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Monetary Policy and Inflation: Evidence from Xinjiang

Jingyi Chen[1], Chee-Lip Tee[1*] & Chee-Hong Law[2]
[1]*School of Economics and Management, Xiamen University Malaysia, Malaysia.*
[2]*School of Social Sciences, Universiti Sains Malaysia, Malaysia.*

Abstract: Research Question: What are the effects of monetary policy on inflation? **Motivation:** Since the COVID-19 pandemic, global monetary policies have undergone unprecedented shifts. In 2020–21, most central banks adopted aggressive easing measures to cushion economic activity. By 2022–23, however, inflation surged, prompting widespread tightening to stabilize prices. More recently, by 2024, many economies returned to easing policies to prevent sharp slowdowns. These rapid and frequent policy adjustments highlight the importance of understanding the transmission mechanisms of monetary policy under evolving economic conditions. For China, where regional disparities in development remain pronounced, examining the effectiveness of monetary easing at the provincial level is critical for policymakers tasked with balancing development objectives and price stability. **Idea:** This paper investigates the effects of monetary easing on inflation in Xinjiang, China's largest province with unique challenges — relatively slower economic development, rising living costs, and structural vulnerabilities. This provincial-level analysis captures localized dynamics and sheds light on how national monetary policy translates into inflationary pressures in less-developed regions. **Data:** The study uses annual data from 1994 to 2020, covering variables such as consumer prices, fixed asset investments, money supply, disposable income per capita, monetary policy-related interest rates, and West Texas Intermediate oil prices. Data sources include the National Bureau of Statistics, the Xinjiang Statistical Yearbook, International Financial Statistics, and the Federal Reserve Bank of St. Louis. **Method/Tools:** A Vector Autoregression (VAR) model is employed to assess the relationships between monetary policy and inflation. **Findings:** The study finds that the policy rate indirectly influences inflation in Xinjiang by affecting fixed asset investment and money supply. Expansionary monetary policies aimed at promoting development must be carefully calibrated to avoid exacerbating the cost of living. **Contributions:** This study provides understanding of how monetary policy affects inflation in less-developed areas, where transmission channels might differ from those at the national level. For policymakers, the findings offer practical guidance in designing monetary interventions that support growth objectives while mitigating

* Corresponding author: Chee-Lip Tee. Tel.: +603-87055390.
Email: cheelip.tee@xmu.edu.my
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inflationary risks. More broadly, the paper enriches debates on regional heterogeneity in monetary policy effectiveness, particularly in emerging economies with uneven development trajectories.

Keywords: Inflation, monetary policy, money supply, fixed asset investment, Xinjiang Province.
JEL Classification: E52, E31, O53, C32, R11

1. Introduction

Xinjiang Uygur Autonomous Region (Xinjiang), positioned in northwest China, holds the distinction of being the largest provincial-level administrative region, covering one-sixth of China's land area. Its strategic location makes it a pivotal hub connecting China with the economic circles of Central, South, and East Asia.

However, despite its vast expanse, Xinjiang grapples with a relatively sparse population, and its productivity levels lag behind other regions. This is reflected in its lower Gross Domestic Product (GDP) per capita compared to the national average, a disparity persisting for decades despite various development initiatives, as depicted in Figure 1.

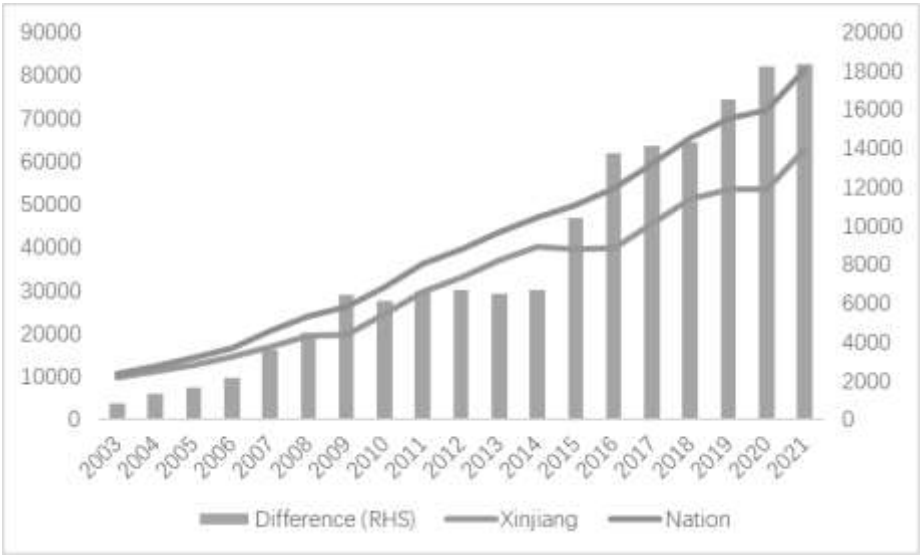
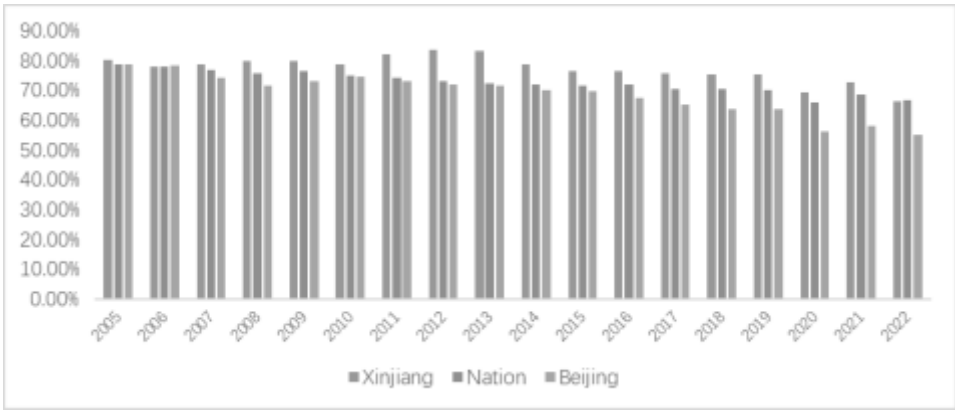


Figure 1: GDP per capita of Xinjiang province and China

In addition to lower income levels, Xinjiang experiences higher inflation rates, with average inflation measured by the Consumer Price Index (CPI) between 2003 and 2022 being higher in Xinjiang (2.6%) compared to the national average (2.49%) and Beijing (2.02%), the municipality with the highest GDP per capita.

As a result of its lower GDP per capita and higher inflation, Xinjiang exhibits a higher ratio of consumption to disposable income per capita compared to the national average and Beijing, as shown in Figure 2.



Source: National Bureau of Statistics of China

Figure 2: Consumption to disposable income per capita ratio

The province's economic challenges are further exacerbated by accusations of forced labor (Rakhmat, 2022), leading to the introduction of the Uyghur Forced Labor Prevention Act (U.S. Customs Border Protection, n.d.), which specifically targets imports from Xinjiang. This legislative move is anticipated to impact Xinjiang's economic performance negatively.

To support Xinjiang's development, the Chinese government has implemented a series of policies, including recent monetary loosening, a departure from the monetary tightening policies adopted by most economies in 2022 to address persistent inflation (International Monetary Fund, 2022). In 2022, Xinjiang saw an aggregate financing size of 4.29 trillion yuan, a year-over-year growth rate of 10%, exceeding the national average (The State Council Information Office of the People's Republic of China, 2022).

Despite these efforts, National Bureau of Statistics of China data indicates that the province's GDP growth slowed to 0.8% quarter to quarter in the second quarter of 2023, compared to 2.2% in the first quarter, experiencing a similar trend of a broader slowdown in the Chinese economy, where the GDP growth forecast for 2024 is 4.6% and is expected to gradually decrease to 3.5% in 2028 (International Monetary Fund, 2024a).

In June 2023, the People's Bank of China notably reduced the market loan rate to historically low levels. Subsequently, in another significant move, the reserve requirement ratio was further slashed in February 2024 (The People's Bank of China, 2024). This strategic policy adjustment is in harmony with the prevailing trend of augmenting the money supply in the economy, increased from 243 trillion Yuan in January 2022 to 287 trillion Yuan in June 2023, as shown in data from National Bureau of Statistics of China, aiming to fortify and uplift overall economic performance.

This pattern aligns with the financing trajectory observed in Xinjiang province, characterized by a year-on-year growth rate of 7.9% as of June 2023, reaching a total of 4.52 trillion yuan subsequent to a 10-basis points reduction in the loan prime rate (The State Council Information Office of the People's Republic of China, 2023).

Considering the interplay between money supply and inflation, as expounded by the neutrality hypothesis in the classical quantity theory of money, an upswing in money supply holds the potential to trigger inflation over the long term, rather than contributing to real income (Moazzami and Gupta, 1995). Therefore, while the relaxation of monetary policy could theoretically bolster disposable income in the province, it's imperative to acknowledge its dual nature as a double-edged sword, capable of exacerbating existing high inflation

levels. Moreover, the efficacy and repercussions of monetary policy are contingent on various factors within the domestic market, such as the financial development of the region (Enock and Nicholas, 2018) and the political affiliations of enterprises (Zhao *et al.*, 2018). Relying solely on estimates for the aggregate Chinese economy might prove inadequate, necessitating a meticulous analysis to discern potential adverse impacts that could impede the realization of desired outcomes.

Furthermore, recent studies highlight the increasing complexity of the relationship between monetary policy and inflation, particularly in the presence of supply chain disruptions and sectoral price pressures. For instance, Ascari *et al.* (2024) find that traditional monetary policy tools may be less effective in addressing inflation caused by supply constraints, a crucial insight for Xinjiang, given its role as a regional trade hub. Similarly, Angelia and Nugraha (2020) confirm that increases in the money supply significantly impact inflation, aligning with the quantity theory of money. Given China's recent monetary easing, these findings raise concerns over whether expansionary policies in Xinjiang could intensify inflationary pressures. Meanwhile, Bhattacharya and Jain (2020) concluding that unexpected interest rate hikes can actually increase inflation, particularly when supply-side factors drive price changes. This challenges the assumption that monetary tightening always reduces inflation, emphasizing the need for a nuanced approach that considers both demand-side and cost-push inflation. By incorporating these insights, this study contributes to the ongoing debate on monetary policy effectiveness at the regional level, particularly in economies like Xinjiang, where both domestic policy and external trade factors play a critical role in inflation dynamics.

This study aims to enhance our understanding of the impact of money supply on inflation in the province over the past decades. Given the limited research on monetary policy and inflation at the provincial level in the Chinese economy, the findings from this research endeavor are expected to provide valuable insights into the relationship between money supply and inflation. This understanding can be harnessed to predict the potential effects of policy measures on the province's inflation. Ultimately, the insights gained will be instrumental in formulating policy recommendations that navigate the delicate balance of leveraging the advantages of monetary loosening while minimizing potential negative consequences, especially concerning inflation.

Since the onset of the COVID-19 pandemic, global monetary policies have experienced unprecedented shifts. In 2020–21, central banks around the world adopted aggressive monetary easing measures to cushion their economies from the pandemic's economic fallout. These policies included cutting interest rates and increasing money supply to support economic activity. However, as economies began to recover in 2022–23, inflation surged, prompting a swift reversal to monetary tightening. Central banks, including the Federal Reserve and the European Central Bank, raised interest rates in efforts to curb rising inflation, leading to a global trend of tightening monetary conditions.

In 2024, a new phase of monetary easing has begun as concerns about economic slowdowns resurface, largely due to factors such as global supply chain disruptions and geopolitical uncertainties. Policymakers now face the challenge of balancing growth and inflation control, especially in economies where inflation remains elevated. The empirical evidence on how monetary easing influences inflation under these evolving conditions is crucial for guiding decisions on whether to ease or tighten policy further.

China is currently facing deflationary pressures (International Monetary Fund, 2024b), prompting policymakers to adopt monetary easing measures to support economic growth (Pan, 2024). Recent reductions in interest rates and increases in money supply reflect efforts to stimulate domestic demand amid slowing economic momentum. However, the effectiveness of these policies is not uniform across regions, as provinces exhibit varying

economic structures, financial development, and inflationary dynamics. Xinjiang, in particular, presents a unique case due to its lower GDP per capita, higher inflation rates, and distinct investment patterns, raising questions about whether monetary expansion will have the intended stabilizing effects or contribute to inflationary risks.

Existing literature on monetary policy and inflation in China primarily focuses on national-level analyses (e.g., Fernald *et al.*, 2014; Zhang, 2010; Zhang, 2011). While these studies establish a clear link between monetary expansion and inflationary trends, they overlook regional disparities that may alter policy transmission mechanisms. The lack of province-level studies creates a significant research gap, as national estimates may not fully capture localized economic responses to monetary policy adjustments. Given Xinjiang's economic distinctiveness, applying generalized findings from national studies may lead to misinterpretations of monetary policy effectiveness at the regional level.

This study addresses this gap by examining the province-specific relationship between monetary policy and inflation in Xinjiang. Unlike prior research that applies aggregate national data, this study utilizes provincial-level insights to assess whether standard monetary tools, such as money supply adjustments and interest rate cuts, have a stabilizing or inflationary impact in Xinjiang. By doing so, the findings will contribute to a more nuanced understanding of regional monetary policy effectiveness, offering valuable insights for policymakers seeking to tailor economic strategies to diverse regional conditions.

The subsequent sections of this paper are structured as follows: Section 2 offers a comprehensive review of related literature, while Section 3 delves into the discussion of the data and methodology employed to fulfil the objectives of this study. The outcomes and their interpretation are presented in Section 4, and Section 5 serves to encapsulate the paper, offering a summary and implications based on the findings.

2. Literature Review

The connection between money supply and inflation, as outlined in the long-established quantity theory of money (MV = PY), posits a direct relationship between the two, where M represents money supply, V is the velocity, P stands for the price level, and Y denotes real output (Karras, 1992). The constant V implies a direct link between money supply and nominal output.

However, literature offers varied perspectives on the existence of this proposed relationship. While some studies support its existence in many countries, including China (Zhou and Meng, 2018), the United States (Wang *et al.*, 2016), and Australia (Makin *et al.*, 2017), others suggest that it is not universally applicable but holds for selected countries (Karras, 1992; Moazzami and Gupta, 1995).

Hence, while an uptick in money supply may be associated with inflation, it does not necessitate a direct inflationary outcome. Variables such as an augmented demand for money can counterbalance inflationary pressures (Cukierman, 2017). Furthermore, factors like sticky prices in the market, where firms might not promptly adjust prices due to associated costs, contribute to a nuanced relationship (Zaidi *et al.*, 2016). Recent research, exemplified by Wang and Zhu (2021), underscores the impact of increased money demand resulting from population aging in developed countries, contributing to the absence of a straightforward connection between money supply and inflation. Moreover, the involvement of the private sector in the money creation process introduces complexities to the relationship between money supply and inflation (Reynard, 2023).

Confirming the quantity theory of money (Pokrovskii and Schinckus, 2016), the unique characteristics of countries, especially the distinction between developed and developing nations, play a crucial role in determining if the proposed relationship between money supply and inflation holds (Sabade, 2014).

Despite the potential inflationary risks, monetary easing can significantly contribute to economic growth (Sun, 2013), though its effectiveness may hinge on the level of financial market development in a given country (Twinoburyo and Odhiambo, 2018). Jiang *et al.* (2024) suggest that in China, money supply significantly boosts growth, particularly during expansion periods (Min *et al.*, 2022). However, the effectiveness of monetary policy differs between entities with or without political connections (Zhao *et al.*, 2018), necessitating a disaggregated analysis for a more accurate estimation of the relationship.

Maintaining controlled money supply growth and a well-designed monetary policy are crucial keys to preventing inflation (Doan Van, 2019). Recent studies propose considering more than a direct relationship between money supply and inflation. Wang (2020) identifies an indirect linkage in China's economy, where expansionary monetary easing supports increased investment, especially during economic downturns. Money supply exerts upward pressure on inflation both directly and indirectly through increased investment. This finding suggests that the impact of monetary easing on inflation may surpass expectations, particularly in regions heavily reliant on investment for growth, such as Xinjiang (Xu, 2015), where about 25.64% of the Consumer Price Index (CPI) is influenced by money supply (Jia and Liu, 2011).

Hence, there is no one-size-fits-all relationship between money supply and inflation applicable to every country, let alone at the provincial level. A meticulous estimation is essential to provide valuable insights for policymakers in crafting appropriate monetary policies that support economic development while minimizing potential negative impacts. Given the differences in inflation mechanisms across provinces, China requires specific attention to enhance the effectiveness of its monetary policy (Mehrotra *et al.*, 2010). To analyze the impact of monetary policy on inflation, this study adopts money supply and the policy rate as key explanatory variables, consistent with established literature (e.g., Adu and Marbuah, 2011; Doan Van, 2019; Fernald *et al.*, 2014; Kandil and Morsy, 2015; Mohanty and John, 2015) as these variables are widely recognized as primary tools through which central banks influence inflationary trends.

Besides, inflation determinants have been extensively examined in prior research, encompassing various demand and supply factors that shape price dynamics across both developed and developing economies. Among these, oil prices have been identified as a crucial driver of inflation, particularly in trade-dependent regions, as fluctuations in global commodity prices directly impact production costs and consumer prices (Dua and Goel, 2021; Kandil and Morsy, 2015; Mohanty and John, 2015). Given Xinjiang’s strategic position as a trade hub, incorporating oil prices into the model ensures a more comprehensive assessment of inflationary pressures stemming from external economic shocks. Additionally, Xinjiang's oil sector plays a significant role in its economy (Xu, 2015), meaning that rising oil prices not only increase production costs but also boost local income levels, which can further fuel inflationary pressures through higher consumer spending and demand-driven price increases (Kandil and Morsy, 2015).

Similarly, fiscal policy plays a pivotal role in shaping inflationary dynamics. Empirical studies suggest that government spending and fiscal deficits contribute to inflation, particularly during periods of expansionary fiscal measures (Adu and Marbuah, 2011; Kandil and Morsy, 2015; Mohanty and John, 2015; Moser, 1995; Wang, 2020). This is particularly relevant for China, where recent fiscal interventions aim to counteract deflationary pressures. To capture the influence of fiscal expansion, this study incorporates fixed asset investment, reflecting the Chinese government’s large-scale infrastructure spending as a key monetary-fiscal interaction channel (Wang, 2020).

Moreover, government spending influences inflation indirectly by driving wage growth, consumer spending, and second-round inflationary effects (Kandil and Morsy, 2015). To

account for this, disposable income in Xinjiang is included as a proxy for domestic demand pressures, as rising wages and household spending tend to sustain inflationary momentum. By integrating these key macroeconomic variables, this study provides a comprehensive framework for assessing the transmission of monetary policy to inflation, particularly in the unique economic landscape of Xinjiang.

3. Research Methodology

Since the time series data is analyzed, this study begins with unit root tests, crucial for determining the method to uncover the relationship between monetary policy and the price level. Neglecting unit root properties risks generating spurious relationships among variables. Three tests, the augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests, are applied, each with unique features. The ADF test overcomes potential autocorrelation by including sufficient lagged dependent variables, the PP adopts non-parametric correction to the t-statistics of lagged one of the dependent variables, while the KPSS is a Lagrange Multiplier test examining if a random walk process has zero variance.

These tests are estimated assuming a constant and trend in the unit root regression with the null hypothesis for ADF and PP tests is that the variable is non-stationary, whereas the null hypothesis is the opposite for the KPSS test. Due to the relatively small sample size used in the estimation, the lag decisions in the ADF test is determine by using Schwartz information criteria (SIC), while the Andrew Bandwidth is chosen for PP and KPSS tests.

This research applies the VAR method to determine the dynamic relationship between inflation, monetary policy and other selected control variables in Xinjiang. The rationale for choosing this method is that VAR estimation allows for assessing the impact of monetary policy on inflation following a shock, through the impulse response function, and determining the significance of monetary policy in explaining inflation via variance decomposition analysis. Considering endogeneity presented among examined variables, this paper adapts the vector autoregression (VAR), which emphasizing only unexpected changes have real effects (Dickinson and Liu, 2007), to assess the impact of monetary policy on inflation. The VAR model in this paper is shown below:

$$x_t = \beta_0 + \beta_1 x_{t-1} + \beta_1 x_{t-2} + \cdots + \beta_p x_{t-p} + \gamma_1 y_t + \varepsilon_t \quad (1)$$

where β_0 is the $(n \times 1)$ vector of intercepts, β_i are the $(n \times n)$ vector of coefficients, x_t is the $(n \times 1)$ vector of n variables included in the model, y_t is the exogenous variable, γ_1 is the coefficient for the exogenous variable and ε_t is the $n(\times 1)$ vector of error terms.

The model includes variables adhering to conventional economic theories: CPI, fixed asset investment, disposable income per capita, money supply (M2), interest rate, and oil prices. Initially, an increase in fixed asset investment positively influences the CPI due to its beneficial impact on aggregate demand and, consequently, prices, as suggested by Jia and Liu (2011). This positive correlation also extends to disposable income per capita. Additionally, the expansion of money supply, M2, contributes to CPI growth (Zhou and Meng, 2018) as economic agents seek to expend excess money. The interest rate stands out as another pivotal variable in monetary policy dynamics (Dickinson and Liu, 2007). Lastly, oil prices play a prominent role in influencing inflation rates across various countries, as highlighted by Oloko *et al.* (2021) and Yang *et al.* (2023).

Hence, the x_t encompasses fixed asset investment in Xinjiang province (LFAI), per capita disposable income of urban residents in Xinjiang province (LURI), consumer price index in Xinjiang province (LCPI), the monetary policy interest rate (IR_MP), and M2 (LM2), while y_t represents the West Texas Intermediate crude oil prices (LOIL). This paper

employed Schwartz Information Criteria (SIC) to determine the lag for endogenous variables in the model. The objective was to achieve more parsimonious models, and given the use of annual data, a maximum lag of two was selected.

Since VAR models are suitable for variables integrated at order zero, I(0), and I(1) if all I(1) variables are cointegrated, the Johansen cointegration test is employed to assess if variables are integrated at order one, I(1). If any variables are I(2), they are transformed into first differences to achieve integration at order one. Additionally, the Jacque Bera, LM autocorrelation test, and White heteroscedasticity test are conducted to identify non-normality, autocorrelation, and heteroscedasticity in the model, respectively.

This study employs Cholesky decomposition as the VAR model's reduced form shocks require identification for retrieving structural shocks, constraining contemporaneous impact from a variable to others. Variables are ordered in a Cholesky sequence, with the leftmost being the most exogenous, exerting an immediate impact on those to its right. Conversely, the rightmost variable does not instantaneously impact those on its left.

This study posits fixed asset investment as the most exogenous variable, succeeded by income per capita, price level, interest rate, and M2. Specifically, the output, represented by fixed asset investment, is assumed to be determined before any alterations in other variables. It precedes price and policy variables, encompassing interest rate and M2, aligning with Dickinson and Liu's (2007) suggestion. Essentially, monetary policy is assumed to be endogenously influenced by other factors in the model.

Impulse Response Functions (IRFs) and Forecast Error Variance Decomposition (FEVD) are then presented to delineate the impact of monetary policy on inflation. IRFs illustrate how variables respond to a structural shock originating from a model variable over time. In the context of this paper, IRFs show the reaction of inflation to a monetary policy innovation, and the outputs match with the research objective. The responses are observed ten years post-shock, and the 90% confidence interval determines the statistical significance. Conversely, FEVD quantifies the percentage of a variable's movement attributable to its shock and shocks from other variables. A higher percentage signifies a more endogenous variable. The result of FEVD tells the importance of monetary policy on inflation quantitatively.

The baseline model outputs undergo a threefold examination to ensure reliability. First, generalized Impulse Response Functions (IRFs) are generated to capture responses. Variable ordering in retrieving structural shocks is irrelevant in this exercise, verifying if Cholesky ordering in the baseline model impacts IRFs. Second, a new ordering is established by repositioning IR_MP and M2, aligning with Hu *et al.* (2018). Third, the Monte Carlo method with 1000 replications scrutinizes standard errors of the IRFs.

The variables, data, and sources are presented in Table 1.

Table 1: Variables, data, and sources

Variable	Data	Unit of Measurement	Source
LCPI	Consumer price index in Xinjiang Province	Index	National Bureau of Statistics
LFAI	Fixed asset investments in Xinjiang Province	Ten Thousand Yuan	Xinjiang Statistical Yearbook
LM2	M2	Hundred Million Yuan	National Bureau of Statistics
LURI	The per capita disposable income of urban residents in Xinjiang Province	Yuan	National Bureau of Statistics
IR_MP	Monetary Policy-Related Interest Rate	Percentage	International Financial Statistics, IMF
LOIL	West Texas Intermediate oil price	US dollar per barrel	Federal Reserve Bank of St. Louis

China's financial system underwent a transformative shift following the country's economic reforms. After 15 years of rapid development, by 1994, China had established a relatively complete and stable market economy, marking a significant departure from the highly controlled system of the past (Li, 2008). Before 1994, frequent policy changes, limited market liberalization, and government-controlled pricing mechanisms resulted in volatile and less reliable data, making it difficult to analyze the true determinants of inflation. Therefore, this study focuses on data from 1994 onwards to ensure consistency and reliability in assessing the relationship between monetary policy and inflation.

Meanwhile, the data span extends only until 2020 due to the unprecedented economic disruptions caused by the COVID-19 pandemic and rising geopolitical tensions. The pandemic led to extraordinary government interventions, supply chain disruptions, and shifts in consumption patterns, creating inflationary pressures unrelated to conventional monetary policy mechanisms. Similarly, escalating geopolitical uncertainties, including trade restrictions and financial decoupling, have reshaped the global economic landscape, altering inflation dynamics in ways that may not align with pre-2020 trends. Given these profound structural shifts, extending the study beyond 2020 could compromise the reliability of the findings, as the economic relationships observed in prior decades may no longer hold in the post-pandemic era. Instead, analyzing the period from 1994 to 2020 provides a more stable and meaningful examination of monetary policy's role in inflation without the confounding effects of extraordinary global events.

4. Result Interpretation

The initial set of findings pertains to the descriptive analysis of the raw data. As outlined in Table 2, the dataset encompasses 27 annual observations spanning from 1994 to 2020. Notably, these observations reveal substantial variations over the data period, a trend underscored by the mean, median, maximum, and minimum values of the variables. It's noteworthy that all variables exhibit considerable data deviation.

Table 2: The descriptive analysis

	LURI	LOIL	LFAI	LCPI	LM2	IR_MP
Mean	14429.95	51.39222	40721060	104.1185	707580.6	3.31
Median	10313	48.66	18508415	102.1	403442.2	2.75
Maximum	34838	99.67	1.18E+08	126.7	2186796	8.0
Minimum	2881.01	14.42	2854786	97.4	46923.5	0.5
Standard Deviation	10534.04	28.1974	41013531	6.191995	676110.6	2.6537
Observations	27	27	27	27	27	27

Notes: The raw variables are studied in this table.

Moving on to Table 3, we delve into the unit root results of the variables. Inflation (LCPI) demonstrates stability at order I(0) across all three unit root tests. Conversely, oil price (LOIL) emerges as I(1) according to each unit root test. Disposable income per capita (LURI) and monetary policy rate (IR_MP) present mixed outcomes, with the KPSS results conflicting with those of ADF and PP tests. For the sake of consistency, we adopt the assumption that these variables are I(1) based on ADF and PP tests. Fixed asset investment (LFAI) and money supply (LM2) exhibit similar ambiguity. While ADF, PP, and KPSS categorize fixed asset investment as I(0), I(1), and I(2) respectively, for money supply, ADF and PP imply I(2), while KPSS suggests I(1). For the sake of this analysis, these variables are treated as I(1).

Next, we ascertain the cointegration among the I(1) variables using the Johansen cointegration test. This confirmation holds significance as it indicates that I(1) variables could be cointegrated with I(0) variables, validating the use of VAR estimation in levels.

Cointegration tests designate all variables as endogenous, excluding oil price, which is exogenously determined. Employing one lag, as recommended by the Schwarz Information Criterion (SIC), the trace cointegration test implies four cointegrating vectors among the variables, though the max-eigenvalue cointegration test disagrees. This discrepancy is rooted in the assumption of an unrestricted trend and an unrestricted constant in the cointegrating equation. Given the trace test's lower sensitivity to non-normality, often encountered in smaller sample sizes, it is concluded in this paper that all I(1) variables are cointegrated. Additional details regarding these results are available upon request.

Table 3: ADF, PP and KPSS unit root results

Variable	ADF		
	Constant and trend		
	Level	first differenced	2nd differenced
LCPI	-4.260 (0)**		
LFAI	-4.753 (3)***		
LM2	-0.308 (1)	-2.983 (0)	-5.831 (0)***
LURI	-2.088 (0)	-4.798 (0)***	
IR_MP	-3.229 (1)	-4.179 (0)**	
LOIL	-0.893 (0)	-4.558 (0)***	
	PP		
	Constant and trend		
	Level	first differenced	2nd differenced
LCPI	-4.577 (1.89)***		
LFAI	-1.129 (2.06)	-3.445 (1.02)*	
LM2	-0.741 (4.21)	-2.983 (0.58)	-5.831 (0.07)***
LURI	-2.495 (2.9)	-4.798 (0.62)***	
IR_MP	-2.689 (2.08)	-4.179 (0.38)**	
LOIL	-0.893 (0.88)	-4.558 (0.09)***	
	KPSS		
	Constant and trend		
	Level	first differenced	2nd differenced
LCPI	0.110 (4.78)		
LFAI	0.421 (19.2)***	0.138 (2.44)*	0.088 (4.52)
LM2	0.324 (20)***	0.094 (4.18)	
LURI	0.100 (6.79)		
IR_MP	0.100 (4.93)		
LOIL	0.154 (11.4)**	0.072 (0.01)	

Notes: All variables, except interest rate, are transformed into natural logarithm form.

Moving forward, our focus turns to the Impulse Response Functions (IRFs). To maintain conciseness, we will highlight the effects of interest rates on inflation and the variance decomposition of inflation in this section. Table 4 provides an overview of the baseline VAR model's performance, showcasing its freedom from issues like non-normality, serial correlation, and heteroskedasticity.

Table 4: Baseline VAR diagnostic tests

Test	Statistics
Normality Jarque-Bera test	2.714 (0.988)
Serial Correlation LM test Rao F-statistics (2 lags)	1.629 (0.155)
Serial Correlation LM test Rao F-statistics (4 lags)	0.697 (0.798)
White Heteroskedasticity Chi-squared statistics	341.505 (0.320)

Notes: The values in the parenthesis are the probability values.

In Figure 3, the responses of inflation to all structural shocks in the system are depicted. Notably, the policy rate doesn't exhibit a direct impact on the Consumer Price Index (CPI) in Xinjiang. However, a shock with a standard deviation (SD) in fixed asset investment statistically results in a decline in inflation in the second quarter following the shock. Conversely, an SD shock in money supply has the opposite effect on inflation in the second quarter. This paper delves into the indirect effects of other variables on inflation through fixed asset investment and money supply.

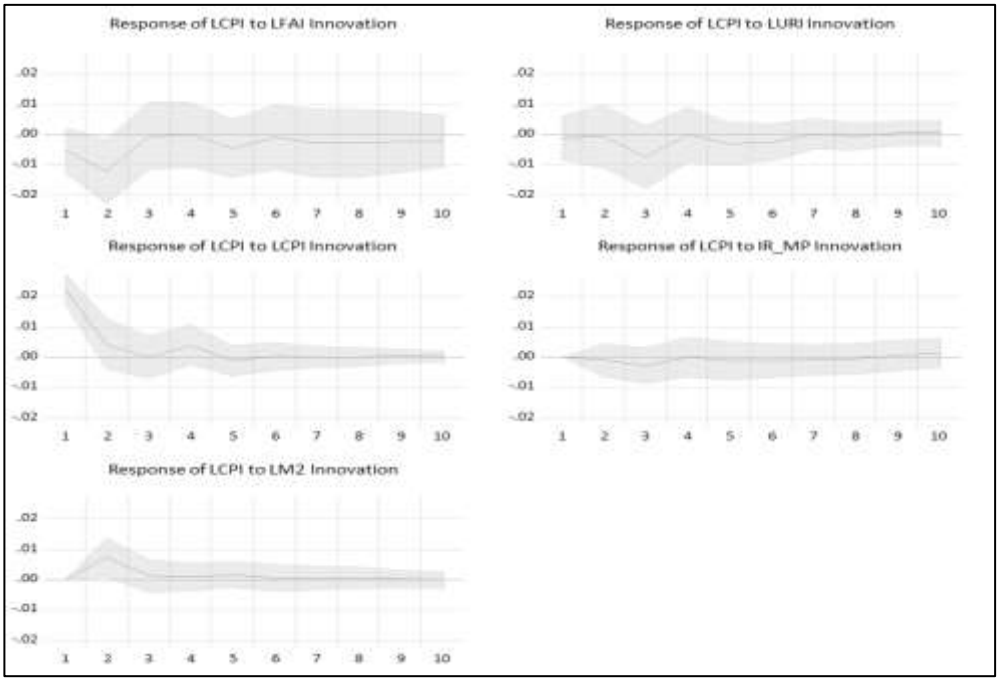


Figure 3: The response of LCPI to structural shocks in the VAR

Figure 4 illustrates that an SD shock from the policy rate statistically causes a decline in fixed assets investment from 3 to 6 quarters after the shock. Similarly, this shock leads to a statistically significant reduction in money supply from 1 quarter to 4 quarters after the shock, as depicted in Figure 5. Consequently, we can deduce that the policy rate, in reflection, has an indirect impact on inflation via its influence on fixed asset investment and money supply.

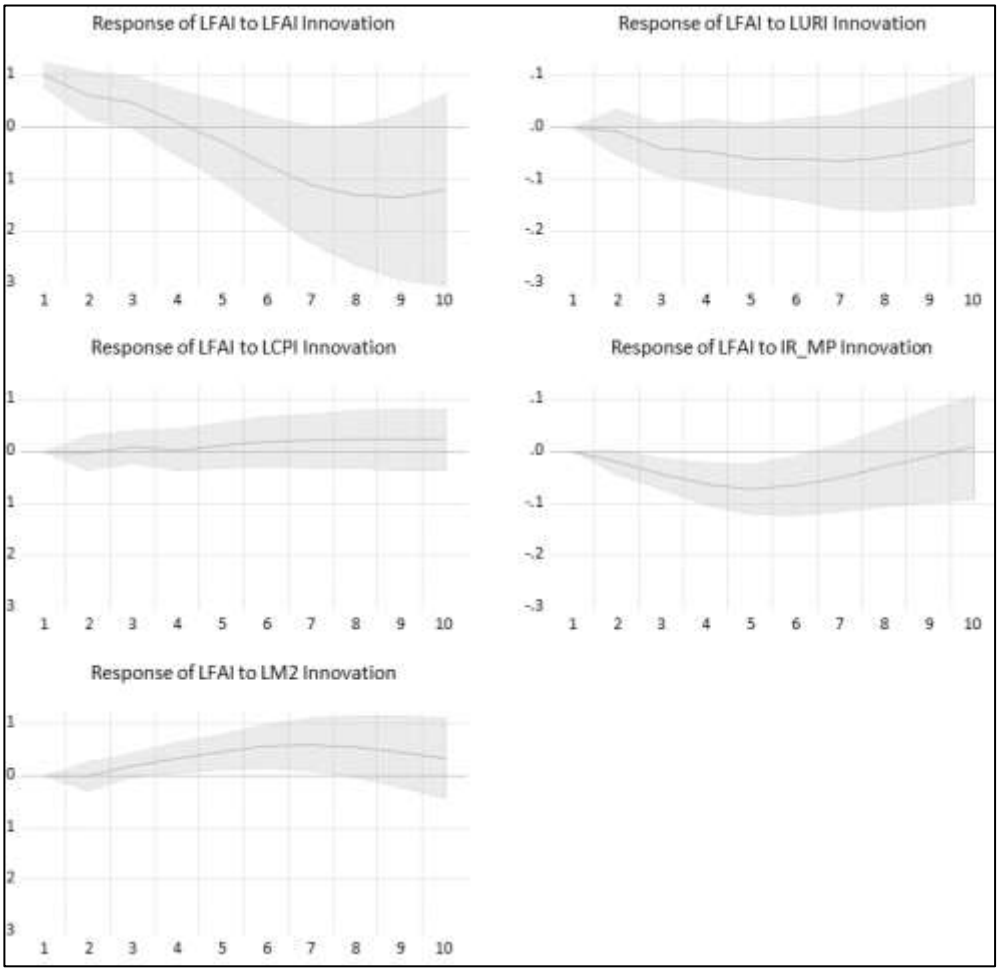


Figure 4: The response of LFAI to structural shocks in the VAR

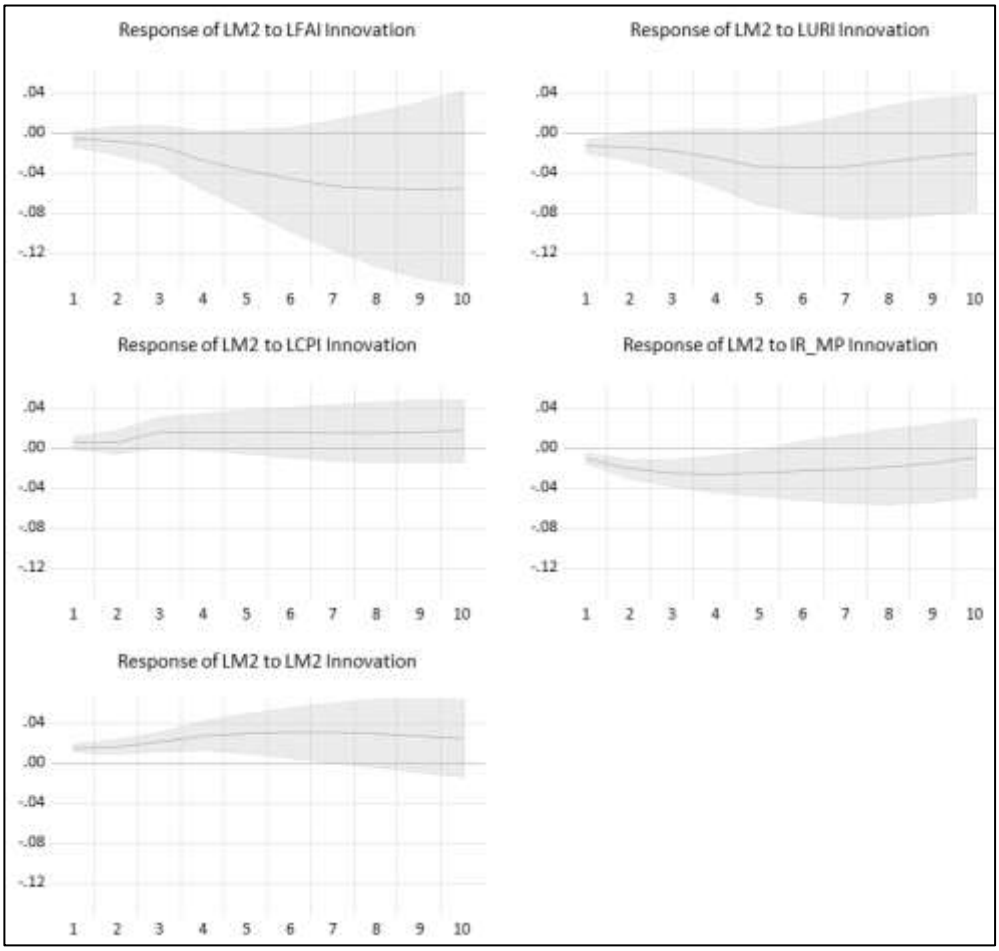


Figure 5: The response of LM2 to structural shocks in the VAR

As depicted in Table 5, the variance decomposition analysis reveals that inflation is predominantly influenced by the variable itself, with fixed asset investment, disposable income, and money supply following in impact, while the policy rate exhibits the smallest effect. This observed minimal impact of the policy rate in explaining the fluctuations in inflation aligns closely with the findings from Figure 3 to Figure 5 where the policy rate has only an indirect effect on inflation.

Table 5: Variance decomposition of LCPI

Period	Standard error	LFAI	LURI	LCPI	IR_MP	LM2
1	0.023	5.062	0.201	94.736	0.000	0.000
2	0.027	23.050	0.191	69.341	0.114	7.303
3	0.029	21.257	6.839	63.890	1.074	6.940
4	0.029	20.814	6.696	64.553	1.052	6.885
5	0.029	22.279	7.447	62.107	1.175	6.992
6	0.030	22.135	8.078	61.497	1.321	6.970
7	0.030	22.802	8.007	60.868	1.364	6.959
8	0.030	23.441	7.960	60.286	1.372	6.941
9	0.030	23.872	7.929	59.885	1.416	6.898
10	0.030	24.179	7.895	59.448	1.630	6.848

The initial set of robustness results is presented through the Generalized Impulse Response Functions (IRFs). Figure 4 illustrates that inflation responds to fixed asset investment in the second quarter subsequent to the shock in fixed asset investments, corroborating the findings in Figure 3. Conversely, there is no discernible evidence of inflation responding to money supply shocks. Instead, a direct impact of policy rate structural shocks on inflation is evident. Notably, a noteworthy observation is the presence of a price puzzle, indicating that a positive shock to the policy rate results in an increase in the price level a quarter after the policy rate shock.

Additionally, Figure 7 below portrays the reactions of fixed asset investment to other structural shocks. It reveals that fixed assets investment is statistically influenced by both money supply and policy rate, mirroring the outcomes in Figure 4. Thus, the first robustness analysis lends support to the notion of a direct impact of policy rate on inflation and its indirect influence through fixed asset investment.

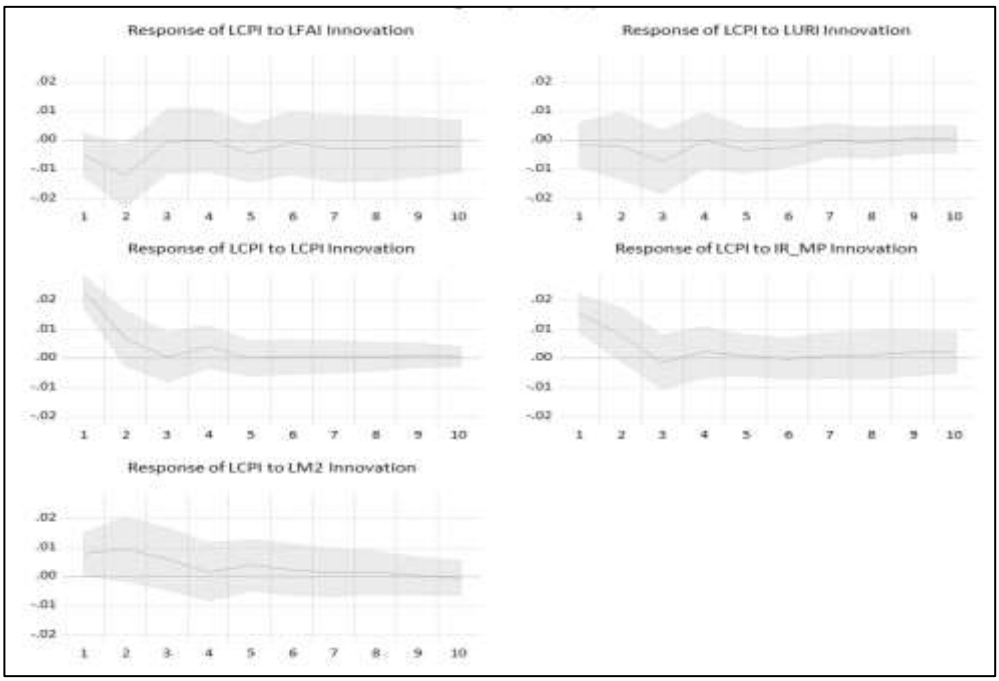


Figure 6: The response of LCPI to structural shocks in the VAR (generalised IRFs)

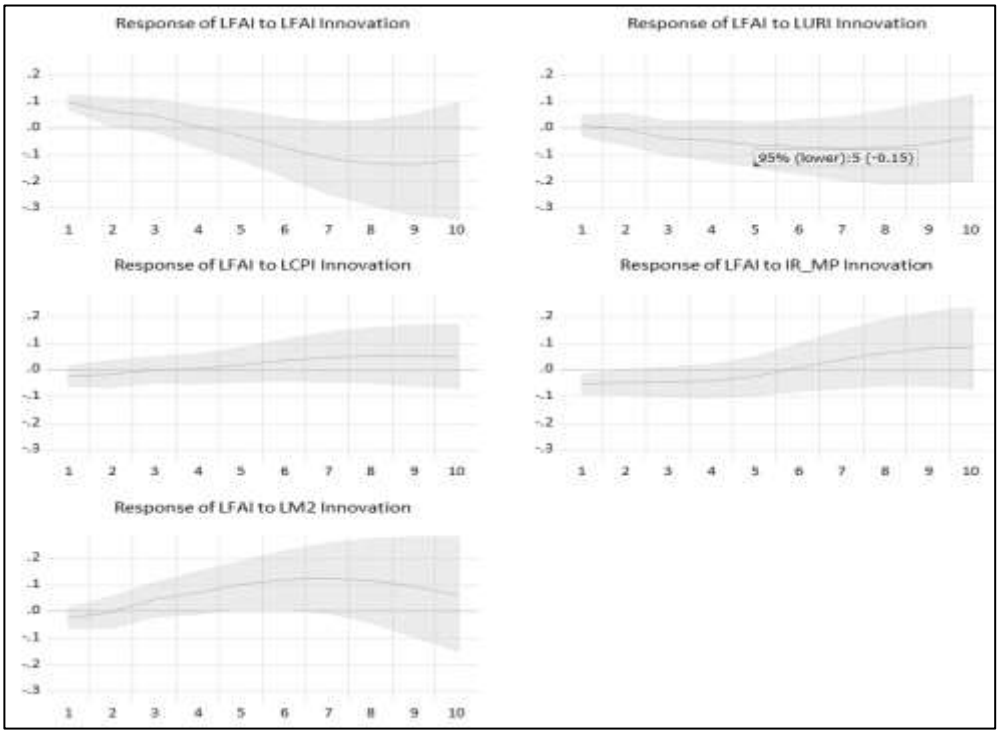


Figure 7: The response of LFAI to structural shocks in the VAR (generalised IRFs)

The outcomes of the second robustness analysis, involving the rearrangement of policy rate and money supply in the Cholesky ordering, are are available upon request. In this estimation, the Schwartz Information Criteria (SIC) suggests the inclusion of two lags in the VAR model. The model exhibits no autocorrelation at 2 and 4 lags, and it is free from issues of non-normality and heteroskedasticity. Figure 8 illustrates the impulse response of inflation to other structural shocks. Similar to the baseline estimation, inflation is observed to statistically react to structural shocks from fixed asset investment and money supply in the early stages of these shocks. However, there is no evidence of a direct effect from policy rate to inflation.

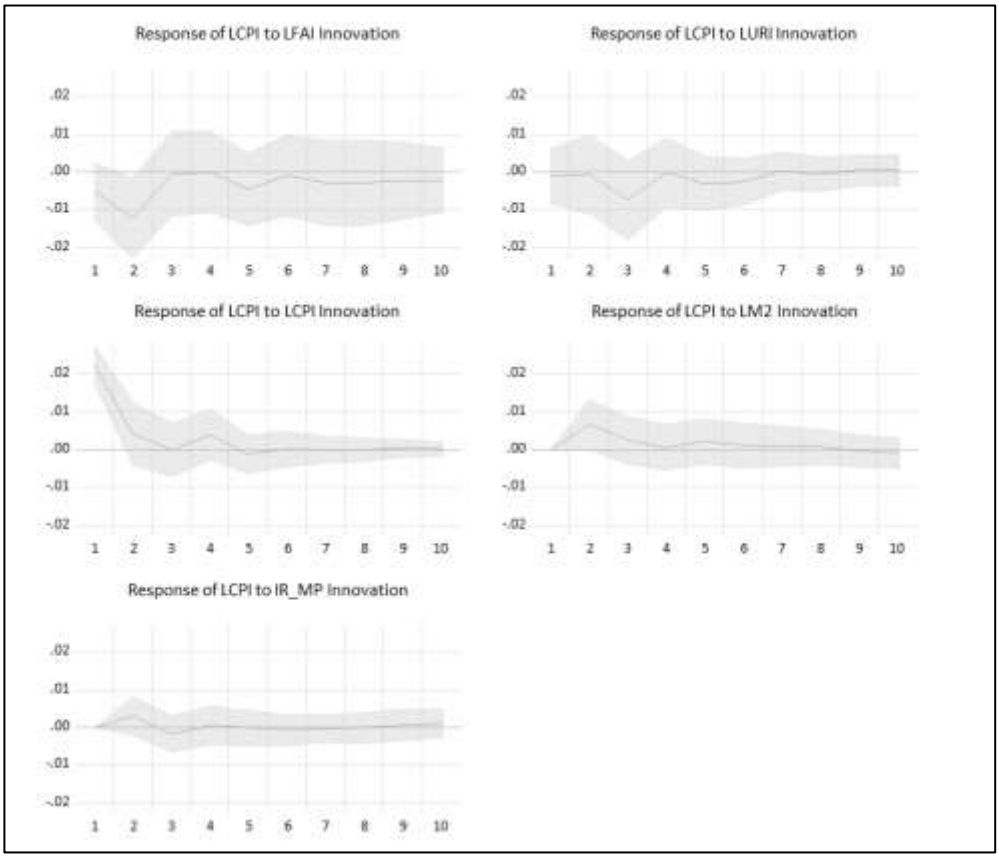


Figure 8: The response of LCPI to structural shocks in the VAR (alternative Cholesky ordering)

Figure 9 demonstrates that fixed asset investment exhibits a statistically significant reaction to policy rate structural shocks in the third to fifth quarter after the shock. Additionally, Figure 10 affirms that money supply also statistically reacts to the policy rate shock in the second and third quarter after its detection. In essence, this paper supports the indirect effect of policy rate on inflation via fixed assets investment and money supply, consistent with the findings in the baseline estimation.

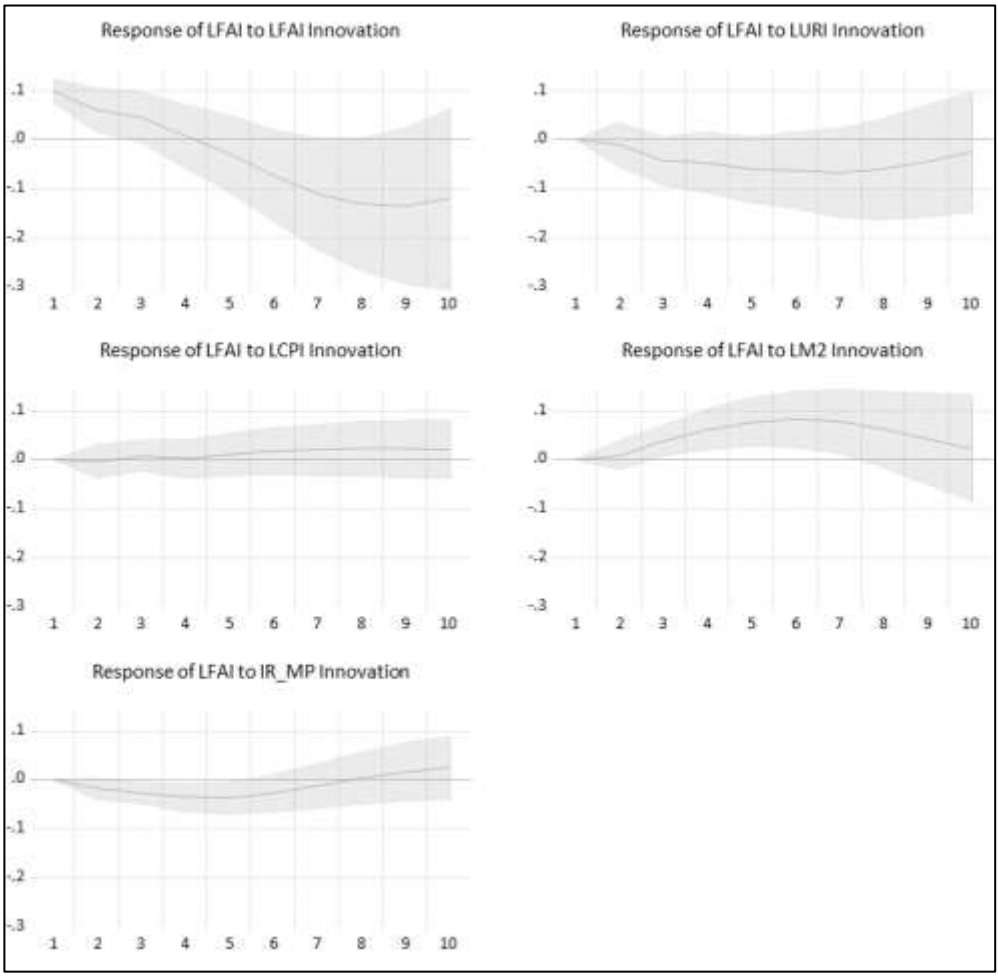


Figure 9: The response of LFAI to structural shocks in the VAR (alternative Cholesky ordering)

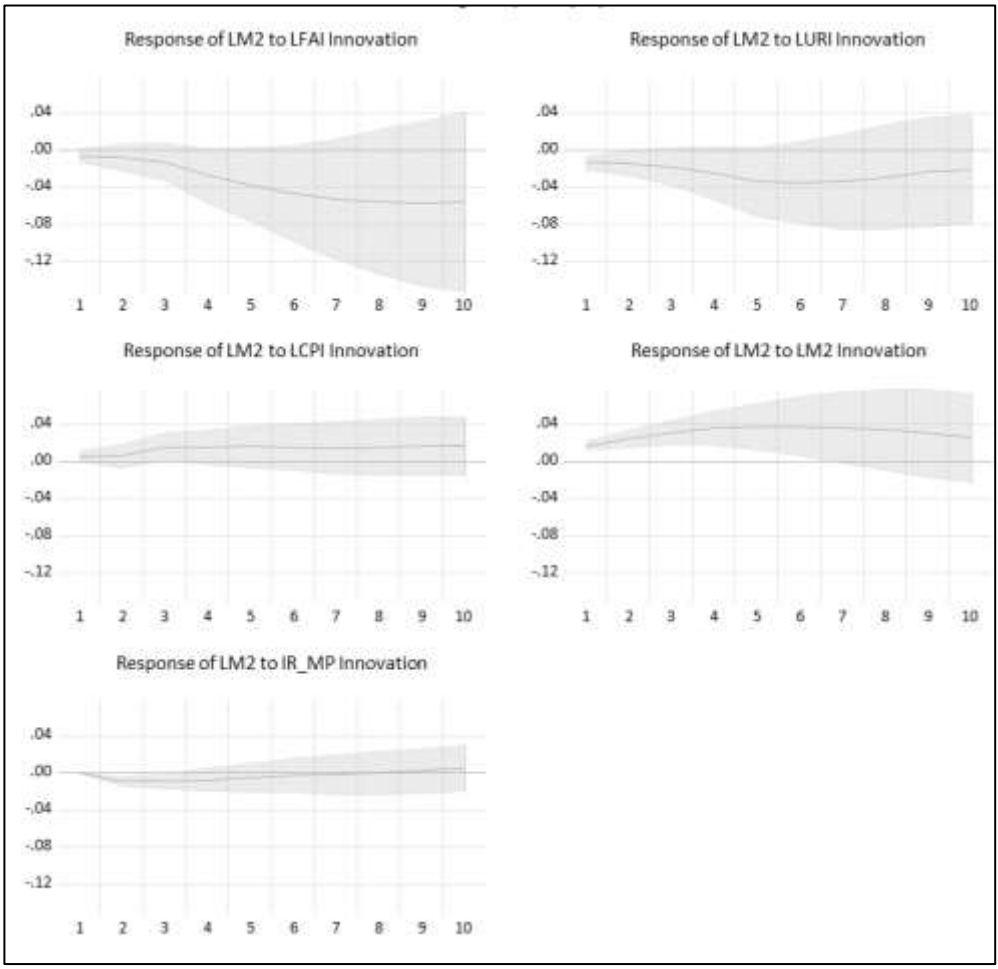


Figure 10: The response of LM2 to structural shocks in the VAR (alternative Cholesky ordering)

The concluding robustness analysis employs the Monte Carlo method with 1000 replications to calculate the standard error of Impulse Response Functions (IRF). As illustrated in Figure 11, inflation is once again found not to statistically react to policy rate structural shocks. However, inflation does exhibit a statistically significant negative response to a structural shock in fixed asset investment in the first and second quarters after the occurrence of that shock. Additionally, money supply has a statistically significant impact on inflation in the second quarter after the shock.

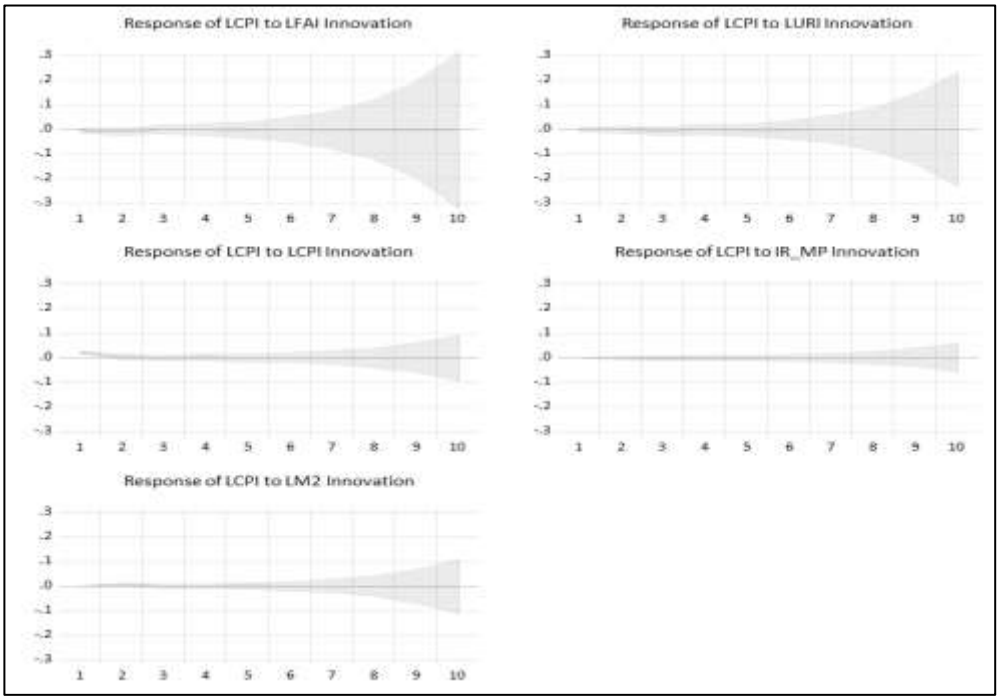


Figure 11: The response of LCPI to structural shocks in the VAR (Monte Carlo)

Examining Figure 12, a structural shock in policy rate induces a drop in fixed asset investment in the third and fourth quarters following the shock. Moreover, Figure 13 indicates that money supply statistically reacts from the first to the fourth quarter after a policy rate shock. Consequently, we can conclude that the indirect effect of policy rate on inflation is observable through its impact on fixed asset investment and money supply.

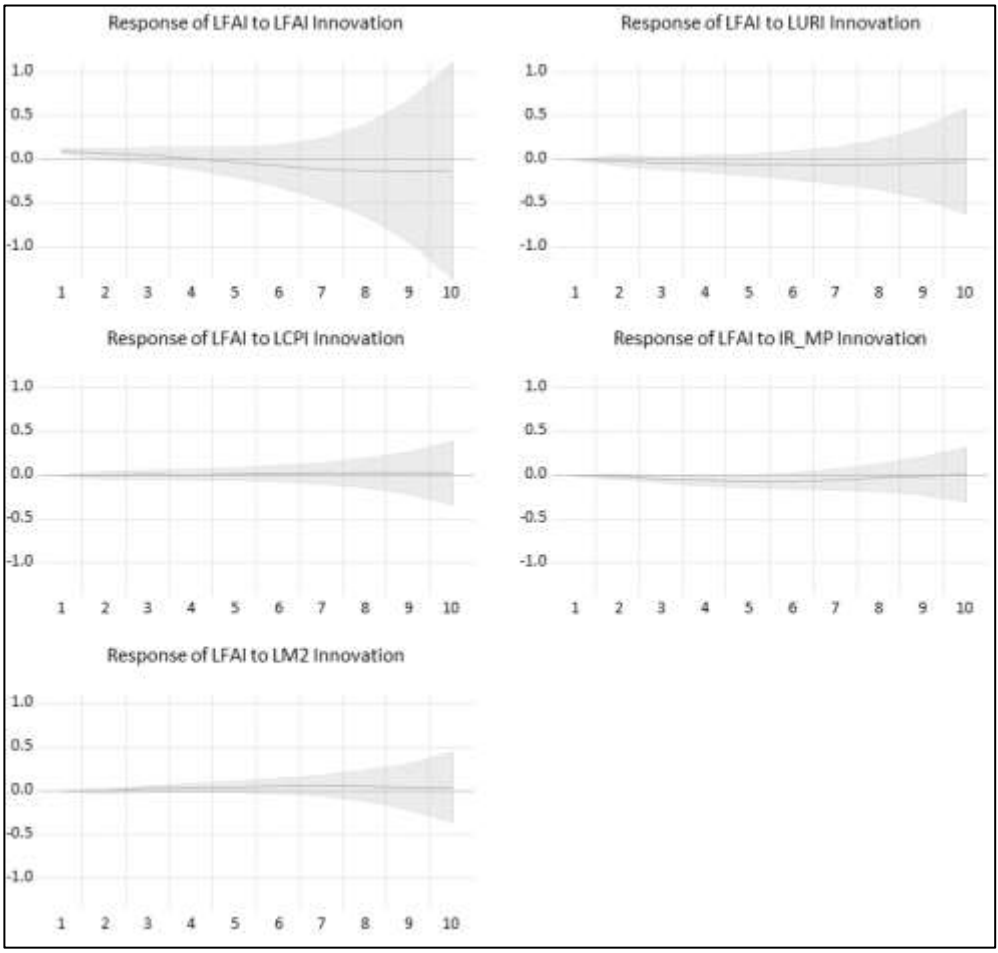


Figure 12: The response of LFAI to structural shocks in the VAR (Monte Carlo)

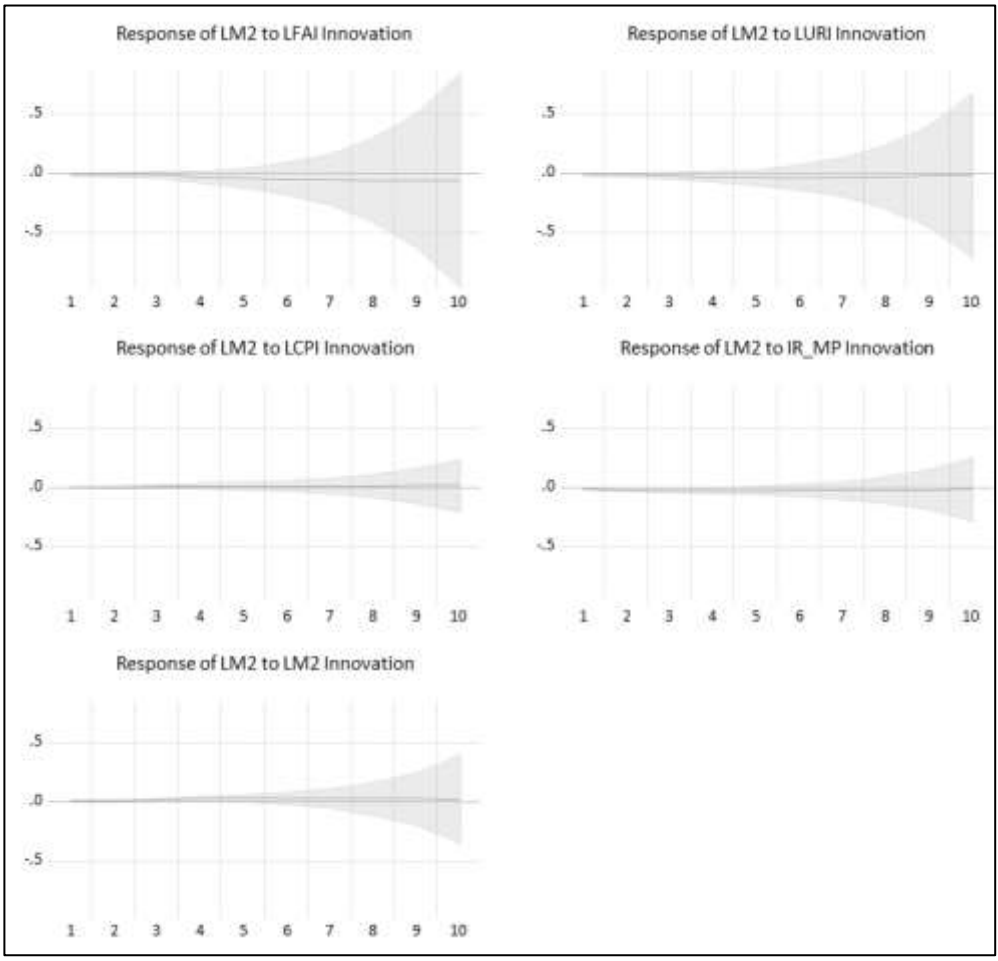


Figure 13: The response of LM2 to structural shocks in the VAR (Monte Carlo)

Conclusively, all robustness analyses align closely with the baseline model's findings, affirming that monetary policy's impact on inflation is predominantly indirect through its influence on investment and money supply. These results are consistent with recent studies, such as Wang (2020), underlining the significance of the indirect effects of monetary policy on the Chinese economy, particularly its impact on inflation in Xinjiang. A well-crafted monetary policy, as advocated by Doan Van (2019), plays a crucial role in maintaining a delicate balance between development and inflation for the province.

5. Conclusion and Implications

As the largest province in China, Xinjiang's economic performance lags behind the national average while grappling with inflation rates higher than the national average. This places a considerable financial burden on citizens, as evidenced by the consumption-to-disposable-income per capita ratio. Geopolitical pressures, such as accusations of forced labor in the U.S., coupled with the anticipated slowdown of the Chinese economy in the near and medium terms, further compound the challenges.

The recent monetary policy shift in China, involving a loosening of monetary policy, is aimed at supporting economic development. This strategy includes lowering interest rates,

reducing reserve requirement ratios, and injecting more financing into the economy, leading to an observable increase in money supply.

However, while a loosening monetary policy is expected to stimulate the economy, the potential drawback is higher inflation, as indicated in the literature. Nonetheless, inflation is not an inevitable consequence and depends on various economic characteristics. This motivates the need for a disaggregated analysis at the provincial level, specifically in Xinjiang, rather than an aggregate analysis of the entire Chinese economy, to provide a more nuanced understanding of the relationship between monetary policy and inflation.

To achieve the research objectives, this paper employs a VAR approach with annual data from 1994 to 2020. The findings indicate that the monetary policy rate significantly contributes to inflation in Xinjiang Province. However, these impacts are predominantly indirect, affecting fixed asset investment and money supply. These conclusions hold across three robustness tests, affirming the reliability of the policy rate's impact on inflation in the province.

The findings affirm the validity of the quantity theory of money in Xinjiang, asserting that an augmented money supply corresponds to inflation. Additionally, they align with recent research emphasizing the significance of indirect impacts resulting from monetary policy. This underscores the importance of precision when implementing a monetary loosening strategy, especially in regions like Xinjiang with consumption ratios surpassing the national average. While easing monetary policy is pivotal for bolstering economic development, a nuanced and carefully calibrated approach is imperative to concurrently stimulate growth and mitigate the impact on living costs.

Given that monetary easing indirectly leads to inflation through fixed asset investment and money supply, policymakers must adopt a more targeted approach to ensure that expansionary measures stimulate growth without fueling excessive inflation. Prevent excessive credit expansion from destabilizing the economy is therefore crucial. Instead of broad-based liquidity injections, monetary expansion should be strategically directed toward sectors that drive sustainable development, such as infrastructure, technology, and high-value manufacturing, ensuring that capital flows into projects with high economic returns rather than inefficient or overheated sectors. Meanwhile, to manage the impact of increased money supply, liquidity controls and financial supervision should be strengthened to prevent inflationary spillovers, particularly in regions like Xinjiang, where higher consumption ratios amplify the effects of monetary expansion. This can be achieved through gradual and data-driven liquidity adjustments, complemented by fiscal measures such as targeted subsidies or tax incentives to support household purchasing power without overheating the economy.

While this study is based on data from 1994 to 2020, its findings remain relevant for post-pandemic monetary policy analysis, particularly in understanding the indirect effects of monetary easing on inflation. The fundamental relationship between money supply, investment, and inflation persists beyond 2020, as monetary transmission mechanisms continue to operate through financial markets, credit allocation, and investment flows.

Post-pandemic economic conditions, however, have introduced new complexities, such as supply chain disruptions, shifts in global trade, and prolonged deflationary pressures in China. These factors necessitate a more calibrated monetary approach, reinforcing the importance of targeted liquidity injections and sector-specific investment strategies—key insights derived from this study. Furthermore, China’s recent monetary easing measures, including interest rate cuts and increased money supply post-2020, align with historical trends observed in the dataset, validating the applicability of these findings in assessing potential inflationary outcomes in the current economic landscape.

Thus, while structural shifts have occurred, the findings in this study remain relevant. Future research can expand upon these findings by incorporating post-2020 data to capture evolving policy impacts, but the existing results still provide a strong analytical foundation for understanding how monetary expansion influences inflation in regional economies like Xinjiang.

References

Adu, G., & Marbuah, G. (2011). Determinants of inflation in Ghana: An empirical investigation. *South African Journal of Economics*, *79*(3), 251-269.

Angelia, S., & Nugraha, N. M. (2020). Effects of monetary policy on inflation and national economy based on analysis of Bank Indonesia annual report. *Technium Social Sciences Journal*, *10*, 423–435.

Ascari, G., Bonam, D., & Smadu, A. (2024). Global supply chain pressures, inflation, and implications for monetary policy. *Journal of International Money and Finance*, *142*, 103029.

Bhattacharya, R., & Jain, R. (2020). Can monetary policy stabilise food inflation? Evidence from advanced and emerging economies. *Economic Modelling*, *89*, 122–141.

Cukierman, A. (2017). Money growth and inflation: Policy Lessons from a comparison of the US since 2008 with hyperinflation Germany in the 1920s. *Economics Letters*, *154*, 109–112.

Dickinson, D., & Liu, J. (2007). The real effects of monetary policy in China: An empirical analysis. *China Economic Review*, *18*(1), 87–111.

Doan Van, D. (2019). Money supply and inflation impact on economic growth. *Journal of Financial Economic Policy*, *12*(1), 121–136.

Dua, P., & Goel, D. (2021). Determinants of inflation in India. *The Journal of Developing Areas*, 55(2).

Enock N. T., & Nicholas M. O. (2018). Monetary Policy and Economic Growth: A Review of International Literature, *Journal of Central Banking Theory and Practice*, *7*(2), 123-137.

Fernald, J. G., Spiegel, M. M., & Swanson, E. T. (2014). Monetary policy effectiveness in China: Evidence from a FAVAR model. *Journal of International Money and Finance*, *49*(A), 83–103.

Hu, L., Han, J., & Zhang, Q. (2018). The Impact of Monetary and Fiscal Policy Shocks on Stock Markets: Evidence from China. *Emerging Markets Finance and Trade*, *54*(8), 1856–1871.

International Monetary Fund. (2022). Countering the cost-of-living crisis. *World Economic Outlook Report October 2022*. Retrieved from https://www.imf.org/en/Publications/WEO/Issues/2022/10/11 /world-economic-outlook-october-2022

International Monetary Fund. (2024a). *IMF Executive Board concludes 2023 Article IV consultation with the People's Republic of China*. Retrieved from https://www.imf.org/en/News/Articles/2024/02/01/pr2433-china-imf-executive-board-concludes-2023-article-iv-consultation

International Monetary Fund. (2024b). *People's Republic of China: Selected issues*. (IMF Staff Country Reports No. 276).

Jia Z. X., & Liu C. Y. (2011). Empirical Analysis of price Influencing factors in Xinjiang - from the perspective of basic vector autoregressive model, *Zhong Guo Wu Jia*, *2011*(09), 14 -16.

Jiang, L., Chen, Y., & Zhang, L. (2024). Monetary policy surprises and corporate investment growth in China. *Economic Modelling*, *131*, 106615.

Kandil, M., & Morsy, H. (2015). Determinants of inflation in GCC. *Middle East Development Journal*, *3*(2), 141-158.

Karras, G. (1992). Investigation of the long-run quantity theory of money relationship. *International Review of Economics & Finance*, *1*(2), 159–168.

Li, Y. (2008). 30 years of financial reform and opening up in China: History, achievements, and further development. *Finance and Trade Economics*, *11*, 38–52.

Makin, A. J., Robson, A., & Ratnasiri, S. (2017). Missing money found causing Australia's inflation. *Economic Modelling*, *66*, 156–162.

Mehrotra, A., Peltonen, T., & Santos Rivera, A. (2010). Modelling inflation in China—a regional perspective. *China Economic Review*, *21*(2), 237–255.

Min, F., Wen, F., & Wang, X. (2022). Measuring the effects of monetary and fiscal policy shocks on domestic investment in China. *International Review of Economics & Finance*, *77*, 395–412.

Moazzami, B., & Gupta, K. L. (1995). The quantity theory of money and its long-run implications. Journal of Macroeconomics, *17*(4), 667–682.

Mohanty, D., & John, J. (2015). Determinants of inflation in India. *Journal of Asian Economics*, *36*, 86-96.

Moser, G. (1995). The main determinants of inflation in Nigeria. *IMF Economic Review*, *42*, 270–289.

National Financial Regulatory Administration. (2023). *The major regulatory indicators data for the banking sector in Xinjiang for the first half of 2023*. Retrieved from https://www.cbirc.gov.cn/branch/xinjiang/view/pages/common/ItemDetail.html?docId=1119482&itemId=2131

Oloko, T. F., Ogbonna, A. E., Adedeji, A. A., & Lakhani, N. (2021). Oil price shocks and inflation rate persistence: A fractional cointegration VAR approach. *Economic Analysis and Policy*, *70*, 259–275.

Pan, G. (2024, June 19). *China's current monetary policy stance and evolution of monetary policy framework in the future* [Keynote speech]. 15th Lujiazui Forum, Shanghai.

Pokrovskii, V. N., & Schinckus, C. (2016). An elementary model of money circulation. *Physica A: Statistical Mechanics and Its Applications*, *463*, 111–122.

Rakhmat, M. Z. (2022). Getting nods from the Muslims: China's Muslim diplomacy in Indonesia. *International Journal of China Studies*, *13*, 237-264.

Reynard, S. (2023). Central Bank balance sheet, money and inflation. *Economics Letters*, *224*, 111028.

Sabade, S. (2014). Is money supply the cause of inflation in India? an alternative postulate to understand inflation. *Procedia - Social and Behavioral Sciences*, *133*, 379–382.

Sun, R. (2013). Does monetary policy matter in China? A narrative approach. *China Economic Review*, *26*, 56–74.

The People's Bank of China. (2024). *The People's Bank of China has decided to lower the reserve requirement ratio for financial institutions and the rediscount and re-lending interest rates for supporting agriculture, rural areas, and small businesses*. Retrieved from http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/5217425/index.html

The State Council Information Office of the People's Republic of China. (2022). *Xinjiang Holds Press Conference on Financial Operation Situation in 2022*. Retrieved from http://www.scio.gov.cn/xwfb/dfxwfb/gssfbh/xj_13856/202303/t20230320_708458.html

The State Council Information Office of the People's Republic of China. (2023). *Xinjiang Holds Press Conference on Financial Operation Situation for the first half year*. Retrieved from http://www.scio.gov.cn/xwfb/dfxwfb/gssfbh/xj_13856/202308/t20230823_765852.html

Twinoburyo, E. N., & Odhiambo, N. M. (2018). Monetary policy and economic growth: A Review of International Literature. *Journal of Central Banking Theory and Practice*, *7*(2), 123–137.

U.S. Customs and Border Protection. (n.d.). *Uyghur forced Labor Prevention Act*. Retrieved from https://www.cbp.gov/trade/forced-labor/UFLPA

Wang, L., & Zhu, T. (2021). Population aging and money demand. *Economics Letters*, *206*, 109984.

Wang, Y., Tu, Y., & Chen, S. X. (2016). Improving inflation prediction with the quantity theory. *Economics Letters*, *149*, 112–115.

Wang, Z. Y. (2020). Will the new Infrastructure Plan lead to price increase?. *Journal of Guangdong Institute of Public Administration*, *32*(6), 85-94.

Xu. L. (2015). Analysis of the reasons why Xinjiang's Price is higher than the national average level. *Jin Mao Shi Jian*, *2015*(07), 63.

Yang, T., Dong, Q., Du, M., & Du, Q. (2023). Geopolitical risks, oil price shocks and inflation: Evidence from a TVP–SV–VAR approach. *Energy Economics*, *127*, 107099.

Zaidi, M. A. S., Karim, Z. A., & Azman-Saini, W. N. W. (2016). Relative Price Effects of Monetary Policy Shock in Malaysia: A SVAR Study. *International Journal of Business and Society*, *17*(1), 47 – 62.

Zhang, C. (2010). Inflation uncertainty and monetary policy in China. *China & World Economy*, *18*(3), 40-55.

Zhang, C. (2011). Inflation persistence, inflation expectations, and monetary policy in China. *Economic Modelling*, *28*(1–2), 622–629.

Zhao, J., Chen, X., & Hao, Y. (2018). Monetary policy, government control and Capital Investment: Evidence from China. *China Journal of Accounting Research*, *11*(3), 233–254.

Zhou Q. Q. & Meng Y. L. (2018). Empirical analysis of the impact of Money supply on prices in China. *Hong Guan Jing Ji Yan Jiu*, *2018*(03), 25-32.