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Project approval, Construction Investment and High-Quality Economic Development——Empirical Evidence from 30 Provinces and Cities in China

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ABSTRACT
Based on the panel data of 30 provinces in China from 2006 to 2020, this paper discusses the impact of project approval efficiency on the high-quality economic development level and verifies the mediating effect of construction investment. The study shows that the efficiency of project approval has a significantly positive impact on the high-quality economic development with decreasing marginal effect.

KEYWORDS
project approval; high-quality economic development; construction investment; mediating effect; super efficiency DEA model

1 Introduction

The world economy is growing rapidly, and many countries not only maintain a high GDP growth rate, but also have a large total GDP scale[1]. However, negative problems caused by rapid development over the years, such as environmental overload, slow innovation development, and unbalanced and inadequate development, have become obstacles on the road of long-term stable economic growth. In the face of these obstacles to development, economic development needs to shift from rapid growth to structural adjustment to achieve high-quality economic development[2]. High-quality economic development will be a long-term dynamic process[3]. The construction industry is an important part of the national economy[4], investment in engineering construction projects promotes economic development, especially large construction projects, which have a greater impact on the local economy[5]. According to the World Bank's Doing Business Report 2020, governments have implemented various policies to optimize the process of building permits[6]. China has made it easier to obtain construction permits by simplifying requirements for low-risk construction projects and reducing the time to obtain water and sewerage connections.

High-quality development is based on aggregate but not only focuses on economic aggregate, but also includes multi-dimensional measurement of economic efficiency, structure, stability and sustainability. It is the evolution and development in coordination between quantity and quality[7]. High-quality development emphasizes the combination of economic, social and ecological benefits, and reflects an inclusive growth that is coordinated between human beings and economic society[8]. Li, Lu[9] used three levels of indicators to build a model of high-quality economic development, and used spatial lag model to prove that environmental regulation has a positive impact on high-quality economic development. Jahanger[10] constructed a high-quality economic development model considering foreign direct investment and environmental regulation as the main independent variables, and studied the regional differences of high-quality economic growth. Yang, Chen[11] further used spatial Durbin model to explore the impact of environmental regulation on high-quality economic development through the mediating effect of industrial upgrading, technological innovation and foreign direct investment. There has been extensive literature on the impact of administrative system reform on economic benefits from a macro perspective. Driffield, Mickiewicz[12] found that the policy liberalization brought about by administrative system reform has the most obvious effect on the productivity of soes, but had no significant positive effect on profitability. Based on provincial marketization NERI index and panel data model, Fan, Ma[13] proved that marketization oriented institutional reform increases economic growth rate and total factor productivity by improving resource allocation. Pariboni and Tridico[14] argued that a loose labor policy helps to increase employment, while a good industrial policy is a necessary but not sufficient condition to keep the economy on a high growth, high productivity path. The construction of regional engineering projects provides an important material foundation for the development of regional economy and is one of the prerequisites for regional economic development. Some studies believe that fixed asset investment affects the demand for industrial structure by forming capital stock and capital structure, and based on the VAR model, using the Granger causality test and other econometric methods, this paper analyzes the lagged relationship between fixed asset investment and industrial structure in China from 1991 to 2017[15]. Fixed asset investment affects energy consumption directly through the purchase and upgrading of energy-saving equipment on the one hand, and indirectly through the expansion of output scale on the other hand. From the perspective of energy consumption of different industries, Wang[16] analyzed the multiple impacts of fixed asset investment on energy consumption of three industrial classes in China from 1991 to 2017, and finds that there is a long-

term stable equilibrium relationship between fixed asset investment and energy consumption. This paper constructs a super-efficiency DEA model, uses the mean value of project approval efficiency to represent the effect of local project approval, empirically examines the impact of project approval on high-quality economic development for the first time.

2 Research hypothesis and Research design

2.1 Research hypothesis

This paper proposes the following hypotheses.

H1: Project approval has a significant positive impact on high-quality economic development.

H2: Construction investment plays a mediating role in the impact of project approval on high-quality economic development.

2.2 Model specification

In order to verify the relationship between project approval and high-quality economic development, as well as the mediating effect of construction investment[17], In this paper, Models (1), (2) and (3) are constructed.

$$Qed_{it} = \alpha_0 + \alpha_1 Cae_{it} + \alpha_3 Control_{it} + \delta_t + \varepsilon_{it} \#(1)$$

$$Lncpi_{it} = \beta_0 + \beta_1 Cae_{it} + \beta_2 Control_{it} + \delta_t + \varepsilon_{it} \#(2)$$

$$Qed_{it} = \gamma_0 + \gamma_1 Cae_{it} + \gamma_2 Lncpi_{it} + \gamma_3 Control_{it} + \delta_t + \varepsilon_{it} \#(3)$$

where i represents the region; t represents the data; Qed_{it} represents the high-quality economic development index of the region(i) of the data(t); Cae_{it} represents the project approval efficiency of the region(i) of the data(t); Cpi_{it} is construction investment; $Control_{it}$ is control variable which contains six indicators; δ_t represents year fixed effect; ε_{it} represents stochastic error term.

2.3 Variable declaration

2.3.1 Explained variable

High-quality economic development index *Qed*. This paper uses economic scale, economic intensity, international trade, regional difference, industrial structure, urban-rural difference, rich and poor difference, air environmental quality, water environmental quality and waste disposal to constitute three secondary indicators, and then constructs the indicators of high-quality economic development, as shown in Table 1.

Table 1 Indicators of high-quality economic development

Level 1 indicator	Level 2 indicator	Level 3 indicator	Explain	Attribute of index
Index of high-quality economic Development	Economic development	Economic scale	GDP	+
		Economic strength	Per capital GDP	+
		International trade	Total export-import volume	-
		Regional differences	Regional Theil index	-
		Industrial structure	Industry Theil index	-
	Social equity	Urban and rural differences	Income ratio of urban and rural residents	+
		Income Discrepancy	Gini coefficient	+
	Environmental protection	Air environmental quality	Proportion of days with good air quality in cities(%)	+
		Water environmental quality 1	Proportion of excellent surface water quality (%)	+
		Water environmental quality 2	Domestic sewage treatment rate(%)	+
		Waste disposal	Harmless disposal rate of urban household garbage(%)	+

The proxy variable that requires complex processing is the industrial Theil index, which is calculated as follows:

$$TL = \sum_{v=1}^{3} \left(\frac{K_v}{K} \right) \ln \frac{\frac{K_v}{S_v}}{\frac{K}{S}} \#(4)$$

where K is the local GDP; P represents employed persons; K_v represents the added value of industry v; S_v represents employed persons of industry v; v=1 represents the primary industry, v=2 represents the secondary industry, and v=3 represents the tertiary industry.

Regional Theil index calculation formula:

$$T=\sum\left(\frac{M_z}{M}\right)\ln\ \frac{\frac{M_z}{M}}{\frac{U_z}{U}}\quad \#(5)$$

where M_z is the income of area z; M is general income; U_z is the population of area z，U is general population.

2.3.2 Explanatory variable

Project approval efficiency *Cae*. The index system of project approval efficiency is shown in Table 2.

Table 2 Measurement indicators of project approval efficiency

Variable classification	Measurement index	Unit
Input	Planned duration of the project	Day
	Project floor area	Spuare metre
	Total construction area of the project	Spuare metre
	Total investment of the project	Yuan
	Number of departments involved in project approval	Individual
	Number of documents on which project approval is based	Individual
	Number of links required for project approval	Individual
	Project approval agency service network points	Individual
Output	Construction drawing approval time	Day
	Construction land approval time	Day
	Construction permit approval time	Day
	Amount required for project approval	Yuan

2.3.3 Mediating variable

Construction investment Lncpi. Construction investment is used as the intermediary variable, measured by the total investment in fixed assets in the current year.

2.3.4 Control variable

The selected control variables are as follows: opening to the outside world (Lnopen), which is expressed by the natural logarithm of the ratio of foreign direct investment to GDP; Government expenditure (Bud), which is represented by the ratio of local general budget expenditure to GDP; Technological innovation (Lntech) is represented by the natural logarithm of R&D expenditure of industrial enterprises above designated size; Industrial structure (Ind), which is expressed by the ratio of the output value of the tertiary industry to the regional GDP; Human capital (Lnhc) is expressed as the natural logarithm of the average number of students enrolled in higher education per 100,000 population.

2.3.5 Data selection

This paper chooses to use provincial data to test the impact of project approval on high-quality economic growth.This paper selects the annual data of the remaining 30 provinces and cities from 2006 to 2020 except for Hong Kong, Macao, Taiwan and Tibet, and finally forms the balanced panel data of the 30 provinces and cities. The data of industrial Theil index, regional Theil index and total factor productivity come from China Statistical Yearbook and statistical yearbooks of provinces and cities. The samples of project approval data of all provinces and cities come from the information published in the online approval system of engineering construction projects of all provinces and cities.

3 Analysis of empirical results

3.1 Description statistic analysis and correlation analysis

Table 3 reports the descriptive statistical results of the variables used in this paper. The standard deviation of the index of high-quality economic development is 0.633, the maximum value is 4.038, and the minimum value is 0.009, indicating that there are large differences in the level of high-quality economic development among regions.

Table 3 Descriptive statistics

Variable	Sample size	Average value	Standard deviation	Minimal value	Maximal value
Qed	450	1.2	0.633	0.009	4.038
Cae	450	1.09	0.524	0.0314	2.832
Lncpi	450	9.149	0.993	6.013	10.990
Lnopen	450	3.115	1.083	-1.818	5.269
Bud	450	0.243	0.110	0.095	0.758
Lntech	450	10.375	1.413	5.698	13.459
Ind	450	0.447	0.098	0.286	0.839
Lnhc	450	7.764	0.353	6.360	8.817
Lnpgdp	450	10.517	0.608	8.717	12.009
TI	450	0.74	0.783	0.359	0.865
Gse	450	8.326	0.953	4.764	13.425
Kcpip	450	0.6538	0.864	0.469	0.785
Eqed	450	1.34	0.753	0.83	2.677
Sqed	450	2.556	0.976	1.968	3.46
Gqed	450	0.69	0.439	0.442	1.569

Correlation analysis is conducted to verify whether there is multicollinearity among indicators, as shown in Table 4. Both explanatory variables and explained variables are significantly correlated before, indicating that the selected explanatory variables are valid. The test results of variance inflation factors among the explanatory variables are all less than 10, indicating that there is no serious multicollinearity among the explanatory variables.

Table 4 Correlation analysis

	Qed	Cae	Lnopen	Gov	Lntech	Ind	Lnhc	VIF
Qed	1							
Cae	0.879***	1						3.297
Lnopen	0.376	0.342***	1					1.732
Bud	-0.396***	-0.390***	-0.587***	1				2.474
Lntech	0.728***	0.666***	0.430***	-0.684***	1			3.207
Ind	0.648***	0.612***	0.061	0.184***	0.184***	1		2.575
Lnhc	0.611***	0.595***	0.413***	0.475***	0.475***	0.602***	1	2.262

*** indicates significance at the level of 1%.

3.2 Regression results of project approval efficiency on high-quality economic development

After the Hausman test, the P value is 0.0005, less than 0.01, so the fixed effect model should be used instead of the random effect model. Since panel data belongs to time series data, the time trend variable is added to the panel fixed effect regression equation, so the two-way fixed effect model is selected for multiple regression analysis. Table 5 reports the regression results of project approval efficiency, regional construction project investment and high-quality economic development in 30 provinces in China. Columns (1), (3) and (5) in the table are the regression results without considering the control variables, and columns (2), (4) and (6) are the regression results after adding the control variables.

Model (1) firstly verifies whether project approval promotes high-quality economic development. Without considering the control variables, the regression coefficient of the project approval efficiency in Model (1) is 0.1723, and it is significant

Table 5 Regression of project approval efficiency, construction investment and high-quality economic development

Variable	Model1) Qed		Model(2) Lncpi		Model(3) Qed	
	(1)	(2)	(3)	(4)	(5)	(6)
Cae	0.1723**(3.88)	0.1630**(4.06)	0.1528**(3.35)	0.1431**(3.37)	0.1723**(3.88)	0.0527**(2.24)
Lncpi						0.7713**(28.19)
Lnopen		0.0324**(2.60)		0.0237(1.80)		0.0141(1.95)
Bud		-0.8695**(-4.06)		-0.8266**(-3.65)		-0.2320(-1.84)
Lntech		0.1632**(7.28)		0.1464**(6.18)		0.0502**(3.70)
Ind		-0.0743**(-0.30)		-0.1168(-0.44)		0.0158(0.11)
Lnhc		-0.0970**(-1.75)		-0.1494**(-2.55)		0.0182(0.56)
Constant		0.6951**(1.26)		1.0921**(1.87)		-0.1472(-0.46)
Fixed year	Yes	Yes	Yes	Yes	Yes	Yes
Fixed region	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.9596	0.9321	0.8973	0.9291	0.9238	0.9563
N	450	450	450	450	450	450

** indicates significance at the level of 5%, with t in parentheses.

at the level of 5%. When the control variables are considered, the regression coefficient of project approval efficiency in Model (1) is 0.1630, which is significant at the level of 5%, indicating that project approval is significantly positively correlated with high-quality economic development, and the improvement of project approval efficiency can promote high-quality economic development. In Model (2) with construction investment as the explained variable, the regression coefficients of project approval efficiency in columns (3) and (4) are still significantly positive at the level of 5%, indicating that there is a significantly positive correlation between project approval efficiency and construction investment. Finally, the regression coefficients of project approval efficiency and construction investment in Model (3) are 0.0527 and 0.7713 respectively, and both pass the significance test of 5%. In addition, the coefficient of project approval efficiency decreases from 0.1723 in Model (1) to 0.0527 in Model (3), and the signs of γ_1 and $\beta_1\gamma_2$ are both positive, which fully indicates that there is partial mediating effect of construction investment, and the mediating effect accounts for 67.68% of the total effect $(\beta_1\gamma_2/\gamma_1)$. The above regression results prove that project approval will promote high-quality economic development, and indirectly improve the level of high-quality economic development by promoting construction investment.

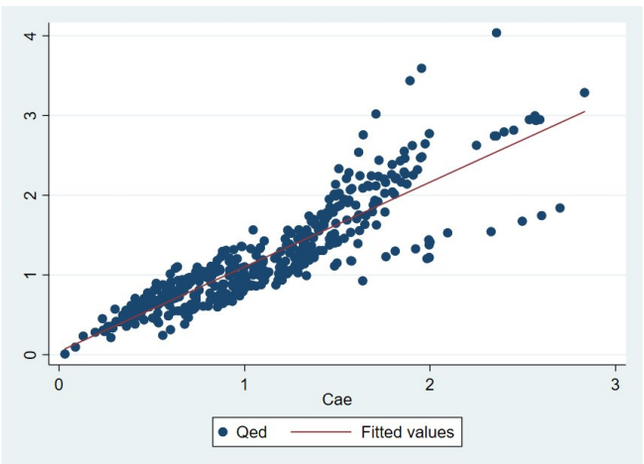

Figure 1 Regression of project approval efficiency on high-quality economic development

According to the regression results of Model (1), the regression analysis chart of project approval efficiency on the indicators of high-quality economic development is made, as shown in Figure 1. However, with the intensification of project approval reform, after the efficiency of project approval rises to a certain stage, the change of high-quality economic development shows a trend of heterogeneous development. The quality of high-quality economic development under the same project approval efficiency is different in different regions, and the strength of project approval efficiency in promoting high-quality economic development is also different. At the same time, the marginal utility of the promotion effect of project approval efficiency on high-quality economic development is not fixed, so it can be speculated that the impact of project approval efficiency on high-quality economic development is not linear.

3.3 Robustness test

In order to strengthen the robustness of the above conclusions, sensitivity analysis is also conducted through the following methods:

The Bootstrap method with 95% confidence interval is used to re-verify the mediating mechanism of "project approval efficiency-construction investment-high-quality economic development," and the samples are set at 500. According to the Bootstrap test rule, if the 95% confidence interval does not include 0, it means that the direct or indirect effect is significant, that is, there is a mediating effect. According to Table 6, the 95% confidence intervals of the indirect effect and the direct effect are [0.0243,0.1948] and [0.0035,0.1014] respectively, which do not contain 0, indicating that there is both indirect effect and direct effect. The mediating effect of construction investment on the promotion of high-quality economic development by project approval is significant and partial. This further proves the results of the regression of project approval, construction investment and high-quality economic development.

Table 6 Bootstrap test method

	Observed Coef.	Bootstrap Std.Err.	P	Normal-based [95% Conf.Interval]	
Indirect effect	0.1103	0.0419	0.0000	0.0243	0.1948
Direct effect	0.0527	0.0248	0.0000	0.0035	0.1014

4 Conclusion

Based on the sample data of 30 provinces in China from 2006 to 2020, this paper constructs the indicators of high-quality economic development from three types of indicators by using the principal component analysis method. And the super efficiency DEA model is used to calculate the project approval efficiency of each province in 15 years. On this basis, this paper analyzes the impact of project approval on the high-quality development of provincial economy, as well as the mediating effect of construction investment in this process. The main conclusions are as follows:

Project approval can promote the high-quality economic development, and the impact of project approval on the high-quality economic development shows a nonlinear characteristic of significant positive and decreasing marginal effect. Construction investment plays a partial intermediary role in the process of project approval promoting high-quality economic development.

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