The Impact of Talent Introduction Policies on the Economic Development Capability of New First-Tier Cities
Based on Multi-period DID Mod

Hongxu Liu$^{(\boxtimes)}$

School of Management, Wuhan University of Technology, 122 Luoshi Road, Hongshan District, Wuhan, China
ayden.h.liu@whut.edu.cn

Abstract. Since the Central Committee of the Communist Party of China (CPC) issued the Opinions on Deepening the Reform of the Institutional Mechanism for Talent Development in 2016, the new first-tier cities have introduced corresponding talent introduction policies to drive innovation-driven economic development. In this paper, annual panel data related to the economic development capacity of 19 new first-tier and other large and medium-sized second-tier cities from 2013 to 2020 are selected, and the impact of talent introduction policies on urban economic growth is empirically studied using a multi-period DID model, and a parallel trend test is conducted. All work is done by STATA. The study proves that the talent introduction policy has a positive impact on the economic growth of the new first-tier cities, and the overall GDP of the experimental group increased by 11.3% compared with the control group.

Keywords: Multi-period differences-in-differences model · talent introduction · new first-tier cities · urban economic growth

1 Introduction

Currently, China is at a critical stage of economic and social transformation and development, and the quality of its nationals largely determines whether society will continue to develop steadily, rapidly and sustainably over the next period of time. China currently attaches great importance to the cultivation of talents, and as early as 2002, the central government published the Outline of the National Talent Team Construction Plan 2002–2005; in 2008, led by many central ministries and commissions, it comprehensively promoted the strategy of strengthening the country with talents; especially since 2016, the Central Committee of the Communist Party of China issued the Opinions on Deepening the Reform of the Institutional Mechanism for Talent Development, and various places have been scrambling to introduce policies for the introduction of talents, from household registration system, land policy, housing allowance, etc. to increase the attractiveness of cities to talents in order to achieve local industrial upgrading and talent structure optimization.

The new first-tier cities are large and medium-sized second-tier cities that have a strong economic base, a large middle-class population and considerable political, educational, cultural and transportation resources, and have the ability to radiate to many neighboring cities, following the first-tier cities Beijing, Shanghai, Guangzhou and Shenzhen, as selected by First Financial. At present, all the new first-tier cities have introduced corresponding talent introduction policies to attract talents to enhance the competitiveness of the city, thus strengthening the city level and adding new momentum to the construction and economic transformation of the city; there are some second-tier cities with a slower development rate that have not introduced talent introduction policies because of their geographical location and political system.

Currently, Heqing Yang and Yi'an Chen take the "Thousand Talents Program" as an example, and use the "cost-benefit" model (benefit = input-output-negative effect) to evaluate the effectiveness of the talent introduction policy by studying the three dimensions of policy input, output and negative effect, and conclude that the overall benefit is positive [1]. This indicates that the domestic talent introduction program is working well. Jiang He applied the PMC index model for policy evaluation and found that the overall score of talent policy PMC index is low in the sub-indexes of policy timeliness, industry orientation, and role level after repeated studies. This indicates that the talent introduction policy has greater limitations and lacks long-term, forward-looking planning for local industrial development [2]. The current academic community has identified the macro impact of talent introduction policies on urban development, but has not specifically explored the direction and weight of the impact of talent introduction policies on the economic development capacity of the new first-tier cities.

This paper selects 19 large and medium second-tier cities, 11 of which are rated as "new first-tier" in 2016–2020, and the remaining 8 are second-tier provincial capitals. A multi-period differences-in-differences model was established to analyze the influence mechanism of talent introduction policies on the economic development capability of new first-tier cities, and to analyze the influence weights of the variables. Through the analysis of the research results, the aim is to clarify the relationship between human capital and the economic development capacity of cities, and then comprehensively promote the sustainable development of cities, provide a continuous source of knowledge power for the further development of cities, and also have important reference value for local governments to formulate relevant policies.

2 Model Selection and Variable Description

2.1 Methodology and Model Selection

This paper adopts a multi-period differences-in-differences approach to test the policy impact of talent introduction policies on the economic development capacity of new first-tier cities, and considers the enactment of talent introduction policies as a quasi-natural experiment. From 2016, when the Central Committee of the Communist Party of China (CPC) promulgated the Opinions on Deepening the Reform of Institutional Mechanisms for Talent Development, cities led by first-tier and new first-tier cities took the lead in responding to the national call to deepen and improve their local talent introduction policies, at which point the talent introduction policies entered a mature

Table 1. Sample Cities

Experimental group	Control group
Chengdu, Hangzhou, Chongqing, Wuhan, Xi'an, Suzhou, Tianjin, Nanjing, Changsha, Qingdao, Shenyang	Nanning, Yinchuan, Guiyang, Hohhot, Kunming, Taiyuan, Hefei, Changchun

and stable stage. Given that most cities have already implemented corresponding talent introduction policies, this paper refers to Bernstein et al. and designates the experimental group as new first-tier cities that implement talent introduction policies between 2016 and 2020, and the control group as large and medium-sized second-tier cities that do not enact talent introduction policies before 2020 [4]. In this paper, we consider the prerequisites for the implementation of the multi-period DID method, and both the experimental group and the control group are large, medium, and second-tier cities, which are mostly central cities with outstanding development in each region of the country and have the same economic development trend before the implementation of the policy. The specific cities are shown in Table 1.

In the traditional differences-in-differences method, it is necessary to distinguish and set the experimental group dummy variables from the staged dummy variables. Specifically, whether the dummy variable is affected by the policy determines the assignment of the experimental group dummy variable, with the control group sample not affected by the policy taking the value of 0 and the experimental group sample taking the value of 1; the time of policy implementation determines the assignment of the staging dummy variable, with the year before the policy implementation taking the value of 0 and the year of policy implementation and after taking the value of 1. The interaction term of grouping and staging dummy variables is the key to test the effect of policy. This paper differs from the traditional differences-in-differences method in the policy point-in-time uniformity characteristic. The talent introduction policy is promulgated by each city independently, so this paper adopts multi-period DID for estimation with reference to Beck et al. to test the impact of the promulgation of the talent introduction policy on regional economic development [5]. The specific econometric model is set as follows.

$$\ln GDP_{it} = \beta_0 + \beta_1 did_{it} + \lambda X_{it} + \mu_i + \gamma_t + \varepsilon_{it} \tag{1}$$

In (1), $\ln GDP_{it}$ is the explanatory variable, indicating the economic development level of city i in year t. In this paper, the logarithm of real GDP is chosen to measure the economic development level of each region. Did_{it} is the dummy variable for the enactment of talent introduction policy, for example, if city i enacts talent introduction policy in year t, then the double difference estimator $did_{it} = 1$ for city i in the year t and subsequent years, otherwise is 0. The coefficient β_1 of did_{it} is the core estimation parameter, which indicates the net effect of enacting talent introduction policy on the regional economic development level. If β_1 is significantly positive, it means that the enactment of talent introduction policy drives the regional economic development, otherwise, there is an inhibitory effect. X_{it} is other control variables affecting economic development, μ_i is the individual fixed effect of each city, and γ_t is the time fixed effect.

Table 2. Control Variables.

Variable name	Variable meaning	Computing method
INVEST	fixed investment amount in cities	fixed investment amount in cities/GDP * 100
CPI	consumer price index	-
URBAN	urbanization level	urban population/total population * 100
INDUSTRY	share of tertiary industry	output value of tertiary industry/GDP * 100
GOV	government size	the government budgets public expenditures/GDP * 100

2.2 Variable Description

2.2.1 Explained Variables

In this paper, the logarithm of regional GDP, lnGDP, is selected as an indicator to measure regional economic development. Since the new first-tier cities were officially selected in 2013, this paper selects the data of each region from 2013–2020 for empirical analysis.

2.2.2 Core Explanatory Variables

The core explanatory variable in this paper is the talent introduction policy dummy variable did, which is assigned according to the time when the talent introduction policy was launched in each city. The dummy variable was assigned a value of 1 in the year when the talent introduction policy was launched and thereafter, otherwise it was assigned a value of 0.

2.2.3 Control Variables

In this paper, the annual fixed investment amount in cities (INVEST), consumer price index (CPI), urbanization level (URBAN), share of tertiary industry (INDUSTRY), and government size (GOV) are selected as control variables. The data of all control variables are from authoritative institutions or journals, such as the National Bureau of statistics and the urban statistical yearbook. The detailed calculation method is listed in Table 2.

3 Results

3.1 Analysis of Multi-period DID Results

The enactment of talent introduction policies is characterized by variation in large and medium-sized cities in China, providing a quasi-natural experiment for the study. Therefore, this paper chooses a differences-in-differences model by using the STATA software to test the impact of the enactment of talent introduction policies on regional economic

Table 3. Regression Results.

Variables	Model 1	Model 2
did	0.115***	0.113***
	(4.87)	(4.84)
control	No	Yes
_cons	4.103**	4.073**
	(2.29)	(2.25)
urban effect	Yes	Yes
year effect	Yes	Yes
N	152	152
R^2	0.733	0.724

Note: t-values in parentheses; *, **, *** indicate significant at the 10%, 5%, and 1% statistical levels, respectively; regression results for each control variable are not presented in detail due to space limitations.

development, and controls for individual and time-point two-way fixed effects in the model, and Table 3 reports the regression results of (1). In Table 3, Model 1 is the estimation result with the inclusion of the variable did only, and Model 2 is the estimation result with the inclusion of other control variables. The results show that the regression coefficients of the main variable of interest in the paper, did, are significantly positive, 0.115 and 0.113, respectively, regardless of whether the control variables are included or not, which indicates that the enactment of talent introduction policies has a significant driving effect on regional economic development. From the regression results in Table 3, it is clear that the promulgation of talent introduction policy has a significant driving effect on the development of regional economy.

3.2 Parallel Trend Test

The premise of the validity of the multi-period DID method is the convergence hypothesis, which means that the economic development trends of cities in the experimental group and the control group should be parallel or not significantly different before the talent introduction policy is enacted. To test the feasibility of the premise hypothesis, this paper draws on Jacobson and Beck's use of event analysis to conduct the test of parallel trends, setting the following estimation model [3].

$$\ln GDP_{it} = \beta_0 + \beta_1 did_{it}^{-4} + \beta_2 did_{it}^{-3} + \ldots + \beta_9 did_{it}^{+4} + \lambda X_{it} + \mu_i + \gamma_t + \varepsilon_{it} \quad (2)$$

In (2), $did_{it}{}^m$ (m = −4, −3,…, +4) represents a series of dummy variables; the sign of m is negative for the mth year before city i enacted its talent introduction policy, and the sign of m is positive for the mth year after the enactment of the talent introduction policy. In this paper, the four years before the talent introduction policy is promulgated and the four years after the beginning of the promulgation are selected for estimation. Other
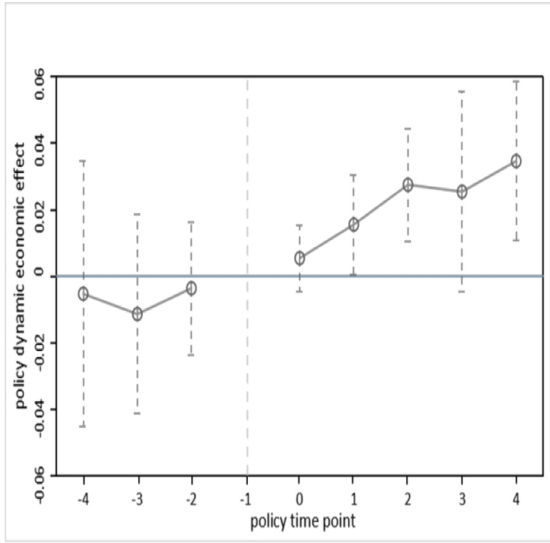
Fig. 1. Parallel Trend Results Graph.

variables have the same meaning as in (1). The paper is concerned with the portrayal m of the coefficient β_m, which indicates the difference in economic development between the experimental group and the control group at the mth year from the beginning of the enactment of the talent introduction policy. If β_m fluctuates less or has a flatter trend during m < 0, it means that the model satisfies the convergence hypothesis of differences-in-differences; conversely, if β_m shows a significant increase or decrease during m < 0, it means that the economic development between the experimental group and the control group of cities has been significantly different before the promulgation of the talent introduction policy and does not satisfy the parallel trend hypothesis. When conducting the parallel trend test, this paper selects m = −1 period as the base period to avoid the problem of multicollinearity. By using the STATA software, the specific trend graph is shown in Fig. 1.

As can be seen from Fig. 1, the estimated values of β_m change slowly and with small fluctuations during the period m < 0, indicating that there is no significant difference in the economic development level between the experimental group and the control group before the enactment of the talent introduction policy, which satisfies the common trend hypothesis. From m = 0 onward, the estimated value of β_m shows a significant increase, indicating that the enactment of the talent introduction policy significantly drives the economic development of the host city.

4   Conclusions and Policy Recommendations

Talent has always been considered as the first resource for a country's survival and development, and the level of talent quality in a country or region will directly determine the overall comprehensive ability of a country or a region. Excellent high-level

talents and specialized talents are the main competitiveness of China in the international market nowadays. To further analyze the impact of talent introduction policy on cities' economic development capacity, this paper takes talent policy as the starting point and constructs a two-way fixed effects model using panel data for 19 large and medium-sized second-tier cities in China from 2013 to 2020, and uses multi-period DID to identify the net impact effect of this policy on economic development. The main findings are as follows: (a) When no control variables are included, the talent introduction policy has a significant positive effect on the economic development capacity of the new first-tier cities, indicating that the talent introduction policy can significantly promote their economic development; (b) After adding the control variables, the talent introduction policy still has a significant effect on the new first-tier cities, which indicates that this effect is still true and effective after excluding other influencing factors.

Since China is a vast country with a large east-west span and diverse geographic environment, the implementation of talent introduction policy has different influencing ability for each city, and the effect of policy implementation is different for eastern cities and western cities, coastal cities and inland cities. Therefore, the policy recommendation of this paper is to implement the basic principle of "one city, one policy" advocated by the state when formulating talent introduction policies, and to combine the comparative advantages of cities with the implementation of talent introduction policies. The talent introduction policy issued by each city should be in line with their own resource endowment, public infrastructure, basic education and development orientation.

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