Nonlinearities in the Inflation-Growth Relationship and the Role of Uncertainty: Evidence from China's Provinces

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Abstract

This paper investigates nonlinearities in the inflation-growth-uncertainty relationship in Chinese provinces over the period 1992 to 2017 using nonlinear models and dynamic panel threshold models. We find that for the full sample period (1992–2017), inflation rates exceeding 9.7% are associated with a positive growth effect ($\hat{\beta}_2 = 0.03$). Below this threshold, the correlation is insignificant. Since inflation rates above 9.7% were mainly observed in the early to mid-1990s, we restrict the sample to 1999–2017. In this period, the inflation threshold lowers to approximately 5.1%. Moreover, the relationship between inflation and growth shifts across the two regimes: below 5%, inflation is positively associated with growth ($\hat{\beta}_1 = 0.01$), while above 5%, the effect turns negative and statistically insignificant. We further explore whether the effect of inflation on growth could be affected by uncertainty at the provincial level. For that purpose, we combine two recent uncertainty indices for the Chinese economy that are based on Chinese newspapers. We find that inflation only has a positive effect on growth for low-levels of uncertainty. For high-levels of uncertainty, the effect of inflation on growth turns negative and statistically insignificant.

Keywords: Inflation, Economic growth, Chinese economy, Nonlinearities, Uncertainty, Dynamic panel threshold models
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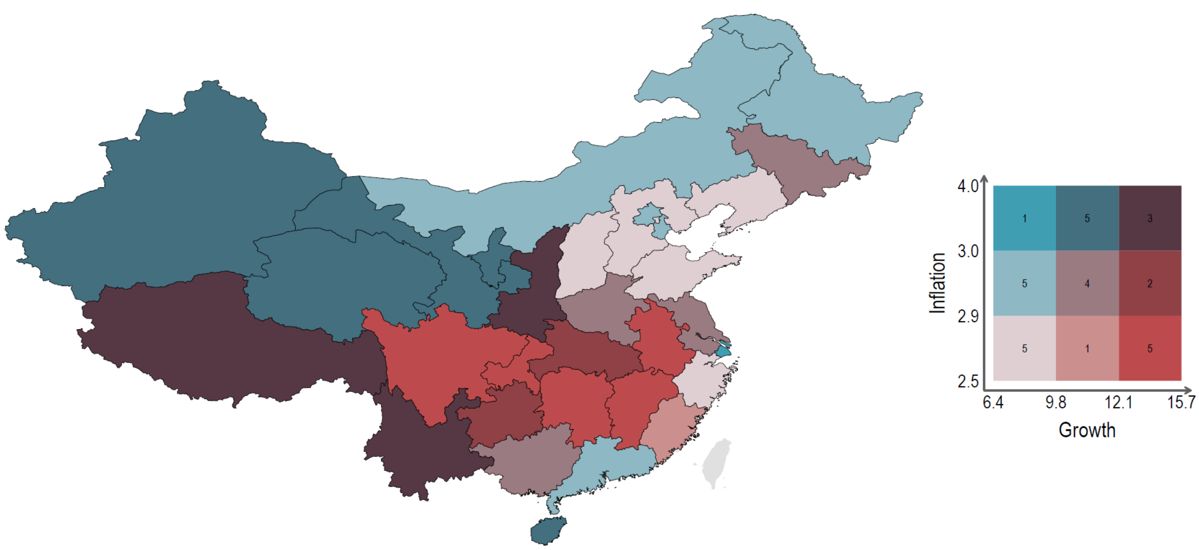
1. Introduction

Over the past few decades, the Chinese economy has experienced one of the most remarkable periods of economic development since World War II, particularly following its entry into the World Trade Organization (WTO) in 2001. This era has been characterized by significant economic reforms, leading to almost double-digit growth, controllable inflation, and, at least prior to the global financial crisis, modest levels of uncertainty. However, alongside this rapid transformation, there have been disparities in economic growth and inflation across different regions of the country. Intuitively, the less advanced provinces should catch up with the most advanced ones. Therefore, we would expect the less developed regions to achieve the highest growth rates.

Figure 1: Bivariate Map of Regional Inflation and Growth



Notes: Bivariate choropleth map comparing inflation (blue) and economic growth (red) in China.
Source: Authors' calculations based on data from the NBS (2024). Economic growth and inflation are averaged over the period 2010-2015.

These provincial disparities can be observed in Figure 1, a bivariate choropleth map depicting inflation (in various blue tones) and economic growth (in various red tones) in China. Many inland provinces attain higher economic growth rates (as indicated by the darker or more intense red tones) compared to coastal regions.[1] In addition, we can see that the level of inflation could also matter. The coastal regions with lower economic growth rates have also experienced lower inflation rates (as indicated by the lighter colors) than the inland regions.[2] While inflation may influence regional growth rates in the short to medium run, the neoclassical growth model suggests that inflation should not have a significant impact on growth in the long run.

Economists generally agree that low but positive inflation can support economic development (see, e.g., Hwang and Wu, 2011). This raises the critical question: What level of inflation is optimal for fostering growth, and when does it begin to hinder it? For a long time, there has been a consensus that inflation targets for industrialized countries should be around 2%. However, following the Global Financial Crisis (GFC), this target has been increasingly questioned, with some economists suggesting that it may be too low (see, e.g., Blanchard et al., 2010). In this regard, the first question of interest is the potential nonlinearities between growth and inflation within China. On the one hand, we may expect, as usual in the literature for industrialized economies, that after surpassing a certain threshold, inflation may damage growth. Higher inflation rates may impact the economic decisions of households and firms in terms of consumption and investment. On the other hand, we may also expect that higher regional inflation is the symptom of a catching-up process. In this situation, higher inflation rates are not associated with slower growth.

In the aftermath of the GFC, the level of uncertainty for the world economy and for China has seen stark evolutions (Bobasu et al., 2020; Bloom et al., 2022; Bannigidadmath et al., 2023). We entered a new regime of uncertainty, as witnessed by the growing US-China rivalry. Many studies show that a high level of uncertainty can signal a conservative economic environment, prompting most economic agents to adopt a more risk-averse stance. This shift in behavior may influence the effectiveness of inflation in driving economic growth. In this context, our second question is related to the role of uncertainty in the inflation-growth relationship.

[1] The bivariate maps for the period 2000-2017 are available in Appendix A.

[2] The combination of low inflation and (relatively) low growth is depicted by the lightest color and high inflation with high growth is represented by the darkest brownish color.

In general, this study aims to decipher the relationship between economic growth, inflation, and uncertainty within China. In particular, we investigate potential nonlinearities in the inflation-growth and inflation-uncertainty-growth relationships in China over the period 1992 to 2017 using nonlinear models as well as dynamic panel threshold models. Identifying inflation and uncertainty thresholds in the relation between economic growth and inflation can help policymakers build a more balanced growth model. Our analysis reveals that the growth effects of inflation vary in both magnitude and direction depending on the prevailing inflation or uncertainty regimes and the time period under consideration. We find that for the full sample period (1992–2017), inflation rates exceeding 9.7% are associated with a positive growth effect. Below this threshold, the correlation is insignificant. Since inflation rates above 9.7% were mainly observed in the early to mid-1990s, we restrict the sample to 1999–2017. In this period, the inflation threshold lowers to approximately 5%. Moreover, the relationship between inflation and growth shifts across the two regimes: below 5%, inflation is positively associated with growth, while above 5%, the effect turns negative and statistically insignificant. Moreover, the second part of our analysis reveals that inflation has, in fact, only a positive effect on growth if the general level of uncertainty is low. In China, the inflation rate itself might be less important than the overall stability of the economy.

The remainder of the paper is organized as follows. The next section offers a review of the literature on the inflation-growth relation both in general terms and within the context of China. Section 3 presents the data for the Chinese provinces and the econometric methodology. The results of the nonlinear and dynamic panel threshold regressions are discussed in Section 4. Section 5 concludes.

2. Literature review

Understanding the relationship between inflation and economic growth is of great importance for academic research as well as policy modeling. The theoretical literature identifies several mechanisms through which inflation can either hinder or promote economic growth, such as the savings rate, tax system distortions, investment efficiency, and bank lending (Temple, 2000; Vaona, 2012; Agarwal and Baron, 2024). The combined and possibly interactive effect of these mechanisms can be complex, as different channels can overlap, cancel each other out, or be relevant only within specific inflation ranges. Thus, we can likely expect threshold effects in the inflation growth relationship (Vaona, 2012).

Many empirical studies employing cross-sectional and panel-data provide support for a nonlinear relationship between inflation and growth. For example, Gylfason (1991) find that economies with inflation above 20% grew less rapidly than those with inflation below 5% per year over the period 1980-1985 in a cross-sectional study of 37 countries. Bruno and Easterly (1998) show that inflation rates above 40% per annum for at least two consecutive years have a detrimental growth effect, using a panel of 97 countries from 1961 to 1992. Gylfason and Herbertsson (2001) report a positive association between inflation and growth for inflation rates below 10% and a negative correlation for rates above 10% in a panel of 170 countries from 1960 to 1992.

Notably, several studies document that the inflation threshold is higher for developing than industrialized countries. Only when inflation surpasses these thresholds does it have a detrimental effect on economic growth. Khan and Senhadji (2001) report thresholds of 1 to 3% for industrialized countries and 11 to 12% for developing countries over the period 1960 to 1998 for 140 countries. Kremer et al. (2013) find a threshold of about 2.5% for industrialized countries and 17.2% for developing countries, using data on 124 countries from 1952 to 2004. More recently, Azam and Khan (2022) identify thresholds of 12.23% and 5.36% for developing and developed economies, respectively, over the period 1975 to 2018, noting that the detrimental effect of inflation is particularly pronounced for developed countries.

The Balassa–Samuelson hypothesis offers theoretical support to these results by suggesting that in rapidly developing economies, inflation tends to be higher as prices of non-tradable goods rise in response to productivity growth in the tradable goods sector (D'Adamo and Rovelli, 2015). This phenomenon is a natural aspect of economic development, as faster productivity growth in the tradable sector leads to rising wages, which then drive up the prices of non-tradable goods. This implies that inflation in developing countries is not inherently problematic and does not necessarily require monetary policy intervention (Mihaljek and Klau, 2008). The dynamic described by the Balassa-Samuelson hypothesis can occur both between and within countries and has been observed in China. For instance, research by Guillaumont-Jeanneney and Ping (2002) shows that variations in inflation across Chinese provinces are largely due to differences in productivity growth between tradable and non-tradable sectors, consistent with the Balassa–Samuelson model. Further, Guérineau and Guillaumont-Jeanneney (2005) suggest that periods of deflation in China can be partially attributed to a slowdown in productivity growth within the tradable sector.

Although China has not experienced hyperinflation compared to other developing countries in the last decades, there have been episodes of high inflation, such as in the 1980s, 1994, 2008, and 2011 (cf. World Bank, 2024). Among then, the unusual structural inflation in 1994 has gained the most widespread academic attention, as it occurred during a period when the Chinese government was vigorously pursuing macroeconomic contraction (Chang and Hou, 1997; Zhang and Clovis, 2010). This episode of inflation was eventually brought under control in 1998 through concerted efforts by the People's Bank of China (PBC), which officially attained its status as a central bank in 1995. Moreover, significant differences in inflation and growth rates across provinces make China a particularly interesting case study. Unfortunately, much of the inflation-growth literature is only available in Chinese. This review will survey both the English and Chinese-language literature on nonlinearities in the inflation-growth relationship in China. Therefore, we are aiming to provide a more complete picture of previous research on China's inflation-growth nexus.

The closest English-language literature to this paper is Hwang and Wu (2011) who find a critical threshold of 2.5% for 29 provincial administrative units over the period 1986 to 2006. Above this threshold, inflation impedes economic growth; below it, inflation has a growth-enhancing effect. Besides the study of Hwang and Wu (2011), research on the nonlinear inflation-growth relationship within China is scarce in the general English-speaking literature. One of the few other contributions is the study conducted by He and Zou (2016) who use data from 1979-2014 and show that inflation has a significant and positive impact on growth. They argue that inflation influences growth through two competing mechanisms: the negative seigniorage effect, where higher seigniorage revenue reduces entrepreneurial profits, and the positive seigniorage effect, where revenue directed to entrepreneurs acting as a subsidy to R&D. However, they focus on the national level and they do not take into account potential nonlinearities.

To address the gap in the English-language literature regarding the nonlinear effects of inflation for China, we draw on relevant studies published in Chinese journals, with a particular emphasis on the threshold-dependent dynamic, as summarized in Table 1. Earlier literature shows that the impact of inflation on growth is complicated and probably non-linear (Liu and Xie, 2003; Liu and Zhang, 2004; Kong, 2011). Later analyses using advanced econometric methods show that only low to moderate inflation rates have a positive impact on economic growth, while excessively high inflation rates are detrimental. Studies such as those by Tang and Jian (2013) and Zhang and Wu (2012) demonstrate that inflation below 5% to 8% promotes economic growth, with the strongest effects within these ranges. Conversely, research by Peng et al. (2013) and Bai and Zhao (2011) indicates that inflation beyond lower thresholds (3.2% to 3.8%) starts to negatively affect growth. The threshold-dependent nature is further supported by Zhu et al. (2011) and Li and Zhu (2013), who find that inflation above thresholds like 5% or 14.9% negatively impacts growth. Additionally, Li (2013) shows how the inflation-growth relationship evolved from a linear, positive effect before 2007 to a nonlinear one thereafter, reflecting changing economic conditions. These studies collectively highlight the importance of maintaining inflation within optimal ranges to foster economic growth, providing valuable insights for economic policy aimed at managing inflation to support sustained economic development. Compared to these studies, our research utilizes a more recent sample and employs more advanced econometric techniques, allowing us to gain a more nuanced understanding of the inflation-growth nexus in China.

This paper also contributes to the literature on the macroeconomic impact of uncertainty, particularly in the context of inflation and growth. The existing literature shows that uncertainty is detrimental to economic growth because high uncertainty depresses firms' investment and households' consumption (Baker et al., 2016; Nam et al., 2021). Istrefi and Piloiu (2014) find that policy uncertainty could influence agents' inflation expectations, which may subsequently affect the re-

Table 1: Inflation-growth studies using threshold analysis in Chinese academia

Study	Journal	Period	Data type	Observations	Model	Semi-log	Findings	Threshold(s)
Wu Jilin and Zhang Erhua (2012)	Economic Theory and Management	1978-2010	Provincial panel	960	Panel Smooth Transition Model	NO	Inflation positively affects growth but this effect reduces as inflation rises.	Single Threshold
Tang Xuelian and Jian Kecheng (2013)	East China Economic Management	1985-2011	Provincial panel	756	Panel Threshold Model (Hansen, 1999)	NO	Inflation below 8% positively affects growth. This positive effect is the strongest when inflation is between 5% and 8% and turns negative when inflation is above 8%.	Double Thresholds (5% and 8%)
Peng Fangping et al. (2013)	Finance Research	2000-2007	Firm Data	25244	Panel Smooth Transition Model	NO	Inflation below 3.8% does not affect growth while it has negative effects when above 3.8%.	Single Threshold (3.8%)
Bai Zhongliang and Zhao Liang (2011)	Statistical Research	1978-2008	Provincial panel	899	Panel Threshold Model (Caner and Hansen, 2004)	YES	Inflation below 3.2% positively affects growth. Inflation between 3.2% and 15.7% negatively affects growth. This negative effect is strongest with inflation above 15.7%.	Double Thresholds (3.2% and 15.7%)
Zhu Yingfeng et al. (2011)	Management Science	1978-2009	Time Series	32	Threshold Model (Khan et al., 2001)	NO	Inflation below 5% positively affects growth and inflation above 5% negatively affects growth.	Single Threshold (5%)
Li Xiaosheng and Zhu Jianping (2013)	Statistical Research	1978-2011	Provincial panel	1020	Panel Smooth Transition Model	NO	Inflation below 14.9% positively affects growth while it has negative effects when above 14.9%	Single Threshold (14.9%)
Li Shaolin (2013)	Journal of Harbin University of Commerce (Social Science Edition))	1952-2010	Time Series	59	Smooth Transitioning Model	YES	The nonlinearity of the inflation-growth effect mainly exists between 1952 and 1976; From 1977 to 2007, the effect was linear (positive); From 2008, it became nonlinear again.	-
Pang Zhen and Wang Kai (2018)	Statistics and Decision	1985-2016	Provincial panel	992	Panel Threshold Model	NO	Inflation below 6.6% positively affects growth, while it has no effect between 6.6% and 15.9%, Inflation above 15.9% negatively affects growth.	Double Thresholds (6.6% and 15.9%)

lationship between inflation and growth. Additionally, uncertainty may alter the impact of other factors on economic activity. For example, Aastveit et al. (2017) find that uncertainty reduces the effectiveness of monetary policy, making it less effective when uncertainty is high. Tarkom and Ujah (2023) demonstrate that policy uncertainty amplifies the positive effects of inflation and the negative impacts of interest rates on firm efficiency. These studies collectively imply that uncertainty plays a crucial role in economic growth and should be considered when investigating the inflation-growth nexus.

3. Methodology and data

3.1. Data

Our sample consists of 31 provinces, autonomous regions, and municipalities over the period 1992-2017.[3] Our dependent variable is the growth rate of provincial real GDP per capita, which is calculated using data from the National Bureau of Statistics of China (NBS, 2024). It is defined as the log difference of real GDP per capita, i.e., $g_{it} = \Delta y_{it}$. The inflation rate is calculated as the annual percentage change of the consumer price index (CPI) using data from (NBS, 2024). The average annual inflation rate over the sample period is around 3.74 percent with a relatively high standard deviation of 5.64 percent.[4] As the dispersion of inflation rates is considerable, we follow Ghosh and Phillips (1998) and use the logarithmic value of inflation rates to avoid the results being distorted by a few extreme observations. Our sample also contains negative inflation rates. Therefore, we follow Khan and Senhadji (2001) and Drukker et al. (2005) and use the semi-logarithmic transformation, which is described in equation (1):

$$\tilde{\pi}_{it} = \begin{cases} \pi_{it} - 1, & \text{if } \pi_{it} \leq 1\% \\ \ln(\pi_{it}), & \text{if } \pi_{it} > 1\% \end{cases} \tag{1}$$

[3]Please note that for reasons of simplicity, we refer to these "provincial-level administrative divisions" as "provinces". The choice of period and regions (we do not include Taiwan, Hong Kong, and Macao) is due to data availability.

[4]The respective semi-log inflation rate summary statistics are 0.55 (for the average) and 1.47 (for the standard deviation).

Following Kremer et al. (2013), π_{it} is defined such that an inflation rate of 1.5% enters the semi-log transformation with 1.5 and not 0.015. This results a value of $\tilde{\pi}_{it} = \ln(1.5) \approx 0.41$. Conversely, an inflation rate of 0.5% implies a value of $\tilde{\pi}_{it} = 0.5 - 1 = -0.5$. In our baseline investigation, the inflation rate is both, our regime-dependent variable and the threshold variable.

We include several standard macroeconomic control variables, namely the investment share, openness measured as the trade share in GDP, population growth, terms of trade, and, in some specifications, the lagged growth rate. All data is calculated using data from the NBS (2024). The descriptive statistics of our key variables for our baseline sample can be found in Table 2.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
Dependent variable					
GDP p.c. growth rate	734	0.13	0.06	-0.02	0.41
Threshold variables					
Inflation rate	734	3.74	5.64	-3.60	26.90
Semi-log inflation rate	734	0.55	1.47	-4.60	3.29
Uncertainty	734	16.06	15.39	0.02	92.11
Control variables					
Trade share	734	30.47	37.92	1.80	219.97
Log trade share	734	2.86	0.99	0.59	5.39
Investment share	734	52.09	22.19	24.96	164.28
Log investment share	734	3.88	0.37	3.22	5.10
Population growth	734	0.01	0.02	-0.30	0.17
Terms of trade change	734	0.00	0.31	-2.03	1.98

Source: Own calculations based on NBS (2024), Yu et al. (2021), and Davis et al. (2019).

The choice of control variables is based, among others, on Kremer et al. (2013), Khan and Senhadji (2001), and Drukker et al. (2005). Openness is anticipated to foster growth by facilitating access to larger markets and advanced technologies. The opening up of the Chinese economy to international trade is widely recognized as a key element of China's economic reform process and an important driver of China's economic success. The investment share is typically expected to positively influence growth by enhancing physical capital accumulation. However, in the context of China, there have been concerns that overinvestment has resulted in the building up of overcapacities, inefficiencies, and lower productivity gains. The impact of population growth has been subject to debate. According to neoclassical growth theory (Solow, 1957), population growth is typically expected to hinder economic growth. However, population growth can also be anticipated to stimulate economic growth, as larger populations can drive innovation and technical progress and benefit from greater economies of scale (Jones, 1995). The impact of terms of trade on economic growth can also be ambiguous. When the terms of trade increase, export prices rise more rapidly than import prices. This increase in international purchasing power leads to higher consumption of both domestic and foreign goods, driving up domestic prices and leading to real currency appreciation (Aizenman et al., 2024). Empirical evidence generally indicates that the income effect prevails over the substitution effect (cf. De Gregorio and Wolf, 1994; Mendoza, 1995).

3.2. Methodology

3.2.1. Dynamic threshold panel approach

To conduct our empirical investigations, we follow Kremer et al. (2013) to investigate the possibility of threshold effects in the dynamic relationship between economic growth and inflation in the short to medium term.[5] For this purpose, we consider the following dynamic panel threshold model:

$$g_{i,t} = \mu_i + \chi g_{i,t-1} + \beta_1 \tilde{\pi}_{i,t} I(\tilde{\pi}_{i,t} \leq \gamma) + \beta_2 \tilde{\pi}_{i,t} I(\tilde{\pi}_{i,t} > \gamma) + \delta' \mathbf{X}_{i,t} + \varepsilon_{i,t} \tag{2}$$

where the subscripts $i = 1, \ldots, n$ represent the provinces and $t = 1, \ldots, T$ index the time. α_0 is a constant term, μ_i is the province-specific fixed effect, τ_t is the time-fixed effects, and ε_{it} is the error term. g denotes the annual GDP per capita growth rate and $I(.)$ is an indicator function indicating the regime defined by the threshold variable, $\tilde{\pi}$, the inflation rate (in semilog). Here, the threshold variable and the regime-dependent variable are the same,[6] the inflation rate, as we can see

[5]One important advantage of this approach is to test the statistical significance of the threshold values. Determining whether thresholds are statistically significant when thresholds are chosen in an ad hoc manner is difficult.

[6]Later, we use the uncertainty indicators at the province level as the threshold variable to test the presence of thresholds in the inflation-growth relationship.

in equation (2). The vector of independent regime control variables, $\mathbf{X}$, includes the trade share, the investment share, the population growth, and the changes in terms of trade. We also include the first lag of our dependent variable, $g_{i,t-1}$.

The dynamic version of the model[7] in equation (2) is estimated in three steps:

1. In the first step, we estimate a reduced form of the endogenous variable, $g_{i,t-1}$, as a function of the instruments on a set of regressors restricted to 1 lag since instruments[8] can overfit instrumented variables as shown by Roodman (2009). The endogenous variable, $g_{i,t-1}$, is then replaced in the structural equation by the predicted values, $\widehat{g}_{i,t-1}$.
2. In the second step, equation (2) is estimated using least squares for a fixed threshold γ where $g_{i,t-1}$, replaced by its predicted values from the first step regression. We can denote the resulting sum of squares as $S(\gamma)$. This step is repeated for a strict subset of the support of the threshold variable, $\tilde{\pi}$.
3. In the third step, the threshold value is estimated as the one with the smallest sum of squared residuals, i.e., $\hat{\gamma} = \underset{\gamma}{\operatorname{argmin}} S_n(\gamma)$. According to Hansen (1999) and Caner and Hansen (2004), the critical values for determining the 95% confidence interval of the threshold value is given by

$$\Gamma = \{\gamma \,:\, LR(\gamma) \geq C(\alpha)\}$$

where $C(\alpha)$ is the 95% percentile of the asymptotic distribution of the likelihood ratio statistic $LR(\gamma)$. Once $\hat{\gamma}$ is determined, the slope coefficients can be estimated using GMM with the previously used instruments and the previously estimated threshold, $\hat{\gamma}$.

3.2.2. *Testing for a threshold*

For clarity, it might be necessary to further elaborate on the third step in estimating the threshold value. We can start with a slightly more intuitive representation of equation (2), inspired by Hansen (1999):

[7] Note that the differences are forward-orthogonal deviations.
[8] Which can be $g_{i,t-2}$ to $g_{i,t-p}$ with $p = T - 1$.

$$g_{i,t} = \begin{cases} \mu_i + \chi g_{i,t-1} + \beta_1 \tilde{\pi}_{i,t} + \delta X_{i,t} + \varepsilon_{i,t}, & \tilde{\pi}_{i,t} \leq \gamma, \\ \mu_i + \chi g_{i,t-1} + \beta_2 \tilde{\pi}_{i,t} + \delta X_{i,t} + \varepsilon_{i,t}, & \tilde{\pi}_{i,t} > \gamma. \end{cases} \tag{3}$$

To test for the absence of a threshold with the following null hypothesis, $H_0 : \beta_1 = \beta_2$, Hansen (1996) uses a bootstrapped likelihood ratio (LR) test which is asymptotically valid: $F_1 = (S_0 - S_1(\hat{\gamma}))/\hat{\sigma}^2$, where S_0 is the residual sum of squares (RSS) for the model without threshold, S_1 is the RSS for the model with a specific threshold $\hat{\gamma}$, and $\hat{\sigma}^2$ is the residual variance for a specific threshold.

When there is a threshold (i.e., the null is rejected in equation (3)), we test the true value of the threshold[9] with the following null hypothesis, (γ_0) $H_0 : \gamma = \gamma_0$.[10]: $LR(\gamma) = (S_1(\gamma) - S_1(\hat{\gamma}))/\hat{\sigma}^2$. The critical values can be obtained with the asymptotic distribution of the $LR(\gamma)$ statistics: $c(\alpha) = -2\log(1 - \sqrt{1-\alpha})$. Finally, when $LR(\gamma) \leq c(\alpha)$, we accept the null hypothesis for the threshold[11].

4. Empirical results

4.1. Nonlinear regressions

Before moving on to threshold models, the first step of our empirical investigation consists of estimating a benchmark nonlinear model. This benchmark model relates GDP per capita growth to the control variables - trade, investment, population growth, terms of trade - and the variable of interest, inflation. Using nonlinear panel regressions including a squared term of inflation will help us to gain a first intuition about possible nonlinearities in the inflation-growth relationship. From a mathematical perspective, nonlinear regressions are more general than threshold regressions, such as piecewise linear regressions. Additionally, threshold regressions can provide clearer interpretations, especially in the case of interactions between two continuous variables. Thus, these two types of regression can be considered complementary.

[9] The threshold effect may be detected only in the investigated sample and not in the statistical population.

[10] Where no further computations are requested since the sequence of the LR statistics is simply a re-normalization of the sequence of the F statistics.

[11] For example, the 5% critical value is 7.35.

Table 3 presents the key regression results. All explanatory variables are lagged by one period to mitigate potential endogeneity issues. Columns (1) and (2) report results for the full sample period from 1992 to 2017. Column (1) includes only inflation, while Column (2) additionally incorporates the squared term of inflation to account for potential nonlinear effects. Both specifications include a set of standard control variables. Most controls have the expected sign: positive for trade shares, and negative for investment shares, population growth, and terms of trade. As argued in Section 3, the negative effect of investment may be attributed to overcapacity in certain sectors. China has invested heavily in infrastructure and industrial capacity, potentially leading to diminishing returns on new investments. This overinvestment can result in inefficiencies and lower productivity gains, which negatively impact growth. More importantly, the coefficients of interest, namely inflation and inflation squared, are always positive and significant. This suggests that the relationship between inflation and growth is nonlinear. In particular, inflation has a positive impact on growth, and this effect gets stronger as inflation increases.

It is important to note that our full sample includes the early to mid-1990s when China experienced a period of particularly high inflation, which may play a significant role in shaping our empirical results. Therefore, in Columns (3) and (4), we re-estimate the regressions using data starting from 1999. While we still identify a positive effect of inflation on growth, the magnitude and statistical significance of the estimated coefficients for inflation decreases. In particular, comparing Columns (2) and (4) reveals that the coefficient for inflation is nearly halved, while the squared term is reduced to just one-third, suggesting a structural break.

The relationship between inflation and growth before the East Asian financial crisis in 1997 may have been driven by the regional catching-up process in China, rather than the standard relation between inflation and growth in industrialized countries. Usually, a higher inflation environment creates uncertainty for firms and, consequently, may threaten economic growth. In the context of China in the 1990s, it is plausible that the relation between inflation and growth was positive due to the low level of development of the Chinese economy at that time. After 1998, the Chinese economy began to reach higher levels of economic and industrial development similar to more advanced countries. Thus, the relationship between inflation and growth began to resemble the inflation-growth nexus in the industrialized economies. More inflation creates more uncertainty and may threaten economic growth. This structural break in the Chinese economic growth model will be further explored in the following sections with the help of dynamic panel threshold models.

Table 3: Nonlinear regressions

	(1)	(2)	(3)	(4)
	Full sample (1992-2017)		After 1998 (1999-2017)	
L.Inflation	0.023***	0.022***	0.013***	0.014***
	(0.001)	(0.001)	(0.002)	(0.002)
L.Inflation squared		0.006***		0.002**
		(0.001)		(0.001)
L.Trade	0.010	0.014*	0.025**	0.025**
	(0.009)	(0.008)	(0.012)	(0.011)
L.Investment	-0.045***	-0.022***	-0.028***	-0.028***
	(0.008)	(0.008)	(0.008)	(0.008)
L.Population growth	-0.098	-0.122	-0.255*	-0.253*
	(0.143)	(0.139)	(0.129)	(0.133)
L.Terms of trade	-0.007	-0.008	-0.009	-0.009
	(0.005)	(0.006)	(0.006)	(0.006)
Constant	0.260***	0.146***	0.150***	0.148***
	(0.034)	(0.036)	(0.047)	(0.047)
R-squared	0.401	0.494	0.208	0.214
Observations	705	705	589	589
Number of provinces	31	31	31	31
Province FE	YES	YES	YES	YES

Notes: (*), (**), (***) denote significance at the 10, 5, and 1 percent level. Robust s.e. are in parenthesis. *L*. denotes the lag operator. *Source*: Own calculations based on NBS (2024) data.

4.2. *Threshold regressions*

The dynamic threshold model of Kremer et al. (2013) incorporates the lagged dependent variable to capture convergence effects and is used to control for endogeneity in a dynamic setup. Our key regression results are displayed in Table 4. Please note that we use the first lags of our explanatory variables and the second lag of our threshold variable to mitigate potential endogeneity issues. As shown in Column (1), we find that inflation rates exceeding $e^{2.27} \approx 9.6\%$ are associated with a positive growth effect ($\hat{\beta}_2 = 0.03$). Below this threshold, the correlation remains insignificant. To ensure that our strategy is not influenced by common trends linked to major events, such as China's entry into the WTO or the 2008 Global Financial Crisis, we include time dummies in our regression to account for these effects. Our results indicate that the inclusion of time dummies in our regression does not change our key finding (cf. Column (2) of Table 4). The only difference is that the inflation threshold and the estimated coefficient $\hat{\beta}_2$ are both slightly higher.[12]

A closer examination of the provinces that experienced inflation rates above 9.7% reveals that this was predominantly a feature of the early to mid-1990s. Inflation began to surge in 1993, along with increased economic activity following the resumption of economic reforms after a period of sluggish growth in the late 1980s.[13] Moreover, in 1995, the PBC gained greater operational independence and its legal status was formally established (Zhang and Clovis, 2010). The PBC also redefined its policy priorities, focusing on inflation control (Fan et al., 2011), and began phasing out the credit plan (Quintyn et al., 1996).[14] These measures effectively reduced inflation, which started to decline in 1995 and continued through 1998.

In Columns (3)-(4) we restrict our sample to the period 1999-2017. Our results change considerably. First of all, the inflation threshold is considerably lower, namely only about $e^{1.63} \approx 5.1\%$. Even more interestingly, the effect of inflation in the two regimes has changed. In particular, inflation only has a positive effect on growth when it is below 5% ($\hat{\beta}_1 = 0.014$). Above the 5%-threshold, the correlation between inflation and growth turns negative and statistically insignificant. As before, adding time dummies does not change our findings, the threshold is slightly higher, namely $e^{1.67} \approx 5.3\%$ (cf. Column (4) of Table 4).

[12] To ensure better comparability with other studies, we also tried restricting our sample to the pre-2010 period. The threshold for this restricted sample is very similar (2.29), and the positive effect observed in the high-inflation regime is also marginally stronger compared to the baseline specification in Table 4 ($\hat{\beta}_1$ is 0.04 instead of 0.03).

[13] In 1989, the growth rate was "only" 4.2%, and in 1990, it declined further to its lowest point since the start of reforms under Deng Xiaoping, reaching 3.9%. However, by 1991, growth had rebounded, exceeding 9% in the subsequent years.

[14] Prior to the reforms, monetary policy was conducted through the credit and cash plans. The credit plan, which was the financial counterpart to the physical or investment plan, allocated the necessary credit for enterprises to meet their production targets. See Quintyn et al. (1996) for more details.

Table 4: Inflation thresholds and growth - Kremer et al. (2013)

	(1)	(2)	(3)	(4)
	Full sample (1992-2017)		After 1998 (1999-2017)	
	Panel A: Threshold estimate			
$\hat{\gamma}$	2.272	2.313	1.629	1.668
95% CI	(2.230; 2.313)	(2.230; 2.322)	(0.642; 1.668)	(1.308; 1.668)
p-value	0.001	0.001	0.001	0.001
	Panel B: Impact of Inflation			
$\hat{\beta}_1$ (L.Inflation < $\hat{\gamma}$)	-0.001	0.001	0.014***	0.019***
	(0.005)	(0.004)	(0.005)	(0.007)
$\hat{\beta}_2$ (L.Inflation > $\hat{\gamma}$)	0.025***	0.0312***	-0.006	-0.004
	(0.010)	(0.009)	(0.007)	(0.011)
	Panel C: Impact of Covariates			
Initial	0.305**	0.215**	0.592***	0.521***
	(0.146)	(0.149)	(0.093)	(0.110)
L.Trade	0.135***	0.116***	0.032	0.006
	(0.047)	(0.044)	(0.036)	(0.043)
L.Investment	-0.047	-0.054	-0.057***	-0.062**
	(0.034)	(0.035)	(0.020)	(0.030)
L.Population growth	-1.406	-1.985*	-1.131	-1.613
	(0.881)	(1.109)	(0.849)	(1.216)
L.Terms of trade	-0.087**	-0.097**	-0.069	-0.081
	(0.041)	(0.045)	(0.052)	(0.066)
Constant	-0.125	-0.033	0.182	0.285***
	(0.119)	(0.126)	(0.119)	(0.169)
Observations	704	704	588	588
Number of provinces	31	31	31	31
Number of IVs	23	23	19	19

Notes: The dependent variable is the provincial GDP per capita growth rate. (*), (**), (***) denote significance at the 10, 5, and 1 percent level. Robust standard errors are in parentheses. Columns (1) and (3) are the baseline samples, and Columns (2) and (4) introduce time fixed effects. The non-significant time dummies have been removed with a general-to-specific approach. L. denotes the lag operator. *Source*: Own calculations based on NBS (2024) data.

As a robustness check, we also used the static Hansen (1999) model to test for thresholds in the inflation growth relationship. Our results are very similar to those obtained with the dynamic Kremer et al. (2013) model. For the period 1992 to 2017, we find a threshold value of 2.27 which is statistically significant at the 1% level (with a 95% confidence interval of $\{2.19, 2.31\}$). In both regimes, inflation has a positive effect on growth; however, the coefficient is much higher for the high inflation regime ($\hat{\beta}_2 = 0.029$ vs. $\hat{\beta}_1 = 0.008$). As before, adding time dummies does not change these findings ($\hat{\gamma} = 2.27$, $\hat{\beta}_1 = 0.009$, and $\hat{\beta}_2 = 0.030$). Once we focus on the sample period

1999 to 2017, the threshold value increases to 1.31, statistically significant at the 1% level (with a 95% confidence interval of $\{1.25, 1.34\}$). In contrast to the longer sampler period, inflation only has a statistically significant positive effect in the low-inflation regime (i.e., inflation $< e^{1.31} \approx 3.7\%$). Above the threshold, the positive effect is reduced considerably and turns insignificant. As before, adding time dummies does not change these findings.[15]

4.3. *Uncertainty effect*

In the macroeconomics literature, uncertainty is characterized as the conditional volatility arising from unpredictable disturbances encountered by the private sector. However, from an empirical standpoint, it is so challenging to measure uncertainty that Jurado et al. (2015) contend that a perfect uncertainty measure is unattainable. Recently, Baker et al. (2016) introduced an innovative method that leverages the frequency of specific uncertainty-related terms in newspapers to quantify uncertainty. This approach has since gained widespread adoption in empirical studies as it requires minimal assumptions and is rather comparable across regions and over time, yielding a wealth of valuable insights.

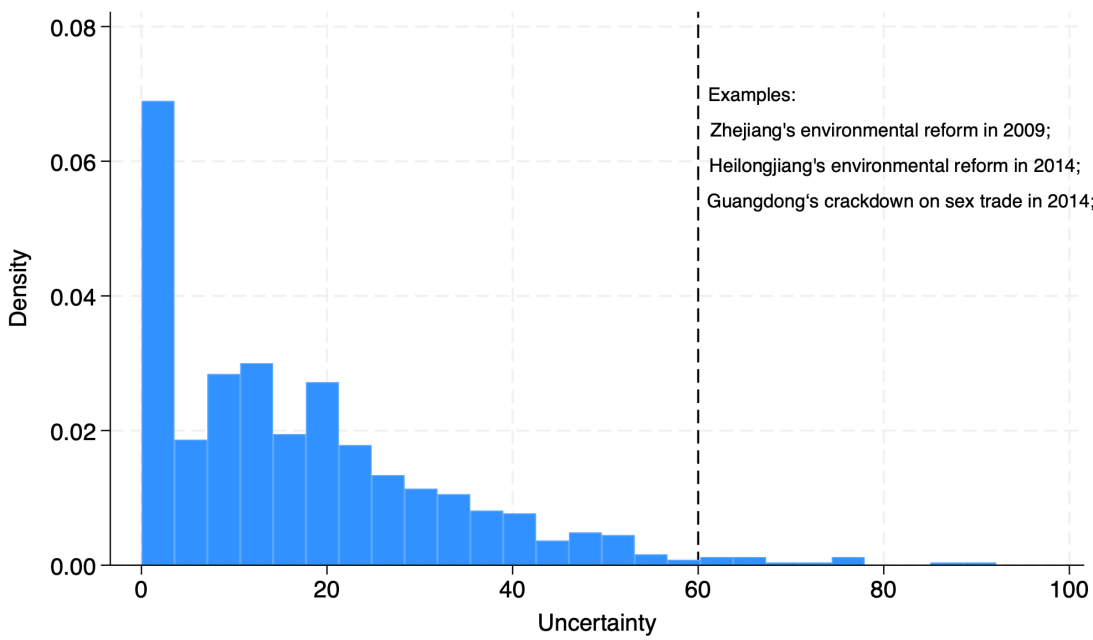
Following a similar strategy, our uncertainty variable is constructed based on two newspaper-derived uncertainty indices for China, developed by Yu et al. (2021) and Davis et al. (2019), who use the number of newspaper articles pertaining to policy uncertainty to construct the index. The underlying premise is that the prevalence of policy uncertainty is directly proportional to the frequency of articles that imply uncertainty. A primary advantage of using this index is its ability to serve as a real-time measure that is immune to data revisions and can be easily replicated and compared over time and across different regions. Additionally, this index is a model-free measure, relying on minimal assumptions and thereby offering a higher degree of objectivity.

The construction of the uncertainty variable in this paper is as follows. First, we utilize the only provincial uncertainty index for China by Yu et al. (2021), who collected and analyzed texts from

[15] The results are not presented here but are available upon request. The Hansen (1999) model allows for testing multiple thresholds. However, for our preferred lag specification, we do not identify a statistically significant second threshold.

31 local newspapers in mainland China over the period from 2000 to 2017. Second, for the period prior to 2000, we use an uncertainty index developed by Davis et al. (2019), who analyzed texts from China's most widely circulated national newspapers, *People's Daily* and *Guangming Daily*[16] To introduce regional variation in Davis' uncertainty index, we multiply this uncertainty index by the weight of aggregate trade of each province in the nation, operating under the assumption that provinces with higher trade openness are more likely to experience higher uncertainty.

Figure 2: Uncertainty



Source: Yu et al. (2021) and Davis et al. (2019).

Figure 2 displays the histogram of the uncertainty index used in this paper. It illustrates a highly skewed distribution of uncertainty, with the majority of observations concentrated at low uncertainty levels, peaking around 0-5. As uncertainty increases, the density diminishes gradually, with few observations beyond a value of 60. For example, uncertainty values above 60 have been associated with major events such as Zhejiang's environmental reform in 2009, Heilongjiang's environmental reform in 2014, and Guangdong's crackdown on sex trade in 2014.

[16] *People's Daily* and *Guangming Daily* are the official newspapers of the Central Committee of the Chinese Communist Party.

To examine the impact of uncertainty in the inflation-growth nexus, we first estimate a simple fixed-effects model with interactions between inflation and uncertainty. Table 5 presents the regression results. All explanatory variables are lagged by one period to alleviate endogeneity concerns. A full sample covering 1992 to 2017 is used in Columns (1) and (2), and Columns (3) and (4) only consider the post-1998 period. We first add uncertainty to our regression without considering interactions to have an intuitive idea. Results from columns (1) and (3) indicate that the coefficients of inflation are positive, while the coefficients of uncertainty are negative. This finding suggests that inflation may support economic growth, whereas uncertainty poses a detrimental effect. This conclusion aligns with previous empirical evidence, including the findings of (Baker et al., 2016; Nam et al., 2021). Columns (2) and (4) show that the coefficients of the interaction between inflation and uncertainty are significantly negative, implying that the impact of inflation on growth reduces as uncertainty increases.

Table 5: Interaction effect between uncertainty and inflation on growth

	(1)	(2)	(3)	(4)
	Full sample (1992-2017)		After 1998 (1999-2017)	
L.Inflation	0.022***	0.025***	0.013***	0.015***
	(0.001)	(0.002)	(0.002)	(0.002)
L.Uncertainty	-0.0005***	-0.0005***	-0.0003***	-0.0003***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
L.Uncertainty×L.Inflation		-0.0003***		-0.0001*
		(0.0001)		(0.0001)
L.Trade	0.012**	0.012**	0.025***	0.025***
	(0.006)	(0.006)	(0.007)	(0.007)
L.Investment	-0.038***	-0.032***	-0.027***	-0.027***
	(0.006)	(0.006)	(0.007)	(0.007)
L.Population growth	-0.132	-0.131	-0.290**	-0.287**
	(0.164)	(0.172)	(0.120)	(0.115)
L.Terms of trade	-0.007	-0.008	-0.008	-0.009*
	(0.005)	(0.006)	(0.005)	(0.005)
Constant	0.235***	0.214***	0.150***	0.154***
	(0.026)	(0.026)	(0.033)	(0.036)
R-squared	0.437	0.450	0.289	0.292
Observations	705	705	589	589
Number of provinces	31	31	31	31
Province FE	YES	YES	YES	YES

Notes: (*), (**), (***) denote significance at the 10, 5, and 1 percent level. Robust s.e. are in parenthesis. *Source*: Own calculations based on NBS (2024), Yu et al. (2021), and Davis et al. (2019).

Table 6: Uncertainty, inflation, and growth - Kremer et al. (2013)

	(1)	(2)	(3)	(4)
	Full sample (1992-2017)		After 1998 (1999-2017)	
	Panel A: Uncertainty threshold estimate			
$\hat{\gamma}$	8.271	8.271	7.287	7.287
95% CI	(5.730, 10.504)	(5.730, 10.227)	(4.625, 8.728)	(4.625, 8.728)
	Panel B: Impact of Inflation			
$\hat{\beta}_1$ (L.Uncertainty<$\hat{\gamma}$)	0.021***	0.023***	0.035***	0.040***
	(0.008)	(0.008)	(0.008)	(0.008)
$\hat{\beta}_2$ (L.Uncertainty>$\hat{\gamma}$)	-0.010**	-0.012*	0.000	0.004
	(0.005)	(0.006)	(0.005)	(0.004)
	Panel C: Impact of Covariates			
Initial	0.237*	0.149	0.597***	0.501***
	(0.122)	(0.132)	(0.095)	(0.093)
L.Trade	0.148***	0.158***	0.006	-0.010
	(0.036)	(0.043)	(0.028)	(0.025)
L.Investment	-0.075**	-0.100**	-0.060***	-0.074***
	(0.036)	(0.043)	(0.016)	(0.018)
L.Population growth	0.146	-0.034	-0.435	-0.743
	(0.912)	(0.881)	(0.807)	(0.620)
L.Terms of trade	-0.096***	-0.109***	-0.059	-0.073**
	(0.026)	(0.030)	(0.038)	(0.034)
Constant	-0.055	0.023	0.267***	0.382***
	(0.145)	(0.168)	(0.100)	(0.101)
Number of IV	23	23	19	19
Observations	704	704	588	588
Number of provinces	31	31	31	31

Notes: (*), (**), (***) denote significance at the 10, 5, and 1 percent level. Robust s.e. are in parenthesis. Columns (1) and (3) are the baseline specifications. Columns (2) and (4) additionally include time dummies. Non-significant time dummies have been removed with a general-to-specific approach. *Source*: Own calculations based on NBS (2024), Yu et al. (2021), and Davis et al. (2019).

We then further test this relation using dynamic threshold model developed by Kremer et al. (2013). Table 6 displays the results on the effect of inflation on growth, conditional on uncertainty. Again, Columns (1) and (2) use the full sample, and Columns (3) and (4) use the post-1998 sample. Columns (1) and (3) use the baseline regression with standard control variables, while columns (2) and (4) further incorporate major time dummies to control for the impact of common shocks.

We find that $\hat{\beta}_1$ is statistically significant and positive across all model specifications, whereas $\hat{\beta}_2$ is negative or statistically insignificant. This indicates that inflation positively impacts economic growth under lower uncertainty conditions, but this effect diminishes as uncertainty increases. That is, uncertainty reduces the growth effect of inflation in China.

Comparing the results from the full sample and the post-1998 sample, we find that the impact of inflation under different regimes of uncertainty is more pronounced in the full sample. We posit that the full sample, which includes a period of considerably high inflation from 1994 to 1998, introduces a wider range of inflation values. This broader range may dilute the observed impact of inflation at normal levels. This is reflected in the relatively lower impact observed in the low-uncertainty regime for the full sample.

4.4. Overview of the results

We find that the relationship between inflation and economic growth in China is complex and nonlinear, with the magnitude and direction of the inflation-induced growth effect varying across inflation or uncertainty regimes and over different time periods.

Using the dynamic model by Kremer et al. (2013), which accounts for the Nickell bias caused by the inclusion of the lagged dependent variable, we find that, for the full sample period (1992-2017), inflation rates exceeding 9.7% are associated with a positive growth effect ($\hat{\beta}_2 = 0.03$). Below this threshold, the correlation remains insignificant. However, as inflation rates above 9.7% were mainly observed in the early to mid-1990s, accompanied by notable macroeconomic policy changes, we subsequently restrict our sample to the period 1999-2017. In this revised sample, the results differ significantly. The inflation threshold is considerably lower, around $e^{1.63} \approx 5.1\%$. Moreover, the relationship between inflation and growth shifts across the two regimes. Below the 5% threshold, inflation is positively associated with economic growth ($\hat{\beta}_1 = 0.014$). However, above the 5% threshold, the correlation between inflation and growth becomes negative and statistically insignificant. These results are confirmed when using the static single-threshold Hansen (1999) model for short-run growth.

Our findings for the post-1998 sample generally align with those reported in the general inflation-growth literature in the sense that we also find evidence of a kind of inverted U-shaped relationship. Moreover, our inflation threshold falls between those identified for developing and developed countries by Kremer et al. (2013) and Khan and Senhadji (2001), which seems reasonable given China's development level. While China has not yet reached the per capita income levels of the most developed countries, such as the United States, the UK, or Germany, it has successfully advanced to the upper-middle-income range/lower end of the high-income category, reflecting China's significant economic and industrial development over the past few decades.

When compared to the findings in the China-specific literature, our inflation threshold is somewhat higher than those identified by Hwang and Wu (2011), Bai and Zhao (2011), and Peng et al. (2013), who all report thresholds between 2.5% and 4%. It is lower than that identified by Li and Zhu (2013) who identify an inflation threshold of about 15%. In this regard, our results mostly align with those of Zhu et al. (2011).While most of these studies indicate that growth becomes negatively affected once inflation surpasses the threshold, our study finds that the effect only turns statistically insignificant. In that respect, our results resemble – at least to some extent – that of Pang and Wang (2018). Common to all of these China-specific studies is that they do not control for the endogeneity problem arising from the inclusion of the lagged dependent variable nor do they differentiate between different sub-periods. Notably, we do not observe the inverted U-shaped relationship in our longer sample period (1992-2017). Overall, our results highlight that it is necessary to take into consideration structural breaks in the inflation rate to obtain reliable results.

Why does the inflation-growth relationship in China seem somewhat unique compared to other countries when we focus on our longer sample period which also includes the early to mid-1990s? First, a significant body of literature suggests that inflation must be extremely high to have a detrimental effect on growth (cf. Gylfason, 1991; Bruno and Easterly, 1998). Moreover, developing countries generally have higher inflation thresholds. In that respect, our findings are not entirely unexpected. Additionally, the general economic conditions in China are somewhat distinctive. Typically, inflation negatively impacts growth through reduced capital accumulation. However, this channel may operate differently in China. The Chinese government provides subsidies and other incentives to encourage investment in key sectors, potentially mitigating the adverse impact of inflation on investment decisions. Moreover, the Communist Party of China can convey a strong signal of stability, reducing concerns among households and investors about inflation and other macroeconomic imbalances (at least to some extent). Other related factors include the high savings rate of Chinese households and the attractiveness of China as a foreign direct investment (FDI) destination, largely independent of inflation developments.

Our second analysis reveals that it might not be inflation per se that constrains growth, but rather the general level of uncertainty. Specifically, we find that inflation positively impacts growth only when uncertainty is low. When uncertainty is high, the effect of inflation on growth turns negative or statistically insignificant.

This finding aligns with prior research highlighting the adverse impact of heightened uncertainty on economic activity (Gomado, 2024), a subject of growing significance for China's economy. Specifically, elevated levels of uncertainty may prompt both households and firms to adopt precautionary saving behaviors. This shift reduces incentives for investment and consumption, often signaling an economic contraction. Consequently, the influence of moderate inflation on economic growth is weakened. These results suggest that the key issue in some provinces may not be high inflation, but rather rising uncertainties and the diminishing effectiveness of the CCP's stability-conveying efforts.

5. Conclusion

Our paper aims to uncover potential nonlinearities in the inflation-growth relationship in China from 1992 to 2017 using different empirical models. China represents a particularly interesting case study due to the lack of consensus in the literature on whether inflation positively or negatively affects growth in Chinese provinces. Previous empirical evidence is sparse and often limited to the period before the global financial crisis. Our study is among the very few that extend the analysis by using more recent data. We are to our knowledge also the first to address the Nickell bias resulting from the inclusion of lagged dependent variables in the China-specific research.

Our analysis reveals a complex and nonlinear relationship between inflation and economic growth in China. The growth effects of inflation vary in both magnitude and direction depending on the prevailing inflation or uncertainty regimes and the time period under consideration.

Using the dynamic model by Kremer et al. (2013), we find that for the full sample period (1992–2017), inflation rates exceeding 9.7% are associated with a positive growth effect ($\hat{\beta}_2 = 0.03$). Below this threshold, the correlation is insignificant. Since inflation rates above 9.7% were mainly observed in the early to mid-1990s, we restrict the sample to 1999–2017. In this period, the inflation threshold lowers to approximately 5.1%. Moreover, the relationship between inflation and growth shifts across the two regimes: below 5%, ($\hat{\beta}_1 = 0.01$), while above 5%, the effect turns negative and statistically insignificant.

Another contribution of our study is the incorporation of regional uncertainty into the analysis, an element largely overlooked in prior research. We find that the positive effect of inflation on growth is sustained only when uncertainty remains low. When uncertainty is high, the association between inflation and growth turns negative. This suggests that in China, the impact of inflation on growth may be less about the inflation rate itself and more about the overall stability of the economic environment.

The key role that regional uncertainty plays in shaping the inflation-growth relationship highlights the importance of policies aimed at boosting economic stability. To ensure that the positive link between inflation and growth remains strong, Chinese policymakers should prioritize reducing economic uncertainty, which can arise from factors like unpredictable policies (for instance, in the context of the management of the Covid-19 pandemic), market fluctuations, or disparities between regions. Strengthening institutional frameworks and making economic policymaking more transparent can help create a stable and predictable environment, especially in provinces where uncertainty is higher. These efforts are crucial for maintaining the beneficial effects of inflation on growth across different regions.

Finally, our paper contributes by surveying not only the limited English-language literature but also the more extensive Chinese academic research on this topic, which is often inaccessible and thus frequently overlooked in international discussions.

References

Aastveit, K. A., Natvik, G. J. and Sola, S. (2017), 'Economic uncertainty and the influence of monetary policy', *Journal of International Money and Finance* **76**, 50–67.

Agarwal, I. and Baron, M. (2024), 'Inflation and disintermediation', *Journal of Financial Economics* **160**, 103902.

Aizenman, J., Ho, S.-H., Huynh, L. D. T., Saadaoui, J. and Uddin, G. S. (2024), 'Real exchange rate and international reserves in the era of financial integration', *Journal of International Money and Finance* **141**, 103014.

Azam, M. and Khan, S. (2022), 'Threshold effects in the relationship between inflation and economic growth: Further empirical evidence from the developed and developing world', *International Journal of Finance & Economics* **27**(4), 4224–4243.

Bai, Z. and Zhao, L. (2011), 'What is the optimal target interval of Chinese inflation rate? [in Chinese]', *Statistical Research* **129**(2), 63–71.

Baker, S. R., Bloom, N. and Davis, S. J. (2016), 'Measuring economic policy uncertainty', *The quarterly journal of economics* **131**(4), 1593–1636.

Bannigidadmath, D., Ridhwan, M. and Indawan, F. (2023), 'Global uncertainty and economic growth – evidence from pandemic periods', *Emerging Markets Finance and Trade* **60**(2), 345–357.

Blanchard, O., Dell'Ariccia, G. and Mauro, P. (2010), 'Rethinking macroeconomic policy', *IMF staff position note* **SPN/10/03**.

Bloom, N., Furceri, D. and Ahir, H. (2022), 'Tracking uncertainty in a rapidly changing global economic outlook'. Accessed: 2024-09-01.

Bobasu, A., Geis, A., Quaglietti, L. and Ricci, M. (2020), 'Tracking global economic uncertainty: implications for global investment and trade'.

Bruno, M. and Easterly, W. (1998), 'Inflation crises and long-run growth', *Journal of Monetary Economics* **41**(1), 3–26.

Caner, M. and Hansen, B. (2004), 'Instrumental variable estimation of a threshold model', *Econometric Theory* **20**(05), 813–843.

Chang, G. H. and Hou, J. (1997), 'Structural inflation and the 1994 'monetary'crisis in china', *Contemporary Economic Policy* **15**(3), 73–81.

Davis, S. J., Liu, D. and Sheng, X. S. (2019), Economic policy uncertainty in China since 1949: The view from mainland newspapers, Working papers, American University.

De Gregorio, J. and Wolf, H. C. (1994), Terms of trade, productivity, and the real exchange rate, NBER Working Paper 4807, National Bureau of Economic Research.

Drukker, D., Gomis-Porqueras, P. and Hernandez-Verme, P. (2005), Threshold effects in the relationship between inflation and growth: a new panel-data approach, Working paper, University of Texas.

D'Adamo, G. and Rovelli, R. (2015), 'The role of the exchange rate regime in the process of real and nominal convergence', *Journal of Macroeconomics* **43**, 21–37.

Fan, L., Yu, Y. and Zhang, C. (2011), 'An empirical evaluation of china's monetary policies', *Journal of Macroeconomics* **33**(2), 358–371.

Ghosh, A. and Phillips, S. (1998), 'Warning: inflation may be harmful to your growth', *IMF Staff Papers* **45**(4), 672–710.

Gomado, K. M. (2024), 'Impact of uncertainty on economic growth: The role of pro-market institutions in developing countries', *Kyklos* .

Guérineau, S. and Guillaumont-Jeanneney, S. (2005), 'Deflation in China', *China Economic Review* **16**(4), 336–363.

Guillaumont-Jeanneney, S. and Ping, H. (2002), 'The Balassa–Samuelson effect and inflation in the chinese provinces', *China Economic Review* **13**(2-3), 134–160.

Gylfason, T. (1991), 'Inflation, growth, and external debt: A view of the landscape', *The World Economy* **14**(3), 279–297.

Gylfason, T. and Herbertsson, T. T. (2001), 'Does inflation matter for growth?', *Japan and the World Economy* **13**(4), 405–428.

Hansen, B. (1996), 'Inference when a nuisance parameter is not identified under the null hypothesis', *Econometrica* **64**(2), 413.

Hansen, B. (1999), 'Threshold effects in non-dynamic panels: Estimation, testing, and inference', *Journal of Econometrics* **93**(2), 345–368.

He, Q. and Zou, H.-f. (2016), 'Does inflation cause growth in the reform-era china? theory and evidence', *International Review of Economics & Finance* **45**, 470–484.

Hwang, J.-T. and Wu, M.-J. (2011), 'Inflation and economic growth in China: An empirical analysis', *China & World Economy* **19**(5), 67–84.

Istrefi, K. and Piloiu, A. (2014), Economic policy uncertainty and inflation expectations, Banque de France Working Paper 511, Banque de France.

Jones, C. I. (1995), 'R & d-based models of economic growth', *Journal of Political Economy* **103**(4), 759–784.

Jurado, K., Ludvigson, S. C. and Ng, S. (2015), 'Measuring uncertainty', *American Economic Review* **105**(3), 1177–1216.

Khan, M. S. and Senhadji, A. S. (2001), 'Threshold effects in the relationship between inflation and growth', *IMF Staff papers* **48**(1), 1–21.

Kong, D. (2011), 'Does inflation hinder financial development and economic growth? [in Chinese]', *Journal of Quantitative & Technical Economics* **24**(10), 56–65.

Kremer, S., Bick, A. and Nautz, D. (2013), 'Inflation and growth: New evidence from a dynamic panel threshold analysis', *Empirical Economics* **44**(2), 861–878.

Li, S. (2013), ‘The non-linear effects of China’s inflation on economic growth empirical analysis based on STR model [in Chinese]’, *Journal of Harbin University of Commerce (Social Science Edition)* **28**(6), 6–10.

Li, X. and Zhu, J. (2013), ‘The nonlinear research of the inflation of China’s impact on economic growth [in Chinese]’, *Statistical Research* **2013**(11). Chinese Full Text.

Liu, J. and Xie, W. (2003), ‘Dynamic relationship between economic growth and inflation [in Chinese]’, *Journal of World Economy* **26**(6), 48–57.

Liu, J. and Zhang, H. (2004), ‘Positive testing for the Tobin effect or anti-Tobin effect in China’s economy [in Chinese]’, *Management World* **20**(5), 18–24.

Mendoza, E. G. (1995), ‘The terms of trade, the real exchange rate, and economic fluctuations’, *International Economic Review* **36**(1), 101–137.

Mihaljek, D. and Klau, M. (2008), ‘Catching-up and inflation in transition economies: the Balassa-Samuelson effect revisited’, *BIS Working Papers No 270* .

Nam, E.-Y., Lee, K. and Jeon, Y. (2021), ‘Macroeconomic uncertainty shocks and households’ consumption choice’, *Journal of Macroeconomics* **68**, 103306.

NBS (2024), *China Statistical Yearbook (Various Issues)*, National Bureau of Statistics of China, Beijing.

Pang, Z. and Wang, K. (2018), ‘Empirical analysis of the nonlinear impact of inflation on China’s economic growth [in Chinese]’, *Statistics and Decision* **2018**(10), 123–125.

Peng, F., Lian, Y. and Zhao, H. (2013), ‘Economic growth and China’s inflation tolerance - Empirical evidence from the firm level [in Chinese]’, *Journal of Harbin University of Commerce (Social Science Edition))* **28**(6), 6–10.

Quintyn, M. G., Laurens, B. J., Mehran, H. and Nordman, T. (1996), *Monetary and Exchange System Reforms in China*, International Monetary Fund, USA. Retrieved Dec 14, 2024.

Roodman, D. (2009), ‘A note on the theme of too many instruments’, *Oxford Bulletin of Economics and Statistics* **71**(1), 135–158.

Solow, R. M. (1957), ‘Technical change and the aggregate production function’, *The Review of Economics and Statistics* pp. 312–320.

Tang, X. and Jian, K. (2013), ‘The threshold effect of inflation and China’s economic growth [in Chinese]’, *East China Economic Management* **27**(7), 44–47.

Tarkom, A. and Ujah, N. U. (2023), ‘Inflation, interest rate, and firm efficiency: The impact of policy uncertainty’, *Journal of International Money and Finance* **131**, 102799.

Temple, J. (2000), ‘Inflation and growth: stories short and tall’, *Journal of Economic Surveys* **14**(4), 395–426.

Vaona, A. (2012), ‘Inflation and growth in the long run: A new Keynesian theory and further semiparametric evidence’, *Macroeconomic Dynamics* **16**(1), 94–132.

World Bank (2024), *World Development Indicators*, World Bank, Washington, DC.

Yu, J., Shi, X., Guo, D. and Yang, L. (2021), ‘Economic policy uncertainty (EPU) and firm carbon emissions: Evidence using a China provincial EPU index’, *Energy Economics* **94**, 105071.

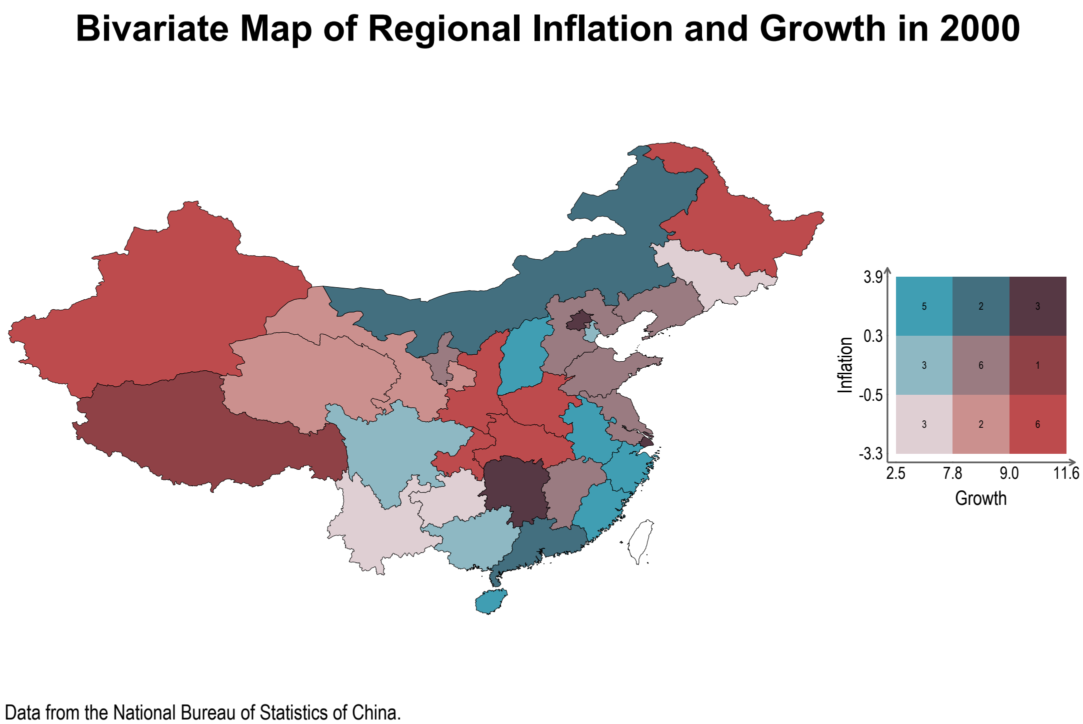
Zhang, C. and Clovis, J. (2010), ‘China inflation dynamics: Persistence and policy regimes’, *Journal of Policy Modeling* **32**, 373–388.

Zhang, E.-h. and Wu, J. (2012), ‘Does there exist threshold effects of inflation on economic growth in China - Empirical analysis on dynamic panel smooth transition model [in Chinese]’, *Economic Theory and Business Management* **2012**(7), 38–48.

Zhu, Y., Fu, Q. and Yuan, C. (2011), ‘Estimate of threshold level of inflation in China [in Chinese]’, *Management Science* **24**(3), 34–45.

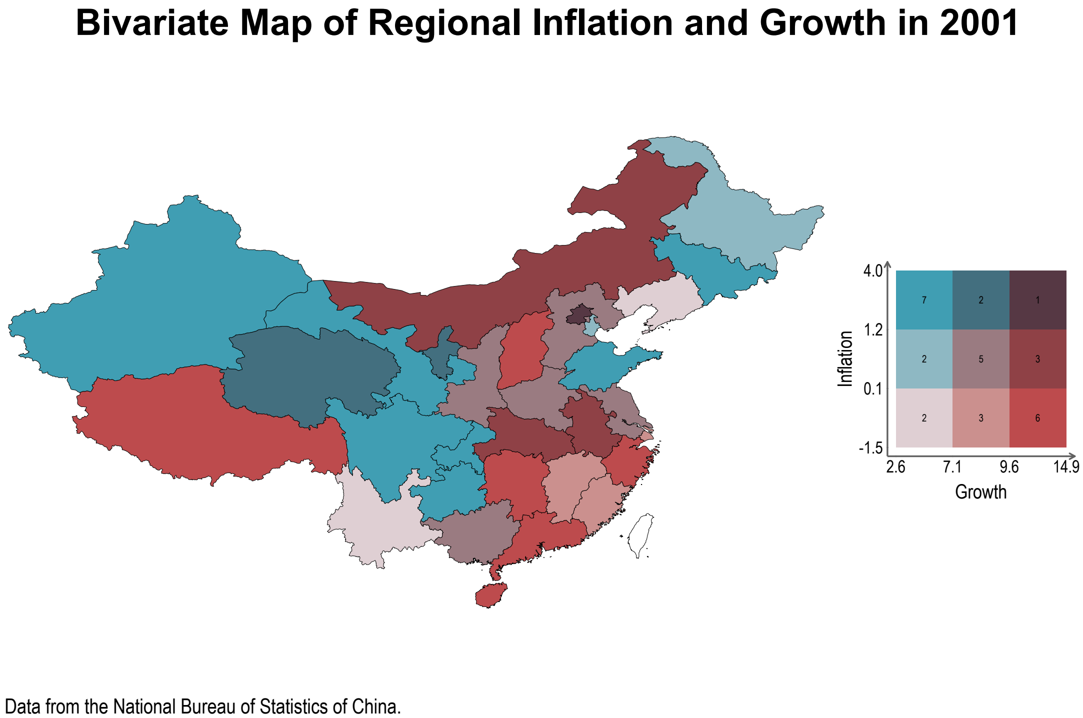
Appendix A. Bivariate maps

Figure A.1: Bivariate Map of Regional Inflation and Growth



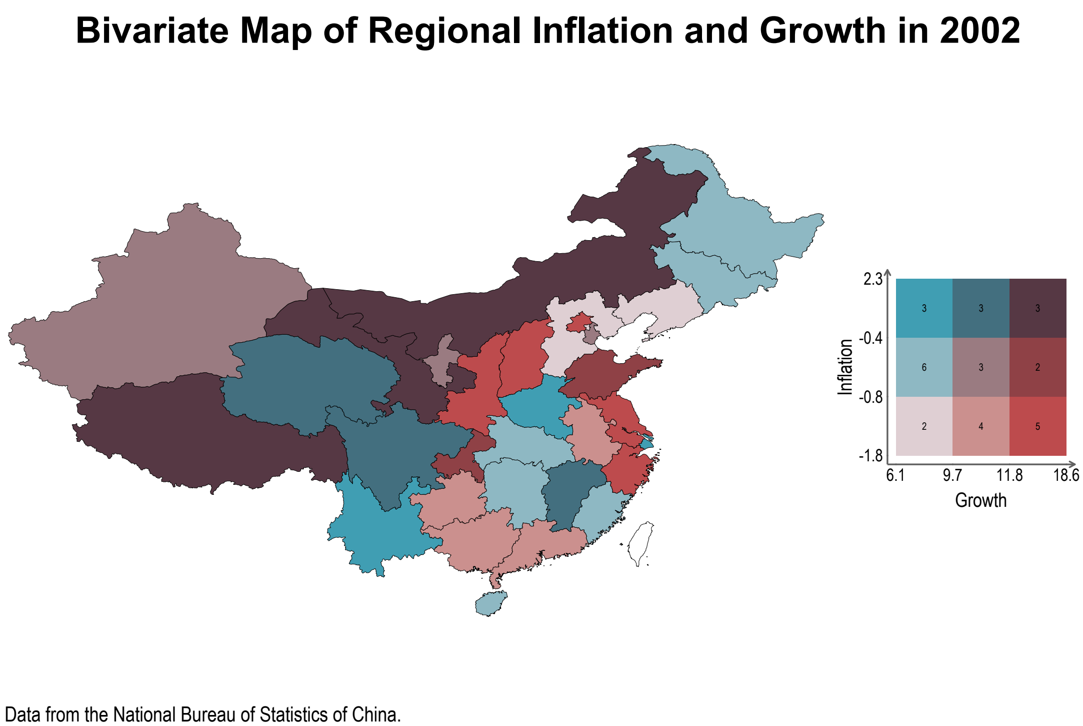
Note: Source: authors' calculations.

Figure A.2: Bivariate Map of Regional Inflation and Growth



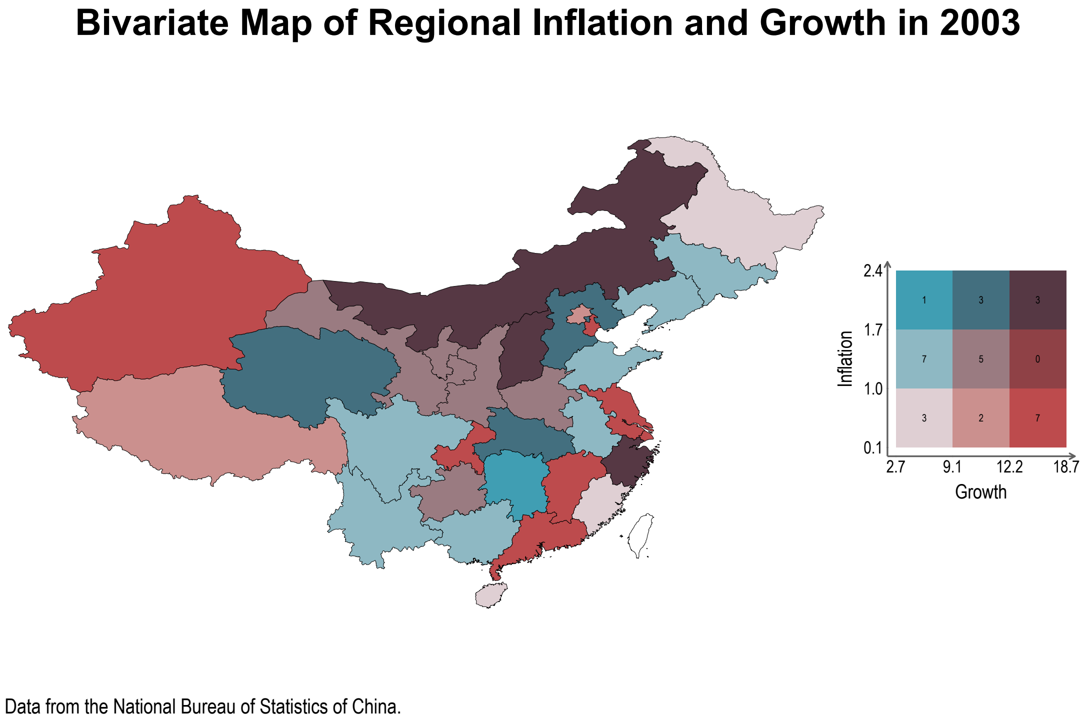
Note: Source: authors' calculations.

Figure A.3: Bivariate Map of Regional Inflation and Growth



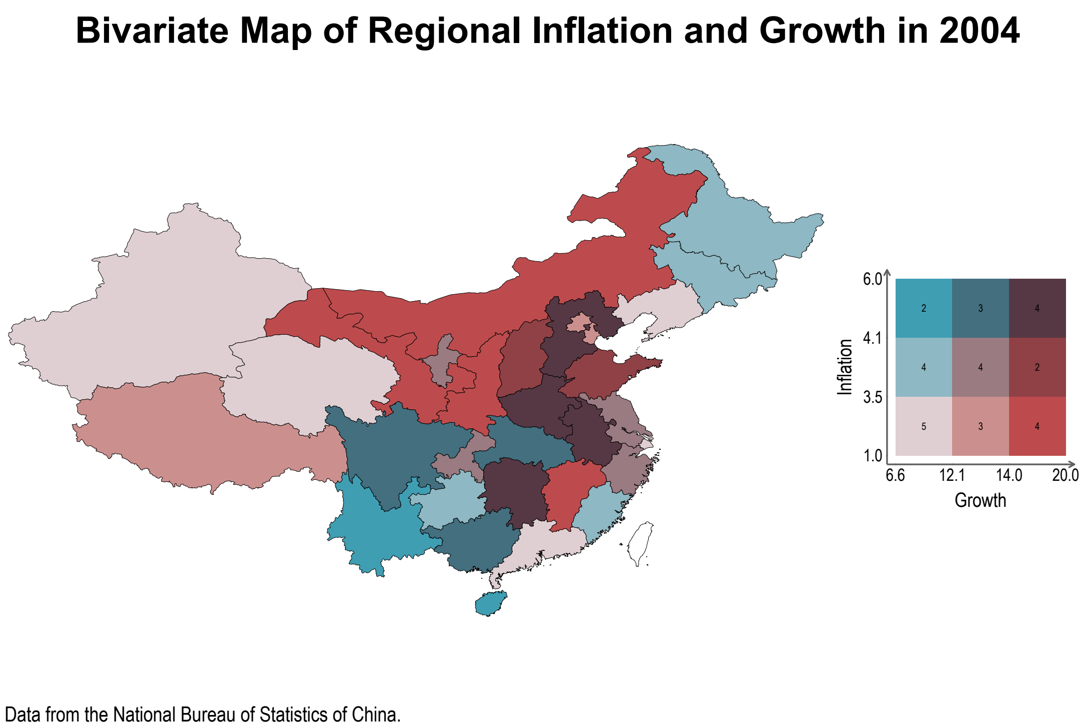
Note: Source: authors' calculations.

Figure A.4: Bivariate Map of Regional Inflation and Growth



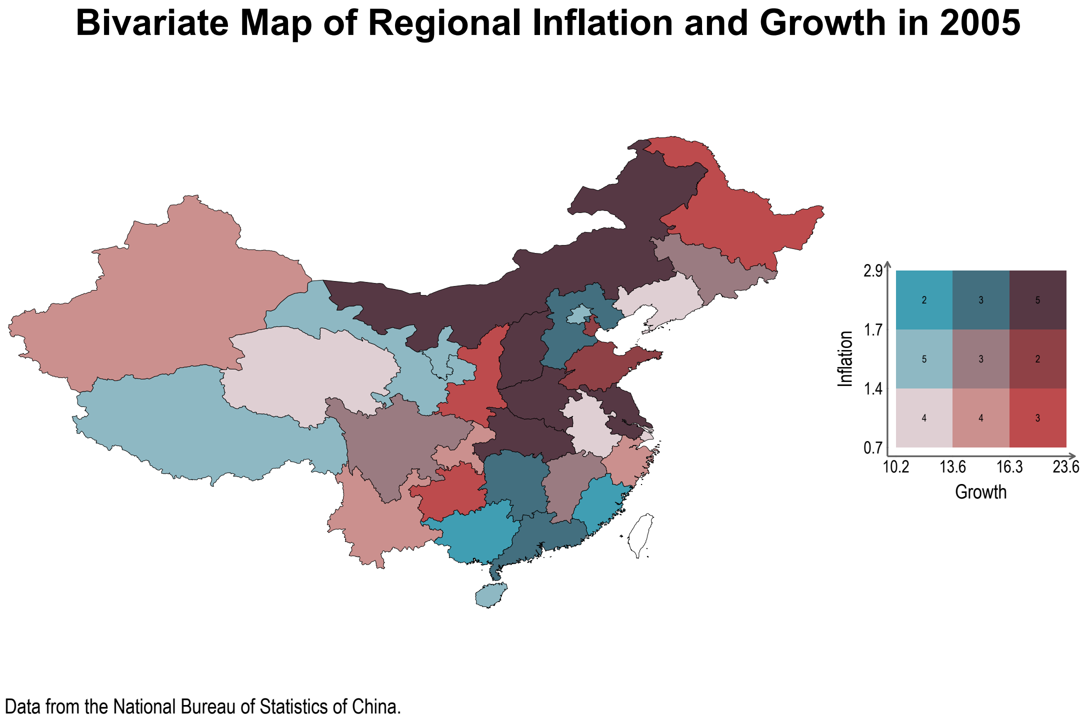
Note: Source: authors' calculations.

Figure A.5: Bivariate Map of Regional Inflation and Growth



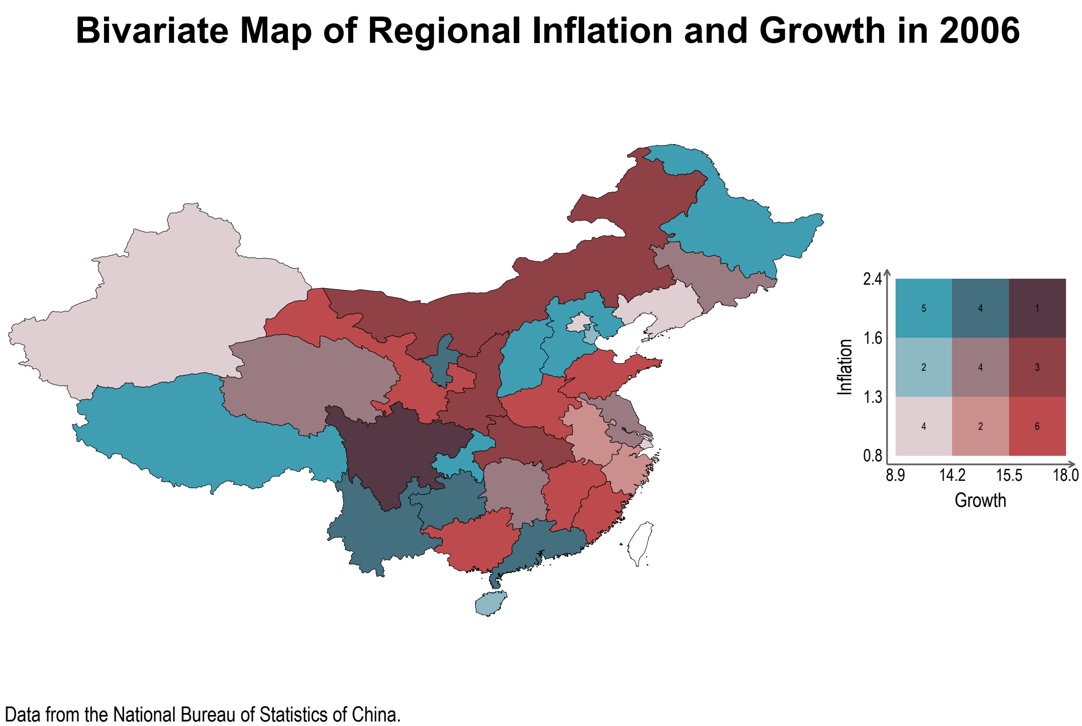
Note: Source: authors' calculations.

Figure A.6: Bivariate Map of Regional Inflation and Growth



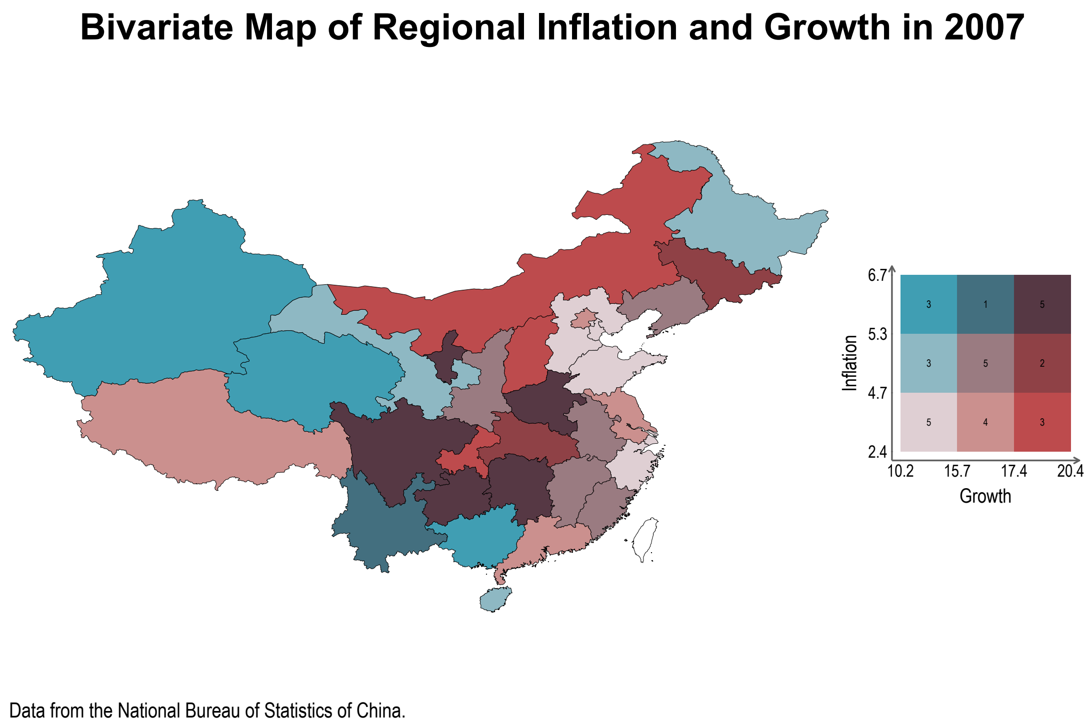
Note: Source: authors' calculations.

Figure A.7: Bivariate Map of Regional Inflation and Growth



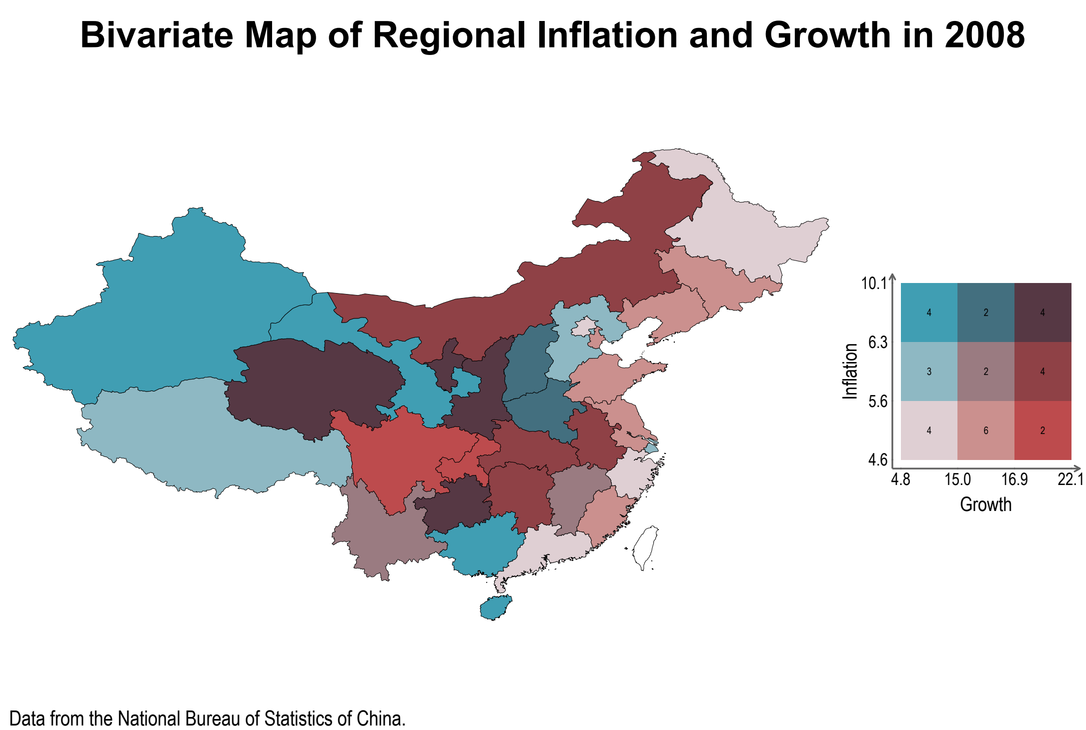
Note: Source: authors' calculations.

Figure A.8: Bivariate Map of Regional Inflation and Growth



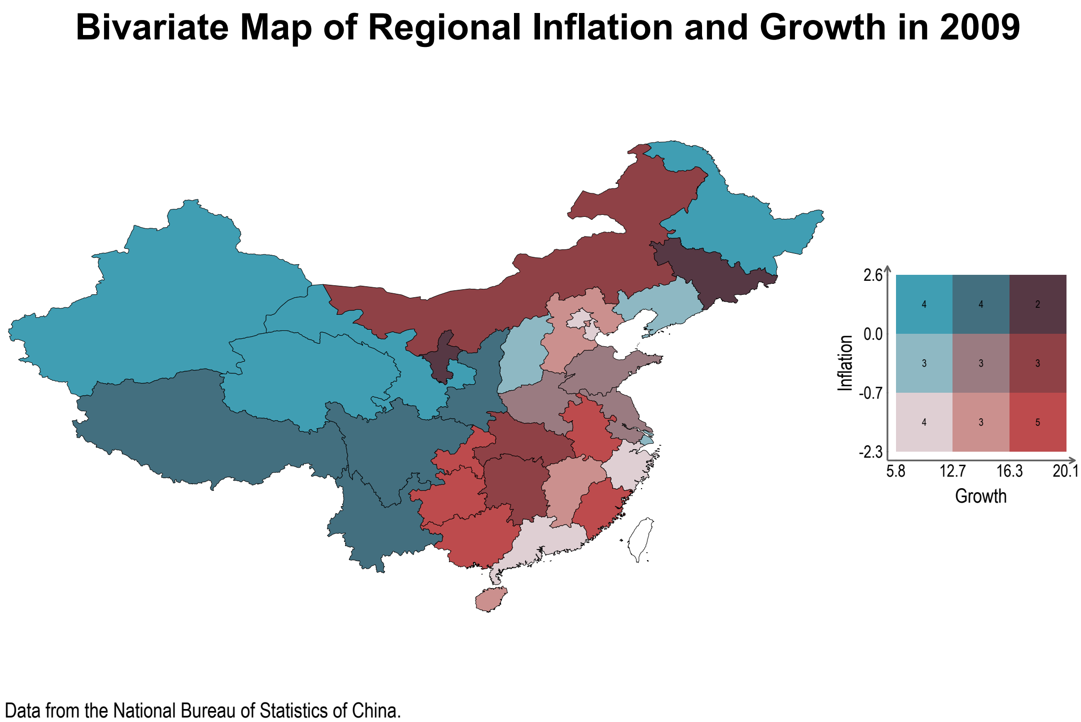
Note: Source: authors' calculations.

Figure A.9: Bivariate Map of Regional Inflation and Growth



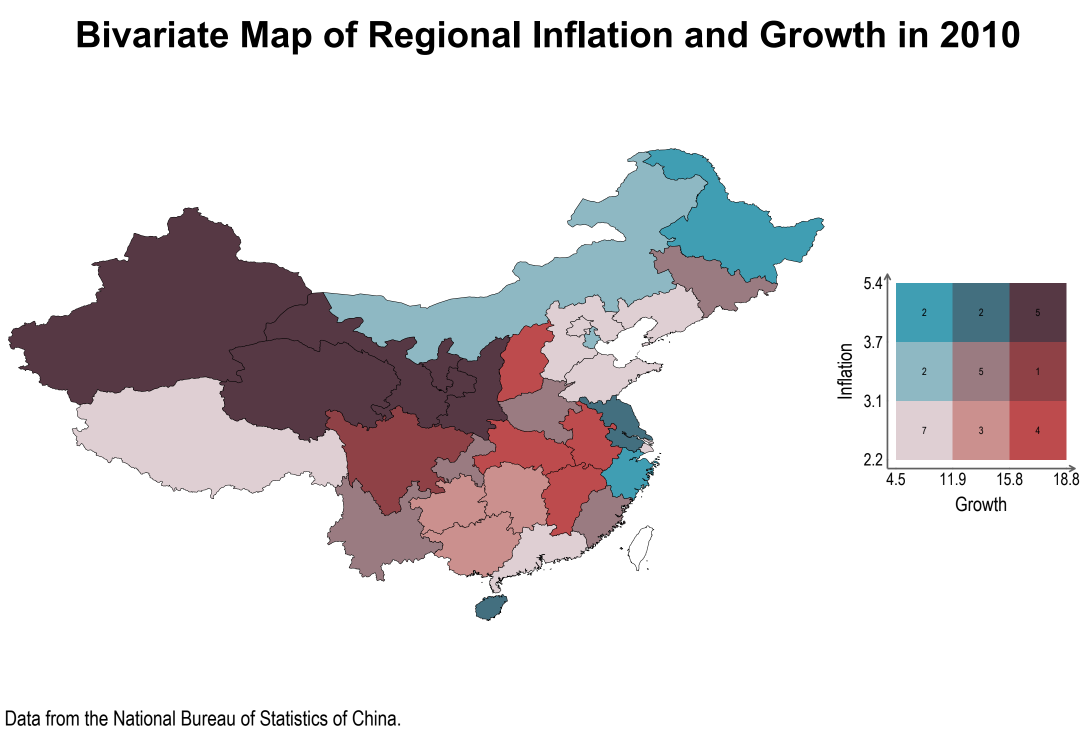
Note: Source: authors' calculations.

Figure A.10: Bivariate Map of Regional Inflation and Growth



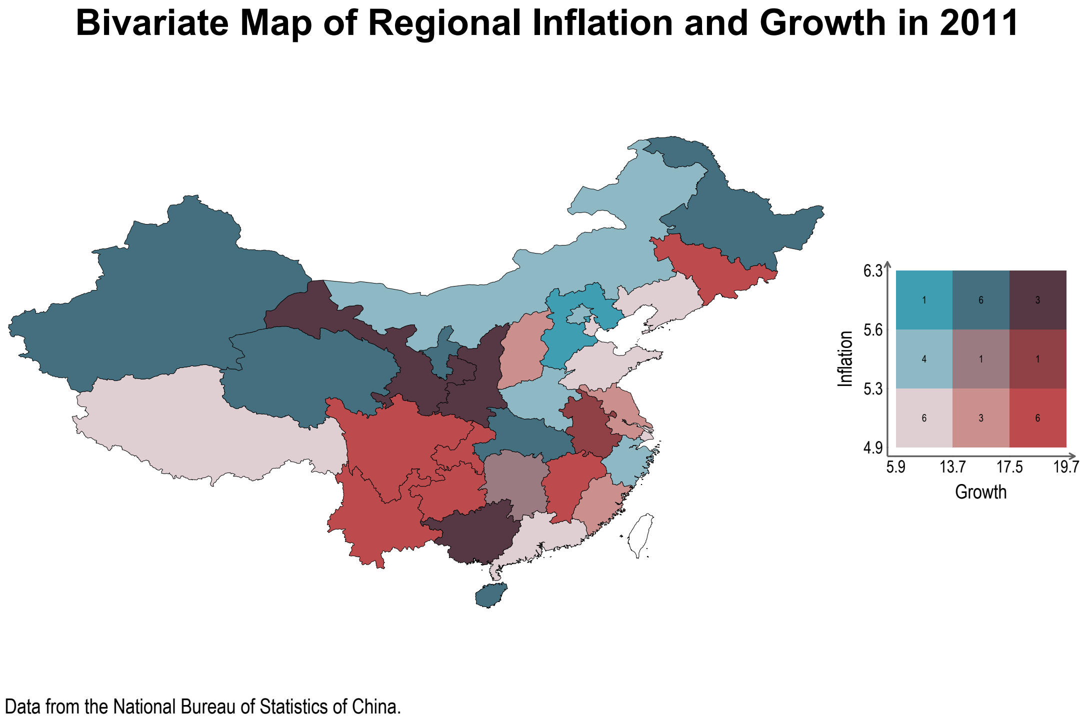
Note: Source: authors' calculations.

Figure A.11: Bivariate Map of Regional Inflation and Growth



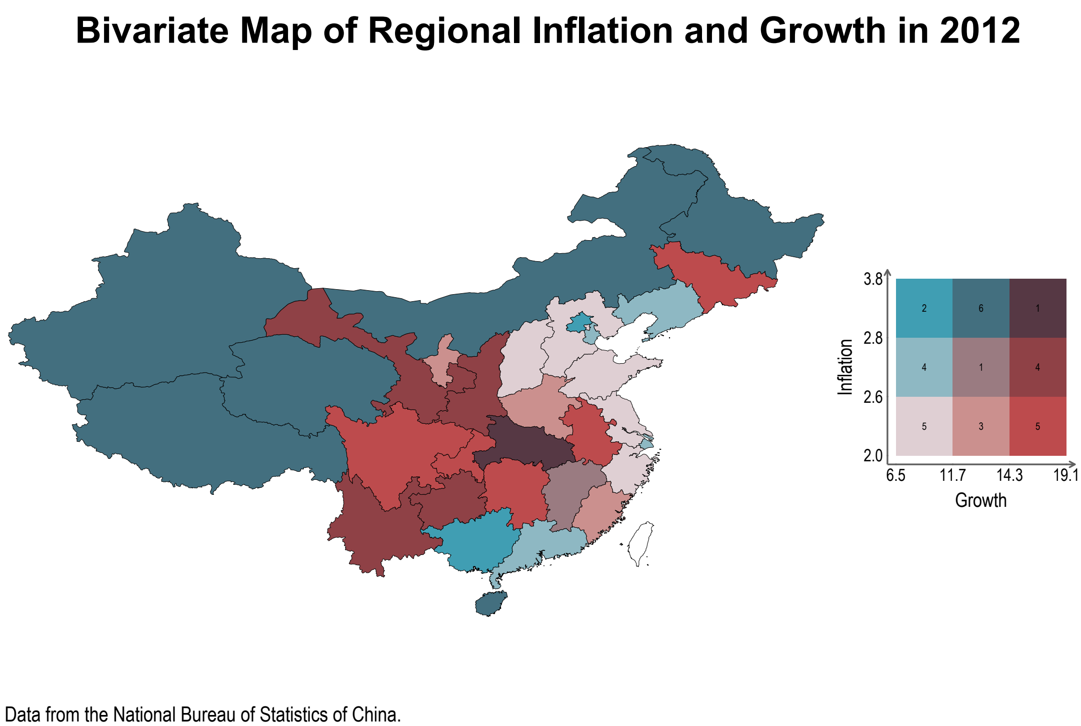
Note: Source: authors' calculations.

Figure A.12: Bivariate Map of Regional Inflation and Growth



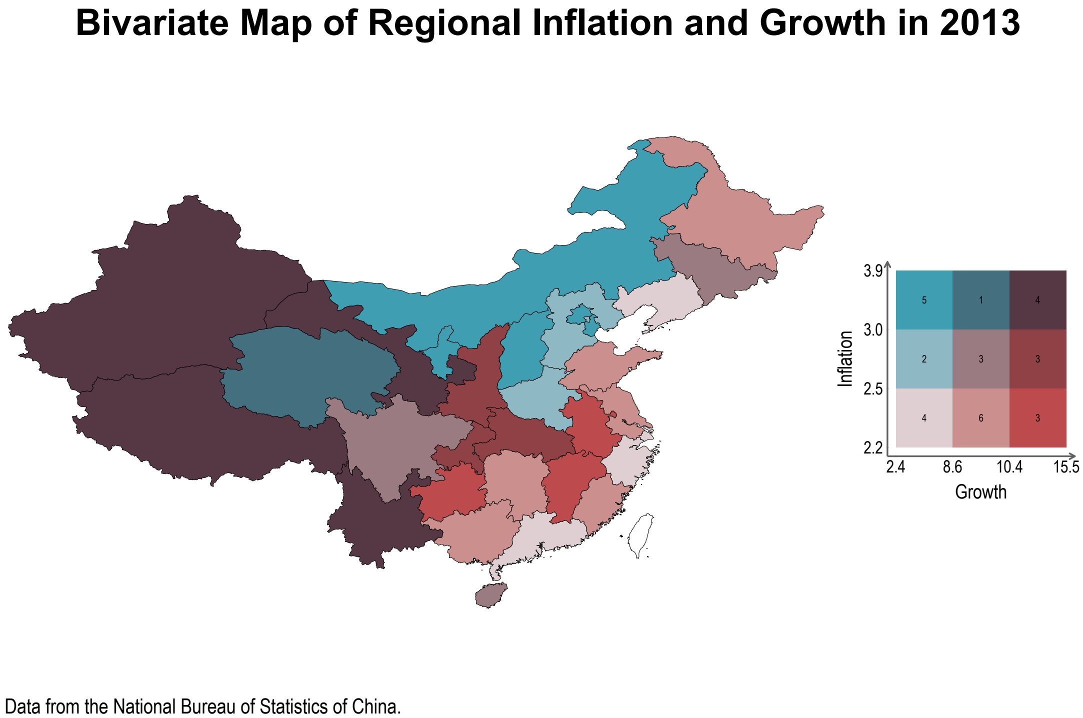
Note: Source: authors' calculations.

Figure A.13: Bivariate Map of Regional Inflation and Growth



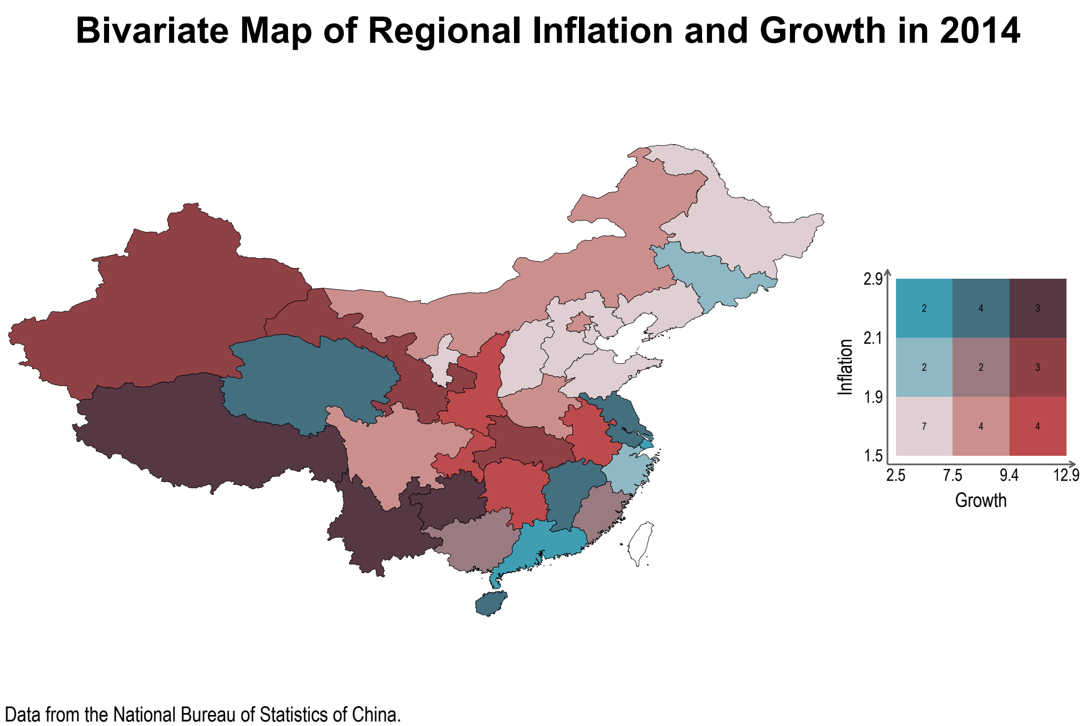
Note: Source: authors' calculations.

Figure A.14: Bivariate Map of Regional Inflation and Growth



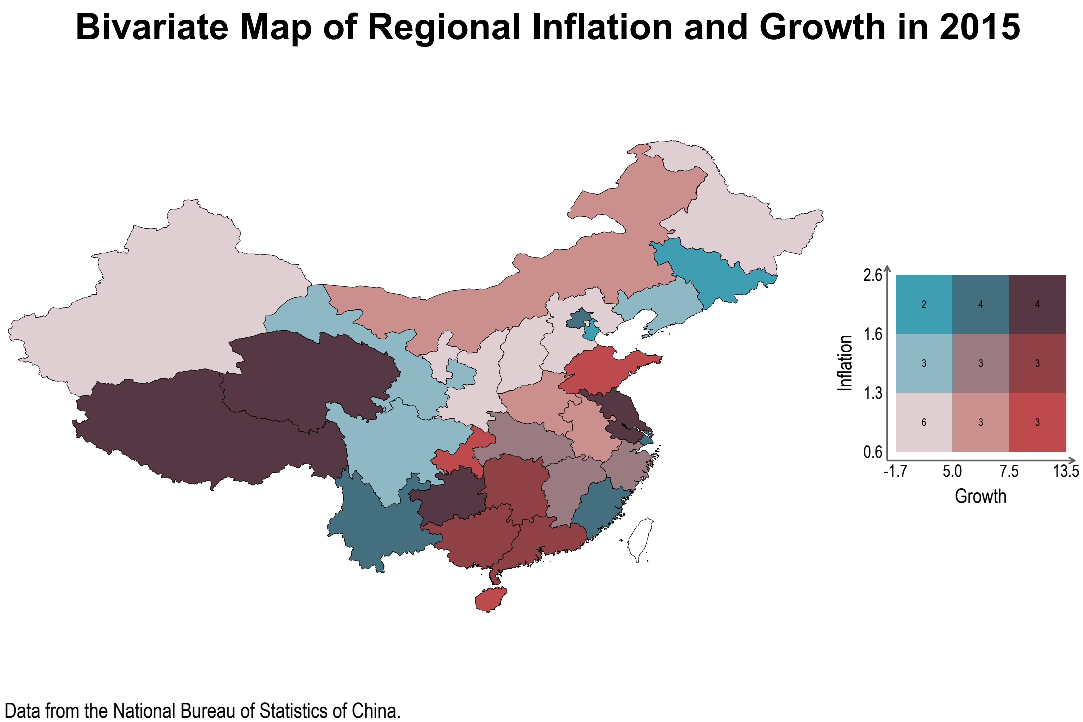
Note: Source: authors' calculations.

Figure A.15: Bivariate Map of Regional Inflation and Growth



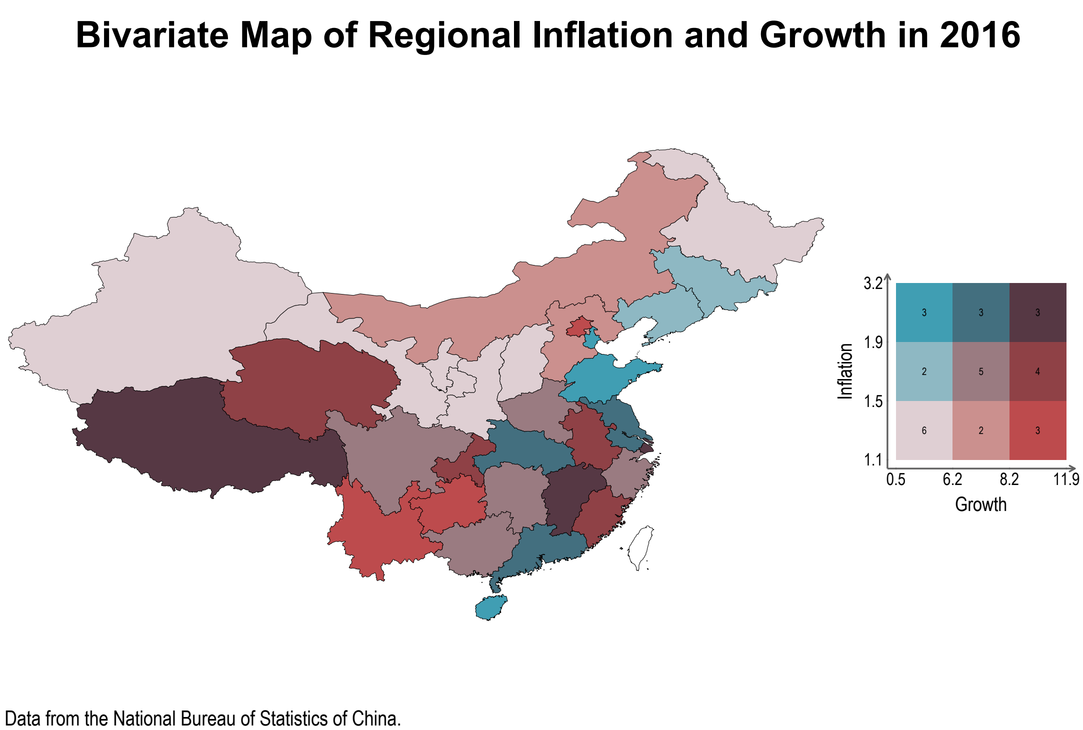
Note: Source: authors' calculations.

Figure A.16: Bivariate Map of Regional Inflation and Growth



Note: Source: authors' calculations.

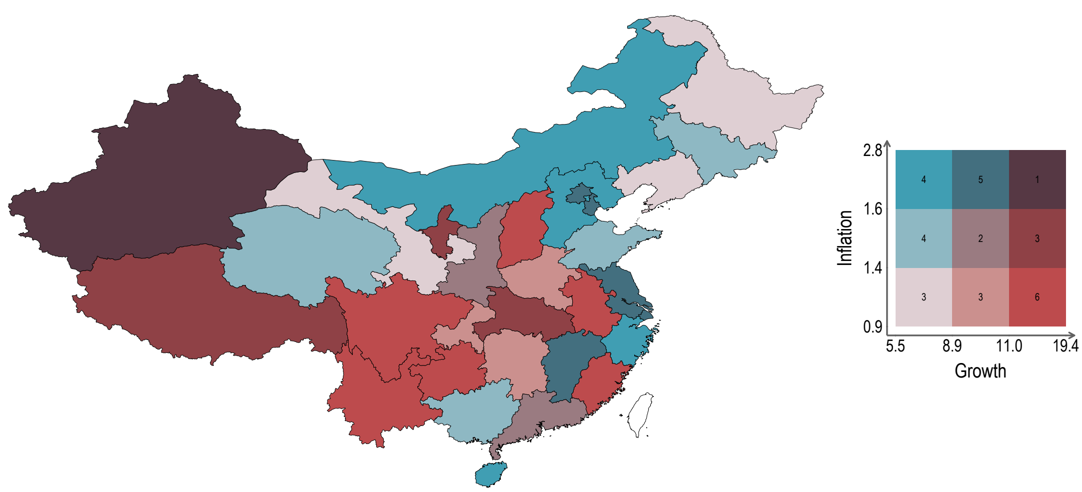
Figure A.17: Bivariate Map of Regional Inflation and Growth



Note: Source: authors' calculations.

Figure A.18: Bivariate Map of Regional Inflation and Growth

Bivariate Map of Regional Inflation and Growth in 2017



Data from the National Bureau of Statistics of China.

Note: Source: authors' calculations.