy of boosting innovation-driven development can be effectively combined in terms of the quality of economic growth in China (Wang and Yang 2015). Facing the current economic situation, in order to change the mode of economic growth and improve the quality of economic growth, it is necessary to explore the impact of innovation drivers on the quality of China's economic growth, so as to find such a way to improve it. However, the existing research on the quality of innovation-driven economic growth is limited to the theoretical level, and the relevant empirical research is rare. In addition, the existing generalized quality indexes of economic growth（QEGI) are not suitable for directly econometric analysis as they mostly contain technological innovation factors such as R & D, patent. Therefore, there are few empirical studies so far on the improvement of quality of economic growth driving by innovation especially the impact of institutional innovation on it. This paper attempts to put forward its own views on the above issues.

Innovation drive in the context of quality growth focuses on technological improvement, which is the reshaping of the production factor combination (Ma 2017). It reduces the impact of the changes in the number of input factors on the production process taking the improvement of TFP and the contribution rate of production efficiency as the main path, and then reaches the stably economic structure as well as the optimal consumption rate of resources and environment under a certain technical level and finally achieve the comprehensively improvement of the quality of economic growth which covers the procedure and results of economic operation. Innovation drive can continuously improve the quality of economic growth by increasing TFP because it is the key factor to change the production function and the effective way to break the old development model.

This paper expounds the relationship between innovation drivers and the quality of economic growth from the perspectives of technological innovation, institutional innovation and their combined effects. By constructing the theoretical analysis framework for it, this paper proposes research hypotheses to be tested.

1.1. The mechanism by which technological innovation affects the quality of economic growth

The Neoclassical economic growth theory provides sufficient theoretical basis for how technological innovation is able to promote economic growth. Also, the development practice in China shows that technological innovation plays an important role in promoting economic growth, transforming the mode of economic growth and improving the quality of economic growth. Technological innovation is conducive to optimizing the economic structure, which is reflected in the fact that it can improve the quality of economic growth by optimizing the industrial structure (Deng and Zhang 2018). For the consumption structure, financial structure and income and expenditure structure, the upgrading path of technological innovation mainly focuses on the maintenance effect on economic stability. Moreover, technological innovation is beneficial to enhancing the efficiency of economic growth (Zhang et al. 2007; Peng and Jiang 2011), which is embodied in the fact that the original scientific and technological innovation can improve the efficiency of resource development and utilization during the process of internal transformation within the production procedure. Technological innovation in the production process makes the productivity of the original input factors increase marginally with the technological spillovers, which is the improvement and optimization of economic growth model. In addition, it helps to reduce resource consumption and environmental pollution.

Hypothesis 1: technological innovation can improve the quality of economic growth.

1.2. The mechanism by which institutional innovation affects the quality of economic growth

Institutional innovation is the foundation of economic growth. It promotes the quality of economic growth mainly through incentive mechanism, restriction of economic subjects, reduction of transaction costs and optimization of resource allocation. Firstly, institutional innovation is about providing the proper "incentives". The lack of "proper incentives" is the main obstacle to economic growth in developing countries (Easterly 2003). Secondly, institutional innovation can stimulate the government, enterprises and individuals to increase the investment on innovation and human capital. It is able to

encourage enterprises to engage in innovation activities and obtain excess profits by providing institutional protection for intellectual property rights, invention patents and "innovation subsidies". Finally, institutional innovation improves the quality of economic growth by reducing transaction costs and optimizing resource allocation. Specifically, market intervention by government (Gao 2017), distortion of factor markets (Zhang and Zhou 2011), development of non-state-owned economy and so on are the serious realities faced by China's imperfect market-oriented system and its transformation from economic system to market-oriented system. The innovation of these system and directions is an important force that causes the quality of China's economic growth to rise.

Hypothesis 2: institutional innovation can improve the quality of economic growth.

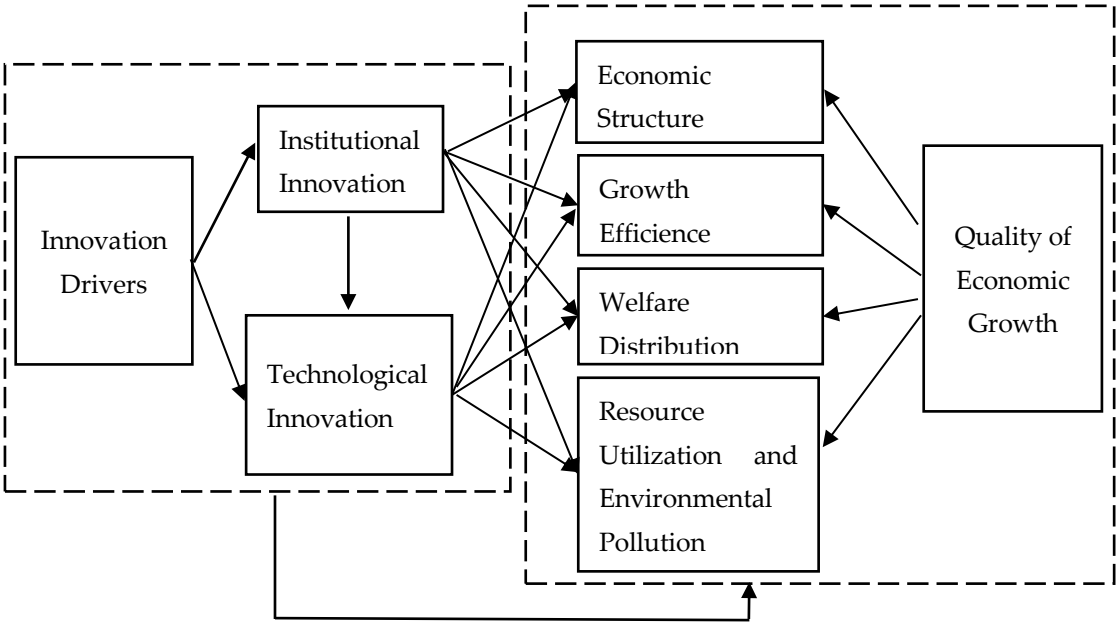

Figure 1. The mechanism by which innovation drivers affect the quality of economic growth.

1.3. The mechanism by which the combination of technological and institutional innovation affects the quality of economic growth

Technological and institutional innovation are unified, both of which work together on economic growth, thus promoting the quality of economic growth. In terms of improving economic efficiency, technological and institutional innovation are the keys to economic efficiency. Therefore, reforming them could bring many "dividends" to the China's economy. Also, in the aspect of reducing environmental pollution, it is possible for economy to realize the green growth model of high economic growth and low pollution in China relying on the transformation and upgrading of industrial structure and technological progress in the long run. At the same time, strong resource and environment policies are also effective inducements to reduce pollution emissions (Wang and Huang 2015). Additionally, in terms of perfecting the welfare distribution, the system improvement can also change the income distribution and then explore the potential for increasing resource utilization.

Hypothesis 3: institutional innovation promotes the quality of economic growth by strengthening technological innovation.

2. Methodology

2.1. Measurement

According to the connotation of the quality of economic growth, this paper constructs an index system to measure the quality of economic growth in China. All 15 basic indicators for measuring QEGI are listed in Table 1, and the brief introduction of sub items, measurement units and the attributes of which are also included.

Table 1. The index system for QEGI measurement.

Aspects	Sub index	Basic index	Measure unit	Criterion Attribute		
				positive	negative	comparative fit index
Progress of economic growth	Structure of industry	Value of secondary industry/ tertiary industry	—	√		
		Theil index of structural deviation	—		√	
	Structure of consumption and investment	Rate of consumption	%			√
		Rate of investment	%			√
	Financial structure	Balance of deposits and loans of financial institutions /GDP	%	√		
	Balance of Payments Structure	total imports and exports /GDP	%	√		
Results of economic growth	growth efficiency	TFP growth rate	%	√		
		Capital productivity	%	√		
		labor productivity	%	√		
	Resource Utilization	Energy consumption per unit of GDP	—		√	
	Environmental pollution	Air pollution degree per unit output	Multiple		√	
		Sewage discharge per unit output	Multiple		√	
		Discharge of solid waste per unit output	Multiple		√	
	Welfare improving	Population weighted urban-rural income ratio	—		√	
		Composite Engel coefficient	—		√	

2.2. Data source

In this study the empirical analysis is conducted to verify the research hypotheses proposed earlier with panel data collected from 30 provinces (in view of the availability of relevant data, Tibet, Hong Kong, Macao, Taiwan four regions are not included in the research objects in this paper), (cities, autonomous regions) in China from 2003 to 2015. The selected explanatory variables mainly include the degree of R & D, the amount of patent application and the degree of marketization. In addition, considering the quality of regional economic growth could be affected by several other factors, the level of human capital, the level of fixed asset investment, social security, infrastructure, total amount of postal and telecommunications business as well as the degree of concentration of producer services are selected as control variables. The data are mainly from <China Statistical Yearbook> in 2004-2016, <China Urban Statistical Yearbook>, <China Science and Technology Statistical yearbook>, < China

Marketization Index 2011> and <China Marketization Index 2016>. Interpolation method is used to complete few missing data.

2.3. Variable declaration

The quality of economic growth (QEG_{it}) as the explained variable is the core variable and the regional data of which is calculated according to the evaluation system in Table 1. It mainly includes two sub indicators which are process dimension ($STRU_{it}$) and result dimension ($RESU_{it}$). Furthermore, the key explanatory variables are those reflecting the level of regional technological and institutional innovation.

1. Level of technological innovation ($tech_{it}$): two indicators including regional R & D expenditure (RD_{it}) and the level of regional patent application ($patent_{it}$) are adopted to measure the level of technological innovation. Specifically, the formula for calculating regional R & D expenditure is: RD_{it} = internal expenditure of Regional R & D and experimental development funds / regional GDP. The level of regional patent application is expressed by the number of patent applications accepted per 10000 people in the region. The calculation formula is: $patent_{it}$ = the number of patent applications accepted in the region/ 10000 people.
2. Level of institutional innovation ($insti_{it}$): the total index score of marketizations (MI_{it}) calculated by Wang and Fan (2011, 2016) is taken to represent the degree of marketizations and then measure the level of institutional innovation. Taking year 2007 as the base period, this paper adjusts the index of marketization from 2008 to 2015 according to the practices of Zhang et al. (2018), so as to make the data is comparable in different years.

Additionally, several factors which are the level of human capital (hum_{it}), the level of fixed asset investment (inv_{it}), social security (soc_{it}), infrastructure ($trans_{it}$), total amount of postal and telecommunications business ($mail_{it}$) as well as the degree of concentration of producer services ($service_{it}$) are selected as control variables ($control_{it}$).

2.4. Model specification

According to the research objectives of this paper, firstly, the impact of innovation driver on the comprehensive level of the quality of economic growth is investigated. The corresponding econometric model is set as follows:

$$QEG_{it} = \alpha + \beta_i \times tech_{it} + \gamma \times insti_{it} + \theta_i \times control_{it} + \varepsilon_{it}$$

In the above formula, the subscripts *i* and *t* indicate the provinces and years respectively.

3. Results

3.1. National QEGI and Provincial QEGI in China

In this paper, principal component analysis (PCA) was adopted with SPSS18 software to obtain QEGI of all provinces (cities, autonomous regions) in China from 2003 to 2015. It can be seen from Figure 2 that QEGI is on the overall continuous rise from -12.77 in 2003 to 24.9 in 2015. In terms of time periods, it is clear that the time evolution process of China's QEGI over 13 years from 2003 to 2015 can be divided into two stages: the first stage is 2003-2008 while the second stage is 2009-2105 with 2008 seen as the turning point of the two stages.

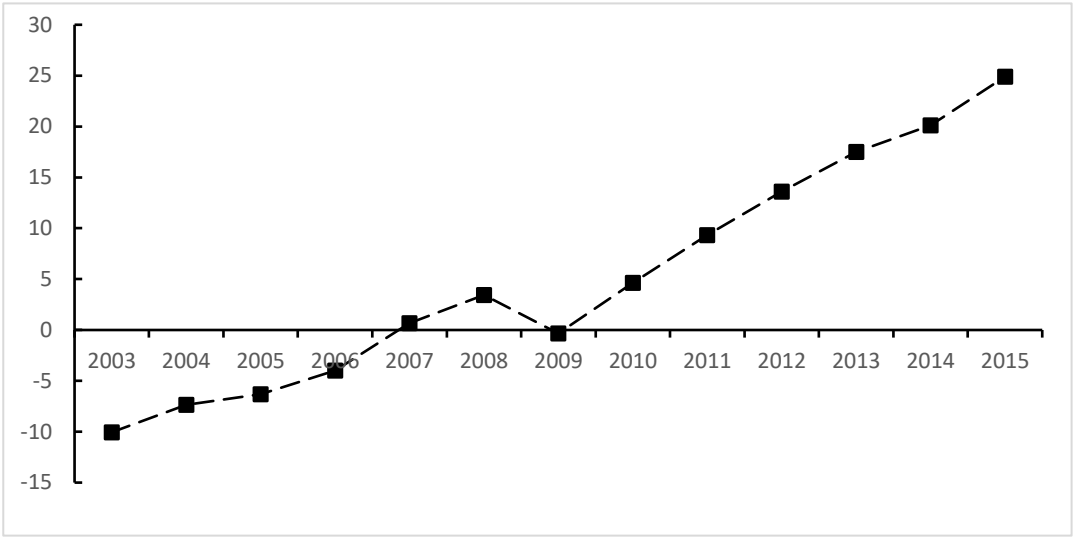

Figure 2. The time evolution process of China's QEGI from 2003 to 2015.

From the perspective of spatial dimension, the quality of economic growth in the eastern region is the highest, which in the northeast region is the second, followed by the central region. The lowest one appears in the western region. Moreover, the eastern region increases most in the quality of economic growth with aspects of range and speed. The western region and the central region are in the second and third places.

3.2. The innovation-driven impact on QEGI in China

The results of the empirical test of innovation-driven impact on the quality of economic growth in China are showed in Table 2. Using the mixed least square method (OLS), the panel fixed effect model (FE) and the random effect model (RE) respectively to run the regression on formula (1), this paper verifies the effects of technological and institutional innovation on the quality of China's economic growth.

Table 2. The regression results of the empirical test of innovation-driven impact on QEGI in China.

variables	**OLS**		**FE**		**RE**	
	（1）	**（2）**	**（3）**	**（4）**	**（5）**	**（6）**
RD	0.491***		0.252**		0.489***	
	(9.33)		(2.01)		(5.60)	
Patent		0.309***		0.0099		0.0104
		(10.13)		(1.45)		(1.48)
MI	0.286***	0.0299***	0.241***	0.267***	0.241***	0.292***
	(10.44)	(3.28)	(5.37)	(6.48)	(6.51)	(7.72)
hum	0.367***	0.630***	0.106	0.103	0.232***	0.340***
	(6.54)	(11.17)	(1.11)	(1.08)	(2.93)	(4.18)
inv	-0.497***	-0.633***	-0.149**	-0.157**	-0.256***	-0.267***
	(-8.02)	(-8.15)	(-2.47)	(-2.44)	(-4.52)	(-4.06)
soc	-0.0209**	-0.0211**	0.0232***	0.0248***	0.0100	0.0118
	(-2.53)	(-2.31)	(2.72)	(2.91)	(1.23)	(1.41)
trans	-0.0237***	-0.0220***	-0.0299***	-0.0300***	-0.0331***	-0.0413***
	(-3.30)	(-2.67)	(-3.17)	(-3.12)	(-3.83)	(-4.53)
mail	0.0003***	0.0003***	-0.0000	0.0000	0.0000	0.0001
	(4.05)	(3.29)	(-0.03)	(0.04)	(1.08)	(1.54)

variables	OLS		FE		RE	
	（1）	（2）	（3）	（4）	（5）	（6）
service	78.70***	146.6***	57.05***	57.63***	59.07***	66.05***
	(4.49)	(8.45)	(4.56)	(4.60)	(4.64)	(5.05)
Cons	-5.063***	-6.848***	-2.718***	-2.612***	-3.876***	-4.525***
	(-12.32)	(-16.62)	(-4.16)	(-4.00)	(-7.06)	(-8.04)
R^2	0.8520	0.8209	0.8035	0.7324	0.8345	0.7869
Observed value	360	360	360	360	360	360

[1] Caption: ** *, * *, and * * represent that the estimated results of the coefficient are at the significant level of 10%, 5% and 1%, respectively.

Column (1) and (2) show the OLS regression results. In column (1), the level of R & D is used for measuring technological innovation, and the level of marketization is taken as a measurement for institutional innovation. According to the output, the level of R & D and the level of marketization have a significant impact on QEGI in China at 99% significant level. The QEGI changes by 0.491 units and 0.286 units while the level of R & D and the level of marketization change 1 unit respectively on average. In column (2), the amount of patent application represents technological innovation. Similarly, regression results show that there is 99% probability that the amount of patent application and the level of marketization affect QEGI significantly. Moreover, the outcomes of FE regression are presented in Column (3) and (4). It can be seen in column (3) that the level of R&D and the level of marketization exert significant effect on QEGI in China at 95% and 99% confidence interval respectively. Unfortunately, the amount of patent application does not have a significant impact on QEGI while the level of marketization is able to affect it with 99% confidence. Furthermore, the outputs of RE regression are showed in Column (5) and (6). There is 99% confidence to believe that the level of R & D and the level of marketization have a significant impact on QEGI in China. However, the amount of patent application has the opposite effect. Moreover, among the control variables, the influence of the level of human capital is not significant according to FE regression, and the coefficients of fixed asset investment and infrastructure are significantly negative, which indicates that China's economy is still driven by investment before 2015, and the human capital does not play a strong role in improving economic quality.

3.3. The innovation-driven impact on QEGI in each region

Table 3 reports the regression results of the impact of innovation drivers on QEGI in each region. Comparing the effects of innovation drivers on QEGI in eastern, central and western parts of China, it is clearly that both the level of R & D and the level of marketization in the eastern region promote the quality of economic growth, even though the roles of the level of R & D is weak. On the other hand, there is only the level of marketization exerting positive effect on the quality of economic growth in central part of China while only the amount of patent application promotes it weakly in western region.

Table 3. The regression results of the empirical test of innovation-driven impact on QEGI in each region

	nation		Eastern region		Central region		Western region	
	（1）	（2）	（3）	（4）	（5）	（6）	（7）	（8）
RD	0.252**		0.0396*		-0.0755		0.159	
	(2.01)		(0.13)		(-0.99)		(1.58)	
Patent		0.0099		-0.0000		0.0000		0.0000***
		(1.45)		(-0.37)		(0.46)		(6.76)
MI	0.241***	0.267***	0.216**	0.241***	0.120***	0.129***	0.0069	0.0432
	(5.37)	(6.48)	(1.98)	(2.73)	(4.93)	(5.51)	(0.22)	(1.64)

	nation		Eastern region		Central region		Western region	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cons	-2.718*** (-4.16)	-2.612*** (-4.00)	-2.430 (-1.37)	-2.736 (-1.50)	-2.372*** (-5.96)	-2.337*** (-5.65)	-0.686** (-1.99)	-0.826*** (-2.80)
R2 (within)	0.8035	0.7324	0.5274	0.5335	0.7924	0.7904	0.5359	0.6622
Observed value	360	360	132	132	96	96	132	132
entity fixed effects	control	control	control	control	control	control	control	control

[2] Caption: ** *, * *, and * * represent that the estimated results of the coefficient are at the significant level of 10%, 5% and 1%, respectively.

3.4. The innovation-driven impact *on QEGI in each stage*

Table 4 and table 5 report the regression outputs of the impact of innovation drivers on QEGI in China during 2003-2007 and 2008-2015. In the first period, the level of R & D, the amount of patent application and the level of marketization influence China's QEGI positively. In the second period, the effects are less significant than which in the first one.

Table 4. The regression results of the empirical test of innovation-driven impact on QEGI during 2003-2007

	FE		RE		FGLS	
	(1)	(2)	(3)	(4)	(5)	(6)
RD	0.554** (2.54)		0.316*** (2.95)		0.184** (2.39)	
patent		0.260*** (4.57)		0.282*** (5.10)		0.419*** (7.19)
MI	0.0531 (0.74)	0.138** (2.06)	0.214*** (4.20)	0.276*** (6.07)	0.310*** (7.79)	0.291*** (8.32)
Cons	-2.568** (-2.29)	-1.538 (-1.41)	-3.979*** (-5.64)	-4.203*** (-7.08)	-4.304*** (-9.19)	-4.252*** (-10.48)
R2	0.7314	0.8128	0.8299	0.8711		
Observed value	150	150	150	150	150	150
Wald test					864.97 (0.0000)	1165.12 (0.0000)

[3] Caption: ** *, * *, and * * represent that the estimated results of the coefficient are at the significant level of 10%, 5% and 1%, respectively.

Table 5. The regression results of the empirical test of innovation-driven impact on QEGI during 2008-2015.

	FE		RE		FGLS	
	(1)	(2)	(3)	(4)	(5)	(6)
RD	-0.0634 (-0.33)		0.536*** (4.37)		0.672*** (8.58)	

	FE		RE		FGLS	
	(1)	(2)	(3)	(4)	(5)	(6)
patent		0.0111		0.0167*		0.0309***
		(1.19)		(1.77)		(2.93)
MI	0.179**	0.144**	0.172***	0.231***	0.264***	0.334***
	(2.54)	(2.31)	(3.14)	(4.19)	(6.54)	(7.30)
Cons	-3.885***	-3.964***	-5.289***	-6.433***	-5.621***	-9.173***
	(-3.30)	(-3.39)	(-5.24)	(-6.32)	(-7.57)	(-12.47)
R2	0.6910	0.7476	0.8390	0.7716		
Observed value	210	210	210	210	210	210
Wald test					1383.86	1018.05
					(0.0000)	(0.0000)

[4] Caption: ** *, * *, and * * represent that the estimated results of the coefficient are at the significant level of 10%, 5% and 1%, respectively.

4. Discussion

The quality of economic growth is a prominent issue in the process of economic development in the world. This paper focuses on the relationship between the quality of economic growth and innovation drivers.

The results show that the quality of economic growth in China during 2003-2015 is on the generally continuous rise with year 2008 as a turning point. According to the outputs of empirical test, both technological and institutional innovation promote the quality of China's economic growth significantly from 2003 to 2015. And the effect of institutional innovation is stronger than that of technological innovation. From a regional perspective, innovation driver plays an important role in promoting the quality of economic growth in eastern China, especially which of institutional driver is more significant. Furthermore, only institutional driver is able to exert a positive impact on the quality of economic growth in central part of China significantly while only technological driver influences which in western region of China significantly. In terms of time period, the role of innovation drivers in promoting the quality of China's economic growth during 2008-2015 is less significant than that during 2003-2007.

It should be noted that this study has examined only the data collected from 30 provinces (cities, autonomous regions) in China from 2003 to 2015. Therefore, the sample size and applicability are relatively limited, and which also provides a space for making progresses in the future studies.

Based on the above outcomes, the policy suggestions given in this paper are as follows: China should take the technological innovation and institutional innovation as the starting point to promote the construction of regional innovation system and improve the quality of economic growth. Enterprises, institutions of higher education and scientific research as micro subjects engaged in scientific and technological R & D and innovation should attach importance to forming a network alliance of multiple enterprises, universities and R & D institutions and establish a long-term cooperative scientific research alliance based on the industrial chain. The reform and opening up policy have entered a stage of comprehensive deepening since the 18th National Congress of the Communist Party of China, showing a good momentum of all-round efforts, multi-point breakthroughs and in-depth progress. In the field of economic development, it needs to accelerate the reform of the market economy system, release the vitality of the market economy through institutional innovation, further improve the socialist market economy system, consolidate the decisive role of the market in the allocation of economic resources and play the role of the government in macro-control better, so as to promote the continuous improvement of the quality of economic growth.

References

Deng Meiwei, and Zhang Fengfeng. 2018. Research on the driving effect of technological innovation on improving the quality of economic growth in Japan - based on the analysis of dynamic panel data in dudaofu Country, Japan. *Modern Japanese economy*: 5, 69-80.

Easterly William, Levine Ross, and Roodman David. 2003. New Data, New Doubts: Revisiting 'Aid, Policies, and Growth'. *American Economic Review*: 86. https://dx.doi.org/10.2139/ssrn.425001.

Gao Fan. 2017. The mystery of innovation in China's economic transformation. *Exploration and contention*: 4, 109-115.

Li Jiang, Nan Yu, and Liu Xiahui. 2017. "Solow paradox" explanation of China's R & D investment and the meaning of human capital matching. *Economist*: 1, 31-38.

Li Yueping. 2001. Economic growth quality evaluation system and empirical analysis. *Jiangsu statistics*: 5, 19-22.

Ma Xingchao. 2017. *Empirical analysis of economic growth effect and technological innovation mechanism of regional industrial agglomeration*. Shenyang: Liaoning University.

Qian Xiaojing, and Hui Kang. 2009. Measurement of the quality of China's economic growth. *Quantitative economic and technological economic research*: 6, 75-86.

Ren Baoping, Chao Xiaojing, and Wei Jie. 2012. *Quality report on China's economic growth.* Beijing: China Economic Press.

Ren Baoping. 2010. *Looking at growth with quality*. Beijing: China Economic Press.

Schwartz Barry. 2016. *The paradox of choice: Why more is less*. New York: ECCO.

Shi Bo, and Ren Baoping. 2018. Measurement and analysis of high-quality development of China's inter provincial economy. *Economic issues*: 4, 1-6.

Wang Haibing, and Yang Huixin. 2016. Innovation driven and modern industrial development system. *Quarterly of economics*: 4, 1351-1386.

Wang Min, and Huang Ying. 2015. Environmental pollution and economic growth in China. *Economic Quarterly*: 2, 557-578.

Wang Wenbo. 2001. Research on statistical index system of economic growth quality. *Forum on statistics and information*: 1, 10-13.

Wei Jie, and Ren Baoping. 2012. Measurement and ranking of quality index of economic growth in different regions of China. *Economic trends*: 4, 27-33.

Xiao Hongye, and Li Lasheng. 1998. Empirical analysis of the quality of economic growth in China. *Statistical research*: 4, 8-14.

Yang Changyou. 2000. Six dimensions to evaluate the quality of economic growth. *Fujian forum*: 1, 33-35.

Zhang Jie, and Zhou Xiaoyan. 2011. Why Chinese enterprises do not innovate: An Interpretation from the perspective of market segmentation. *Journal of Shanxi University of Finance and economics*: 6, 82-93.

Zhang Jie, Zhang Shaojun, and Liu Zhibiao. 2007. Multi-dimensional technology spillover effect, innovation power of local enterprises and path selection of industrial upgrading. *Nankai economic research*: 3, 47-67.