4. Empirical Analysis

4.1 Empirical Results

4.1.1 Result of Inflation Threshold Estimation

First, according to the historical occurrence of inflation rate in China, the interval of our inflation rate is between 0% and 22%.[22] After that, we divide this interval by 89 inflation knots—the beginning is inflation rate 0%, then 0.25%, 0.50%, 0.75%, and so forth. The rest of knots can be deduced by analog, i.e. every 0.25% a knot, until reaching 22%. Next, we treat each knot as one trial point for estimation of inflation threshold; then, by subtracting actual inflation rate from each knot, we obtain 89 sets of $(\pi - \pi^*)$ based on each trial threshold. And next, by substitute every set of trial $(\pi - \pi^*)$ into Eq. (5), we can get 89 sets of result; that means we can collect 89 sets of adjusted R-square ($\overline{R}^2$) at the same time. All the $\overline{R}^2$s are plotted in as Figure 2.

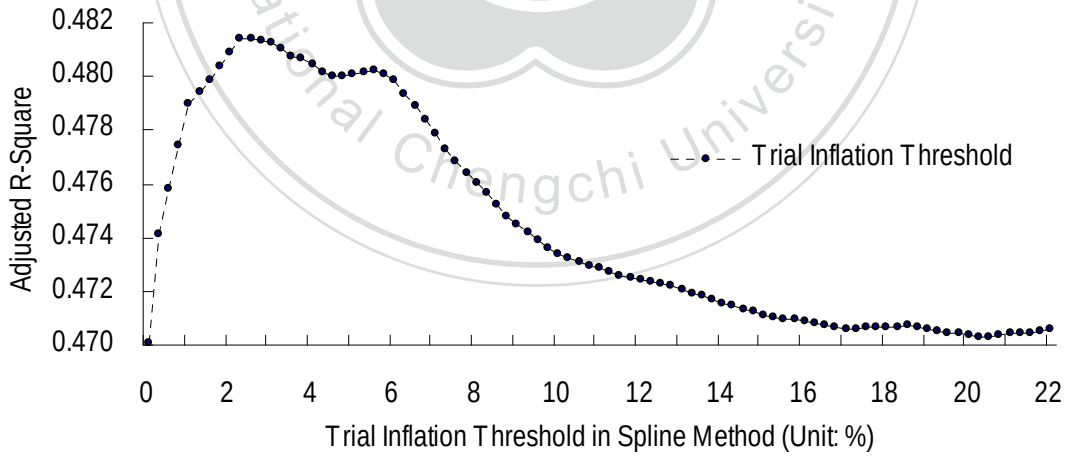

Figure 3 : Goodness of Fit against Each Trial Inflation Threshold Rate

In Figure 3, each $\overline{R}^2$ against the trial inflation threshold rate is estimated by Eq. (5) with random effect model. It can be found that the inflation rate 2.5% strikes the

[22] Because there are no more than 30 of 609 observations of inflation rate above 23% in our case.

highest $\overline{R}^2$ (= 0.4814); so the point is the best inflation threshold rate in China (with t-ratio 3.59). All the $\overline{R}^2$s for various inflation threshold levels can be referred in Appendix 3.

4.1.2 Result of Threshold Effect of Inflation on Growth

We now test the linear and nonlinear effects of inflation on provincial growth. The results of regression are presented with and without control for inflation rate and excess inflation rate multiplied by inflation threshold dummy, i.e. π and $D^{\pi}(\pi - \pi^*)$.

Initially, we run Eq. (5) excluding π and $D^{\pi}(\pi - \pi^*)$. It is obtained that

$$\Delta \ln Y = \underset{}{3.06} + \underset{(6.52)^{***}}{0.18}\,\Delta \ln K + \underset{(9.99)^{***}}{0.13}\,\Delta \ln L + \underset{(1.33)}{0.05}\,D^K(\Delta \ln K) + \underset{(2.21)^{**}}{0.08}\,D^L(\Delta \ln L) + \underset{(0.66)}{}$$

$$\underset{(3.50)^{***}}{0.08}\,\Delta \ln H + \underset{(6.04)^{***}}{0.24}\,T, \qquad (8)$$

Samples = 609; $\overline{R}^2 = 0.47$; $F = 16.15$; Hausman = 3.91

in which number in parentheses is t-ratio underlying its coefficient, *, **, and *** represent significance level at 10%, 5%, and 1%, respectively. All coefficients, have an expected sign and are also significant, except for labor growth rate (t-ratio equals 1.33) and coastal effect on labor growth rate (t-ratio equals 0.66).[23] Such estimation is based on random effect model (Hausman statistic equals 3.91).

Then, we estimate Eq. (5) excluding the term $D^{\pi}(\pi - \pi^*)$ and acquire

$$\Delta \ln Y = \underset{}{3.24} + \underset{(5.11)^{***}}{0.17}\,\Delta \ln K + \underset{(9.53)^{***}}{0.13}\,\Delta \ln L + \underset{(1.34)}{0.05}\,D^K(\Delta \ln K) + \underset{(2.22)^{**}}{0.09}\,D^L(\Delta \ln L) + \underset{(0.66)}{}$$

[23] It should be noted that the sum of elasticity of capital and labor is smaller that one. That means, under a Solow growth equation, there is decreasing return to scale of output in China.

$$0.08\,\Delta\ln H + \underset{(3.39)^{***}}{0.23}\,T \; \underset{(5.61)^{***}}{-} \; \underset{(0.43)}{0.01}\,\pi\,. \tag{9}$$

Samples = 609; $\quad \overline{R}^2 = 0.47$; $\quad F = 15.67$; $\quad$ Hausman = 3.89

However, the result of Eq. (8) reveals that inflation (t-ratio equals 0.43) seems negligible to explain growth in the province, even if it still has an expected sign. The regression is run by random effect model (Hausman statistic equals 3.89).

Now, we run the complete Eq. (5), which includes not only inflation rate but also the measure of threshold effect. If the outcome is still similar to what we see in Eq. (8), then this can be implied that inflation is insignificant and fails to shape regional growth in China, whether nonlinear possibility is considered or not. The estimation of complete Eq. (5) as follows:

$$\Delta\ln Y = \underset{(3.64)^{***}}{2.43} + \underset{(8.44)^{***}}{0.16}\,\Delta\ln K + \underset{(1.43)}{0.13}\,\Delta\ln L + \underset{(2.34)^{**}}{0.05}\,D^K(\Delta\ln K) + \underset{(0.76)}{0.10}\,D^L(\Delta\ln L) +$$

$$\underset{(3.58)^{***}}{0.08}\,\Delta\ln H + \underset{(6.34)^{***}}{0.27}\,T + \underset{(3.45)^{***}}{0.53}\,\pi \; \underset{(3.59)^{***}}{-} \; 0.61\,D^{\pi}(\pi - \pi^*)\,, \tag{10}$$

Samples = 609; $\quad \overline{R}^2 = 0.48$; $\quad F = 15.93$; $\quad$ Hausman = 4.16; $\quad \pi^* = 2.5\%$

where π^* equals 2.5(%), according to the result in sub-section 5.1, and result of estimation are completed by random effect model (Hausman statistic equals 4.16). To our surprise, the coefficient of excess inflation rate to the threshold rate 2.5% is negative (-0.61) and highly significant. At the same time, the coefficient of inflation rate (π) turns larger and also highly significant against the result in Eq. (8). To explain economically, in China, the inflation threshold rate is around 2.5%. When inflation rate is higher than 2.5%, every increase of inflation rate by 1% impedes growth by 0.61%. Besides, as inflation rate can be controlled below 2.5%, every increase by 1%

stimulates growth 0.53%.

4.1.3 Result of Robustness Test

As what Sarel (1996) indicates, if inflation harms growth significant and direct, it is expected to see a still strong direct effects of inflation and inflation threshold, even though we control for another involved explanatory variable, i.e. to regress Eq. (6).[24] The result of addition of trade-output ratio is demonstrated as bellow:

$$\Delta \ln Y = \underset{(3.36)^{***}}{2.24} + \underset{(8.92)^{***}}{0.17}\,\Delta \ln K + \underset{(1.65)^{*}}{0.15}\,\Delta \ln L + \underset{(1.34)}{0.03}\,D^{K}(\Delta \ln K) + \underset{(0.25)}{0.03}\,D^{L}(\Delta \ln L) +$$

$$\underset{(3.52)^{***}}{0.08}\,\Delta \ln H + \underset{(5.61)^{***}}{0.24}\,T + \underset{(3.40)^{***}}{0.52}\,\pi - \underset{(3.56)^{***}}{0.60}\,D^{\pi}(\pi - \pi^{*}) + \underset{(2.94)^{***}}{0.02}\,TR\,, \qquad (11)$$

Samples = 609; $\overline{R}^{2} = 0.49$; $F = 15.88$; Hausman = 4.23; $\pi^{*} = 2.5\%$

in which estimation is completed by random effect model (Hausman statistic equals 4.23). Compared with Eq. (9), we find that all the coefficients have a right sign as previous; both inflation and inflation threshold have almost same effects on growth. As well, we find that if international trade is controlled, the location difference between factors input and economic growth become insignificant (as the forth and fifth term in the right-hand side reveal), it means that international trade is an essential reason to explain the difference of factor elasticity of production between coastal and inland provinces; one possible interpretation is “learning by doing” international trade generates, as some pros of endogenous growth theory suggest.

In this sub-section, we examine the robustness of the coefficient of inflation threshold of Eq. (9). The result supports that the inflation plays a very significant role

[24] Similar sensitivity test is frequently adopted in inflation-growth empirics, for instance, Sarel (1996) and Khan and Senhadji (2001).

to determine growth in China. If we omit threshold effect at all, that would be very likely to make an incorrect conclusion on the relation between inflation and growth. All the estimation of Eq. (8), (9), (10), and (11) are presented together in table 2.

Table 2: Estimated Results of Inflation-Growth Regression

Dependent variables: provincial growth rate				
	Eq. (8)	Eq. (9)	Eq. (10)	Eq. (11)
Concern π or not?	No	Yes	Yes	Yes
Concern π^* or not?	No	No	Yes	Yes
Add *TR*, robust test?	No	No	No	Yes
$\Delta \ln K$	0.18 (9.99)***	0.17 (9.53)***	0.16 (8.44)***	0.17 (8.92)***
$\Delta \ln L$	0.13 (1.33)	0.13 (1.34)	0.13 (1.43)	0.15 (1.65)*
$D^K(\Delta \ln K)$	0.05 (2.21)**	0.05 (2.22)**	0.05 (2.34)**	0.03 (1.34)
$D^L(\Delta \ln L)$	0.08 (0.66)	0.09 (0.66)	0.10 (0.76)	0.03 (0.25)
$\Delta \ln H$	0.08 (3.50)***	0.08 (3.39)***	0.08 (3.58)***	0.08 (3.52)***
T	0.24 (6.04)***	0.23 (5.61)***	0.27 (6.34)***	0.24 (5.61)***
π		-0.01 (0.43)	0.53 (3.45)***	0.52 (3.40)***
$D^{\pi}(\pi - \pi^*)$, π^* =2.5%			-0.61 (3.59)***	-0.60 (3.56)***
TR				0.02 (2.94)***
Observations	609	609	609	609
$\overline{R}^2$	0.47	0.47	0.48	0.49
F statistic	16.15	15.67	15.93	15.88
Hausman statistic	3.91	3.89	4.16	4.23

Note: All coefficients are estimated by random effect model with autocorrelation correction, if needed. *, **, and *** represent significance level at 10%, 5%, and 1%, respectively. All constant terms are omitted.

4.2 Implication for China's Economy

Since the beginning of 1980s, China has experienced price uncertainty for times; excluding deflation in late 1990s, most of them are inflation. It is confirmed that inflation has nonlinear effect on growth. According to our estimation, 2.5% annual inflation rate should be an adequate level to for China's economic growth. For an emerging economy, the suggested inflation rate seems too ideal and impractical due to rising and vast aggregate demand, which indeed causes serious inflation in the first half of past three decades.

However, the amplitude of inflation rate turns smaller and the level of inflation rate become more moderate. Since late 1990s (until 2007), it has gotten very hard to see annual growth rate of CPI exceed 5%. Compared with the earlier time of reform period, the inflation rate gets nearer around the threshold point by our estimation. One probable interpretation is degree of price deregulation. As time passes, more and more goods have accomplished switch of pricing institution from official determination toward market mechanism. During the transition, most prices of goods present an up trend to reflect market values; such trend exacerbates price fluctuation. With substantially completed market machinery, the fluctuation is no longer violent as before. Besides, a more skilled macro-control helps much. In the past, China authorities used to manage uncertainty of economy by administrative intervention. Because of less experience, the outcome often goes counter to their desire, i.e. hard-landing or invalid control. After mid-1990s, the government adjusts their control approach and depends on fiscal and monetary tools considerably. This change is believed to stabilize inflation rate more effective.

Therefore, we suggest China government should continue to carry out adequate macro-control to maintain inflation rate within the considerable range, especially for some over-heating industries. As to foreign and local investors in China, they may

need to take inflation into consideration of investment decision. For example, interest rate is usually raised along with inflation and the government would likely reduce original incentive measures on over-heating industries, e.g. decreasing export tax rebates; restrict capital lending to certain fields. Corporations and individual investors should take necessary hedge against the operation risk as well.