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Monetary Policy Transmission and Policy Coordination in China

Sonali Das and Wenting Song

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Monetary Policy Transmission and Policy Coordination in China
Prepared by Sonali Das and Wenting Song*

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ABSTRACT: We study the transmission of conventional monetary policy in China, focusing on the interaction between monetary and fiscal policy given the unique institutional set-up for macroeconomic policy making. Our results suggest some progress but also continued difficulties in the transmission of monetary policy. Similar to recent studies, we find evidence of monetary policy pass-through to interest rates. However, the impact of monetary policy measures that are not coordinated with fiscal policy is significantly weaker than that of coordinated measures. This suggests the need for further improvements to the interest-rate based framework.

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Contents

1.	INTRODUCTION	4
2.	MONETARY POLICY FRAMEWORK.....	6
3.	RELATED LITERATURE	7
4.	DATA AND DESCRIPTIVE STATISTICS.....	11
	A. Data.....	11
	B. Monetary shocks.....	11
	C. Monetary-fiscal coordination: Text-based measure.....	14
5.	EMPIRICAL MODELS.....	16
	A. Local projections.....	16
	B. External-instrument Structural VAR.....	17
6.	RESULTS.....	18
	A. Local projections – transmission to interest rates	18
	B. External instrument SVAR – aggregate effects of monetary shocks.....	21
7.	CONCLUSION	22
	REFERENCES	37

FIGURES

1: Interest Rate Corridor	27
2: Time Series of Monetary Shocks	27
3: Monetary Shocks and Changes in Monetary Instruments	28
4: Illustration of IRS Movements around Monetary Event	29
5: LDA Output for Weekly State Council Meetings	30
6: LDA Output for Weekly State Council Meetings: Selected topics	31
7: Dynamic Responses to Monetary Shocks	32
8: Aggregate Responses to Monetary Shocks	36

TABLES

1: Stylized Comparison of PBC’s Monetary Policy Framework	24
2: Liquidity of IRS by Instrument	24
3: Movements in IRS	25
4: Monetary and Fiscal Keywords	25
5: Movements in IRS by Coordination Type	26
6: Effects of Monetary Policy on Interest Rates	26

1. Introduction

China's monetary policy framework has been gradually transitioning to a standard interest-rate based framework. De jure interest rate liberalization was largely completed with the removal of the ceiling on deposit rates in 2015,¹ alongside which a new interest rate corridor was developed (shown in Figure 1). While the financial system remains largely bank-based, the government has regularly implemented measures to develop financial markets, including to open up China's bond market (see e.g. Schipke et al. 2019). Accordingly, a growing literature finds that monetary policy transmission in China is becoming more like that of advanced economies, with monetary policy increasingly transmitting through interest rates and policy rates now having a larger effect than monetary aggregates on economy activity (Fernald et al. 2014; Harjes 2017; Kamber and Mohanty 2018; Kim and Chen 2019). Two factors, however, complicate the analysis of monetary transmission in China. First, the monetary framework remains complex, with a lack of clarity on several aspects of the framework and multiple monetary policy instruments in use (see next section). Second, the unique institutional set-up for macroeconomic policy making, with the State Council as the ultimate decision-making body, results in a high degree of coordination between monetary and fiscal policies.

In this paper, we study monetary policy transmission in China accounting for these two features. First, we construct a series of monetary shocks using the high-frequency identification approach developed for the U.S. (Cook and Hahn 1989; Gorodnichenko and Weber 2016). Extending the methodology in Kamber and Mohanty (2018), we construct monetary shocks based on daily changes in interest rate swap (IRS) rates, which reflect market expectations of the underlying policy rate, around the date of monetary policy events. These changes in the IRS rates around a narrow window give a measure of the surprise, or "shock", component of the corresponding monetary policy event. This approach to constructing monetary policy shocks helps address the first challenge of studying monetary policy transmission in China, as the shocks are comparable across different monetary policy instruments. The set of monetary policy events we include in

¹ China undertook interest rate liberalization gradually over a about twenty years from the mid-1990s to 2015. Restrictions on money market and bond market rates were removed first, by 1999, followed by the removal of floors on deposit rates and ceilings on lending rates in 2004. Floors for lending rates were removed in 2013, and ceilings for deposit rates removed in 2015.

constructing the shocks incorporates the People's Bank of China's (PBC) four main policy instruments: the required reserve ratio for banks (RRR), benchmark bank deposit and lending rates, the medium-term lending facility (MLF) rate, and the PBC 7-day reverse repo rate. As a separate, broader measure of monetary policy, we also include the release of PBC's quarterly monetary policy reports, reforms in foreign exchange policy, and other changes to the MLF, in addition to the main policy instruments. To address the second challenge, we then employ textual analysis of the State Council website to measure coordination between monetary and fiscal policy. Textual analysis has been increasingly used to study policy communications (Hansen et al., 2018). Using a dictionary-based approach, we search through news and meeting releases from the State Council for keywords relating to monetary and fiscal policies. We use joint occurrences of monetary and fiscal keywords to determine whether a monetary policy shock is coordinated with fiscal policy.

With the high-frequency monetary shocks and text-based measure of monetary-fiscal coordination, we study the empirical effects of monetary policy on a range of interest rates including interbank rates, central and local government bond yields, and corporate bond spreads. Our results suggest some progress but also continued difficulties in the transmission of monetary policy. Similar to recent studies, we find evidence of monetary policy pass-through to interest rates. However, the impact of monetary policy measures that are not coordinated with fiscal policy is significantly weaker than that of coordinated measures. When uncoordinated measures do pass-through to interest rates, they have shorter-lived effects than the persistent effects of coordinated measures. We also find evidence of monetary transmission to aggregate economic variables when taking fiscal policy into account.

Our main contributions to the literature on China's monetary policy are threefold. First, we account for the unique nature of Chinese policymaking, whereby monetary and fiscal policy measures are often coordinated. Previous studies that have not incorporated the often coincident implementation of accommodative monetary policy and fiscal measures are likely to have been mis-specified and overestimated the effects of monetary policy. Second, we employ the recent high-frequency approach to identifying monetary policy shocks for China. As China's monetary policy transmission starts to become more interest-rate based, the high-frequency monetary policy shocks we construct in this paper provide a useful empirical measure for future research.

Third, we carefully catalogue monetary policy events in China across the range of policy instruments, building on the work of Kamber and Mohanty (2018).

The rest of the paper proceeds as follows. In section 2 we start by discussing the unique aspects of China's monetary policy framework. Section 3 surveys the literature on monetary policy transmission in China. Section 4 introduces the monetary policy shocks and text-based measure of monetary-fiscal coordination, and section 5 discusses the data sources and empirical models employed: local projection and external instrument structural VAR. The results are presented in section 6, starting with the local projection estimates of monetary transmission to various interest rates and the differential effects of monetary policy shocks that are coordinated and uncoordinated with fiscal policy, and finishing with the findings from the structural VAR of monetary transmission to the aggregate economy. Section 7 concludes and discusses policy implications.

2. Monetary Policy Framework

China's monetary policy framework is complex, with multiple objectives, targets, and instruments (see Table 1, and Jones and Bowman 2019). Although communications have improved (McMahon, Schipke, and Li 2018), a lack of clarity remains on several parts of the framework, particularly on the nominal anchor (intermediate target). The previous official intermediate target, M2 growth, was de-emphasized in 2017 but has not been formally replaced with a new intermediate target. The PBC had begun treating the 7-day interbank repo rate, known as "DR007", as the de facto target rate around the same time (Harjes 2016).² However, the improvements to the loan prime rate (LPR) regime that were introduced in mid-2019 elevated the importance of the MLF rate, making it the main medium-term policy rate. Previously, the PBC's main short-term policy rate, the PBC 7-day reverse repo rate, which has DR007 as its target, had been seen as the rate that would become the key policy rate when benchmark lending rates were phased out. Overall, there are many policy instruments that appear to be aimed at several intermediate targets.

² From late 2016, the PBC's Monetary Policy Reports featured increasing discussion of the 7-day interbank repo rate (specifically, the volume-weighted daily average of repo transactions between depository institutions, known as DR007).

Moreover, the institutional set-up for macroeconomic policy making in China is unique. The State Council³ (SC) is the decision-making body and the PBC does not have full operational (instrument) independence. The PBC's recommendations carry significant weight in the SC, but decisions on key monetary policy matters are collective and are often taken in the context of a larger policy decisions. From Article 5 of the PBC Law:

“The People’s Bank of China shall report its decisions to the State Council for approval concerning the annual money supply, interest rates, foreign exchange rates and other important matters specified by the State Council before they are implemented.”

This decision-making structure limits the ability of the PBC to shape market expectations through forward guidance. The monetary policy committee of the PBC exists as a consultative body. It meets quarterly but does not pre-announce the dates of its meetings, and usually issues a press release a few days after meetings.

3. Related Literature

In the vast literature on monetary policy transmission, our paper falls methodologically in the category of papers that identify monetary policy shocks using a high-frequency approach and financial market information (Cook and Hahn 1989; Kuttner 2001; Gürkaynak, Sack and Swanson 2004).⁴ Studies of monetary policy transmission in China can be grouped into (i) earlier studies that seek to understand the framework and analyze how remnants of the regulated interest rate era continue to affect transmission, and (ii) more recent studies that compare the effects of different policy instruments and search for evidence of the new interest-rate channel of transmission.

³ China's 13th SC consists of 35 members: the Premier, Vice Premiers, heads of 25 ministries, and the Governor of the PBC. The Standing Committee of the SC consists of 10 members, not including the heads of most ministries and the PBC Governor. The whole SC meets biannually or an ad hoc basis, while the Standing Committee meets weekly.

⁴ Recent papers using this approach to study the effects of U.S. monetary policy include Gorodnichenko and Weber 2016, Nakamura and Steisson 2018, Ottonello and Winberry 2020. In the international context, they include Cesa-Bianchi, Thwaites and Vicendoa 2020 for U.K. and Corsetti, Duarte and Mann 2018 for the Euro area.

Interest rate liberalization in progress and policy transmission

As a result of the multiple objectives and monetary policy instruments in use, several earlier empirical studies focused solely on measuring or estimating the stance of monetary policy and then uncovering the key economic variable to which it responds (e.g., Xiong 2012). The contemporaneous theoretical literature aimed at understanding how different unique aspects of China's monetary policy framework affected transmission. Ma (2017) summarizes previous work with others that shows how remnants from the previous quantity-targeting and price control monetary regimes still weaken interest rate transmission. This includes the models of Ma and Wang (2014) and Ma et al (2015) which demonstrate how multiple factors – the loan-to-deposit ratio, quantitative loan limits, the then-high RRR, soft budget constraints on some borrowers, and regulatory arbitrage by shadow banks – all contributed to weakening interest rate transmission.

A strand of the literature has emphasized how the “dual-track” interest-rate system – with *regulated* bank deposit and lending rates and *market-determined* money market and bond rates – combined with multiple monetary policy instruments. He and Wang (2012) model the dual system and show that (i) the transmission of monetary policy instruments to market interest rates, together with the indicative credit target in the banking system, were ultimately the means by which monetary policy affected the real economy, and (ii) in this framework, market rates responded to changes in the (then) policy benchmark deposit rate and RRR, but not to open market operations. Porter and Xu (2016) find empirical evidence consistent with this, estimating an EGARCH model for seven-day interbank repo rates and finding that the levels and volatility of (market-determined) interbank rates are affected by changes to both regulated bank interest rates and the RRR. The implication of these papers was that further deposit rate liberalization would be needed to allow for a short-term policy interest rate to be effective in transmitting to short-term interbank rates and beyond. Hoyle and Jeasakul (2020) elaborate on how interest rate guidance policies continue to affect the pass-through of policy interest rates to bank funding costs.

Focusing on the bank-lending channel against this backdrop of regulated deposit and lending rates, He and Wang (2013) analyze loan-level data and find that the loan rates were affected by other (both regulated and market-determined) interest rates but that loan size instead responded

to an implicit quota imposed on aggregate bank lending. Chen et al (2017) use a Qual VAR, a conventional VAR system augmented with binary policy announcements to extract a latent indicator of tightening and easing pressure, and find that the transmission of monetary policy impulses to the rest of the economy is similar to the transmission process in advanced economies in terms of both output growth and inflation, but that bank lending is not sensitive to policy changes. Kaiji, Ren, and Zha (2018) study how monetary policy in China has influenced banks' shadow-banking activities, finding that the effectiveness of contractionary monetary policy after the 2009 stimulus was hampered as it contributed to a rapid rise in shadow banking loans. In a further study of the impact of the 2009 monetary stimulus, Chen et al (2020) focus on its interaction with infrastructure spending and find that infrastructure investment driven by non-monetary factors enhanced the monetary transmission to bank credit allocated to local government financing vehicles (LGFVs) in infrastructure, and at the same time weakened the impact of monetary stimulus on bank credit to non-state owned enterprises (SOEs) in non-infra manufacturing sectors. Outside of the manufacturing sector, however, monetary stimulus did not favor SOEs over non-SOEs in credit access.

Recent studies of China's monetary policy transmission

With the deregulation of deposit and lending interest rates complete in 2015 and the beginning of the PBC's interest rate corridor, recent literature on China's monetary policy has focused on studying the transmission through the various policy instruments and trying to identify an interest-rate channel of transmission. Fernald et al (2014) use a broad set of economic indicators and a dynamic factor model to estimate Chinese economic activity and inflation as latent variables, and then incorporate the estimated latent variables into a factor-augmented vector autoregression (FAVAR). They find that increases in RRR reduce economic activity and inflation, consistent with previous studies, but also that changes in interest rates have substantial effects on economic activity and inflation, while other measures of changes in credit conditions, such as shocks to M2 or loan levels, do not once other policy variables are taken into account. Harjes (2017) also finds a significant impact of changes in the PBC's policy rates on economic activity, and with some lag, on prices, in a quarterly VAR analysis. Kim and Chen (2019) take a SVAR approach, incorporating relationships between the various monetary policy instruments and targets, and find that benchmark lending rates and short-term interest rates have had a larger effect on activity than the RRR, particularly in recent years. Kamber and Mohanty (2018), on

which this paper builds, build a measure of monetary policy surprises using financial market data and find that policy surprises have persistent effects on interest rates and that contractionary surprises significantly reduce inflation and economic activity. Overall, these studies characterize monetary policy in China and its transmission as becoming more like that of advanced economies.

Jones and Bowman (2019) counter that, while monetary policy in China has evolved significantly over time, assertions that it operates similarly to advanced economies are narrowly based. They provide a comprehensive stock-taking of the evolution of monetary policy in China along several dimensions – the institutional, operational, and communication frameworks, as well as the empirical behavior of monetary policy pass-through. On the PBC’s communications, they document considerable evolution of the framework, with a number of elements now similar to those observed in advanced economies, and remaining differences relating to institutional constraints over forward guidance (and thus, the management of expectations), unexpected policy deliberations, and the difficulties in clearly characterizing the stance of monetary policy due to the large suite of policy instruments deployed by authorities. McMahon, Schipke and Li (2018) also find that significant progress has been made by the PBC in improving communications and guiding financial markets in recent years, but that communication is still evolving toward the level of other major economies.

To study the effects of collateral-based monetary policy tools, Fang, Wang, and Wu (2020) estimate the effects of the PBC’s one-off expansion in 2018 of bonds eligible to pledge as collateral for the MLF and find a sizeable decline in the spreads of the newly collateralizable bonds.

4. Data and Descriptive Statistics

A. Data

The data used in this study comes from a variety of sources. For interest rate swaps, the rates, nominal principal, and the number of deals traded are from Bloomberg. We hand collect the precise timestamps of monetary policy events from PBC's website. We scrape the weekly meeting and Premier news section of the SC website for texts of the news releases. Financial data on sovereign yields, bond yields, policy rates and interbank funding costs, together with macro variables including inflation and M2, are from CEIC. We then construct bond spreads for LGFVs, enterprise bonds, corporate bonds, medium term notes, and commercial paper by computing the differences between the yield and the treasury yield of matching maturities. Finally, we use two series on China constructed by IMF staff: the economic activity tracker (see IMF 2020, Box 3), a monthly measure of overall economic activity, and the economic-based “augmented” definition of the general government debt (which includes estimated off-budget investment spending).⁵

B. Monetary shocks

Methodology. Following Kamber and Mohanty (2018), we use a financial market measure to capture the unexpected component of monetary policy events. We measure the unexpected component of changes to monetary policy instruments as the daily close-to-close change in the rate on one-year interest rate swaps based on the interbank 7-day repo rate, around the date of policy announcements. The advantages of this measure are two-fold. First, it directly captures the “surprise” component of the policy change. Second, it provides a measure that is comparable across monetary policy instruments. We use the one-year swap maturity since the one-year and five-year swaps on the 7-day repo rate are the most liquid swaps traded in the market and the

⁵ IMF staff's economic-based “augmented” definition of the general government sector includes estimated off-budget investment spending. See Mano and Stokoe (2017).

one-year time frame corresponds more closely to the expected horizon of monetary policy effects.

The main monetary policy events we study are changes to the PBC's main policy instruments from 2008 onwards. There are:

- (i) the reserve requirement ratio (RRR), which is the share of banks' deposit kept in reserve with the PBC, including both broad-based changes and those targeted to a subset of banks,
- (ii) PBC's 7-day reverse repo rate, which is the policy rate at the center of the interest rate corridor,
- (iii) benchmark deposit and lending rates (LDR), which have not been changed since 2015 and are in the process of gradually being phased out but were in use in the earlier part of our sample, and
- (iv) the rate on the PBC's medium-term lending facility (MLF), which has become the main policy instrument by which to influence bank lending rates since mid-2019, when the LPR was linked to this policy rate.

We record the timing of announcements on changes to these instruments in order to construct the surprise measure using the IRS rate. To incorporate a broader range of monetary policy events beyond these policy rates, we also construct a "broad" measure of monetary shocks, which is based on the timing of:

- (v) quarterly releases of monetary policy reports,
- (vi) foreign exchange policy reforms, and
- (vii) recent changes to the MLF, which include a change to the eligible collateral and the establishment of a targeted lending facility.

It is natural to connect the quarterly monetary policy report to its US counterpart – Federal Open Market Committee (FOMC) meeting releases. However, since the monetary policy committee of the PBC exists as a consultative body (as described in section II), we only include the monetary policy report releases in the broad measure, not in the main measure. Foreign exchange policy and monetary policy are closely related since the renminbi is still carefully managed, even though it has become more flexible over time (Das 2019). The adjustment of collateral accepted

for using the MLF and the establishment of a targeted MLF for rural and micro-to-small banks indirectly affect the amount of lending available through the facility, and thus we include the changes as part of a broader change in monetary stance.

Figure 2 shows the time series of the monetary shocks constructed with the 1-year and 5-year IRS based on 7-day repo and also the deviation of economic activity from trend estimated with high-frequency data by IMF staff (see IMF 2020, Box 3).⁶ The figure shows that PBC's monetary policy has generally been countercyclical, with expansionary monetary shocks in downturns and contractionary shocks in expansions.

Validation. We first ensure the liquidity of the IRS on the instrument chosen to capture surprises in monetary policy stance. Table 2 shows the average nominal principal and number of deals traded over the sample period for the IRS of each of the 7-day repo and 3-month SHIBOR by tenor. The 1-year IRS based on 7-day repo is the most liquid by nominal principal traded and is therefore our preferred measure. The 5-year IRS based on 7-day repo has under half of the nominal principal traded but has the highest number of deals traded, and therefore we use it for robustness.

Next, the daily measure is validated by a shorter sample of higher-frequency data. High-frequency studies of monetary policy transmission in advanced economies use tick-by-tick data to construct 30 to 60-minute windows around announcements (Gorodnichenko and Weber 2016). For most of our sample period, China's tick-level data for IRS is available only to interbank market participants through a physical trading infrastructure. We check the validity of our daily measure, however, using minute-by-minute snapshots of IRS rates from Bloomberg for the monetary policy announcements in 2020. Figure 4 shows the IRS rates on April 4, 2020, when the PBC announced a cut in the RRR and the decision to cut the interest rate on excess deposit reserves (IOER). The RRR cut was previewed by the State Council several days before, on April 1. The figure illustrates that the PBC announcement date is when the market reacted to the change and a daily measure would sufficiently capture the market movements in response to

⁶ The China economic activity tracker (CTEA) measures the economic activity gap as the cyclical components of economic activities based on a multivariate state-space model with leading economic indicators.

monetary policy announcements. It also demonstrates the daily frequency sufficiently captures movements in China's IRS market attributable to surprises in monetary policy.

Summary Statistics. Turning back to the daily measure of monetary surprises, Table 3 shows movements in the IRS market for days with and without monetary policy events. It shows the IRS market is more volatile during event days than non-event days, consistent with the assumption that movements in the IRS market are driven by monetary policy during event days. The average absolute changes in IRS rates on days with policy events is 5 basis points, 2 basis points higher than on days without policy events. The standard deviation of IRS changes is 8 percent during event days, 3 percent higher than in non-event days.

Figure 3 shows movements in the IRS rate compared to changes in the underlying monetary instruments. IRS and the monetary instruments move in the same direction. Furthermore, changes in IRS provide a continuous measure of surprises in monetary policy even though changes in monetary instruments are usually in fixed increment, such as 25 basis points for the RRR.

C. Monetary-fiscal coordination: Text-based measure

We conduct dictionary-based frequency searches of China's State Council (SC) website to determine whether monetary policy measures are coordinated with fiscal policy. Our data source are the texts of news releases from the English version of State Council website⁷. As discussed in the introduction, SC is the decision-making body for China's macroeconomic policy. Its news releases are thus the most timely source of a substantial information on monetary and fiscal policies. The online archive begins in May 2013, thus our sample goes from May 2013 to April 2020. We include two sections from the SC website: the weekly SC meetings, which consists of 937 releases, and the "Premier News" section, which consists of 4883 releases.

As descriptive statistics on the unstructured text data, Figure 5 and Figure 6 show topics discussed in the news releases of SC weekly meetings. We use latent Dirichlet allocation (LDA),

⁷ Searching the text news releases from the English version of the website does not result in missing any relevant information on coordination since China's SC provides a high-quality official English translation of all news releases. It also allows a broader audience to understand the details of the text search.

an unsupervised learning method (Blei et al., 2003), to cluster words in SC meeting release into related topics. Each row in Figure 5 represents a topic as output of LDA, and the darkness of a cell represents the likelihood of a word to appear in that topic. Figure 6 shows selected topics, which highlight the policy priorities from State Council meetings. Notably, topic 5 and topic 12 represent monetary policy and fiscal policy, which further motivates the use of SC releases to construct measure of monetary-fiscal coordination.

We then search for joint fiscal and monetary keywords (see Table 4) and sort the monetary policy shocks into coordinated and uncoordinated, by quarter. Two main types of monetary-fiscal coordination emerge from the SC releases: joint measures focused on micro and small enterprises⁸, and accommodative monetary policy to provide supportive conditions for fiscal stimulus.⁹ Uncoordinated and coordinated monetary policy shocks are similar in size (see Table 5).

We also use another measure of monetary policy coordination, that captures the intensity of monetary policy. Specifically, monetary policy measures are considered to be coordinated when multiple monetary instruments are changed within a two-week span. This is done both to study the impact of a more intense monetary policy push, and also because this type of monetary action is more likely to be coordinated with fiscal policy and so provides a cross-check on our text-based coordination measure. The results (not shown) are similar to those presented below on the text-based measure.

⁸ For example, from the SC news release on June 20, 2018: “Premier Li Keqiang called for giving greater priority to small and micro businesses in providing affordable financing to energize businesses and boost employment. *The meeting approved a series of fiscal, tax and financial incentives.*”

⁹ For example, from the State Council news release on September 4, 2019: “All special local government bonds in this year’s quota must be issued by the end of September and disbursed to projects by the end of October. [...] The government will keep a prudent monetary policy with anticipatory adjustments and fine-tuning as appropriate. *Measures to reduce real interest rates will be implemented at a faster pace.*”

5. Empirical Models

A. Local projections

With the monetary policy shocks and measure of monetary-fiscal coordination, we have a framework which incorporates multiple monetary policy tools and policy coordination between monetary and fiscal authorities. We employ local projections (Jordà 2005) to estimate the effects of monetary policy shock on a variety of interest rates, for the main measure of monetary policy shocks to estimate the average responses to monetary shocks, as well as separately for coordinated and uncoordinated monetary policy shocks to measure the differential responses to monetary shocks that are coordinated and uncoordinated with fiscal policies.

Average response. First, for the impact of all monetary policy shocks we estimate:

$$\Delta_h y_{t+h,t-1} = \alpha_h + \beta_h v_t + \Gamma_h' \mathbf{Z}_t + \varepsilon_{h,t} \quad (1)$$

for horizon $h = 0, 1, 2, \dots, H$. where the dependent variable is measured as the change from the day before the shock to h periods after the shock, $\Delta_h y_{t-1,t+h} = y_{t+h} - y_{t-1}$. The dependent variables studied are interbank market rates, sovereign bond yields, and credit bond (bonds issued by non-financial firms) spreads, at various maturities. α_h is a constant, v_t is the daily monetary shock measure, and the control variables \mathbf{Z}_t are a measure of the output gap (the deviation of economic activity from trend, described in Section IV.B.) and inflation at a monthly frequency. For interpretability of empirical results, we invert the signs of monetary shocks, v_t , so that a positive shock corresponds to monetary expansion. The coefficients of interest are the β_h , the path of which traces the cumulative response of the dependent variable to the monetary policy shock.

Uncoordinated versus coordinated. Next, we estimate local projections separately for the uncoordinated and coordinated monetary policy shocks to gauge the effect of coordination on transmission:

$$\Delta_h y_{t+h,t-1} = \alpha_h^k + \beta_h^k v_t^k + \Gamma_h^{1k'} \mathbf{X}_t + \Gamma_h^{2k'} \mathbf{X}_t v_t^k + \varepsilon_{t,h} \quad , \quad k \in \{coord, uncoord\} \quad (2)$$

for horizons $h = 0, 1, 2, \dots$. The variables are as in equation (1) except for the including of two interaction terms, the monetary policy shock with the output gap and the monetary policy shock with inflation, to account for the possibility that monetary policy may have a different impact in a downturn.¹⁰ This is important to ensure that any potential differential effects found between coordinated and uncoordinated monetary shocks are not being driven by the state of economy activity. For each set of impulse responses, we present 90 percent confidence intervals for the average response (solid black line), as well as p-values for tests of the null hypothesis that the impulse response to coordinated monetary shocks is equal to the impulse response to uncoordinated monetary shocks for all horizons (the corresponding F-tests are implemented as in Coibion et al (2017)). We use $H=30$ days for each impulse response.

B. External-instrument Structural VAR

To study the macroeconomic response to monetary policy and policy coordination, we employ the external instrument structural VAR approach as in Mertens and Ravn (2013) and Gertler and Karadi (2015). When monetary and fiscal variables are both present in a structural VAR system, the ordering of variables for Cholesky decomposition becomes challenging, monetary and fiscal variables would be endogenous to each other, particularly with the high degree of policy coordination. To address this challenge, we use the high-frequency monetary policy shock series as an external instrument for monetary policy. The identifying assumption is that, within the day, all surprises to IRS are driven by monetary policy news.

Our specification follows Gertler and Karadi (2015) with the structural VAR:

$$AY_t = c + \sum_{j=1}^p C_j Y_{t-j} + \varepsilon_t \quad (3)$$

where Y_t is a vector of macroeconomic, fiscal and financial variables included in the VAR. The reduced form VAR is given by:

$$Y_t = c + \sum_{j=1}^p B_j Y_{t-j} + u_t \quad (4)$$

¹⁰ See, for example, Tenreyro and Thwaites (2016) for discussion on the state dependency of monetary policy.

where u_t is reduced from shock. As mentioned, we use the IRS-based monetary policy shock series as the external instrument Z_t to identify the structural monetary policy shocks. Specifically, for structural monetary shocks ε_t^p and structural non-monetary shocks ε_t^q our identifying assumptions are:

$$E(u_t \varepsilon_t^{p'}) = \varphi \neq 0 \quad (5)$$

$$E(Z_t \varepsilon_t^{q'}) = 0 \quad (6)$$

which requires the IRS-based monetary shock series to be correlated with the structural monetary shocks but orthogonal to other structural shocks. As we have shown in Section IV.B, the exclusion restrictions are satisfied with the IRS-based shocks. We follow the procedure in Gertler and Karadi (2015) to estimate the impulse responses to monetary policy shocks.

Our baseline specification is a 6-variable VAR including: RRR, inflation, output, government debt, interbank funding costs, and benchmark lending rate, with RRR being the main monetary policy variable in the system.

6. Results

A. Local projections – transmission to interest rates

On impact. We first present the same-day effects of all monetary shocks, by estimating the special case of equation (1) with $h=0$. Each estimate comes from a different regression and the dependent variable is a particular maturity yield or spread. We investigate the responses from the credit market by studying how monetary transmission differs for various types of borrowers. China's credit bond market is unique, reflecting its development and successive waves of financial sector development and liberalization (see Schipke et al 2019). *Enterprise bonds* were launched in 1982 and are almost exclusively for SOEs. They make up about 8 percent of the bond market, and 80 percent of enterprise bonds have been issued by local government financial vehicle (LGFVs). *Corporate bonds* have been issued since 2007, accounting for 5 percent of the market. Companies also raise funds through *medium-term notes* (7 percent of the market) and *commercial paper* (2 percent). We start with rates for borrowers closely related to the government, including the treasury bond yields and the spreads for local government financing vehicles and

enterprise bonds. Then we investigate the responses private borrowers, including corporate bond spreads, 1-year medium-term notes, and 3-year commercial paper spreads.

The results (Table 5) show that monetary policy shocks have an immediate impact on sovereign bond yields and state-owned enterprise bond spreads, but less of an impact on corporate bond spreads and other credit bond spreads.

- *An expansionary monetary policy shock moves the whole term structure of sovereign yields downwards.* Focusing first on the sovereign yields, the coefficient estimates are positive and significant for the 1- to 10-year maturities. A shock that is accompanied by a 100 bps decrease in the IRS rate is associated with about a 15-30 bps decrease in the sovereign yields.
- *An expansionary monetary policy shock also affects all enterprise bond spreads.* The coefficient estimates are positive and significant at the 1- to 10-year maturities for the *enterprise bond spreads*. The same monetary policy shock is associated with about a 15-25 bps decrease in the spreads.
- *But the shock does not appear to affect corporate and other credit bond spreads on impact.* The coefficient estimates are positive but smaller and not generally statistically significant for the corporate and other credit bonds spreads.

Dynamic response to all monetary policy shocks. Next, turning to the dynamic response to interest rates of monetary policy shocks, we plot in Figure 7 the cumulative impulse responses to a 1 percentage point expansionary monetary policy shock (solid black line), as well as the differential impulse responses to monetary policy shocks that are coordinated with fiscal policy (dashed red line) and uncoordinated (dotted blue line). The shaded area represents the 90 percent confidence intervals. The cumulative impulse response functions show that monetary policy has persistent effects on interest rates.

- *Monetary policy transmits to the interbank market.* We start with the interbank market by looking at the responses of the 7-day repo rate and the 3-month SHIBOR rate to the monetary policy shock. While the primary source of banks' funds are deposits, they also issue structured deposits which are priced off of the 3-month SHIBOR. Panel A reports the responses of the interbank market to monetary policy shocks. The expansionary monetary

policy shock has a significant and persistent effect on the 3-month SHIBOR rate, with the peak effect of a 1.8 percentage point reduction in the SHIBOR rate. The effect of the monetary policy shock on the 7-day repo rate, although less persistent, is also substantial with a peak response of a 2.4 percentage point reduction.

- *Monetary policy also affects sovereign yields.* Panel B reports the responses of the yield curve, including treasury bond yields of 1-year, 3-year, 5-year and 10-year maturities. Monetary policy has a strong and persistent effect on treasuries across the yield curve.
- *Transmission to enterprise bond spreads is mixed.* Panels C and D reports the responses of spreads of the 1-year, 3-year, 5-year and 10-year enterprise bonds and LGFV bonds, respectively. Enterprise bonds are issued by state-owned enterprises and LGFVs and have similar characteristics to LGFV bonds. Monetary shocks have the strongest effect on the 5-year bond spreads. The average response of enterprise and LGFV spreads is initially statistically significant (as seen in Table 5 for the first day), but dies out after a few days for the 1, 3, and 10-year maturities. At peak, a 1 percentage point expansionary shock reduces the 5-year enterprise bond spread by 0.6 percentage points.
- *Monetary policy also affects corporate bond spreads.* Monetary policy has a significant effects on 1, 3-, and 5-year corporate spreads (Panel E). The statistical significance of the 1-year response dies out after about two weeks, but remains for the other maturities.
- *Interest rate spreads on medium-term notes and commercial paper are not affected by monetary policy, on average.* We report the responses for commercial papers rated AAA, AA+, AA and AA-, which is currently the entire range of ratings in the commercial paper market. As seen in panels F and G, the average response of these interest rates to monetary shocks is not statistically significantly different than zero over the horizon.

Dynamic response – differential effects of coordinated and uncoordinated monetary policy.

The impact of monetary policy is significantly stronger when coordinated with fiscal policy. The effect of coordinated monetary policy is larger and more persistent in most cases. Overall, only the 3-month SHIBOR and sovereign yields are significantly affected by both coordinated and uncoordinated monetary policy shocks. Even for these interest rates, however, the effects of uncoordinated policies are not persistent.

- *Interbank market* (Figure 7, Panel A). Compared to shocks that are uncoordinated with fiscal policy, monetary shocks coordinated with fiscal policy generate both a stronger and more persistent effect on interbank funding costs.
- *Sovereign yields* (Panel B). The persistent effects of monetary on sovereign yields are driven by the coordinated shocks. While both coordinated and uncoordinated shocks pass-through initially, the effect of uncoordinated reverses after about 5 days while the effects of coordinated shocks remain.
- *Enterprise and LGFV spreads* (Panels C and D). While the average responses of these spreads are muted, the response to coordinated is significant and persistent. The 1-year enterprise spread decreases by around 3 percentage points at peak in response to a 1 percentage point monetary expansion that is coordinated with fiscal expansion.
- *Corporate spreads* (Panel E). Similarly, for corporate spreads, the significant impact of the monetary policy shock is conditional on fiscal policy moving in the same direction. For example, coordinated shocks reduce 1-year corporate spreads by 3 percentage points 20 days after the shock.
- *Medium-term notes and commercial paper* (Panels F and G). Coordinated monetary policy has some effect, with a short-lived effects on 3-year medium-term notes with varying borrower quality (ratings) and more persistent effects on 1-year commercial paper.

B. External instrument SVAR – aggregate effects of monetary shocks

After understanding the transmission of monetary policy to financing costs in different sectors of the economy, we now study the response of aggregate economic activity to monetary policy. To account for the effects of fiscal policy, we include government debt, measured as the “augmented” government debt, as a ratio of nominal GDP, in the VAR system. Our baseline specification is a 6-variable VAR including measures of monetary policy: RRR, 7-day repo and the benchmark lending rates, as well as aggregate variables of core inflation, output gap, and government debt. We use RRR as the primary variable for monetary policy and instrument it with the IRS-based monetary shock constructed in Section IV.B to identify the structural monetary policy shocks. The augmented government debt is of annual frequency, while core inflation and output gap are

of monthly frequency. We time aggregate monetary policy shocks by summing all shocks in a month, and we take the monthly average of interest rates. The frequency for the VAR is monthly.

Figure 8 reports the impulse responses to a one standard deviation expansionary monetary policy shock, together with 90% confidence intervals. The shock corresponds to a RRR cut of roughly 25 basis points. In response to the expansionary shock, the interbank funding rate and benchmark lending rate both decrease, consistent with the conventional transmission of monetary policy to other interest rates. Government debt rises after the monetary shock, consistent with the institutional feature of frequent monetary-fiscal coordination. Output rises in response to the expansionary shock and the effects persist for 12 months, reaching a peak response of over 0.2 percent 5 months after the shock. Aggregate responses from the structural VAR provide suggestive evidence of monetary policy having effects on the macroeconomy, after taking into account the effects of fiscal policy.

7. Conclusion

In this paper, we study China's monetary policy transmission while taking into account the use of multiple monetary policy instruments and coordination between monetary and fiscal policies. Our results suggest some progress in the transmission of monetary policy but also highlight continued difficulties. Similar to recent studies, we find evidence of monetary policy affecting interest rates. Considering the average response to all monetary policy shocks – both coordinated and uncoordinated with fiscal policy – we find evidence of significant and persistent pass-through to interbank interest rates, sovereign yields, and corporate spreads. Transmission to enterprise and LGFV spreads is mixed, however, with evidence of pass-through only for some maturities, and there appear to be no significant effects on commercial paper and medium-term note spreads. When distinguishing between coordinated and uncoordinated measures, which is the focus of the analysis, we find the impact of coordinated monetary measures to be significantly stronger than that of the uncoordinated measures, and also persistent. Given the collective decision making around macroeconomic policy, it is not surprising that monetary and fiscal policy work in tandem to counter economic shocks. While policy coordination can clearly be beneficial in certain circumstances, monetary policy needs the ability to respond quickly and independently to economic events. A muted market response to uncoordinated

monetary policy weakens the ability of the monetary authority to use its tools to affect the economy, particularly through standard interest-rate channels.

Our results suggest that continued reforms to strengthen the interest-rate based framework are needed. First, formulating a clear inflation objective and granting the PBC operational (instrument) independence. Having the SC set the overall goals for monetary policy (but not specific interest rate targets) and delegating the responsibility to meet them to the PBC is particularly important within a collective decision-making structure. This is to ensure that multiple stakeholders are not steering policies towards different objectives at different times, and to limit fiscal dominance (large, augmented deficits and resulting pressures for credit expansion) in non-crisis periods.¹¹ Second, streamlining and clarifying the monetary policy framework, with a focus on one key policy interest rate. The PBC should guide the short-term interbank rate in the clearest manner possible, and let longer-term rates be market-determined, reflecting expectations of the central bank's future policy rates and future inflation, among other factors. The clearer the policy framework, the easier it will be for the market to establish a yield curve. Third, reforms to further improve interest rate pass-through, including continued progress on LPR reform and phasing out the benchmark deposit rate (Hoyle and Jeasakul 2020). Lastly, steps are needed to increase the financial robustness of the banking system to fluctuations in short-term interest rates. These include raising bank capital and further developing interest-rate hedging instruments.

¹¹ For example, Ma (2020) suggests that historically “many government agencies and stakeholders will attempt to steer monetary policies in their favor through the SC, often leading to pressures for excessive monetary expansion and a rising leverage ratio in the economy.”

TABLE 1. STYLIZED COMPARISON OF PBC'S MONETARY POLICY FRAMEWORK

	PBC	Advanced Economy Central Banks
High-level objective(s) (Mandate)	Multiple objectives: price stability, economic growth, employment, and broadly maintaining balance of payments; financial reform and opening up, and financial market development	Single, dual, or triple mandate
Intermediate target(s) (Nominal anchor)	Inflation M2 Total social financing (TSF) Credit to MSEs Exchange rate	Inflation
Operational target(s)	Monetary base 7-day interbank repo rate (DR007) Loan prime rate (LPR)	Overnight cash rate target Reserves/asset purchases
Primary instruments(s)	PBC 7-day repo rate in corridor system Open market operation Benchmark lending/deposit rates Lending facility rates, notably MLF rate Required reserve ratio (broad and targeted)	Open market operations: corridor system Administered rates: floor system

Source: Adapted from Jones et al. (2019)

Reference rate	Tenor	Nominal principal (mn)	Number of deals
7-day repo	1M	9,036	15
	3M	29,938	92
	6M	73,423	241
	9M	67,223	322
	1Y	225,670	1,898
	2Y	52,672	406
	3Y	9,188	120
	4Y	7,125	124
	5Y	115,754	3,269
3-month Shibor	6M	18,043	88
	9M	21,461	105
	1Y	66,273	514
	2Y	9,373	97
	3Y	2,600	33
	4Y	912	13
	5Y	14,468	357

Notes: Liquidity in the IRS market measured with both nominal principal traded (million RMB) and number of deals traded.

TABLE 3: MOVEMENTS IN IRS

	Mean Δ IRS (bps)	Std Dev Δ IRS (%)
RRR	7.3	11.9
PBC 7-day reverse repo rate	10.9	15.6
Benchmark lending and deposit rate	5.5	6.8
MLF rate	4.3	3.2
Monetary policy report	2.8	2.9
Foreign exchange policy	3.9	5.0
Change to MLF	1.1	1.7
All policy events	6.9	10.4
Non-event days	3.1	5.0

Notes: Descriptive statistics for movements of 1-year IRS on 7-day repo for days with each monetary policy event and days without any monetary policy events.

TABLE 4: MONETARY AND FISCAL KEYWORDS

Category	Keywords
Monetary	monetary, money supply, credit supply, reserve requirement ratio, RRR, interest rate(s), re-lending, re-discount, government-backed financing guarantee fees, expand coverage
Fiscal	fiscal, deficit-to-GDP, local government (special) bond(s), subsidies, tax exemptions, tax relief, social benefits, social protection, social assistance, bond quotas, value-added tax, fee cuts
General	financing costs, Central Economic Work Conference, Government Work Report, National People's Congress

Notes: Monetary, fiscal, and general keywords used in frequency search on the texts from the State Council website. Frequency search is case-insensitive.

TABLE 5: MOVEMENTS IN IRS BY COORDINATION TYPE

2013 onwards	Mean Δ IRS (bps)	Std Dev Δ IRS (%)
All policy events	4.6	4.7
Uncoordinated	4.2	4.7
Coordinated	5.0	4.8

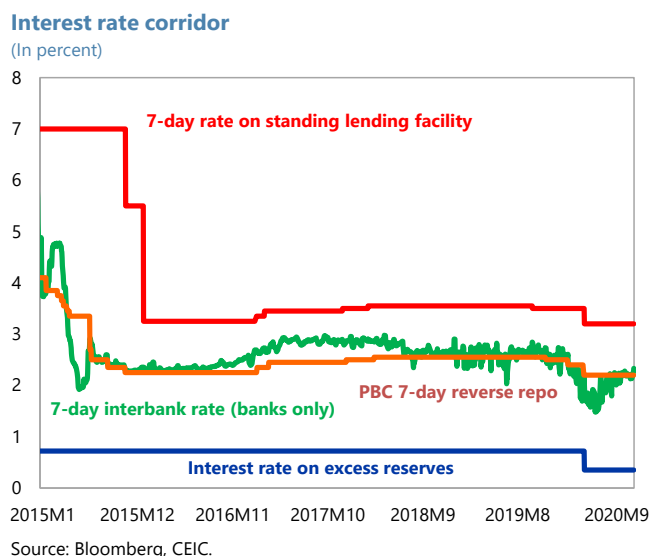
Notes: Descriptive statistics for movements of 1-year IRS on 7-day repo for days with monetary policy events.

TABLE 6: EFFECTS OF MONETARY POLICY ON INTEREST RATES

Maturity	Sovereign Yields	Enterprise Bonds Spreads	Corporate Bond Spreads	Other Credit Bond Spreads 1/
3 month	0.02 (0.10)	--	--	--
6 month	0.03 (0.08)	--	--	--
1 year	0.15*** (0.06)	0.24* (0.08)	0.29* (0.10)	0.02 (0.08)
3 year	0.20*** (0.05)	0.18** (0.07)	0.16 (0.08)	-0.12* (0.07)
5 year	0.26*** (0.06)	0.16** (0.08)	0.07 (0.09)	--
10 year	0.28*** (0.05)	0.14** (0.05)	-0.03 (0.07)	--
<i>N</i>	84	84	69	84
Macro controls	Y	Y	Y	Y

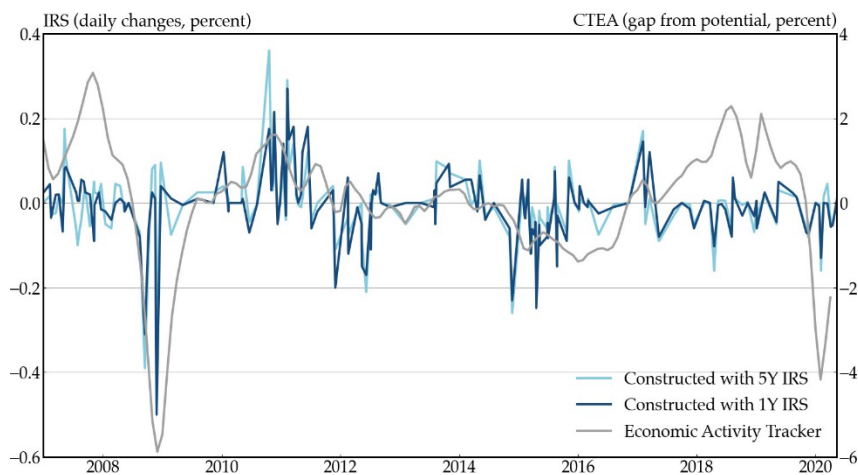
Note: The table present the effect of monetary policy surprises on sovereign yields and credit bond spreads as specified in equation (1). Signs of monetary shocks are normalized so that a positive sign corresponds to an expansionary shock. Spreads are computed as bond yields in excess to sovereign yields of matching maturity. Bond data are from CEIC: sovereign yields, enterprise yield, commercial paper, and note data are from May 2013 to August 2020; corporate yields are from December 2015 to August 2020. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are in brackets. 1/ Other credit bonds are commercial paper at the 1 year maturity and medium-term notes at the 3 year maturity of AAA ratings.

FIGURE 1: INTEREST RATE CORRIDOR



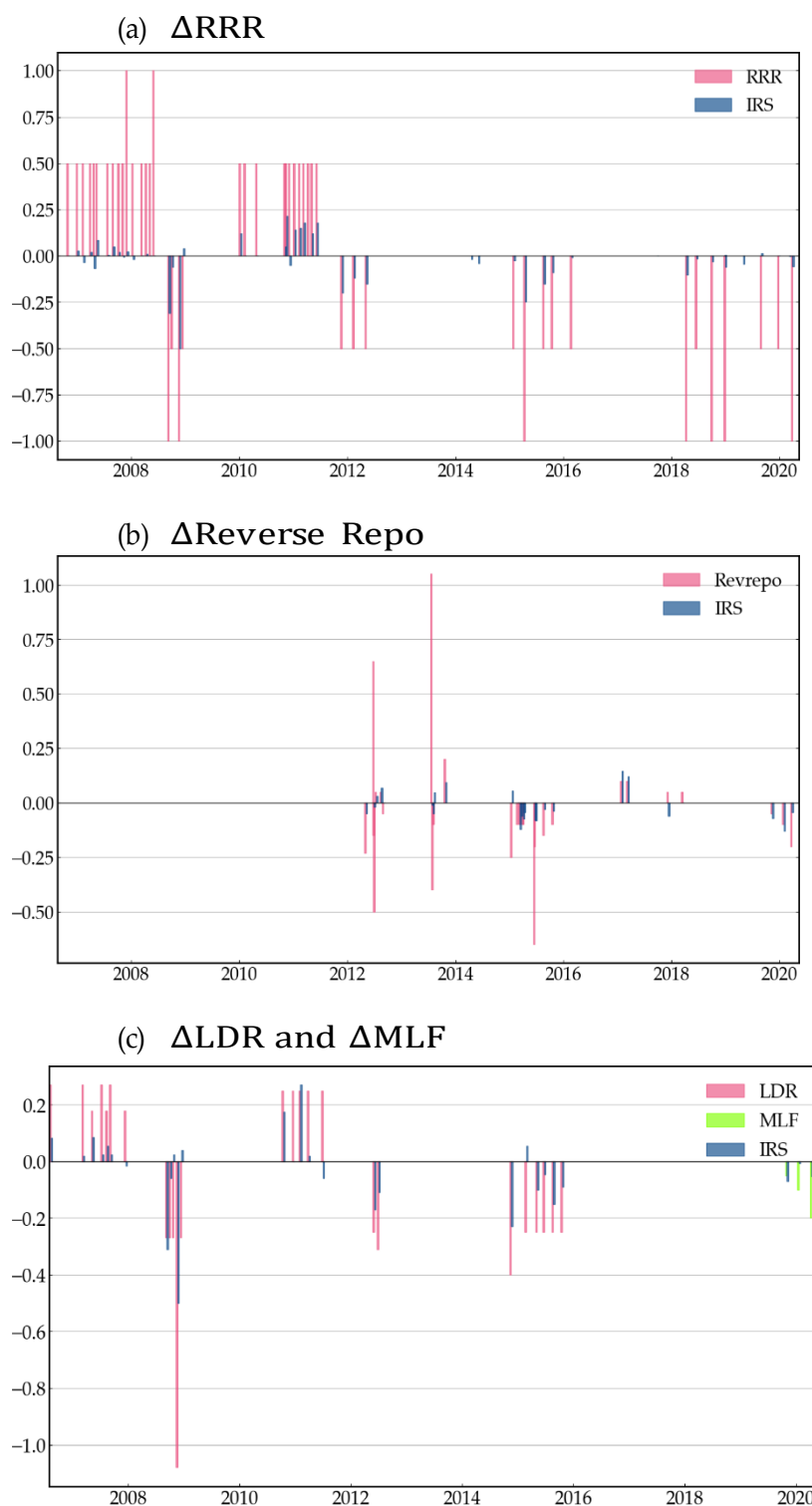
Note: Illustration of the interest rate corridor as part of PBC's interest rate liberalization.

FIGURE 2: TIME SERIES OF MONETARY SHOCKS



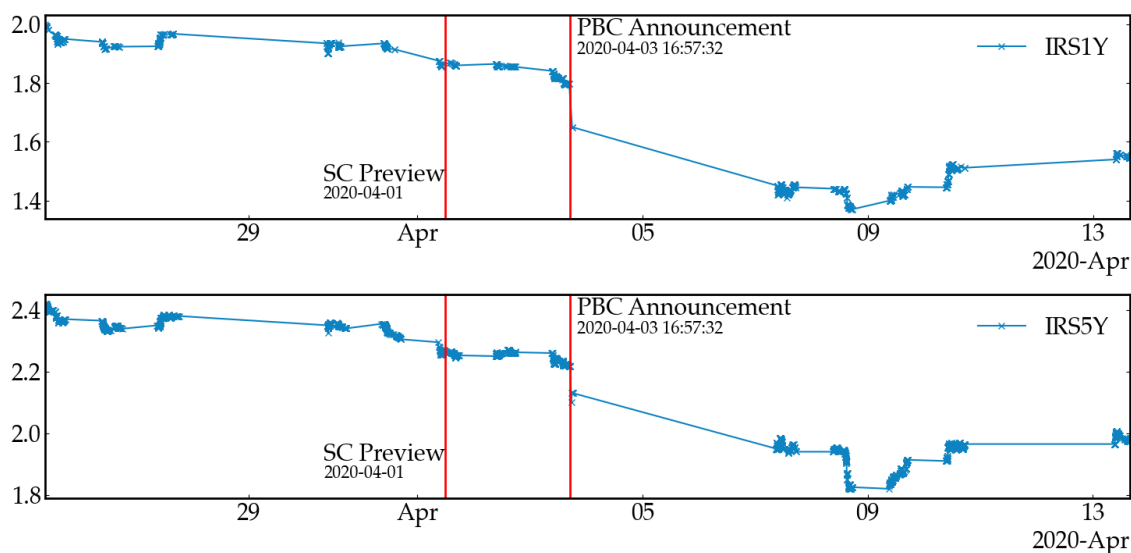
Notes: Time series of monetary shocks constructed with the 1-year and 5-year IRS based on 7-day repo. CTEA denotes the China Economic Activity Tracker constructed by IMF staff as a measure of cyclical economic activity.

FIGURE 3: MONETARY SHOCKS AND CHANGES IN MONETARY INSTRUMENTS



Notes: Monetary policy shocks compared against changes in each underlying monetary instrument. RRR refers to the required reserve ratio, Rev repo refers to the reverse repo rate, LDR refers to the benchmark lending and deposit rates, MLF refers to the medium-term lending facility rate, and IRS refers to the 1-year IRS based on the 7-day repo rate.

FIGURE 4: ILLUSTRATION OF IRS MOVEMENTS AROUND MONETARY EVENT



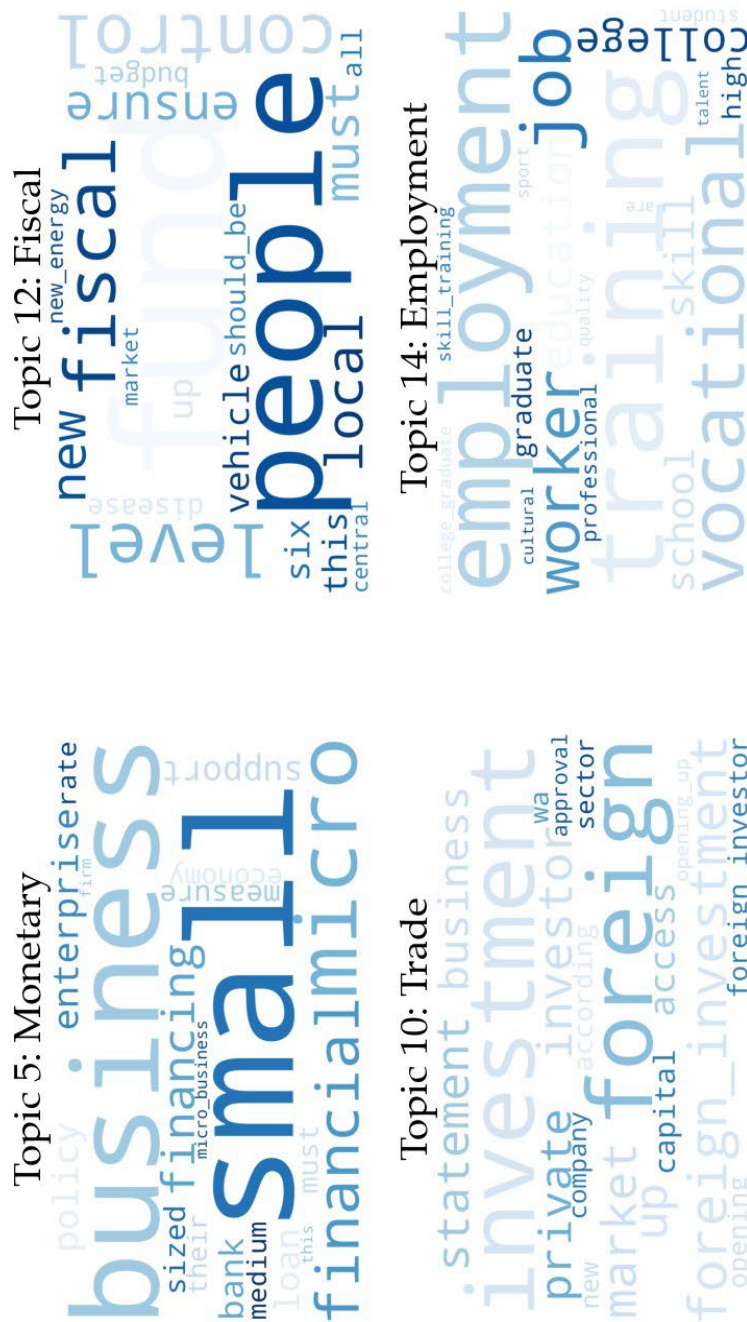
Notes: Illustration of IRS movements with minute IRS data from Bloomberg. “SC Preview” refers to the date the RRR and IOER cuts were previewed in the state council, and “PBC Announcement” refers to the time of PBC announcement of the rate cuts. Top panel reports changes in the 1-year IRS based on 7-day repo, and bottom panel reports the change in 5-year IRS.

FIGURE 5: LDA OUTPUT FOR WEEKLY STATE COUNCIL MEETINGS

topic 1	people	poverty	work	social	area	effort	local	employment	child	development	new	all	are	policy	from	their	living	this	measure	wa
topic 2	he	enterprise	tax	reform	department	not	are	policy	market	he said	should be	this	but	have	administrative	fee	cut	people	approval	business
topic 3	he	reform	central	project	economic	private	investment	are	sees	growth	this	have	from	development	new	well	major	should be	not	capacity
topic 4	business	market	environment	business environment	approval	reform	law	regulation	up	system	all	license	administrative	further	permit	decided	must	effort	inspection	this
topic 5	small	business	micro	financial	financing	enterprise	policy	loan	support	bank	sized	measure	must	economy	their	medium	rate	micro business	firm	this
topic 6	product	quality	price	manufacturing	production	industry	he	made	standard	industrial	good	consumer	ha	we	equipment	market	upgrade	should be	enterprise	country
topic 7	trade	foreign	import	export	foreign trade	border	up	commerce	cross	cross border	percent	opening	policy	opening up	good	custom	from	tax	domestic	clearance
topic 8	innovation	tax	new	enterprise	entrepreneurship	policy	development	from	research	business	capital	their	percent	support	economy	industry	fund	mass	income	national
topic 9	service	medical	development	new	internet	area	industry	zone	insurance	care	people	reform	up	system	city	improve	rural	need	support	region
topic 10	investment	foreign	foreign investment	investor	market	up	statement	private	business	access	capital	foreign investor	wa	according	opening	new	sector	company	approval	opening up
topic 11	asean	cooperation	trade	regional	partnership	between	development	south	new	country	strategic	economic	sea	we	singapore	people	ha	have	side	south china
topic 12	fund	people	fiscal	level	control	local	new	must	ensure	vehicle	up	six	this	should be	disease	all	budget	new energy	market	central
topic 13	service	information	public	migrant	worker	migrant worker	sharing	data	level	platform	department	all	this	should be	he	rail	their	wage	development	wa
topic 14	training	employment	vocational	job	worker	education	college	skill	school	graduate	high	professional	student	skill training	sport	quality	college graduate	cultural	are	talent
topic 15	member	country	trade	work	free	proposal	he	free trade	npc	from	resp	suggestion	all	leader	cpccc	people	deputy	economic	rule	public

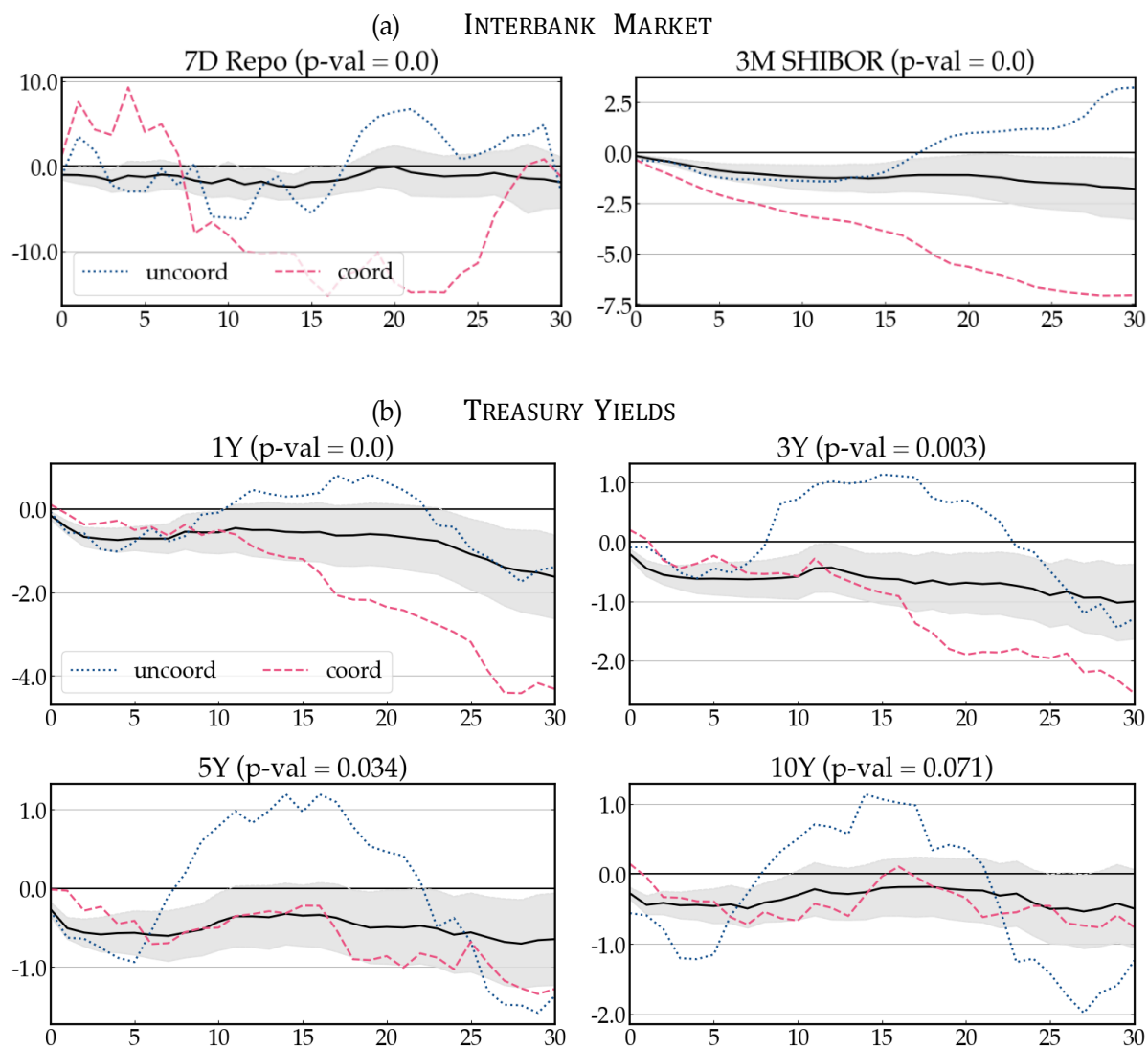
Notes: Topics discussed in state council weekly meetings. We specify the LDA model to output 15 topics. Each row represents a topic, and the darkness of a cell represent the likelihood of a word/biagram to appear in a topic.

FIGURE 6: LDA OUTPUT FOR WEEKLY STATE COUNCIL MEETINGS: SELECTED TOPICS



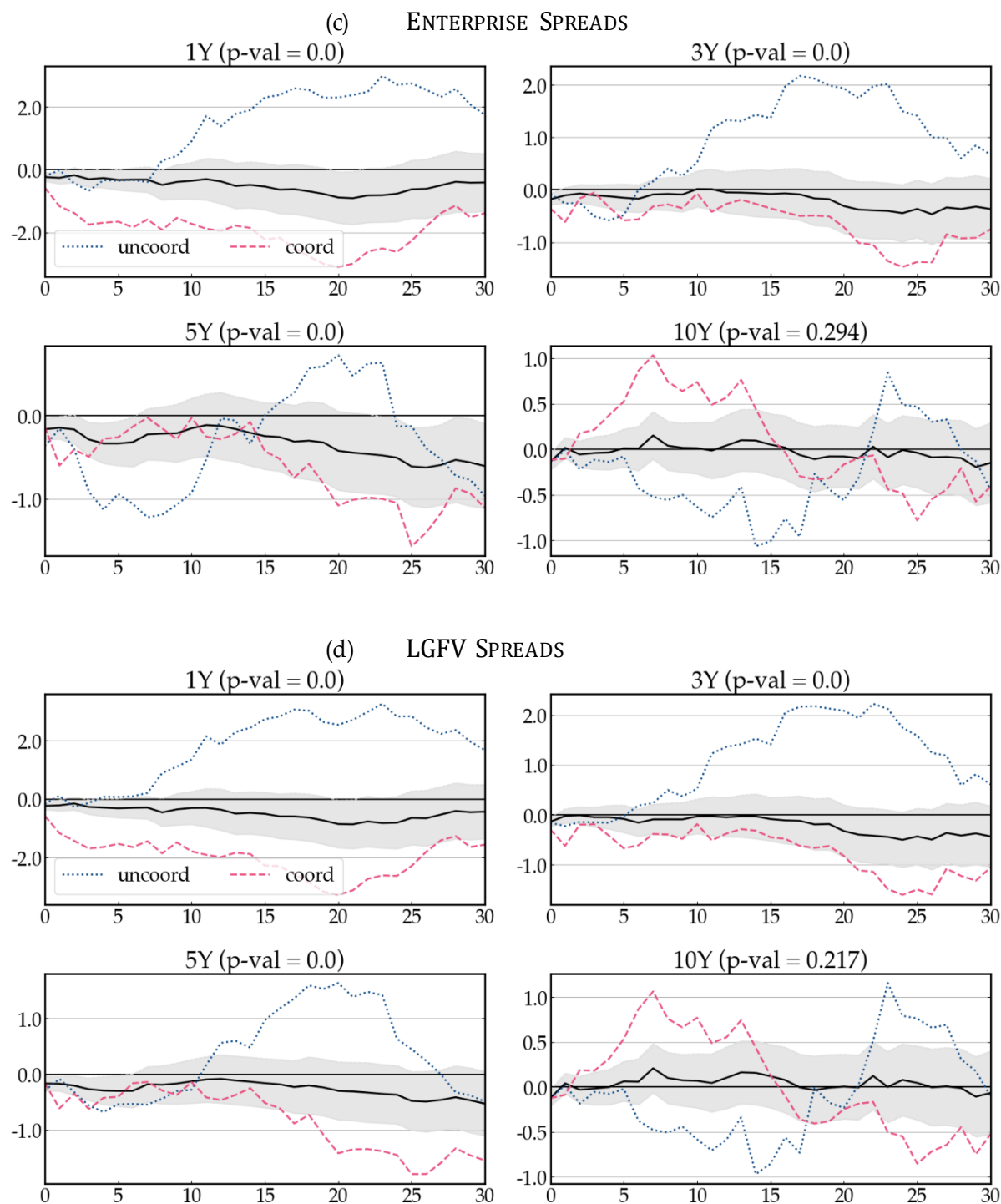
Notes: Word cloud of selected topics from LDA output of the state council weekly meetings. The size and darkness of a word/biagram represent the likelihood of the word/biagram to appear in a topic.

FIGURE 7: DYNAMIC RESPONSES TO MONETARY SHOCKS



Notes: Cumulative impulse responses (coefficients β_h) from local projections as described in the main text. Signs of monetary shocks are normalized so that a positive sign corresponds to an expansionary shock. Solid black, dashed red, and dotted blue lines refer to the average, coordinated and uncoordinated responses, respectively. Confidence intervals are reported at 90%.

FIGURE 7: DYNAMIC RESPONSES TO MONETARY SHOCKS (CONT.)



Notes: Cumulative impulse responses (coefficients β_h) from local projections as described in the main text. Signs of monetary shocks are normalized so that a positive sign corresponds to an expansionary shock. Solid black, dashed red, and dotted blue lines refer to the average, coordinated and uncoordinated responses, respectively. Confidence intervals are reported at 90%.

FIGURE 7: DYNAMIC RESPONSES TO MONETARY SHOCKS (CONT.)

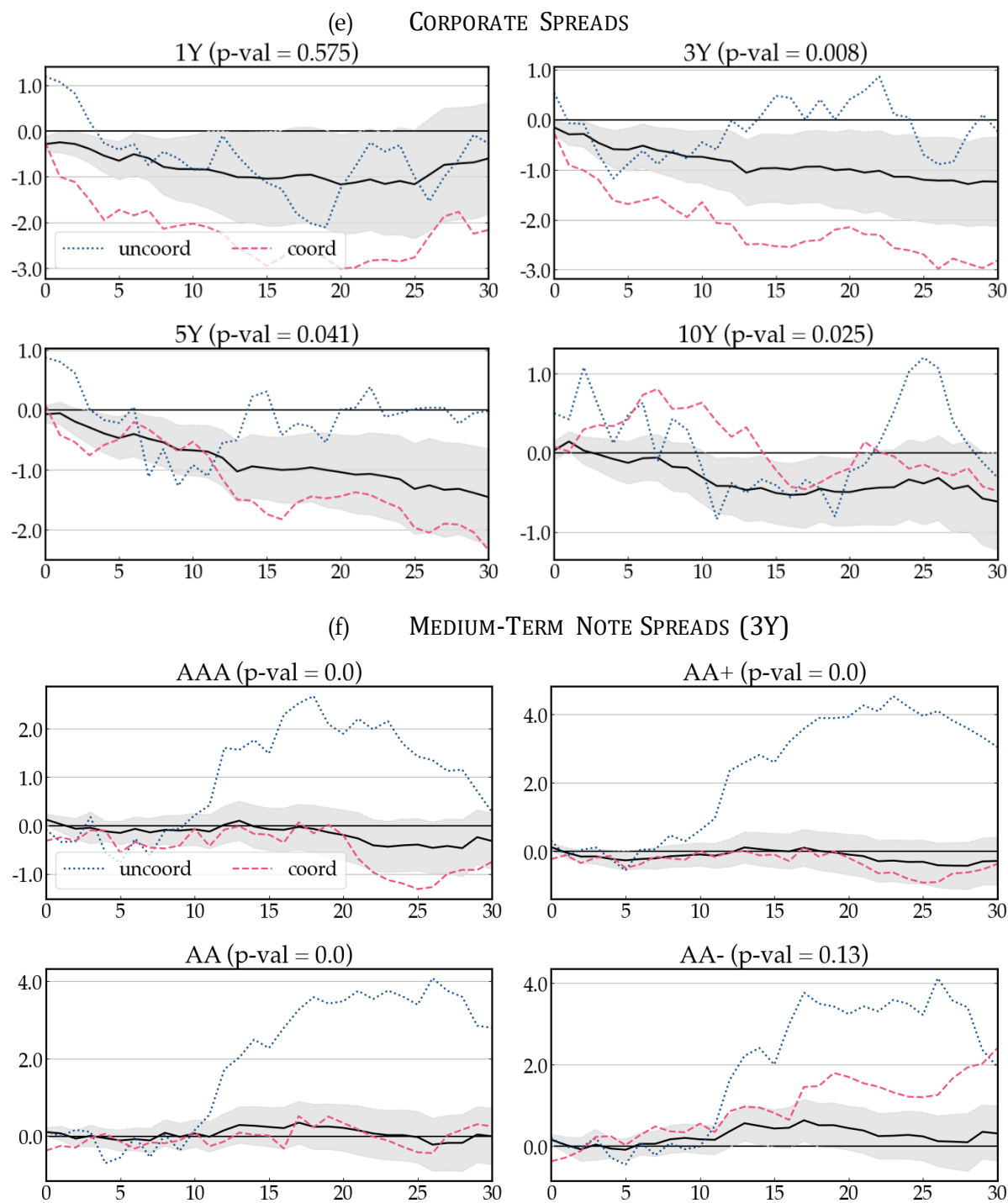
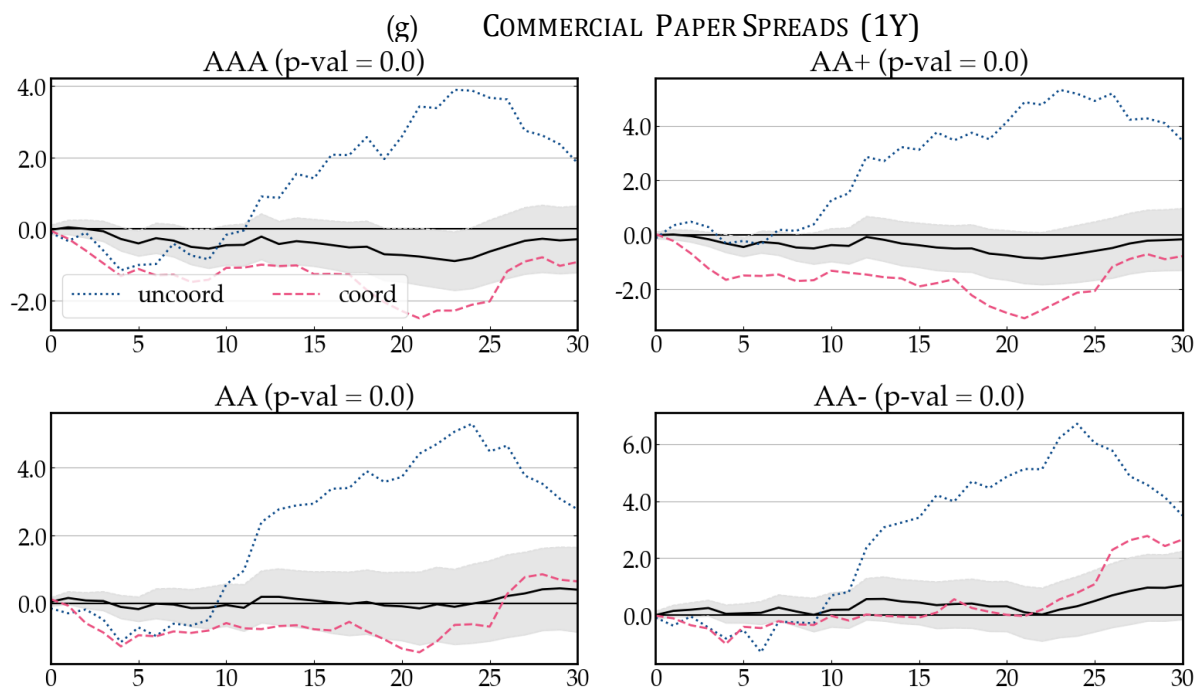
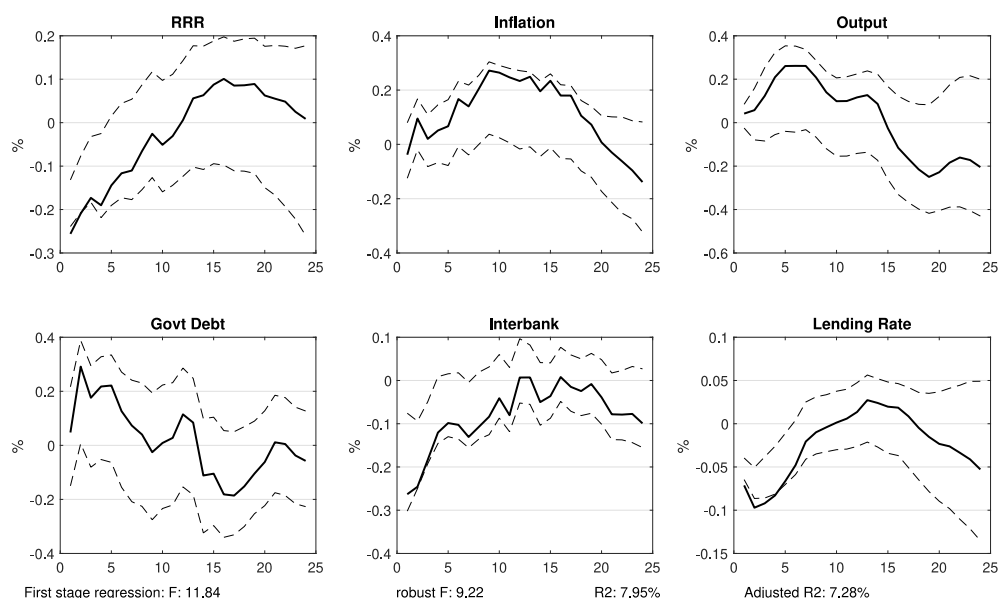


FIGURE 7: DYNAMIC RESPONSES TO MONETARY SHOCKS (CONT.)



Notes: Cumulative impulse responses (coefficients β_h) from local projections as described in the main text. Signs of monetary shocks are normalized so that a positive sign corresponds to an expansionary shock. Solid black, dashed red, and dotted blue lines refer to the average, coordinated and uncoordinated responses, respectively. Confidence intervals are reported at 90%.

FIGURE 8: AGGREGATE REPOSSES TO MONETARY SHOCKS



Notes: Impulse responses of the external instrument VAR with 6 variables. RRR denotes the required reserve ratio and is instrumented with the monetary shocks constructed with IRS changes. Confidence interval is 90%. Inflation is measured with core CPI, output is measured with output gap from China Economic Activity Tracker, government debt is measured as the augmented government debt as a fraction of nominal GDP, interbank is the 7-day reverse repo rate, and lending rate is the benchmark lending rate.

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PUBLICATIONS

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